City of Hattiesburg, MS

200 Forrest St.
P.O. Box 1898
Hattiesburg, MS 39401

Meeting Agenda - Final

Monday, November 19, 2018

4:00 PM

Council Chambers

City Council - Agenda Review

Call to Order

Agenda Adjustments

Add Policy Items V.-22, V.-23 and V.-24; at the request of the Administration as follows:

V.-22 2018-981 Acknowledge receipt of the Audited Financial Statements of the City of Hattiesburg for the fiscal year ending September 30, 2017, from Topp McWhorter Harvey PLLC.

Attachments: COH Final Financial Statements FYE 9.30.2017

V.-23 2018-978 Approve and authorize Mayor to execute Release of Lien of Deed of Trust from Community Connections, Inc., Grantor, for property at 620 Barkley Road, to City of Hattiesburg, Beneficiary, recorded in the Deed of Trust Book 1939 at Page 0225-0229 in the office of the Chancery Clerk of Forrest County, Mississippi, in conjunction with the sale of the property to a HOME-eligible buyer. {Entitlement}

Attachments: Release of Deed of Trust 620 Barkley Rd - 11-16-18

Executed Release of Deed of Trust 520 Barkley Road

V.-24 2018-977 Approve Amendment to the CHDO contract with Community Connections (found at MB 2010-3 / 28-38), including all amendments through October 8, 2013 (found at MB 2013 / 303-304), changing the scope of the agreement from "Rental" to "Homebuyer" (no change to total proposed expenditure) and authorize Mayor to execute agreement in triplicate for same. {Entitlement - HOME}

Attachments: Homeownership Agreement - Amended 11-2018

Executed Homeownership Agreement Amendment with Community Connection

And, Add Routine Item VI.-14 as follows:

VI.-14 2018-980 Approve Plans and Specifications for the Public Safety Complex Historic Hospital Building, Police and Court Building Project; Authorize advertisement for bids for same.

Attachments:
2018_11_19 HPSC Civil Drawings 100%
2018_11_19 HPSC Hospital Drawings 100%
2018_11_19 HPSC Police + Court Drawings (Vol 1) 100%
2018_11_19 HPSC Police + Court Drawings (Vol 2) 100%
2018_11_19 HPSC South Site Drawings 100%
2018_11_19 HPSC Specifications 100% (Vol 1)
2018_11_19 HPSC Specifications 100% (Vol 2)
2018_11_19 HPSC Specifications 100% (Vol 3)
ADVERTISEMENT FOR BIDS 2018 Hattiesburg Public Safety Complex

1. Agenda Review

2. Citizen Forum

3. Recess

City of Hattiesburg, MS

200 Forrest St.
P.O. Box 1898
Hattiesburg, MS 39401

Master

File Number: 2018-981

File ID: 2018-981 **Type:** Regular Agenda Item **Status:** Approved

Version: 1 **Reference:** **In Control:** City Council

Requester: Ann Jones **File Created:** 11/16/2018

Brief Title: Acknowledge receipt of Audited Financial Statements of City of Hattiesburg for fiscal year ending 9/30/2017 **Final Action:** 11/20/2018

Minute Book Number: MB 2018-292

Title:

Acknowledge receipt of the Audited Financial Statements of the City of Hattiesburg for the fiscal year ending September 30, 2017, from Topp McWhorter Harvey PLLC.

Notes:

Agenda Date: 11/20/2018

Indexes: **Agenda Number:** V.-22

Sponsors: **Enactment Date:**

Attachments: COH Final Financial Statements FYE 9.30.2017 **Enactment Number:**

Contact: **Meeting Date:** 11/20/2018

Drafter: Ann Jones **Effective Date:**

History of Legislative File

Version:	Acting Body:	Date:	Action:	Sent To:	Due Date:	Return Date:	Result:
1	City Council - Agenda Review	11/19/2018					
1	City Council	11/20/2018	Acknowledge				Pass

Action Text: A MOTION was made by Council Member Delgado and seconded by Council Member Brown to Acknowledge receipt of the Audited Financial Statements of the City of Hattiesburg for the fiscal year ending September 30, 2017, from Topp McWhorter Harvey PLLC.

There being no discussion, the Motion received the affirmative vote of the Council as follows:

Yeas: 5 - George, Delgado, Carroll, Dryden and Brown

Nays: 0

Yea: 5 Council Member George
Council Member Delgado
Council President Carroll
Council Vice President Dryden
Council Member Brown

Text of Legislative File 2018-981

Title

Acknowledge receipt of the Audited Financial Statements of the City of Hattiesburg for the fiscal year ending September 30, 2017, from Topp McWhorter Harvey PLLC.

Summary

Acknowledge receipt of Audited Financial Statements for the City of Hattiesburg for fiscal year ending 9/30/2017.

Budget Information

Expenditure Type

Purchasing Item

Publication Information

CITY OF HATTIESBURG, MISSISSIPPI

AUDITED FINANCIAL STATEMENTS
AND SUPPLEMENTARY INFORMATION

Year Ended September 30, 2017

CITY OF HATTIESBURG, MISSISSIPPI

AUDITED FINANCIAL STATEMENTS
AND SUPPLEMENTARY INFORMATION
YEAR ENDED SEPTEMBER 30, 2017

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CITY OF HATTIESBURG, MISSISSIPPI

AUDITED FINANCIAL STATEMENTS
AND SUPPLEMENTARY INFORMATION
YEAR ENDED SEPTEMBER 30, 2017

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FINANCIAL SECTION

INDEPENDENT AUDITOR'S REPORT

To the Honorable Mayor and
Members of the City Council
City of Hattiesburg, Mississippi

Report on the Financial Statements

We have audited the accompanying financial statements of the governmental activities, the business-type activities, the discretely presented component unit, each major fund, and the aggregate remaining fund information of the City of Hattiesburg, Mississippi, as of and for the year ended September 30, 2017, and the related notes to the financial statements, which collectively comprise the City's basic financial statements as listed in the table of contents.

Management's Responsibility for the Financial Statements

The City of Hattiesburg, Mississippi's management is responsible for the preparation and fair presentation of these financial statements in accordance with accounting principles generally accepted in the United States of America; this includes the design, implementation, and maintenance of internal control relevant to the preparation and fair presentation of financial statements that are free from material misstatement, whether due to fraud or error.

Auditor's Responsibility

Our responsibility is to express opinions on these financial statements based on our audit. We conducted our audit in accordance with auditing standards generally accepted in the United States of America and the standards applicable to financial audits contained in *Government Auditing Standards*, issued by the Comptroller General of the United States. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free from material misstatement.

An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in the financial statements. The procedures selected depend on the auditor's judgment, including the assessment of the risks of material misstatement of the financial statements, whether due to fraud or error. In making those risk assessments, the auditor considers internal control relevant to the entity's preparation and fair presentation of the

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financial statements in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the entity's internal control. Accordingly, we express no such opinion. An audit also includes evaluating the appropriateness of accounting policies used and the reasonableness of significant accounting estimates made by management, as well as evaluating the overall presentation of the financial statements.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinions.

Opinions

In our opinion, the financial statements referred to above present fairly, in all material respects, the respective financial position of the governmental activities, the business-type activities, the discretely presented component unit, each major fund, and the aggregate remaining fund information of the City of Hattiesburg, Mississippi, as of September 30, 2017, and the respective changes in financial position, and, where applicable, cash flows thereof for the year then ended in accordance with accounting principles generally accepted in the United States of America.

Emphasis of Matter

Deficit Fund Balance

As described in Note 16 to the financial statements, deficit fund balances were reported in certain governmental funds as a result of modified accrual recognition of expenditures for which reimbursements were not available resources. Our opinion is not modified with respect to this matter.

Matters Related to Funding

Subsequent to September 30, 2017, certain federal and state grant reimbursements were delayed because of delinquency in submission of City annual financial reports. In addition, the City's credit rating was suspended in November 2016. Our opinion is not modified with respect to these matters.

To the Honorable Mayor and Members of the City Council
City of Hattiesburg, Mississippi

Other Matters

Required Supplementary Information

Management has omitted management's discussion and analysis (MD&A), budgetary comparison schedules for the general fund, trend factors and schedules of funding progress of the City's defined benefit pension plans, and trend factors and schedules of funding progress and employer contributions for the City's other postemployment benefit plans (OPEB) that accounting principles generally accepted in the United States of America require to be presented to supplement the basic financial statements. Such missing information, although not a part of the basic financial statements, is required by the Governmental Accounting Standards Board, who considers it to be an essential part of financial reporting for placing the basic financial statements in an appropriate operational, economic, or historical context. Our opinion on the basic financial statements is not affected by this missing information.

Supplementary and Other Information

Our audit was conducted for the purpose of forming opinions on the financial statements that collectively comprise the City of Hattiesburg, Mississippi's basic financial statements. The accompanying schedule of expenditures of federal awards, as required by Title 2 U.S. Code of Federal Regulations Part 200, *Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards*, is presented for purposes of additional analysis and is not a required part of the basic financial statements.

The schedule of expenditures of federal awards is the responsibility of management and was derived from and relates directly to the underlying accounting and other records used to prepare the basic financial statements. Such information has been subjected to the auditing procedures applied in the audit of the basic financial statements and certain additional procedures, including comparing and reconciling such information directly to the underlying accounting and other records used to prepare the basic financial statements or to the basic financial statements themselves, and other additional procedures in accordance with auditing standards generally accepted in the United States of America. In our opinion, the schedule of expenditures of federal awards is fairly stated, in all material respects, in relation to the basic financial statements taken as a whole.

To the Honorable Mayor and Members of the City Council
City of Hattiesburg, Mississippi

Other Reporting Required by Government Auditing Standards

In accordance with *Government Auditing Standards*, we have also issued our report dated November 15, 2018, on our consideration of the City of Hattiesburg, Mississippi's internal control over financial reporting and on our tests of its compliance with certain provisions of laws, regulations, contracts and grant agreements and other matters. The purpose of that report is to describe the scope of our testing of internal control over financial reporting and compliance and the results of that testing, and not to provide an opinion on internal control over financial reporting or on compliance. That report is an integral part of an audit performed in accordance with *Government Auditing Standards* in considering the City of Hattiesburg, Mississippi's internal control over financial reporting and compliance.

TMH

Hattiesburg, Mississippi
November 15, 2018

FINANCIAL STATEMENTS

EXHIBIT A
PAGE 1 OF 2

CITY OF HATTIESBURG, MISSISSIPPI

Statement of Net Position
September 30, 2017

	PRIMARY GOVERNMENT			
	Governmental Activities	Business-type Activities	Total	Component Unit
ASSETS				
Cash and cash equivalents	$ 17,224,190	$ 9,667,411	$ 26,891,601	$ 6,644,065
Cash with fiscal agent	1,289,898	26,414,781	27,704,679	-
Sales tax receivable	3,670,355	-	3,670,355	864,352
Property taxes receivable	21,081,340	-	21,081,340	-
Accounts receivable - Water and Sewer, net	-	1,297,757	1,297,757	-
Accounts receivable - Solid Waste Services	311,177	-	311,177	-
Intergovernmental receivable	4,874,558	-	4,874,558	-
Fines receivable, net	3,203,825	-	3,203,825	-
Other receivables	866,589	57,000	923,589	79,963
Internal balances	99,023	(99,023)	-	-
Due from other agencies	10,192	-	10,192	-
Inventory - food and beverage	-	-	-	70,706
Inventory - gas and oil	31,225	-	31,225	-
Notes receivable	3,509,683	-	3,509,683	-
Capital assets not being depreciated:				
Land and construction in progress	31,555,165	2,173,106	33,728,271	5,240,462
Capital assets, net of accumulated depreciation:				
Infrastructure	64,096,840	100,513,737	164,610,577	-
Buildings and improvements	35,147,908	177,486	35,325,394	10,430,227
Machinery and equipment	5,475,559	544,169	6,019,728	128,096
Total assets	192,447,527	140,746,424	333,193,951	23,457,871
DEFERRED OUTFLOWS OF RESOURCES				
Related to pensions	6,225,650	466,687	6,692,337	-
Prepaid bond insurance	139,726	188,379	328,105	-
Total deferred outflows of resources	6,365,376	655,066	7,020,442	-

The notes to the financial statements are an integral part of this statement.

CITY OF HATTIESBURG, MISSISSIPPI

Statement of Net Position
September 30, 2017

	PRIMARY GOVERNMENT			
	Governmental Activities	Business-type Activities	Total	Component Unit
LIABILITIES				
Accounts payable	$ 1,987,659	$ 804,147	$ 2,791,806	$ 174,534
Accrued wages and benefits	572,530	47,073	619,603	279,132
Other liabilities	1,366,695	18,826	1,385,521	85,108
Due to other agencies	242,674	-	242,674	-
Accrued expenses	344,757	-	344,757	-
Accrued interest	297,253	534,456	831,709	-
Non-current liabilities:				
Portion due or payable within one year:				
General obligation bonds	1,700,000	2,111,000	3,811,000	-
Revenue bonds	-	2,830,000	2,830,000	-
Unamortized bond premium	43,507	45,384	88,891	-
Limited obligation tax increment financing bonds	1,022,000	-	1,022,000	-
Economic development limited obligation bonds and notes	119,354	-	119,354	-
General obligation notes payable	-	96,001	96,001	-
Certificate of participation	175,000	-	175,000	-
Capital leases	1,149,592	-	1,149,592	-
Unamortized certificate of participation premium	13,158	-	13,158	-
Compensated absences	204,386	14,559	218,945	-
Portion due or payable after one year:				
General obligation bonds	5,465,000	10,300,000	15,765,000	-
Revenue bonds	-	57,945,000	57,945,000	-
Unamortized bond premium	130,519	347,033	477,552	-
Limited obligation tax increment financing bonds	10,039,000	-	10,039,000	-
Economic development limited obligation bonds and notes	1,708,128	-	1,708,128	-
General obligation notes payable	-	24,683	24,683	-
Certificate of participation	5,125,000	-	5,125,000	-
Capital leases	7,903,996	-	7,903,996	-
Unamortized certificate of participation premium	236,827	-	236,827	-
Compensated absences	1,158,185	82,498	1,240,683	-
Net pension liablility	71,019,339	4,603,894	75,623,233	-
Other post employment benefits obligation	1,600,905	151,572	1,752,477	-
Customer meter deposits	-	1,416,755	1,416,755	-
Total liabilities	113,625,464	81,372,881	194,998,345	538,774
DEFERRED INFLOWS OF RESOURCES				
Related to pensions	930,448	78,496	1,008,944	-
Deferred revenues	-	617,189	617,189	-
Unearned revenue - property taxes	20,753,000	-	20,753,000	-
Total deferred inflows of resources	21,683,448	695,685	22,379,133	-
NET POSITION				
Net investment in capital assets	114,719,895	29,709,397	144,429,292	15,798,785
Restricted for:				
Debt service	6,162,469	7,685,090	13,847,559	-
Capital projects	-	-	-	772,499
Unrestricted	(57,378,373)	21,938,437	(35,439,936)	6,347,813
Total net position	$ 63,503,991	$ 59,332,924	$ 122,836,915	$ 22,919,097

The notes to the financial statements are an integral part of this statement.

EXHIBIT B

CITY OF HATTIESBURG, MISSISSIPPI

STATEMENT OF ACTIVITIES
YEAR ENDED SEPTEMBER 30, 2017

Functions/Programs	Expenses	Program Revenues: Fees, Fines and Charges for Services	Program Revenues: Operating Grants and Contributions	Program Revenues: Capital Grants and Contributions	Net (Expense) Revenue and Changes in Net Position: Primary Government: Governmental Activities	Primary Government: Business-type Activities	Primary Government: Total	Component Unit
PRIMARY GOVERNMENT:								
Governmental Activities:								
General government	$ 9,454,614	$ -	$ -	$ -	$ (9,454,614)		$ (9,454,614)	
Public safety	24,876,846	1,485,491	859,667	-	(22,531,688)		(22,531,688)	
Public services	22,301,631	2,218,076	4,175,142	753,784	(15,154,629)		(15,154,629)	
Other services	1,429,409	-	-	403,969	(1,025,440)		(1,025,440)	
Mass transit	1,901,374	35,771	825,639	345,010	(694,954)		(694,954)	
Culture and recreation	4,336,206	87,804	-	16,721	(4,231,681)		(4,231,681)	
Human/social assistance	772,346	-	738,268	-	(34,078)		(34,078)	
Economic development	255,000	-	-	-	(255,000)		(255,000)	
Interest and fiscal charges	1,119,296	-	-	-	(1,119,296)		(1,119,296)	
Total governmental activities	66,446,722	3,827,142	6,598,716	1,519,484	(54,501,380)		(54,501,380)	
Business-Type Activities:								
Water and sewer system	16,373,370	20,748,288	-	-	-	$ 4,374,918	4,374,918	
Interest and fiscal charges	2,389,665	-	-	-	-	(2,389,665)	(2,389,665)	
Total business-type activities	18,763,035	20,748,288	-	-	-	1,985,253	1,985,253	
Total primary government	$ 85,209,757	$ 24,575,430	$ 6,598,716	$ 1,519,484	(54,501,380)	1,985,253	(52,516,127)	
COMPONENT UNIT:								
Hattiesburg Convention Commission	$ 6,858,893	$ 2,873,619	$ -	$ 305,000				$ (3,680,274)
Total component unit	$ 6,858,893	$ 2,873,619	$ -	$ 305,000				(3,680,274)
GENERAL REVENUES:								
Taxes:								
Property taxes, levied for general purposes					16,247,175	-	16,247,175	-
Property taxes, levied for debt service					4,535,778	-	4,535,778	-
Sales taxes					22,440,431	-	22,440,431	-
Franchise taxes and other licenses and permits					4,228,559	-	4,228,559	-
Special sales tax					-	-	-	5,224,823
Grants and contributions not restricted to specific programs					98,932	-	98,932	-
Unrestricted investment earnings					227,856	99,295	327,151	26,114
Other local sources					2,441,347	-	2,441,347	-
Miscellaneous					1,889,376	200,116	2,089,492	40,466
Gain (loss) on sale of assets					1,484	-	1,484	-
TRANSFERS:								
Transfers, component unit					24,733	-	24,733	(24,733)
Transfers, net					306,908	(306,908)	-	-
Total general revenues and transfers					52,442,579	(7,497)	52,435,082	5,266,670
CHANGE IN NET POSITION					(2,058,801)	1,977,756	(81,045)	1,586,396
NET POSITION - BEGINNING					66,869,395	57,197,908	124,067,303	21,332,701
Prior period adjustment					(1,306,603)	157,260	(1,149,343)	-
NET POSITION - BEGINNING, AS ADJUSTED					65,562,792	57,355,168	122,917,960	21,332,701
NET POSITION - ENDING					$ 63,503,991	$ 59,332,924	$ 122,836,915	$ 22,919,097

The notes to the financial statements are an integral part of this statement.

EXHIBIT C
PAGE 1 OF 2

CITY OF HATTIESBURG, MISSISSIPPI

BALANCE SHEET
GOVERNMENTAL FUNDS
SEPTEMBER 30, 2017

	General Fund	Other Governmental Funds	Total Governmental Funds
ASSETS			
Cash and cash equivalents	$ 6,744,149	$ 10,480,041	$ 17,224,190
Cash with fiscal agent	-	1,289,898	1,289,898
Sales tax receivable	1,833,328	-	1,833,328
Intergovernmental receivable	3,340,198	1,434,360	4,774,558
Fines receivable, net of allowance	3,203,825	-	3,203,825
Other receivables	742,468	17,204	759,672
Due from other funds	810,486	110,387	920,873
Property taxes receivable	17,284,084	3,674,535	20,958,619
Due from other agencies	10,192	-	10,192
Gas and oil inventory	31,225	-	31,225
Advances to other funds	300,000	-	300,000
Prepaid insurance	123,349	-	123,349
Prepaid debt service	-	16,377	16,377
Total assets	$ 34,423,304	$ 17,022,802	$ 51,446,106
LIABILITIES			
Accounts payable	$ 943,690	$ 1,043,969	$ 1,987,659
Accrued wages and benefits	523,174	49,356	572,530
Due to other funds	244,523	577,327	821,850
Other liabilities	1,325,614	385,838	1,711,452
Due to other agencies	242,674	-	242,674
Advances from other funds	-	300,000	300,000
Total liabilities	3,279,675	2,356,490	5,636,165
DEFERRED INFLOWS OF RESOURCES			
Unavailable revenue - property taxes	17,114,000	3,639,000	20,753,000
Unavailable revenue - fines	3,203,825	-	3,203,825
Total deferred inflows of resources	20,317,825	3,639,000	23,956,825
FUND BALANCES			
Nonspendable:			
Inventories	31,225	-	31,225
Prepaid expenses	123,349	-	123,349
Long-term interfund advance	300,000	-	300,000
Restricted:			
Fire protection	-	767,933	767,933
Street improvements and repairs	-	1,634,942	1,634,942
Law enforcement	-	1,128,847	1,128,847
Mass transit	-	187,836	187,836

The notes to the financial statements are an integral part of this statement.

EXHIBIT C
PAGE 2 OF 2

CITY OF HATTIESBURG, MISSISSIPPI

BALANCE SHEET
GOVERNMENTAL FUNDS
SEPTEMBER 30, 2017

	General Fund	Other Governmental Funds	Total Governmental Funds
FUND BALANCES (Cont.)			
Restricted: *(Cont.)*			
Debt service	$ -	$ 6,162,469	$ 6,162,469
Parks and recreation projects	-	104,862	104,862
Committed:			
Parks and recreation	-	1,309,663	1,309,663
Assigned:			
General government	78,840	-	78,840
Public safety	388,159	-	388,159
Public services	174,993	-	174,993
Other services	5,730	-	5,730
Unassigned	9,723,508	(269,240)	9,454,268
Total fund balances	10,825,804	11,027,312	21,853,116
Total liabilities, deferred inflows of resources, and fund balances	$ 34,423,304	$ 17,022,802	$ 51,446,106

The notes to the financial statements are an integral part of this statement.

EXHIBIT C.1
PAGE 1 OF 2

CITY OF HATTIESBURG, MISSISSIPPI

Reconciliation of the Governmental Funds Balance Sheet to the Government-Wide Statement of Net Position September 30, 2017

Total *fund balances* for governmental funds (Exhibit C)		$ 21,853,116
Total *net position* reported for governmental activities in the statement of net position is different because:		
Capital assets used in governmental activities are not financial resources and therefore are not reported in the funds. Those assets consist of:		
Land	$ 29,934,169	
Construction in progress	1,620,996	
Infrastructure, net of $86,751,847 accumulated depreciation	64,096,840	
Buildings and improvements, net of $27,043,565 accumulated depreciation	35,147,908	
Machinery and equipment, net of $30,484,690 accumulated depreciation	5,475,559	
Total capital assets		136,275,472
Other long-term assets are not available to pay for current period expenditures and therefore are reported as deferred revenue in the funds.		3,203,825
Receivables not received within thirty days of year end are not reported in the funds.		2,477,842
Notes receivable are not available to pay for current period expenditures and therefore are not reported in the funds.		3,509,683
Deferred outflows related to pensions are not reported in the funds		6,225,650

The notes to the financial statements are an integral part of this statement.

EXHIBIT C.1
PAGE 2 OF 2

CITY OF HATTIESBURG, MISSISSIPPI

Reconciliation of the Governmental Funds Balance Sheet to the Government-Wide Statement of Net Position September 30, 2017

Deferred inflow related to pension are not reported in the funds.		$ (930,448)
Long-term liabilities applicable to the City's governmental activities are not due and payable in the current period and accordingly are not reported as fund liabilities. Interest on long-term debt is not accrued in the governmental funds, but rather is recognized as an expenditure when due. All liabilities – both current and long-term – are reported in the statement of net position.		
Balances for these liabilities at September 30, 2017 are:		
Accrued interest on bonds and notes		(297,253)
General obligation bonds	$ (7,165,000)	
Limited obligation tax increment financing bonds	(11,061,000)	
Limited obligation economic development bonds and notes	(1,827,482)	
Unamortized premiums on bonds	(174,026)	
Certificates of participation	(5,300,000)	
Unamortized premiums on certificates of participation	(249,985)	
Capital leases	(9,053,588)	
Compensated absences	(1,362,571)	
Net pension liability	(71,019,339)	
Other post employment benefits obligation	(1,600,905)	
Total long-term liabilities		(108,813,896)
Total *net position* of governmental activities (Exhibit A)		$ 63,503,991

The notes to the financial statements are an integral part of this statement.

EXHIBIT D
PAGE 1 OF 2

CITY OF HATTIESBURG, MISSISSIPPI

Statement of Revenues, Expenditures, and Changes in Fund Balances
Governmental Funds
Year Ended September 30, 2017

	General Fund	Other Governmental Funds	Total Governmental Funds
REVENUES			
General property taxes	$ 14,752,256	$ 5,607,479	$ 20,359,735
Sales tax collections	22,408,645	-	22,408,645
Other taxes	34,769	-	34,769
Licenses and permits	4,035,805	-	4,035,805
Fines, forfeitures and penalties	1,182,893	118,758	1,301,651
Interest, rents and concessions	148,440	119,527	267,967
Intergovernmental	4,212,489	5,977,745	10,190,234
Charges for services	2,357,915	227,304	2,585,219
Other revenues	742,044	318,803	1,060,847
Total revenues	49,875,256	12,369,616	62,244,872
EXPENDITURES			
Current:			
General government	9,232,396	1,760,927	10,993,323
Public safety	21,273,366	1,889,935	23,163,301
Public services	14,200,838	3,779,259	17,980,097
Other services	1,499,740	690,072	2,189,812
Mass transit	-	1,487,305	1,487,305
Culture and recreation	-	4,113,007	4,113,007
Human/social assistance	209,880	714,185	924,065
Economic development	255,000	-	255,000
Capital outlay	96,618	-	96,618
Debt service:			
Principal payments	590,646	3,268,048	3,858,694
Interest and fiscal charges	590,613	855,639	1,446,252
Total expenditures	47,949,097	18,558,377	66,507,474
Excess (deficiency) of revenues over expenditures	1,926,159	(6,188,761)	(4,262,602)

The notes to the financial statements are an integral part of this statement.

EXHIBIT D
PAGE 2 OF 2

CITY OF HATTIESBURG, MISSISSIPPI

Statement of Revenues, Expenditures, and Changes in Fund Balances
Governmental Funds
Year Ended September 30, 2017

	General Fund	Other Governmental Funds	Total Governmental Funds
OTHER FINANCING SOURCES (USES)			
Proceeds from sale of capital asset	$ 2,362	$ -	$ 2,362
Compensation for loss of capital assets	1,454,243	-	1,454,243
Transfers in	401,299	3,671,591	4,072,890
Transfers out	(3,460,000)	(305,982)	(3,765,982)
Other sources	49,204	100,887	150,091
Total other financing sources (uses)	(1,552,892)	3,466,496	1,913,604
NET CHANGE IN FUND BALANCES	373,267	(2,722,265)	(2,348,998)
Fund balances – beginning	10,452,537	13,749,577	24,202,114
Fund balances – ending	$ 10,825,804	$ 11,027,312	$ 21,853,116

The notes to the financial statements are an integral part of this statement.

EXHIBIT D.1
PAGE 1 OF 2

CITY OF HATTIESBURG, MISSISSIPPI

Reconciliation of the Statement of Revenues, Expenditures, and Changes in Fund Balances of Governmental Funds to the Statement of Activities
Year Ended September 30, 2017

Net change in *fund balances* - governmental funds (Exhibit D)	$ (2,348,998)
The change in *net position* reported for governmental activities in the statement of activities is different because:	
Governmental funds report capital outlays as expenditures. However, in the statement of activities, the cost of those assets is allocated over their estimated useful lives and reported as depreciation expense. This is the amount by which depreciation expense ($8,218,289) exceeded capital outlay ($7,722,358) in the current period.	(495,931)
Intergovernmental revenues are recognized on the full-accrual basis in the statement of activities for revenues received thirty days after year end. This is the amount of effect of the change in revenue.	(113,759)
Fine revenue deferred in the funds for the modified accrual basis during the current year decreased because prior year recognition would have been required on the Statement of Activities using the full-accrual basis of accounting.	289,744
Proceeds from the sale of capital assets ($2,362) are reported in the governmental funds. However, in the statement of net position the net gain is recorded ($1,484).	(878)
Proceeds from issuance of long-term debt are reported in the governmental funds. However, in the statement of net position a long-term liability is recorded. Repayments of long-term debt are reported as expenses in the governmental funds but are recorded against the liability in the statement of net position. Thus, the change in net positions differs from the change in fund balances by the amount of the debt repayments.	3,858,694

The notes to the financial statements are an integral part of this statement.

EXHIBIT D.1
PAGE 2 OF 2

CITY OF HATTIESBURG, MISSISSIPPI

Reconciliation of the Statement of Revenues, Expenditures, and Changes in Fund Balances of Governmental Funds to the Statement of Activities
Year Ended September 30, 2017

Under the modified accrual basis of accounting used in governmental funds, expenditures are not recognized for transactions that are not normally paid with expendable available financial resources. In the statement of activities, however, which is presented on the accrual basis, expenses and liabilities are reported regardless of when financial resources are available. In addition, interest on long-term debt is not recognized under the modified accrual basis of accounting until due, rather than as it accrues. The following adjustments combine the net changes of the two balances:		
Accounts payable	$ 150,000	
Compensated absences	415,168	
Amortization of certificate of participation premium	13,157	
Amortization of bond premium	43,507	
Accrued interest on bonds and notes	112,350	
Combined adjustment		$ 734,182
Change related to pension deferred outflows and inflows and obligations		(3,381,546)
Change related to other post employment benefit obligations		(543,609)
Governmental funds report annual note repayment received ($195,856) as the installment receipt of the sale of real estate. In the statement of activities, only the portion of these payments attributable to interest is reported as interest revenue ($139,156).		(56,700)
Change in *net position* of governmental activities (Exhibit B)		$ (2,058,801)

The notes to the financial statements are an integral part of this statement.

EXHIBIT E
PAGE 1 OF 2

CITY OF HATTIESBURG, MISSISSIPPI

Statement of Net Position
Proprietary Fund
September 30, 2017

	Combined Water & Sewer System
CURRENT ASSETS	
Cash and cash equivalents - unrestricted	$ 9,667,411
Cash with fiscal agent	26,414,781
Accounts receivable - trade (net of allowance for doubtful accounts of $1,848,880)	1,297,757
Due from governmental funds	152,764
Other receivables	57,000
Total current assets	37,589,713
NONCURRENT ASSETS	
Capital assets	
Land	321,243
Construction in progress	1,851,863
Infrastructure, net	100,513,737
Buildings and improvements, net	177,486
Machinery and equipment, net	544,169
Total noncurrent assets	103,408,498
Total assets	140,998,211
DEFERRED OUTFLOW OF RESOURCES	
Related to pensions	466,687
Prepaid bond insurance	188,379
Total deferred outflows	655,066
CURRENT LIABILITIES	
Due to governmental funds	251,787
Sales tax payable	18,826
Accounts payable	804,147
Accrued wages and benefits	47,073
Accrued interest payable	534,456
Unamortized bond premium - current	45,384
Revenue bonds - current	2,830,000
General obligation bonds - current	2,111,000
General obligation note payable - current	96,001
Compensated absences - current	14,559
Total current liabilities	6,753,233

The notes to the financial statements are an integral part of this statement.

EXHIBIT E
PAGE 2 OF 2

CITY OF HATTIESBURG, MISSISSIPPI

Statement of Net Position
Proprietary Fund
September 30, 2017

	Combined Water & Sewer System
NON-CURRENT LIABILITIES	
Revenue bonds	$ 57,945,000
General obligation bonds	10,300,000
General obligation note payable	24,683
Unamortized bond premium	347,033
Compensated absences	82,498
Net pension obligation	4,603,894
Other post employment benefits obligation	151,572
Customer meter deposits payable from restricted assets	1,416,755
Total non-current liabilities	74,871,435
Total liabilities	81,624,668
DEFERRED INFLOWS OF RESOURCES	
Related to pensions	78,496
Deferred revenues	617,189
Total deferred inflows	695,685
NET POSITION	
Net investment in capital assets	29,709,397
Restricted for debt service	7,685,090
Unrestricted	21,938,437
Total net position	$ 59,332,924

The notes to the financial statements are an integral part of this statement.

EXHIBIT F

CITY OF HATTIESBURG, MISSISSIPPI

Statement of Revenues, Expenses, and Changes In Net Position
Proprietary Fund
Year Ended September 30, 2017

	Combined Water & Sewer System
OPERATING REVENUES	
Water charges	$ 10,219,321
Sewer charges	10,320,408
Sewer connections	24,530
Turn-on fees	50,560
Taps	133,469
Total operating revenues	20,748,288
OPERATING EXPENSES	
Personal services	2,925,767
Other services and charges	8,455,703
Supplies and expenses	946,462
Depreciation	3,666,108
Other operating expenses	379,330
Total operating expenses	16,373,370
OPERATING INCOME	4,374,918
NON-OPERATING REVENUES (EXPENSES)	
Interest revenue	99,295
Interest expense	(2,389,665)
Other revenues	200,116
Total non-operating revenues (expenses)	(2,090,254)
INCOME BEFORE TRANSFERS	2,284,664
Transfers out	(306,908)
CHANGE IN NET POSITION	1,977,756
NET POSITION - beginning	57,197,908
Prior period adjustments	157,260
NET POSITION - beginning, as adjusted	57,355,168
NET POSITION - ending	$ 59,332,924

The notes to the financial statements are an integral part of this statement.

EXHIBIT G
PAGE 1 OF 2

CITY OF HATTIESBURG, MISSISSIPPI

Statement of Cash Flows
Proprietary Fund
Year Ended September 30, 2017

	Combined Water & Sewer System
CASH FLOWS FROM OPERATING ACTIVITIES	
Receipts from customers	$ 21,691,020
Payments to suppliers and service providers	(9,970,009)
Payments to employees for salaries and benefits	(2,392,737)
Net cash provided by operating activities	9,328,274
CASH FLOWS FROM NONCAPITAL FINANCING ACTIVITIES	
Transfers from other funds	(306,908)
Net cash provided by noncapital financing activities	(306,908)
CASH FLOWS FROM CAPITAL AND RELATED FINANCING ACTIVITIES	
Proceeds from long-term debt issued	-
Principal payments - bonds and notes	(4,977,771)
Acquisition and construction of capital assets	(5,284,195)
Other receipts (payments)	200,116
Interest paid on capital debt	(2,622,595)
Net cash provided by capital and related financing activities	(12,684,445)
CASH FLOWS FROM INVESTING ACTIVITIES	
Interest Income	99,295
Net cash provided by investing activities	99,295
NET INCREASE IN CASH AND CASH EQUIVALENTS	(3,563,784)
CASH AND CASH EQUIVALENTS - Beginning	39,645,976
CASH AND CASH EQUIVALENTS - Ending	$ 36,082,192
Displayed on Exhibit E as:	
Cash and cash equivalents	$ 9,667,411
Cash with fiscal agent	26,414,781
	$ 36,082,192

The notes to the financial statements are an integral part of this statement.

EXHIBIT G
PAGE 2 OF 2

CITY OF HATTIESBURG, MISSISSIPPI

Statement of Cash Flows
Proprietary Fund
Year Ended September 30, 2017

	Combined Water & Sewer System
RECONCILIATION OF OPERATING INCOME TO NET CASH PROVIDED BY OPERATING ACTIVITIES:	
OPERATING INCOME	$ 4,374,918
ADJUSTMENTS TO RECONCILE OPERATING INCOME TO NET CASH PROVIDED BY OPERATING ACTIVITIES:	
Depreciation expense	3,666,108
Changes in assets and liabilities:	
(Increase) in accounts receivable - trade	738,399
(Increase) in other receivables	(57,000)
Decrease in prepaid insurance - bonds	41,781
(Increase) in deferred outflows related to pensions	402,113
(Decrease) in accounts payable	174,924
(Decrease) in other liabilities	(265,691)
(Decrease) in wages and benefits payable	4,846
Increase in customer meter deposits	89,404
Increase in sales tax payable	(13,029)
(Decrease) in due from/to other governmental funds	(139,528)
(Decrease) in compensated absences	225,682
Increase in net pension obligation	(214,722)
Increase in other post employment benefits	45,989
(Decrease) in deferred inflows related to pensions	69,122
Increase in deferred revenues	184,958
Total adjustments	4,953,356
NET CASH PROVIDED BY OPERATING ACTIVITIES	$ 9,328,274

The notes to the financial statements are an integral part of this statement.

EXHIBIT H

CITY OF HATTIESBURG, MISSISSIPPI

Statement of Fiduciary Assets and Liabilities
September 30, 2017

	Agency Funds
ASSETS	
Cash and cash equivalents	$ 2,145,457
Property taxes and fees receivable	431,268
Sales tax receivable	458,008
Total assets	$ 3,034,733
LIABILITIES	
Employee contributions payable	$ 1,544,446
Due to other agencies	978,234
Other liabilities	5,958
Amounts held in custody for others	506,095
Total liabilities	$ 3,034,733

The notes to the financial statements are an integral part of this statement.

NOTES TO THE FINANCIAL STATEMENTS

CITY OF HATTIESBURG, MISSISSIPPI

NOTES TO THE FINANCIAL STATEMENTS
YEAR ENDED SEPTEMBER 30, 2017

NOTE 1 - SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES

A. General Information

The City of Hattiesburg, Mississippi (the City) was incorporated in 1884 under the laws of the State of Mississippi and presently operates under a Mayor/Council form of government. It is the third largest municipality in the state with nearly 50,000 residents. The policy-making and legislative authority, as well as budgetary responsibilities, are vested with the City Council. The following services are provided by the City: Public safety (Police, Fire, and Code Enforcement), Public Works, Engineering, Solid Waste Collection, Water and Sewer, Culture and Recreation, Mass Transit, Federal Programs, Urban Development, and General Administrative Services.

The accounting and reporting framework and the more significant accounting policies and practices are discussed in subsequent sections of this Note. The remainder of the notes are organized to provide explanations, including required disclosures, of the City's financial activities.

B. Reporting Entity

The City is a charter city in which citizens elect the mayor at large and five council members by wards. The accompanying financial statements present the City's primary government and its component unit, an entity for which the government is considered to be financially accountable. The discretely presented component unit is reported in a separate column in the government-wide financial statements (see note below for description) to emphasize that it is legally separate from the primary government.

Discretely presented component unit - The Hattiesburg Convention Commission (the Commission) is composed of a seven member board whose members are appointed by the Hattiesburg City Council. The purpose of the Commission is to promote conventions and tourism. The Commission has authority over all matters relating to the establishment, development, construction, furnishing, and equipping of convention and tourism related facilities. The Commission is primarily funded by a 2% sales tax on local food, beverage, and alcoholic beverage package retailer permits. The Commission is presented as a governmental fund type. Pursuant to component unit criteria guidelines, the Commission is presented as a discretely presented component unit based upon the budgetary oversight provided by the City in conjunction with other related criteria including, but not limited to, the City's ability to make board appointments and the Commission's status as a legally separate entity.

A separate financial statement of the Commission can be obtained by contacting the Hattiesburg Convention Commission, 1 Convention Center Plaza, Hattiesburg, Mississippi 39401.

CITY OF HATTIESBURG, MISSISSIPPI

NOTES TO THE FINANCIAL STATEMENTS
PAGE TWO
YEAR ENDED SEPTEMBER 30, 2017

NOTE 1 - SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (Cont.)

C. Government-wide and Fund Financial Statements

The government-wide financial statements (i.e., the statement of net position and the statement of activities) report information on all of the nonfiduciary activities of the primary government and its component unit. Governmental activities, which normally are supported by taxes and intergovernmental revenues, are reported separately from business-type activities, which rely to a significant extent on fees and charges for support. Likewise, the primary government is reported separately from a certain legally separate component unit for which the primary government is financially accountable.

The statement of activities demonstrates the degree to which the direct expenses of a given function or segment are offset by program revenues. Direct expenses are those that are clearly identifiable with a specific function or segment. Program revenues include 1) charges to customers or applicants who purchase, use, or directly benefit from goods, services, or privileges provided by a given function or segment, and 2) grants and contributions that are restricted to meeting the operational or capital requirements of a particular function or segment. Taxes and other items not properly included among program revenues are reported instead as general revenues.

Separate financial statements are provided for governmental funds, proprietary funds, and fiduciary funds, even though the latter are excluded from the government-wide financial statements. The major individual governmental fund and the major individual enterprise fund are reported as separate columns in the fund financial statements. Internal activities, including interfund transfers and due to/due from balances attributable to governmental activities have been eliminated for government-wide financial statement presentation purposes.

D. Measurement Focus, Basis of Accounting, and Financial Statement Presentation

The government-wide financial statements are reported using the economic resources measurement focus and the accrual basis of accounting, as are the proprietary fund and fiduciary fund financial statements. Revenues are recorded when earned and expenses are recorded when a liability is incurred, regardless of the timing of related cash flows. Property taxes are recognized as revenues in the year for which they are levied based on historical trends of collections in relation to assessments. Grants and similar items are recognized as revenue as soon as all eligibility requirements imposed by the provider have been met.

CITY OF HATTIESBURG, MISSISSIPPI

NOTES TO THE FINANCIAL STATEMENTS
PAGE THREE
YEAR ENDED SEPTEMBER 30, 2017

NOTE 1 - SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (Cont.)

Governmental fund financial statements are reported using the current financial resources measurement focus and the modified accrual basis of accounting. Revenues are recognized as soon as they are both measurable and available. Revenues are considered to be available when they are collectible within the current period or soon enough thereafter to pay liabilities of the current period. For this purpose, the City considers revenues to be available if they are collected within 30 days of the end of the current fiscal period. Expenditures generally are recorded when a liability is incurred, as under accrual accounting. However, debt service expenditures, as well as expenditures related to compensated absences and claims and judgments, are recorded only when payment is due.

Property taxes, sales taxes, franchise taxes, licenses, and interest associated with the current fiscal period are all considered to be susceptible to accrual and so have been recognized as revenues of the current fiscal period. Only the portion of special assessments receivable due within the current fiscal period is considered to be susceptible to accrual as revenue of the current period. All other revenue items are considered to be measurable and available only when cash is received by the City.

The City reports the following major governmental fund:

General Fund - The General Fund is the City's primary operating fund. It accounts for all financial resources of the general government, except those required to be accounted for in another fund. Activities accounted for in the general fund include police and fire protection, public services, general government, sanitation, city courts, urban development, and other services.

The City reports the following major proprietary fund:

Combined Water and Sewer System Fund - The Combined Water and Sewer System Fund accounts for the activities of the water and sewer system. The City operates the sewage treatment plant, sewage pumping stations and collection systems, and the water distribution system.

Additionally, the City reports the following fund types:

Special Revenue Funds - These funds are used to account for and report the proceeds of specific revenue sources that are restricted or committed to expenditure for specified purposes other than debt service or capital projects.

CITY OF HATTIESBURG, MISSISSIPPI

NOTES TO THE FINANCIAL STATEMENTS
PAGE FOUR
YEAR ENDED SEPTEMBER 30, 2017

NOTE 1 - SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (Cont.)

Debt Service Funds - These funds are used to account for and report financial resources that are restricted, committed, or assigned to expenditures for principal and interest on long-term debt.

Capital Project Funds - These funds are used to account for and report financial resources that are restricted, committed, or assigned to expenditure for capital outlays, including the acquisition or construction of capital facilities and other capital assets.

Agency Funds - The City's agency funds account for employee payroll tax withholdings, initial tax deposits from the county tax collectors, initial special sales tax receipts, the Police and Firemen Disability and Relief Fund, and the Forrest County Industrial Park Commission Fund.

Private sector standards of accounting and financial reporting issued prior to December 1, 1989, generally are followed in both the government-wide and proprietary fund financial statements to the extent that those standards do not conflict with or contradict guidance of the Governmental Accounting Standards Board. Governments also have the *option* of following subsequent private-sector guidance for their business-type activities and enterprise funds, subject to this same limitation. The government has elected not to follow subsequent private-sector guidance.

As a general rule, the effect of interfund activity has been eliminated from the government-wide financial statements. Exceptions to this general rule are payments-in-lieu of taxes and other charges between the government's water and sewer function and various other functions of the government. Elimination of these charges would distort costs and program revenues reported for the various functions concerned.

Amounts reported as program revenues include 1) charges to customers or applicants for goods, services, or privileges provided, 2) operating grants and contributions, and 3) capital grants and contributions, including special assessments. Internally dedicated resources are reported as general revenues rather than program revenues. Likewise, general revenues include all taxes.

CITY OF HATTIESBURG, MISSISSIPPI

NOTES TO THE FINANCIAL STATEMENTS
PAGE FIVE
YEAR ENDED SEPTEMBER 30, 2017

NOTE 1 - SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (Cont.)

The proprietary fund distinguishes operating revenues and expenses from nonoperating items. Operating revenues and expenses generally result from providing services and producing and delivering goods in connection with a proprietary fund's principal ongoing operations. The principal operating revenues of the water and sewer system enterprise fund are charges to customers for sales and services. The water and sewer system also recognizes as operating revenue the portion of tap fees intended to recover the cost of connecting new customers to the system. Operating expenses for proprietary funds include the cost of sales and services, administrative expenses, and depreciation on capital assets. All revenues and expenses not meeting this definition are reported as nonoperating revenues and expenses.

When both restricted and unrestricted resources are available for use, it is the government's policy to use restricted resources first, then unrestricted resources as they are needed.

E. Assets, Liabilities, Deferred Outflows/Inflows of Resources, and Net Position/Fund Balance

Deposits and investments

The government's cash and cash equivalents are considered to be cash on hand, demand deposits, and short-term investments with original maturities of three months or less from the date of acquisition.

To maximize interest earnings, the City's cash resources are combined to form a cash pool. Excluded from this pool is the cash of the Water and Sewer Fund, the 1999 Tax Increment Financing Bond and Interest and Construction Funds, the Water and Sewer USA Yeast Bond and Interest and Construction Funds, the Community Development Block Grant Fund for Entitlement and HOME Entitlement, the 2001 Bond Construction Fund, the 1998 Infrastructure Fund, the Group Insurance Trust Fund, the Series 2006 Water and Sewer Bond Funds, and certain other legally restricted funds.

Investments for the City and its component unit are reported at fair value.

Receivables and payables

Activity between funds that is representative of lending/borrowing arrangements outstanding at the end of the fiscal year is referred to as either "due to/from other funds" (i.e., the current portion of interfund loans) or "advances to/from other funds" (i.e., the non-current portion of interfund loans). Any residual balances outstanding between the governmental activities and business-type activities are reported in the government-wide financial statements as "internal balances".

CITY OF HATTIESBURG, MISSISSIPPI

NOTES TO THE FINANCIAL STATEMENTS
PAGE SIX
YEAR ENDED SEPTEMBER 30, 2017

NOTE 1 - SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (Cont.)

All sales taxes, property taxes, and notes receivables are considered collectible; therefore no reduction has been made for an allowance for these receivables. Fees paid in lieu of ad valorem taxes pursuant to separate agreements are recognized when collected or when probability of receipt is reasonably certain. Fines receivable is reported net of allowance for uncollectible accounts in the amount of $17,915,651 at September 30, 2017. Credits against fines are applied for any jail time served, community service, or electronic monitoring. Since any such credits are not known until actual events occur, the amounts of those credits cannot be reasonably estimated before they are earned. Therefore, future credits to be applied against existing fines receivable are not estimated or reflected in the City's financial statements.

Customer accounts receivable in the enterprise fund are attributable to unpaid balances at year-end for charges for services and are netted with an allowance for doubtful accounts. The City estimates the allowance for doubtful water and sewer account balances based upon a review of outstanding balances and status of customer accounts and upon consideration of historical collection trends and other factors.

Property taxes are levied annually for the upcoming fiscal year beginning October 1st on property values assessed as of the previous January 1st. Such levy, which establishes a lien against the underlying property, is made by the City Council in September before the beginning of the fiscal year. Property taxes are recognized in the year for which they are levied. Property tax statements on real property are typically mailed in December each year, with the taxes due annually on February 1st. All taxes are collected and remitted to the City on a monthly basis by Forrest and Lamar County governments. Delinquent tax payments, received throughout the year, are recognized as revenue in the year received. Property with delinquent taxes as of August is subject to sale for collection of such taxes. Property taxes on vehicles are assessed annually and become due throughout the year based upon the month of acquisition.

Inventories and prepaid items

All inventories are valued at the lower of cost using the first-in/first-out (FIFO) method or market. Inventories of governmental funds are recorded as expenditures when consumed rather than when purchased.

Certain payments to vendors reflect costs applicable to future accounting periods and are recorded as prepaid items in both government-wide and fund financial statements.

CITY OF HATTIESBURG, MISSISSIPPI

NOTES TO THE FINANCIAL STATEMENTS
PAGE SEVEN
YEAR ENDED SEPTEMBER 30, 2017

NOTE 1 - SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (Cont.)

Capital assets

Capital assets, which include property, plant, equipment, and infrastructure assets (e.g., roads, bridges, street lights, sewer and water lines, and similar items), are reported in the applicable governmental or business-type activities columns in the government-wide financial statements. Capital assets are defined by the government as assets with an initial, individual cost of more than $5,000 and an estimated useful life in excess of two years. Such assets are recorded at historical cost or estimated historical cost if purchased or constructed. Donated capital assets are recorded at estimated fair market value at the date of donation.

The costs of normal maintenance and repairs that do not add to the value of the asset or materially extend assets lives are not capitalized.

Major outlays for capital assets and improvements are capitalized as projects are constructed. Interest incurred during the construction phase of capital assets of business-type activities is included as part of the capitalized value of the assets constructed.

Property, plant, equipment, and infrastructure of the primary government, as well as the component unit, is depreciated using the straight line method over the following estimated useful lives:

Buildings and improvements	20 – 50 years
Infrastructure	18 – 50 years
Machinery and equipment	5 – 10 years

Net pension liability

For purposes of measuring the net pension liability and deferred outflows/inflows of resources related to pensions, and pension expense, information about the fiduciary net position of the City's pension plans and additions to/deductions from the plan's net position have been determined on the same basis as they are reported by Public Employees' Retirement System of Mississippi. For this purpose, benefit payments (including refunds of employee contributions) are recognized when due and payable in accordance with the benefit terms. Member contributions are recognized in the period in which they are earned. Investments are reported at fair value.

CITY OF HATTIESBURG, MISSISSIPPI

NOTES TO THE FINANCIAL STATEMENTS
PAGE EIGHT
YEAR ENDED SEPTEMBER 30, 2017

NOTE 1 - SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (Cont.)

Deferred outflows/inflows of resources

Deferred outflows of resources are a separate financial statement element that represents a consumption of net position that applies to a future period and so will not be recognized as an outflow of resources (expense/expenditure) until then. The City reports prepaid insurance on the Water & Sewer Revenue Bonds in the government-wide and the proprietary statements of net position as a deferred outflow of resources. Bond insurance paid from debt proceeds as a credit enhancement feature with the bonds is deferred and amortized over the life of the bonds. In addition, deferred outflows include amounts related to pensions, including contributions to the employee pension plans subsequent to the measurement date of the actuarial valuations for the plans.

Deferred inflows of resources are a separate financial statement element that represents an acquisition of net position or fund balance that applies to a future period and so will not be recognized as an inflow of resources (revenue) until that time. The governmental funds report unavailable revenues from special assessments, and these amounts are deferred and recognized as an inflow of resources in the period that the amounts become available. Both the government-wide statements and governmental funds report property taxes levied for the subsequent year, which are deferred and recognized as an inflow of resources in the period for which they are levied. The government-wide statements also reflect pension related items resulting from the difference between estimated and actual return on pension plan investments, which are being amortized over a five year period using the straight-line method.

Compensated absences

It is the City's policy to permit employees to accumulate earned but unused vacation, sick pay, overtime, and holiday pay benefits. There is no liability for unpaid accumulated sick leave since the City does not have a policy to pay any amounts when employees separate from service with the government. All vacation, overtime, and holiday pay is accrued when incurred in the government-wide financial statements and in the proprietary fund financial statements. A liability for these amounts is reported in governmental funds only if they are expected to be paid from current resources, for example, as a result of employee resignations and retirements, based on management's estimates.

CITY OF HATTIESBURG, MISSISSIPPI

NOTES TO THE FINANCIAL STATEMENTS
PAGE NINE
YEAR ENDED SEPTEMBER 30, 2017

NOTE 1 - SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (Cont.)

Long-term obligations

In the government-wide financial statements and the proprietary fund financial statements, long-term debt and other long-term obligations are reported as liabilities in the applicable governmental activities, business-type activities, or proprietary fund statement of net position. Bond discounts and premiums are amortized over the life of the related bonds. Bond issuance costs, other than prepaid insurance costs, are recognized as expenses in the period incurred. Prepaid insurance costs are reported as an asset and are recognized as expenses over the duration of the related debt.

Governmental fund types recognize bond issuance costs during the current period. The face amount of debt is reported as other financing sources, and bond discount is recorded as another financing use. Issuance costs, whether or not withheld from the actual debt proceeds received, are reported as other services in expenditures.

Net position

The government-wide statement of net position presents financial information on all of the City's assets, liabilities, and deferred inflows/outflows of resources, with the difference reported as net position. Net position invested in capital assets, net of related debt, consists of capital assets, net of accumulated depreciation, reduced by the outstanding balances of any borrowing used for the acquisition, construction or improvements of those assets, and adding back any unspent proceeds. Net position is reported as restricted when there are limitations imposed on their use either through enabling creditors, grantors, or laws or regulations of other governments.

Fund balance policies

The City provides fund balance categories to report the nature and extent of the constraints placed on the government's fund balances. The following classifications describe the relative strength of the spending constraints placed on the purposes for which resources can be used:

- *Nonspendable fund balance* – amounts that are not in spendable form, such as inventories and prepaid items, or are legally or contractually required to remain intact.
- *Restricted fund balance* – amounts constrained to specific purposes by their providers (such as grantors, bondholders, and higher levels of government) through constitutional provisions, or by enabling legislation.

CITY OF HATTIESBURG, MISSISSIPPI

NOTES TO THE FINANCIAL STATEMENTS
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YEAR ENDED SEPTEMBER 30, 2017

NOTE 1 - SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (Cont.)

- *Committed fund balance* – amounts that can only be used for specific purposes pursuant to constraints imposed by formal action of the City Council, the government's highest level of decision-making authority.
- *Assigned fund balance* – amounts a government intends to use for a specific purpose; intent can be expressed by the governing body or official to which the governing body has delegated the authority to assign amounts to be used for specific purposes.
- *Unassigned fund balance* – residual amounts that are available for any purpose; positive amounts are reported only in the general fund.

The City Council, the City's highest level of decision-making authority, establishes, modifies, or rescinds fund balance commitments by passage of resolutions that also establish the City's spending policy, which prescribes that restricted fund balance amounts are to be spent first, followed by committed, assigned, and lastly, unassigned fund balances.

The City does not have a formal minimum fund balance policy but transfers resources among funds as necessary to address any deficiencies at the fund level.

F. Budgets and Budgetary Accounting

The City's procedures for establishing its budget and for reporting budgetary data reflected in the financial statements are as follows:

1. In August, the City's Chief Financial Officer submits to the City Council a proposed operating budget for the fiscal year commencing the following October 1. The operating budget includes proposed expenditures and the means of financing them.

2. Prior to September 15, the budget is legally enacted through the passage of an ordinance by the City Council. The budget may be subsequently amended by action of the City Council.

3. The City's Chief Financial Officer is authorized to transfer budgeted amounts within departments within the published expenditure categories; however, any revisions that alter the total expenditures of any fund must be approved by the City Council.

4. All funds, with the exception of Agency Funds, are budgeted, including the General Fund, Special Revenue Funds, Debt Service Funds, Capital Projects Funds, and Proprietary Funds. These budgets are prepared on a cash basis, modified for encumbrances for goods and services which have been received.

CITY OF HATTIESBURG, MISSISSIPPI

NOTES TO THE FINANCIAL STATEMENTS
PAGE ELEVEN
YEAR ENDED SEPTEMBER 30, 2017

NOTE 1 - SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (Cont.)

Each fund's appropriated budget is prepared on a detailed line item basis. Revenues are budgeted by source. Pursuant to the Mississippi State Department of Audit's prescribed format, expenditures are budgeted by department and class as follows: personal services, supplies, other services and charges, capital outlays, transfers, and debt service. This constitutes the legal level of control. Expenditures may not exceed appropriations at this level. All budget revisions at this level are subject to final approval of the City Council. Cumulative increases to departmental expenditures in excess of 10% must also be published in the local newspaper.

Encumbrances arise from the issuance of purchase orders, which must be within the adopted budgetary limits. Encumbrances are recorded when purchase orders are issued but are not considered expenditures until liabilities for payments are incurred upon receipt of goods or services. Encumbrances do not lapse at the close of the fiscal year but are carried forward. If necessary, subsequent year budgets are amended to cover prior year encumbrances.

G. Use of Estimates

The preparation of financial statements in conformity with accounting principles generally accepted in the United States of America requires management to make estimates and assumptions. This affects the reported amounts of assets and liabilities, disclosure of contingent assets and liabilities at the date of the financial statements, and the reported amounts of revenues and expenditures/expenses during the reporting period. Actual results could differ from these estimates. Significant estimates which could change in the near-term include collectible portions of receivables from property taxes levied but not yet due, the allowance for doubtful Water and Sewer customer accounts receivable, the net collectible amounts of Municipal Court fines receivable, claims liabilities for the employee health insurance plan, useful lives of capital assets, and liabilities for pension and other post-employment benefits. In addition, long-term and current portions of compensated absences are based on estimates and assumptions relating to when earned compensated absences will be paid. Actual results may differ from those estimates.

H. Changes in Accounting Standards

The City implemented the following standards issued by the Governmental Accounting Standards Board (GASB) in the current fiscal year as required: GASB Statement No. 77, *Tax Abatement Disclosures* and GASB Statement No. 82, *Pension Issues – an amendment of GASB Statements No. 67, No. 68, and No. 73*. The provisions of these standards have been incorporated into the financial statements and notes.

CITY OF HATTIESBURG, MISSISSIPPI

NOTES TO FINANCIAL STATEMENTS
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YEAR ENDED SEPTEMBER 30, 2017

NOTE 2 - PRIOR PERIOD ADJUSTMENTS

A summary of prior period adjustments reflected on the City's financial statements is presented below:

Explanation	Amount
Exhibit B (Governmental Activities)	
Correction of Error:	
To adjust compensated absences balance	$ (1,306,603)
Exhibit B (Business-Type Activities) and Exhibit F	
Correction of Error:	
To adjust other liablities balance from prior years	$ 265,691
To adjust compensated absences balance	(108,431)
	$ 157,260

NOTE 3 - DEPOSITS

Deposits - The collateral for public entities' deposits in financial institutions is held in the name of the State Treasurer under a program established by the Mississippi State Legislature and is governed by Section 27-105-5, Miss. Code Ann. (1972). Under this program, the entity's funds are protected through a collateral pool administered by the State Treasurer. Financial institutions holding deposits of public funds must pledge securities as collateral against those deposits. In the event of failure of a financial institution, securities pledged by that institution would be liquidated by the State Treasurer to replace the public deposits not covered by the Federal Depository Insurance Corporation (FDIC).

The carrying amount of the City's deposits with financial institutions reported in the government-wide statements was $26,891,601 (exclusive of cash with fiscal agents disclosed below). The bank balance was $27,439,541. The City's long standing, although not formally adopted, investment policy is based upon all bank accounts being fully collateralized (using the procedures described above) and interest-bearing with rates updated on a quarterly basis and benchmarked using verifiable appropriate federal funds rates. Interest is calculated using average balances and recorded monthly.

CITY OF HATTIESBURG, MISSISSIPPI

NOTES TO FINANCIAL STATEMENTS
PAGE THIRTEEN
YEAR ENDED SEPTEMBER 30, 2017

NOTE 3 - DEPOSITS (Cont.)

Custodial credit risk - deposits - Custodial credit risk is defined as the risk that, in the event of a financial institutions failure, the government's deposits may not be returned to it. The City does not have a deposit policy for custodial credit risk. As of September 30, 2017, the City's bank balance was not exposed to custodial credit risk because deposits are covered by the State Treasurer collateral pool.

Cash with fiscal agents - The carrying amount of the City's cash with fiscal agents held by financial institutions was $27,704,679.

Interest rate risk - The City does not have a formal investment policy that limits investment maturities as a means of managing its exposure to fair value losses arising from increasing interest rates.

NOTE 4 - NOTES RECEIVABLE

In 2010, the City Council authorized a purchase of property located at 510 West Pine Street for the Sacred Heart Catholic Parish. Pursuant to the terms of this agreement, the City financed the purchase price of $2,500,000 through the issuance of the City's General Obligation Pool Loan Refunding Bonds, Series 2010, to be repaid over 20 years with the final bonds maturing July 1, 2030. The Diocese of Biloxi executed a $2,500,000 promissory note requiring annual payments not to exceed $219,000 at an interest rate not to exceed 5.5% to coincide with the scheduled principal, interest and servicing fees attributable to the City's Series 2010 bonds. At September 30, 2017, the balance of this note receivable was $1,915,000.

In 2012, the City Council authorized a loan agreement and promissory note for $2,000,000 to be repaid over 20 years, at a rate of 2% in monthly installments of $10,118, commencing February 1, 2013 and continuing until February 1, 2033. This arrangement was executed pursuant to Katrina Supplemental CDBG Program grant agreements that resulted in loan funding for site acquisition for two historic downtown buildings, with monthly repayments required from the City to the Mississippi Development Authority (MDA). Under the terms of the loan agreement, HCL Leverage Lender, LLC will remit the above-noted monthly payments to the City, and after the receipt of these payments, the City will in turn remit the resulting payments to MDA. At September 30, 2017, the balance of this note receivable was $1,594,683.

CITY OF HATTIESBURG, MISSISSIPPI

NOTES TO FINANCIAL STATEMENTS
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YEAR ENDED SEPTEMBER 30, 2017

NOTE 5 - CAPITAL ASSETS

Capital asset activity for the year ended September 30, 2017, was as follows:

	Primary Government			
	Beginning Balance	**Additions**	**Retirements**	**Ending Balance**
Governmental Activities:				
Capital assets not being depreciated:				
Land	$ 29,854,169	$ 80,000	$ -	$ 29,934,169
Construction in progress	11,207,129	6,915,512	(16,501,645)	1,620,996
Total capital assets not being depreciated	41,061,298	6,995,512	(16,501,645)	31,555,165
Capital assets being depreciated:				
Buildings and improvements	48,667,616	13,523,857	-	62,191,473
Machinery and equipment	35,335,377	726,846	(101,974)	35,960,249
Infrastructure	147,870,899	2,977,788	-	150,848,687
Total capital assets being depreciated	231,873,892	17,228,491	(101,974)	249,000,409
Less accumulated depreciation for:				
Buildings and improvements	25,267,199	1,776,366	-	27,043,565
Machinery and equipment	28,675,395	1,908,174	(98,879)	30,484,690
Infrastructure	82,218,098	4,533,749	-	86,751,847
Total accumulated depreciated	136,160,692	8,218,289	(98,879)	144,280,102
Total capital assets being depreciated, net	95,713,200	9,010,202	(3,095)	104,720,307
Governmental activities capital assets, net	$ 136,774,498	$ 16,005,714	$ (16,504,740)	$ 136,275,472

CITY OF HATTIESBURG, MISSISSIPPI

NOTES TO FINANCIAL STATEMENTS
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YEAR ENDED SEPTEMBER 30, 2017

NOTE 5 - CAPITAL ASSETS (Cont.)

	Primary Government			
	Beginning Balance	**Additions**	**Retirements**	**Ending Balance**
Business-type Activities:				
Capital assets not being depreciated:				
Land	$ 315,243	$ 6,000	$ -	$ 321,243
Construction in progress	5,262,259	5,232,124	(8,642,520)	1,851,863
Total capital assets not being depreciated	5,577,502	5,238,124	(8,642,520)	2,173,106
Capital assets being depreciated:				
Buildings and improvements	321,108	156,963	-	478,071
Machinery and equipment	9,023,210	42,200	-	9,065,410
Infrastructure	122,743,366	8,489,427	-	131,232,793
Total capital assets being depreciated	132,087,684	8,688,590	-	140,776,274
Less accumulated depreciation for:				
Buildings and improvements	298,325	2,260	-	300,585
Machinery and equipment	8,304,845	216,396	-	8,521,241
Infrastructure	27,271,604	3,447,452	-	30,719,056
Total accumulated depreciation	35,874,774	3,666,108	-	39,540,882
Total capital assets being depreciated, net	96,212,910	5,022,482	-	101,235,392
Business-type activities capital assets, net	$ 101,790,412	$ 10,260,606	$ (8,642,520)	$ 103,408,498

CITY OF HATTIESBURG, MISSISSIPPI

NOTES TO FINANCIAL STATEMENTS
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YEAR ENDED SEPTEMBER 30, 2017

NOTE 5 - CAPITAL ASSETS (Cont.)

Depreciation expense was charged to the functions/programs of the governmental activities of the City as follows:

Governmental Activities:	
General government	$ 235,748
Public safety	933,047
Public works – which includes the depreciation of infrastructure assets	5,323,388
Health and welfare	23,408
Other services	469,890
Culture and recreation	564,576
Mass transit	668,232
Total depreciation expense - governmental activities	$ 8,218,289

NOTE 6 - INTERFUND RECEIVABLES, PAYABLES, AND TRANSFERS

Balances due to/from various City funds at September 30, 2017, consist of the following:

Receivable Fund	Payable Fund	Amount
General fund	Nonmajor governmental funds	$ 567,199
General fund	Combined water and sewer system	243,287
Nonmajor governmental funds	Combined water and sewer system	8,500
Nonmajor governmental funds	General fund	91,759
Nonmajor governmental funds	Nonmajor governmental funds	10,128
Combined water and sewer system	General fund	152,764
Total		$ 1,073,637

The outstanding balances between funds result mainly from the time lag between the dates that goods and services are provided or reimbursable expenditures occur and satisfaction of those amounts. These balances are expected to be collected within one year.

CITY OF HATTIESBURG, MISSISSIPPI

NOTES TO FINANCIAL STATEMENTS
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YEAR ENDED SEPTEMBER 30, 2017

NOTE 6 - INTERFUND RECEIVABLES, PAYABLES, AND TRANSFERS (Cont.)

Advances to/from other funds for governmental funds at September 30, 2017, consist of the following:

Receivable Fund	Payable Fund	Amount
General fund	Nonmajor governmental fund	$ 300,000

The amount payable to the General Fund is attributable to working capital loans made to the Community Development Block Grant Fund. None of the balance shown is scheduled to be collected in the subsequent year.

The composition of interfund transfers for the year ended September 30, 2017, is as follows:

	Transfers In:		
Transfers out:	General Fund	Nonmajor Governmental Funds	Total
General fund	$ -	$ 3,460,000	$ 3,460,000
Nonmajor governmental funds	94,391	211,591	305,982
Combined water and sewer system	306,908	-	306,908
Total	$ 401,299	$ 3,671,591	$ 4,072,890

Interfund transfers are authorized components of the budget and are typically used to (1) move revenues from the fund that statute or budget requires to collect them to the fund that statute or budget requires to expend them, (2) move receipts restricted to debt service from the fund collecting the receipts to the debt service fund as debt service payments become due, and (3) use unrestricted revenues collected in the general fund to finance various programs accounted for in other funds in accordance with budgetary authorizations.

CITY OF HATTIESBURG, MISSISSIPPI

NOTES TO FINANCIAL STATEMENTS
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YEAR ENDED SEPTEMBER 30, 2017

NOTE 7 - AD VALOREM TAXES LEVIED FOR OTHER GOVERNMENTAL ENTITIES

Section 35-57-1 et seq., Mississippi Code 1972, requires that the City levy and collect all taxes for and on behalf of the municipal separate school district. Section 39-3-7, Mississippi Code 1972, authorizes the City to levy and collect a tax not in excess of three mills for the support of any public library system located within the municipality.

For the reported fiscal year, the following ad valorem tax levies were made in accordance with the applicable statutory requirements and authorizations:

Entity/Purpose of Levy	Applicable State Law	Mills Levied
School District:		
Operational Support	37-57-105	57.69
School Bonded Indebtedness	37-59-23	7.37
Library (support, upkeep and maintenance of Hattiesburg Public Library System)	39-3-7	1.95

NOTE 8 - CLAIMS AND JUDGMENTS

The City provides employee health and accident coverage through a self-insurance program that utilizes a plan administrator as its claims-servicing organization, with the City retaining the risk of loss on all claims to which the City is exposed. Premium payments into the plan are established as a part of the City's budgetary process and upon consideration of actuarial recommendations are provided by the plan administrator. The City has opted to set premium rates for individual and family coverage at somewhat lower levels than those recommended. Therefore, additional costs not expected to be covered by premiums are separately budgeted in individual funds in which related payroll costs are incurred. When necessary based upon the claims paid during the fiscal year, the City makes supplemental transfers from payroll budgets of various funds into separate self-insurance fund accounts, which are included in the general fund for financial reporting purposes for fiscal year 2017.

To limit its exposure to risk under this self-insured program, the City maintains reinsurance which provides two separate stop loss coverages: specific and aggregate. These coverages are provided by an outside commercial carrier. For fiscal year 2017, the specific coverage begins when an individual participant's claim exceeds $100,000, with unlimited maximum benefit per covered person. The aggregate policy covers all submitted claims in excess of the minimum aggregate deductible, which is the greater of $4,226,552 or 95% or the annualized first monthly aggregate deductible. Maximum covered expenses of $100,000 per covered person accumulate toward the unlimited maximum aggregate benefit.

CITY OF HATTIESBURG, MISSISSIPPI

NOTES TO FINANCIAL STATEMENTS
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YEAR ENDED SEPTEMBER 30, 2017

NOTE 8 - CLAIMS AND JUDGMENTS (Cont.)

Claims expenses and liabilities are reported when it is probable that a loss has occurred and the amount of that loss can be reasonably estimated. Liabilities include an amount for claims that have been incurred but not reported (IBNRs). The following table provides changes in the balances of claims liabilities for fiscal year 2017:

Unpaid claims, beginning of fiscal year	$ 338,721
Plus: Incurred claims (including IBNRs)	4,579,322
Less: Claims payments	(4,573,286)
Unpaid claims, end of fiscal year	$ 344,757

Cash on deposit in the Group Insurance Fund at September 30, 2017 was $235,190. Based on the above projection of net unpaid claims in excess of cash on deposit, interfund receivables were established from the respective operating funds at September 30, 2017.

NOTE 9 - LEASE OBLIGATIONS

The City has entered into various lease agreements as lessee for financing equipment purchases and for a major energy improvement project for various City facilities. The assets under capital lease have useful lives ranging from 7 to 10 years for machinery and equipment and from 10 to 15 years for buildings and improvements and are being depreciated based on those useful lives.

For fiscal year 2017, the assets recorded under capital leases and included in capital assets in the accompanying statement of net position are as follows:

Governmental Activities:

Machinery and equipment	$ 3,856,259
Buildings and improvements	7,726,727
Less accumulated depreciation	(1,953,597)
Net book value	$ 9,629,389
Current year depreciation expense	$ 556,666

NOTE 9 - LEASE OBLIGATIONS (Cont.)

These leases qualify as capital leases for accounting purposes and therefore, have been recorded at the present value of future minimum lease payments as of the inception date. The future minimum lease obligations and the net present value of minimum lease payments as of September 30, 2017 are as follows:

Year Ending September 30,	Governmental Activities
2018	$ 1,360,098
2019	980,957
2020	732,406
2021	568,822
2022	585,887
2023-2027	3,107,476
2028-2032	3,447,342
Total minimum lease payments	10,782,988
Less: amount representing interest	(1,729,400)
Present value of minimum lease payments	$ 9,053,588

NOTE 10 - LONG-TERM LIABILITIES

General Obligation Bonds and Notes

The City issues general obligation bonds and notes to provide funds for the acquisition and construction of major capital facilities. General obligation bonds and notes are direct obligations and pledge the full faith and credit of the City and have been issued for both governmental and business-type activities. Notes are generally issued with a five-year maturity. The City has no special assessment bonds or anticipation notes at September 30, 2017. Bonds are generally issued as serial bonds with essentially level principal and interest payments maturing each year with maturities that range from 5 to 20 years. General obligation notes and bonds outstanding at September 30, 2017 are as follows:

(See Table on Next Page)

CITY OF HATTIESBURG, MISSISSIPPI

NOTES TO FINANCIAL STATEMENTS
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YEAR ENDED SEPTEMBER 30, 2017

NOTE 10 - LONG-TERM LIABILITIES (Cont.)

General Obligation Bonds

Governmental Activities:	Sale Date	Original Borrowing	Interest Rates to Maturity	Final Maturity	Outstanding 9/30/17
Public Improvements	2007	$ 6,025,000	4.00%	2018	$ 710,000
Public Improvements	2010	2,560,000	6.00%	2030	1,915,000
Public Improvements	2015	5,400,000	3.50 - 5.00%	2022	4,540,000
Total					$ 7,165,000
Business-type Activities:					
Public Improvements	2010	$ 7,500,000	2.75 - 3.80%	2030	$ 2,680,000
Public Improvements	2015	4,605,000	2.00 - 3.00%	2024	3,990,000
Public Improvements	2016	7,125,000	1.60%	2021	5,741,000
Total					$ 12,411,000

Economic Development Limited Obligation Bonds and Notes

The City also has issued limited obligation debt for economic development purposes that is repaid from revenues pledged under the terms of the respective contractual agreements made pursuant to the authorization for these projects by the governing authorities. Thus, future revenues are pledged in the amount of future debt service requirements. These limited obligation bonds and notes are generally issued with essentially level annual principal and interest payments with maturities that range from 10 to 20 years. Limited obligation bonds and notes outstanding at September 30, 2017 are as follows:

Economic Development Limited Obligation Bonds and Notes

Governmental Activities:	Sale Date	Original Borrowing	Interest Rates to Maturity	Final Maturity	Outstanding 9/30/17
MDB Limited Obligation Bonds (Church)	2009	$ 2,937,000	2.90 - 6.00%*	2030	$ 225,352
Hub City Lofts	2012	2,000,000	2.00%	2033	1,602,130
Total					$ 1,827,482

**Variable rate for MDB debt is adjusted weekly using the SIFMA Muni-Index plus 1.2%.*

CITY OF HATTIESBURG, MISSISSIPPI

NOTES TO FINANCIAL STATEMENTS
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YEAR ENDED SEPTEMBER 30, 2017

NOTE 10 - LONG-TERM LIABILITIES (Cont.)

Limited Obligation Tax Increment Financing Bonds

Tax increment financing (TIF) bonds are issued by the City to provide funds for the acquisition and construction of infrastructure and related improvements in conjunction with commercial development projects. Bonds are generally issued as serial bonds with essentially level principal and interest payments with maturities that range from 10 to 20 years. These bonds are secured by the payment of the incremental increase in City property taxes from each project's TIF taxing district as authorized under the TIF plan document approved by the governing authorities. These bonds may also be secured by county participation as authorized by executed interlocal agreements pledging incremental increase in county property taxes in the TIF taxing district. Limited obligation TIF bonds outstanding at September 30, 2017 are as follows:

Limited Obligation TIF Bonds

Governmental Activities:	Sale Date	Original Borrowing	Interest Rates to Maturity	Final Maturity	Outstanding 9/30/17
Chauvet Square	2003	$ 1,100,000	4.50 - 5.35%	2023	$ 480,000
Chauvet Square	2007	1,400,000	4.50%	2027	1,030,000
Turtle Crossing	2007	4,100,000	4.35%	2021	1,470,000
Lincoln Center	2008	610,000	4.00%	2023	290,000
Turtle Creek Crossing	2011	400,000	5.68%	2025	220,000
Kohls	2012	715,000	5.00%	2021	320,000
Southern Pointe	2014	2,600,000	4.85%	2029	2,215,000
Hattiesburg Clinic - Midtown Project	2015	845,000	4.00%	2031	803,000
Ridge at Turtle Creek	2015	1,225,000	5.50%	2031	1,165,000
Midtown Market	2015	210,000	5.50%	2031	200,000
Whispering Pines	2016	3,021,000	4.00 - 4.75%	2031	2,868,000
Total					$ 11,061,000

Certificates of Participation

In accordance with Section 31-8-1, et seq. Miss. Code Ann. (1972), the City issued Certificates of Participation and transferred the proceeds to the Southern Mississippi Investment Company, Inc. (Corporation). The funds were used to construct a City Public Safety Complex, including renovations of an existing building to be used as a multi-purpose building and a Parks and Recreation administration building.

CITY OF HATTIESBURG, MISSISSIPPI

NOTES TO FINANCIAL STATEMENTS
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YEAR ENDED SEPTEMBER 30, 2017

NOTE 10 - LONG-TERM LIABILITIES (Cont.)

At completion, the Corporation entered into a 20 year agreement with the City, with the City being obligated to make payments to the Corporation equal to the principal and interest payments on the debt. When the debt is paid, the City will assume ownership of the facilities. The obligation is not a general obligation and does not constitute a pledge of full faith and credit of the City. There is an unamortized premium of $263,142 which is not included in the principal in the following schedule:

Certificates of Participation

Governmental Activities:	Sale Date	Original Borrowing	Interest Rates to Maturity	Final Maturity	Outstanding 9/30/17
Certificates of Participation	2016	$ 5,300,000	3.00 - 5.00%	2035	$ 5,300,000

Business-type Activities (Water and Sewer) Revenue Bonds

In addition to water and sewer general obligation bonds, the City also issues water and sewer revenue bonds to provide funds for the acquisition and construction of water and sewer system infrastructure and related improvements and system rehabilitation. These bonds are secured by water and sewer operating revenues and are subject to the requirements of the respective revenue bond documents. These bond documents include important parity debt requirements with the issuance of each new series of revenue bonds and require annual net revenue tests to be performed in accordance with the prescribed calculations.

Bonds are generally issued as serial bonds with essentially level principal and interest payments maturing each year with maturities that range from 15 to 25 years. Revenue bonds outstanding at September 30, 2017 are as follows:

Revenue Bonds

Business-type Activities:	Sale Date	Original Borrowing	Interest Rates to Maturity	Final Maturity	Outstanding 9/30/17
W&S Revenue Project, Series 2012	2012	$ 12,500,000	2.50 - 5.00%	2032	$ 10,095,000
W&S Refunding Bonds, Series 2014	2014	28,000,000	3.00 - 5.00%	2039	27,850,000
W&S Refunding Bonds, Series 2016	2016	25,000,000	3.03%	2026	22,830,000
Total					$ 60,775,000

CITY OF HATTIESBURG, MISSISSIPPI

NOTES TO FINANCIAL STATEMENTS
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YEAR ENDED SEPTEMBER 30, 2017

NOTE 10 - LONG-TERM LIABILITIES (Cont.)

Business-type Activities (Water and Sewer) State Revolving Loan Fund (SRF) Notes

In addition to water and sewer revenue bonds, the City has utilized financing available under the State of Mississippi Revolving Loan Fund (SRF) program to provide funds for qualified sewer projects. Monthly principal and interest payments for the repayment of these notes is deducted from the City's monthly sales tax diversion payments from the Mississippi Department of Revenue, with monthly reimbursements to the City's general fund being made from monthly operating sewer system revenues as authorized by the City's budget document. The SRF notes outstanding at September 30, 2017 are as follows:

State Revolving Loan Funds

Business-type Activities:	Sale Date	Original Borrowing	Interest Rates to Maturity	Final Maturity	Outstanding 9/30/2017
SRF #3	1999	$ 1,293,195	4.50%	2019	$ 120,683

Compensated Absences

Vested or accumulated vacation leave, holiday leave, and accrued overtime that is expected to be liquidated with expendable available financial resources is reported as an expenditure and a fund liability of the governmental fund that will pay it. Amounts of vested or accumulated vacation leave, holiday leave, and accrued overtime that are not expected to be liquidated with expendable available financial resources are reported as noncurrent liabilities. In accordance with the provisions of ASC 710-10-20, *Compensation*, no liability is recorded for nonvesting accumulating rights to receive sick pay benefits. Compensated absences at September 30, 2017 are as follows:

	Governmental Activities	Business-Type Activities	Primary Government
Accrued vacation pay	$ 1,280,950	$ 96,403	$ 1,377,353
Accrued overtime pay	13,905	654	14,559
Accrued holiday pay	67,716	-	67,716
Total	$ 1,362,571	$ 97,057	$ 1,459,628

CITY OF HATTIESBURG, MISSISSIPPI

NOTES TO FINANCIAL STATEMENTS
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YEAR ENDED SEPTEMBER 30, 2017

NOTE 10 - LONG-TERM LIABILITIES (Cont.)

Changes in Long-Term Liabilities

Changes in the City's long-term liabilities for the year ended September 30, 2017 are as follows:

Governmental Activities:	**Balance September 30, 2016**	**Additions**	**Reductions**	**Adjustments**	**Balance September 30, 2017**	**Due Within One Year**
Bonds and notes payable						
General obligation bonds and notes	$ 8,810,000	$ -	$ (1,645,000)	$ -	$ 7,165,000	$ 1,700,000
Limited obligation TIF bonds	12,041,000	-	(980,000)	-	11,061,000	1,022,000
Certificates of participation	5,300,000	-	-	-	5,300,000	175,000
Economic development limited obligation bonds and notes	2,227,454	-	(399,972)	-	1,827,482	119,354
Unamortized premium on bonds	217,533	-	(43,507)	-	174,026	43,507
Unamortized premium on certificates of participation	263,142	-	(13,157)	-	249,985	13,158
Total bonds and notes payable	28,859,129	-	(3,081,636)	-	25,777,493	3,073,019
Capital leases	9,800,255	-	(833,722)	87,055	9,053,588	1,149,592
Compensated absences	471,136	-	(415,168)	1,306,603	1,362,571	204,386
Governmental activities long-term liabilities	$ 39,130,520	$ -	$ (4,330,526)	$ 1,393,658	$ 36,193,652	$ 4,426,997

Business-type Activities:	**Balance September 30, 2016**	**Additions**	**Reductions**	**Adjustments**	**Balance September 30, 2017**	**Due Within One Year**
Bonds and notes payable						
General obligation bonds and notes	$ 14,480,000	$ -	$ (2,069,000)	$ -	$ 12,411,000	$ 2,111,000
Revenue bonds	63,510,000	-	(2,735,000)	-	60,775,000	2,830,000
State revolving loan funds	294,454	-	(173,771)	-	120,683	96,001
Unamortized premium on bonds	437,801	-	(45,384)	-	392,417	45,384
Total bonds and notes payable	78,722,255	-	(5,023,155)	-	73,699,100	5,082,385
Compensated absences	28,635	-	(40,009)	108,431	97,057	14,559
Business-type activities long-term liabilities	$ 78,750,890	$ -	$ (5,063,164)	$ 108,431	$ 73,796,157	$ 5,096,944

Note: Adjustments represent corrections to the capital lease obligation and to the compensated absences balances.

CITY OF HATTIESBURG, MISSISSIPPI

NOTES TO FINANCIAL STATEMENTS
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YEAR ENDED SEPTEMBER 30, 2017

NOTE 10 - LONG-TERM LIABILITIES (Cont.)

The debt service requirements for the City's bonds and notes are as follows:

Governmental Activities:

Year Ending	G.O. Bonds and Notes		Limited Obligation TIF Bonds	
September 30,	Principal	Interest	Principal	Interest
2018	$ 1,700,000	$ 223,350	$ 1,022,000	$ 508,003
2019	1,020,000	186,475	1,068,000	461,023
2020	1,050,000	163,075	1,116,000	411,880
2021	1,085,000	134,075	1,157,000	360,700
2022	975,000	99,875	706,000	307,452
2023-2027	590,000	313,307	3,755,000	1,033,112
2028-2032	745,000	70,500	2,237,000	229,081
Total	$ 7,165,000	$ 1,190,657	$ 11,061,000	$ 3,311,251

Year Ending	Economic Development Limited Obligation Bonds and Notes		Certificates of Participation	
September 30,	Principal	Interest	Principal	Interest
2018	$ 119,354	$ 34,017	$ 175,000	$ 228,025
2019	113,730	31,899	185,000	219,025
2020	115,590	29,774	190,000	209,650
2021	117,488	27,637	200,000	199,900
2022	119,424	25,486	205,000	191,825
2023-2027	627,562	94,445	1,195,000	854,375
2028-2032	584,079	33,272	1,555,000	558,037
2033-2036	30,255	101	1,595,000	146,588
Total	$ 1,827,482	$ 276,631	$ 5,300,000	$ 2,607,425

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CITY OF HATTIESBURG, MISSISSIPPI

NOTES TO FINANCIAL STATEMENTS
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YEAR ENDED SEPTEMBER 30, 2017

NOTE 10 - LONG-TERM LIABILITIES (Cont.)

Year Ending September 30,	Total Governmental Activities	
	Principal	Interest
2018	$ 3,016,354	$ 993,395
2019	2,386,730	898,422
2020	2,471,590	814,379
2021	2,559,488	722,312
2022	2,005,424	624,638
2023-2027	6,167,562	2,295,239
2028-2032	5,121,079	890,890
2033-2036	1,625,255	146,689
Total	$ 25,353,482	$ 7,385,964

Business-type Activities:

Year Ending	G.O. Bonds and Notes		State Revolving Loan Funds	
September 30,	Principal	Interest	Principal	Interest
2018	$ 2,111,000	$ 264,555	$ 96,001	$ 3,467
2019	2,159,000	225,154	24,682	185
2020	2,206,000	184,665	-	-
2021	2,260,000	145,109	-	-
2022	815,000	101,359	-	-
2023-2027	2,095,000	247,370	-	-
2028-2030	765,000	49,813	-	-
Total	$ 12,411,000	$ 1,218,025	$ 120,683	$ 3,652

(Table Continued on Next Page)

CITY OF HATTIESBURG, MISSISSIPPI

NOTES TO FINANCIAL STATEMENTS
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YEAR ENDED SEPTEMBER 30, 2017

NOTE 10 - LONG-TERM LIABILITIES (Cont.)

Year Ending September 30,	Revenue Bonds		Total Business-type Activities	
	Principal	Interest	Principal	Interest
2018	$ 2,830,000	$ 2,211,892	$ 5,037,001	$ 2,479,914
2019	3,010,000	2,124,593	5,193,682	2,349,932
2020	3,155,000	2,032,550	5,361,000	2,217,215
2021	3,240,000	1,936,961	5,500,000	2,082,070
2022	3,535,000	1,836,225	4,350,000	1,937,584
2023-2027	20,025,000	7,134,011	22,120,000	7,381,381
2028-2032	11,230,000	4,385,531	11,995,000	4,435,344
2033-2037	9,350,000	2,197,838	9,350,000	2,197,838
2038-2039	4,400,000	212,819	4,400,000	212,819
Total	$ 60,775,000	$ 24,072,420	$ 73,306,683	$ 25,294,097

During the year ended September 30, 2017, interest expense paid for governmental activities and business-type activities totaled $1,119,296 and $2,389,665, respectively.

NOTE 11 - SCHEDULE OF STATUTORY DEBT LIMITATIONS

The City is subject to the limitations of indebtedness prescribed by Section 21-33-303, Mississippi Code 1972. No municipality may issue bonds secured by a pledge of its full faith and credit in an amount which, when added to the then outstanding bond indebtedness of such municipality, would exceed the 15% and 20% tests prescribed in Section 21-33-303. These percentages are applied to the assessed value of the taxable property within such municipality, with certain types of bond issues being excluded from the authorized debt limit tests. Presented in the schedule below are the calculations of the applicable statutory debt limitations as of September 30, 2017:

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CITY OF HATTIESBURG, MISSISSIPPI

NOTES TO FINANCIAL STATEMENTS
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YEAR ENDED SEPTEMBER 30, 2017

NOTE 11 - SCHEDULE OF STATUTORY DEBT LIMITATIONS (Cont.)

		15% Test	20% Test
Assessed value as of September 30, 2017			
($457,006,290) times applicable percentage	[a]	$ 68,550,944	$ 91,401,258
Present debt subject to debt limits as of			
September 30, 2017:			
Total bonds and notes other than water and sewer		20,053,482	20,053,482
Less: Bonds exempt from debt limitation calculations		(12,888,482)	(12,888,482)
Add: Water & sewer debt other than revenue bonds		N/A	12,411,000
General obligation debt subject to applicable tests	[b]	7,165,000	19,576,000
Margin for additional debt [a] minus [b]		$ 61,385,944	$ 71,825,258

NOTE 12 - TAX ABATEMENTS

GASB Statement No. 77, *Tax Abatement Disclosures,* defines a tax abatement as a reduction in tax revenues that results from an agreement between one or more governments and an individual or entity in which (a) one or more governments promise to forgo tax revenues to which they would otherwise be entitled and (b) the individual or entity promises to take a specific action after the agreement has been entered into that contributes to economic development or otherwise benefits the government or citizens of those governments.

The City negotiates property tax abatements on an individual basis. All abatements are for 5 and/or 10 years and are for economic development purposes. The City had three types of abatements, one of which provides for the abatement of school or state tax levies, as follows:

Section 27-31-101 and 27-31-105, Miss. Code (Ann.) 1972 – All allowable tax levies
There are twenty-four companies that have tax abatements under this statute.

Section 17-21-5, Miss. Code (Ann.) 1972 – Historic district exemptions
There are seven companies that had tax abatements under this statute.

Section 27-31-104, Miss. Code (Ann.) 1972 – Payment-in-lieu of taxes
There is one company that had tax abatements under this statute.

(See Table on Next Page)

CITY OF HATTIESBURG, MISSISSIPPI

NOTES TO FINANCIAL STATEMENTS
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YEAR ENDED SEPTEMBER 30, 2017

NOTE 12 - TAX ABATEMENTS (Cont.)

Category	Amount of Taxes Abated During the Fiscal Year	Direct Employment Impact	Indirect Employment Impact
Construction and expansion of a manufacturing facility	$ 1,472,568	5,421 jobs	4,762 jobs
Historic district exemptions	35,402	13 jobs	5 jobs
Fee-in-lieu exemptions	296,251	-	-

The projected public investment for jobs impacted by industrial expansions is $272 per direct job and $145 per indirect job. The projected public investment for historic district exemptions is $2,723 per direct job and $1,970 per indirect job.

The economic impact information presented above was compiled by consultants contracted by the City and was prepared in conjunction with fiscal year 2017 tax abatement totals obtained from the Forrest County Tax Assessor's office. There were no tax abatement agreements for Lamar County properties in fiscal year 2017.

The companies were required to comply with certain special provisions, and did so in order to receive the abatements, and the City made no commitments as part of the agreements other than to reduce taxes.

NOTE 13 - RELATED ORGANIZATION

The following related organization is excluded from the financial reporting entity because the City's accountability does not extend beyond making appointments. Audited financial statements are available from the organization.

Hattiesburg Tourism Commission - The Commission consists of seven members appointed by the Mayor and ratified by the City Council. Funding is from a special tax levied upon the gross proceeds from hotel and motel overnight room rentals. The City collects that tax and distributes it to the Tourism Commission. Amounts disbursed for the fiscal year ended September 30, 2017 totaled $672,705. Amount due from special tax agency fund to the Tourism Commission at September 30, 2017 was $35,102 and was included in the accompanying statement of fiduciary net position under the caption due to other funds and was distributed within thirty days.

CITY OF HATTIESBURG, MISSISSIPPI

NOTES TO FINANCIAL STATEMENTS
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YEAR ENDED SEPTEMBER 30, 2017

NOTE 14 - JOINT VENTURES

The City of Hattiesburg is a participant with Forrest County in a joint venture authorized by Section 57-31-1, Mississippi Code Annotated (1972), to operate the Forrest County Industrial Park Commission. The joint venture was created to develop and operate an industrial park complex for citizens of Forrest County and the City of Hattiesburg. The Commission is governed by a ten member board. The governing authorities of the City of Hattiesburg and the Forrest County Board of Supervisors each appoint five members. Each entity is obligated to provide equal funding for the ongoing financial support of the Commission. A separate financial statement of the Forrest County Industrial Park Commission can be obtained by contacting the Commission at Post Office Box 1898, Hattiesburg, Mississippi 39403.

The City of Hattiesburg is a participant with Forrest County, Jones County, and the State of Mississippi to operate the Hattiesburg/Laurel Regional Airport Authority authorized by Section 61-3-5, Mississippi Code Annotated (1972). The joint venture, governed by a five member board of commissioners, was created to maintain and develop the Authority for the City and aforementioned counties. Each governmental entity appoints one board member. A separate financial statement of the Hattiesburg/Laurel Regional Airport Authority can be obtained by contacting the Authority at 1002 Terminal Drive, Moselle, Mississippi 39459.

The City of Hattiesburg is a participant with Forrest County and the City of Petal in a joint venture authorized by Section 39-3-38, Mississippi Code Annotated (1972) to operate the Library of Hattiesburg, Petal, and Forrest County. The joint venture was created to provide free public library service to the citizens of Forrest County and the Cities of Hattiesburg and Petal. The library is governed by a fifteen member board appointed by the governments involved as follows: City of Hattiesburg - six members; Forrest County - six members; and City of Petal - three members. Each entity is obligated by contract to levy not less than 1.25 mills as authorized by Sections 39-3-35 and 39-3-37, Mississippi Code Annotated (1972), for the ongoing financial support of the library. A separate financial statement of the library can be obtained by contacting the Library at 329 Hardy Street, Hattiesburg, Mississippi 39401.

NOTE 15 - JOINTLY GOVERNED ORGANIZATIONS

The Emergency Management District provides emergency services to the City of Hattiesburg and Forrest County. The entity is controlled by an eight member council. The Council is chosen as follows by the following authorities: Mayor of Hattiesburg - one; Forrest County Board of Supervisors - one; Sheriff of Forrest County - one; AAA Ambulance - one; Hattiesburg Police Chief - one; Hattiesburg Fire Chief - one; the University of Southern Mississippi - one; and Forrest General Hospital - one. Operating funds are provided by state grants, E-911 charges and direct contributions.

CITY OF HATTIESBURG, MISSISSIPPI

NOTES TO FINANCIAL STATEMENTS
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YEAR ENDED SEPTEMBER 30, 2017

NOTE 16 - DEFICIT FUND BALANCES OF INDIVIDUAL FUNDS

At September 30, 2017, the City's Community Development Block Grant Fund and the Airport Improvement Fund reported deficit fund balances of $40,913 and $228,397, respectively, which are attributable to the cumulative effect of program expenditures in excess of grant reimbursements.

NOTE 17 - COMMITMENTS

Significant encumbrances at September 30, 2017, included $147,124 for paving projects, $248,410 police cars and radio equipment, $49,950 for bus stops improvements, and $13,286 for fire department furniture.

September 30, 2017	**Amount**
Airport Improvements	$ 888,075
Infrastructure Projects	834,100
Water & Sewer Projects	703,100
Commitments for construction projects in progess, end of fiscal year	$ 2,425,275

NOTE 18 - CONTINGENCIES

USA Yeast Facility - During fiscal year 2015, the City completed construction of a wastewater pretreatment facility, or evaporator plant for a manufacturing facility located within the City. Project costs were funded with CDBG Economic Development Grant funds and with private funds provided by the manufacturer. Under the terms of the grant agreement, the City has title to assets constructed with grant funds, and the manufacturing company owns the assets constructed with its funds. Pursuant to an agreement between the City and the company and to terms of the CDBG grant agreement, title to the equipment and components will transfer to the company upon expiration of the agreement on December 31, 2021. In conjunction with this project, the City has a ground lease for company property on which the evaporator plant is located. This lease requires payment of $1 per year and expires December 31, 2021.

CITY OF HATTIESBURG, MISSISSIPPI

NOTES TO FINANCIAL STATEMENTS
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YEAR ENDED SEPTEMBER 30, 2017

NOTE 18 - CONTINGENCIES (Cont.)

Mississippi Department of Environmental Quality Consent Order - Stipulated Order Terminating Amended Consent Judgment - In August 2017, GRN, the City and MDEQ, the parties involved in the rehabilitation and improvement of the City's sewer system mandated under the Amended Agreed Order, negotiated a settlement. Pursuant to this settlement, a conditional Stipulated Order Terminating Amended Consent Judgment (the Stipulated Order) was entered on August 23, 2017. Terms of the Stipulated Order include submission of a revised permit request for the South Lagoon which incorporates certain monitoring requirements. Upon issuance of the amended permit and entry of a separate Agreed Order by the Mississippi Commission on Environmental Quality establishing a stipulated penalty of $1,500 per day for future violations, the Amended Consent Judgment will automatically terminate. The stipulated order further requires the City to provide certain effluent and performance information to GRN for a limited time.

As a result, the litigation aspect of this matter is conditionally concluded, and the City is also conditionally no longer liable for unpaid fines, penalties or construction obligations under the Amended Consent Judgment, subject to the City complying with terms of the Stipulated Order. The Stipulated Order precludes the City from having to immediately move forward to construct a fully mechanical wastewater treatment plant at an estimated cost exceeding $150 million, as was required by the Amended Consent Judgment. As a result of relief granted under the Stipulated Order, the City has suspended certain project elements that were in development and design stages in prior years. The City expects that it will continue its efforts to improve the performance of the existing lagoon treatment system and also expects that modifications to the system may be recommended, potentially requiring additional capital outlays. However, the cost of any such improvements and modifications is not determinable at this time.

Litigation - The City is party to various legal proceedings which normally occur in governmental operations. While the City cannot predict the results of any litigation, legal counsel for the City of Hattiesburg believes that it has meritorious defenses for those actions, proceedings and claims, or they are without merit or are of such kind, or involve such amounts, that unfavorable dispositions not covered by insurance resulting from such litigation would not materially affect the financial statements of the City of Hattiesburg, Mississippi. The City includes anticipated attorney fees for ongoing matters in its annual budget for the year in which such fees are incurred.

Federal Grants - In the normal course of operations, the City receives grant funds from various Federal and State agencies. The grant programs are subject to audit by agents of the granting authority, the purpose of which is to ensure compliance with conditions precedent to the granting of funds. Any liability for reimbursement which may arise as the result of these audits is not believed to be material.

CITY OF HATTIESBURG, MISSISSIPPI

NOTES TO FINANCIAL STATEMENTS
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YEAR ENDED SEPTEMBER 30, 2017

NOTE 18 - CONTINGENCIES (Cont.)

Group Insurance Programs - The City obtains its workers' compensation, general and automobile liability insurance through certain group insurance programs of the Mississippi Municipal Service Company. Under these programs and pursuant to State of Mississippi regulations, participants are jointly and severally liable for claims incurred; however, the City has experienced no loss under such provisions and cannot reasonably estimate the amount or possibility of losses under these programs.

Self-Funded Health Insurance Program - The City provides health insurance to its employees under a self-insured program, as previously described. The City obtains reinsurance to protect against significant loss; however, under the terms of such reinsurance policies, the City is ultimately responsible for covered claims. While the City estimates and recognizes expected claims liabilities related to this program, the amount or possibility of any additional loss cannot be reasonably estimated.

NOTE 19 - OTHER POSTEMPLOYMENT BENEFITS

The City allows eligible retirees to obtain health insurance by participating in its self-funded health insurance plan provided to employees and certain eligible dependents. Retirees are eligible for these benefits upon attaining age 60 with 8 years of service or any age with 25 years of service for medical benefits. Since retirees may obtain health insurance by participating in a group with active employees and consequently receive a health insurance premium rate differential, such postemployment healthcare benefits are reportable by the City under GASB Statement 45 as a single employer defined benefit health care plan. This type of plan is considered an "other postemployment benefit plan", or "OPEB".

Plan Description - The City provides health insurance coverage to participating eligible retirees through its single employer defined benefit healthcare plan, which is a self-funded plan administered by United Healthcare. The plan also provides health benefits to employees and their eligible dependents. The portion of the plan attributable to retirees represents other postemployment benefits for financial reporting purposes. Although the City expects to continue the plan indefinitely, it has the right to discontinue, alter, or modify the plan in whole or in part at any time and for any reason, at its sole determination. The Plan does not issue a stand-alone financial report. Instead, accounts of the Plan are included in the financial statements of the City. The City Council must approve any changes to the Plan provisions.

CITY OF HATTIESBURG, MISSISSIPPI

NOTES TO FINANCIAL STATEMENTS
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YEAR ENDED SEPTEMBER 30, 2017

NOTE 19 - OTHER POSTEMPLOYMENT BENEFITS (Cont.)

Funding Policy - Benefits of the plan are self-insured by the City. The City maintains an account for the purpose of paying claims and administrative costs of its self-funded health insurance plan. The account requires that a minimum balance be maintained, and the City deposits additional funds for claims incurred and anticipated payments on a pay-as-you-go basis. Balances in the account belong to the City. Amounts contributed to this account are earmarked for plan expenses but may be revoked at the City's discretion. Therefore, balances are reported in assets of the general fund, and employer contributions are not recognized until payment of claims by the administrator to retirees or their beneficiaries.

Participating retirees make monthly contributions through premium payments based on coverage type. Monthly retiree contributions for single and family coverage for the fiscal year ended September 30, 2017 totaled $388 and $638, respectively. For the years ended September 30, 2017, 2016, and 2015, the City contributed $211,305, $161,224, and $149,281, respectively, to the plan for expected payouts for retiree benefits, which represented 26.38%, 21.20%, and 20.97%, respectively, of the actuarially determined annual required contribution of $800,903, $762,287, and $712,017, respectively. No amounts have been contributed to finance future medical benefits under the plan for either current or future retirees.

Annual OPEB Cost and Net OPEB Obligation - The City's annual other postemployment benefit (OPEB) cost (expense) is calculated based on the annual required contribution of the employer (ARC), an amount actuarially determined in accordance with the parameters of GASB Statement 45. The ARC represents a level of funding that, if paid on an ongoing basis, is projected to cover normal cost each year and amortize any unfunded actuarial liabilities (or funding excess) over a closed 30 year period. The following table shows the components of the City's annual OPEB cost for the year, the amount actually contributed to the plan, and changes in the City's net OPEB obligation related to the plan:

CITY OF HATTIESBURG, MISSISSIPPI

NOTES TO FINANCIAL STATEMENTS
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YEAR ENDED SEPTEMBER 30, 2017

NOTE 19 - OTHER POSTEMPLOYMENT BENEFITS (Cont.)

Year Ended September 30	2017	2016	2015
Normal cost	$ 510,191	$ 591,613	$ 568,859
Amortized accrued liability in excess of actuarial assets	277,655	155,871	129,331
Interest	15,602	14,803	13,827
Annual required contribution	803,448	762,287	712,017
Interest on net OPEB obligation	46,515	22,509	-
Adjustment to annual required contribution	(49,060)	(23,429)	-
Annual OPEB cost (expense)	800,903	761,367	712,017
Contributions made for payment of retiree benefits	(211,305)	(161,224)	(149,281)
Increase in net OPEB obligation	589,598	600,143	562,736
Net OPEB obligation - beginning of year	1,162,879	562,736	-
Net OPEB obligation - end of year	$ 1,752,477	$ 1,162,879	$ 562,736

Funded Status and Funding Progress - As of October 1, 2017, the most recent actuarial valuation date, the plan was unfunded. The actuarial accrued liability for benefits was $6,605,614, which was also the amount of the unfunded actuarial accrued liability (UAAL).

NOTE 19 - OTHER POSTEMPLOYMENT BENEFITS (Cont.)

Actuarial valuations of an ongoing plan involve estimates of the value of reported amounts and assumptions about the probability of occurrence of events far into the future. Examples include assumptions about future employment, mortality, and the healthcare cost trend. Amounts determined regarding the funded status of the plan and the annual required contributions of the employer are subject to continual revision as actual results are compared with past expectations and new estimates are made about the future.

Actuarial Methods and Assumptions - Projections of benefits for financial reporting purposes are based on the substantive plan (the plan as understood by the employer and the plan members) and include the types of benefits provided at the time of each valuation and the historical pattern of sharing of benefit costs between the employer and plan members to that point. The actuarial methods and assumptions used include techniques that are designed to reduce the effects of short-term volatility in actuarial accrued liabilities and the actuarial value of assets, consistent with the long-term perspective of the calculations.

In the October 1, 2017, actuarial valuation, the entry age normal level percent of salary actuarial cost method was used. The actuarial assumptions included an annual healthcare cost trend rate of 8% initially, grading uniformly to 5% over a 10-year period, a 4% discount rate, a 2.5% salary scale, and 100% participation rate of eligible future retirees. The UAAL is being amortized as a level percentage of projected payroll over a closed 30 year period. The remaining amortization period at September 30, 2017 was 27 years. Pre-65 annual per capital medical claims costs are assumed to be $8,927 per participant per year at age 65, and claims are assumed to decrease 3% per attained age. No claims costs are assumed for post-65 retirees. Additionally, administrative costs were assumed to be $383 per retiree per year and were assumed to increase 5% annually.

NOTE 20 - DEFINED BENEFIT PENSION PLANS

Public Employees Retirement Plans

Pension Plan Descriptions - The City contributes to the PERS cost-sharing multiple-employer defined benefit pension plan (the Cost-Sharing Plan), which covers all eligible employees, except certain sworn and uniformed policemen and firemen who participate in the City of Hattiesburg Police and Fire Disability and Relief Fund (PFDR), also administered by PERS. Both plans provide retirement and disability benefits, annual cost-of-living adjustments, and death benefits to plan members and beneficiaries. PFDR Plan members consist of all full-time sworn and uniformed policemen and firemen who were employed by July 1, 1987. All full-time sworn and uniformed policemen and firemen employed after July 1, 1987, participate in the Cost-Sharing Plan. The PFDR Plan is affiliated with the Mississippi Municipal Retirement

CITY OF HATTIESBURG, MISSISSIPPI

NOTES TO FINANCIAL STATEMENTS
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YEAR ENDED SEPTEMBER 30, 2017

NOTE 20 - DEFINED BENEFIT PENSION PLANS (Cont.)

System (MRS), an agent multiple-employer defined benefit pension plan, and as of June 30, 2017, included one active member and 147 retirees and beneficiaries currently receiving benefits. Benefit provisions for both plans are established by State law and may be amended only by the State of Mississippi Legislature. The Plans' provisions and the Board of Trustees' authority to determine contribution rates are established by Miss. Code Ann. § 25-11-1 et seq. (1972, as amended), and may be amended only by the Mississippi Legislature.

PERS is administered by a 10-member Board of Trustees that includes: the State Treasurer; one gubernatorial appointee who is a member of PERS; two state employees; two PERS retirees; and one representative each from public schools and community colleges, state universities, municipalities, and counties. With the exception of the State Treasurer and the gubernatorial appointee, all members are elected to staggered six-year terms by the constituents they represent.

The Board of Trustees is responsible for the general administration and proper operation of PERS. The executive director is designated by the Board to lead and conduct all business for PERS. PERS operates under legislative mandate with respect to administrative budgets, human resources, and purchasing guidelines.

The financial statements of PERS are prepared using the economic resources measurement focus and accrual basis of accounting. Member and employer contributions are recognized as revenue when due pursuant to legal requirements; investment income is recognized when earned. Benefits and refunds are recognized when due and payable in accordance with the terms of the plan. Expenses are recognized when the corresponding liability is incurred, regardless of when the payment is made. Investments are reported at fair value. Financial statements are prepared in accordance with requirements of the Governmental Accounting Standards Board {GASB). Under these requirements, PERS is considered a component unit of the State of Mississippi for financial reporting purposes and, as such, the financial statements issued by PERS are included in the State of Mississippi's Comprehensive Annual Financial Report. PERS issues a publicly available financial report that includes financial statements and required supplementary information. Supporting actuarial information for the Cost-Sharing Plan is also provided in the GASB Statement No. 68 Report for the PERS prepared as of June 30, 2017. The auditor's opinion on that report, which includes in an accompanying schedule of collective pension amounts as of June 30, 2017 and for the year then ended is also available. PERS also issues a publicly available financial report for the MRS, which includes separate information for the PFDR plan. All such information is available at www.pers.ms.gov or may be obtained by writing to Public Employees Retirement System, PERS Building, 429 Mississippi Street, Jackson, MS 39201-1005 or by calling (601) 359-3589 or 1-800-444- PERS.

CITY OF HATTIESBURG, MISSISSIPPI

NOTES TO FINANCIAL STATEMENTS
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YEAR ENDED SEPTEMBER 30, 2017

NOTE 20 - DEFINED BENEFIT PENSION PLANS (Cont.)

Cost-Sharing Plan Benefits Provided - Participating members who are vested and retire at or after age 60 or those who retire regardless of age with at least 30 years of creditable service (25 years of creditable service for employees who became members of the Cost-Sharing Plan before July 1, 2011) are entitled, upon application, to an annual retirement allowance payable monthly for life in an amount equal to 2.0% of their average compensation for each year of creditable service up to and including 30 years (25 years for those who became members of the Cost-Sharing Plan before July 1, 2011), plus 2.5% for each additional year of creditable service with an actuarial reduction in the benefit for each year of creditable service below 30 years or the number of years in age that the member is below 65, whichever is less.

Average compensation is the average of the employee's earnings during the four highest compensated years of creditable service. A member may elect a reduced retirement allowance payable for life with the provision that, after death, a beneficiary receives benefits for life or for a specified number of years. Benefits vest upon completion of eight years of membership service (four years of membership service for those who became members of the Cost-Sharing Plan before July 1, 2007). The Cost-Sharing Plan also provides certain death and disability benefits. In the event of death prior to retirement of any member whose spouse and/or children are not entitled to a retirement allowance, the deceased member's accumulated contributions and interest are paid to the designated beneficiary.

A cost-of-living adjustment payment is made to eligible retirees and beneficiaries equal to 3.0% of the annual retirement allowance for each full fiscal year of retirement up to the year in which the retired member reaches age 60 (55 for those who became members of the Cost-Sharing Plan before July 1, 2011), with 3.0% compounded for each fiscal year thereafter.

PFDR Plan Benefits Provided - MRS provides retirement and disability benefits, annual cost-of-living adjustments and death benefits to plan members and beneficiaries. Membership eligibility and benefit provisions are governed by the general laws of the State of Mississippi, as well as local and private legislation enacted by the Mississippi State Legislature. Statutes may only be amended by the Mississippi Legislature. The PFDR retirement allowance is payable under this plan to any member who retires and has completed at least 20 years of creditable service, regardless of age. The retirement benefits are calculated in an amount equal to 50% of the employee's average compensation, plus 1.7% of average compensation for each year of credited service over 20 with an aggregate amount not to exceed 66-2/3%. Annual cost-of-living (COLA) adjustments are made to allowances of all retirees and beneficiaries, as further described below. Disability and death benefits are also provided under the plan. Upon a member's termination for any reason before retirement, that member's accumulated contributions are refunded.

CITY OF HATTIESBURG, MISSISSIPPI

NOTES TO FINANCIAL STATEMENTS
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YEAR ENDED SEPTEMBER 30, 2017

NOTE 20 - DEFINED BENEFIT PENSION PLANS (Cont.)

Cost-Sharing Plan Contributions - Employer and member contributions are based on actuarially determined rates that, expressed as percentages of annual covered payroll, are adequate to accumulate sufficient assets to pay benefits when due and are determined through the most recent June 30 annual valuation. Employer contribution rates consist of an amount for service cost; the amount estimated to finance benefits earned by current members during the year; and an amount for amortization of the unfunded actuarial accrued liability. Contribution requirements of PERS members and employers are established by the State of Mississippi Legislature, and at September 30, 2017, PERS members were required to contribute 9% of their annual salary, and employers were required to contribute 15.75% of covered payroll. The City's contributions (employer share only) to PERS for the years ended September 30, 2017, 2016 and 2015 were $3,707,145, $3,738,948, and $3,501,030, respectively, equal to the required contributions each year.

PFDR Funding Policy - The PERS System Board of Trustees establishes the funding policy for MRS plans. The funding policy for PFDR provides for periodic employer contributions at actuarially determined rates, expressed as millage rate tax applied to assessed property tax values, and active employee contributions at stated rates. The employee contribution rate as of September 30, 2017, was 10% of covered payroll. Contributions under this funding policy, established beginning in the 2011-2012 fiscal year, will generate an ultimate asset reserve level equal to a reasonable percentage (initially 100% - 150%) of the next year's projected benefit payment. At that point, actuarially determined employer contributions will be set equal to the fiscal year's projected benefit payments and adjusted as necessary to maintain the assets at the established reserve level; however, ultimately the City has the option of determining the contribution rate to set as its certified millage rate. The millage rate set by the City must be at a level that will ensure actuarial soundness of the System.

In developing the annual required contribution shown in the following paragraphs, the normal cost and actuarial accrued liability are determined using the entry age actuarial cost method. Unfunded actuarial accrued liability is being amortized on a closed basis as a level dollar amount over a remaining amortization period of twenty years. The asset valuation method used is a 5-year smoothed market method. The City has the option to set property tax rates to allow for extended contributions beyond 2020 under the funding policy adopted by the PERS Board of Trustees in February 2011. The millage rates certified as of September 30, 2016 under the Pre-2011 and Post-2011 Funding Policy rates are 17.97 mills and 3.08 mills, respectively. The actual tax levy set in 2016 for the pension fund for policemen and firemen for the year ended September 30, 2017 was 3.11 mills.

For the year ended September 30, 2017, contributions totaling $1,340,135 ($1,334,659 employer and $5,476 employee) were made in accordance with contribution requirements determined by an actuarial valuation of the System as of June 30, 2017. The employer's annual required contribution (ARC) was actuarially determined to be $1,586,000 (consisting of $-0- normal ARC and $1,586,000 accrued liability ARC).

CITY OF HATTIESBURG, MISSISSIPPI

NOTES TO FINANCIAL STATEMENTS
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YEAR ENDED SEPTEMBER 30, 2017

NOTE 20 - DEFINED BENEFIT PENSION PLANS (Cont.)

Pension Liabilities and Pension Expense - At September 30, 2017, the City reported a liability of approximately $75,623,233 for its proportionate share of the collective net pension liability of the Cost-Sharing Plan and the net pension liability allocated to PFDR. The net pension liability (NPL) for both plans was measured as of June 30, 2017, and the total pension liability (TPL) used to calculate the NPL was determined by an actuarial valuation as of June 30, 2017 for the Cost-Sharing Plan and for the PFDR Plan. The NPL recorded as of September 30, 2017, and the pension expense recognized by the City for the year ended September 30, 2017, was as follows:

	Cost - Sharing Plan	PFDR	Total
Net pension liability	$ 60,775,128	$ 14,848,105	$ 75,623,233
Net pension expense	$ 5,956,556	$ 1,777,950	$ 7,734,506

The NPL is the difference between the TPL and the pension plans' fiduciary net position (FNP). The TPL is the present value of the pension benefits that are allocated to current members due to past service by entry age normal actuarial cost method. The TPL includes benefits related to projected salary and service, and automatic cost of living adjustments. The FNP is determined on the same basis as that used by the pension plans. The City's proportion of the collective Cost-Sharing Plan NPL was based on the employers' shares of contributions to the pension plan relative to the total employer contributions of all participating PERS employers. At June 30, 2017 the City's proportion was 0.365585% as compared to its proportion measured at June 30, 2016 of 0.356159%, or an increase of 0.009426%.

NOTE 20 - DEFINED BENEFIT PENSION PLANS (Cont.)

The change in the NPL for PFDR was as follows:

Year Ended September 30, 2017	Total Pension Liability	Fiduciary Net Position	Net Pension Liability
Service cost	$ -	$ -	$ -
Interest	2,698,813	-	2,698,813
Changes of assumptions	145,391	-	145,391
Difference between expected and actual experience	251,676	-	251,676
Contributions - employer	-	1,346,302	(1,346,302)
Contributions - employee	-	5,383	(5,383)
Net investment income	-	2,778,391	(2,778,391)
Benefit payments, including refunds of employee contributions	(3,394,117)	(3,394,117)	-
Administrative expense	-	(26,926)	26,926
Other changes	-	(16,601)	16,601
Net change	(298,237)	692,432	(990,669)
Net pension liability, beginning of year	36,520,448	20,681,674	15,838,774
Net pension liability, end of year	$ 36,222,211	$ 21,374,106	$ 14,848,105

Sensitivity to the City's Proportionate Share of the Net Pension Liabilities to Changes in the Discount Rate - The following table presents the City's net pension liabilities calculated using the discount rate of 7.75%, as well as what the System's net pension liabilities would be if they were calculated using a discount rate that is 1-percentage point lower (6.75%) or 1-percentage point higher (8.75%) than the current rate:

	1% Decrease	Current Rate	1% Increase
Cost-sharing plan net pension liability	$ 83,736,022	$ 60,775,128	$ 50,013,755
PFDR plan net pension liability	$ 18,033,715	$ 14,848,105	$ 12,107,795

CITY OF HATTIESBURG, MISSISSIPPI

NOTES TO FINANCIAL STATEMENTS
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YEAR ENDED SEPTEMBER 30, 2017

NOTE 20 - DEFINED BENEFIT PENSION PLANS (Cont.)

Deferred Outflows of Resources and Deferred Inflows of Resources Related to Pensions - The City reported deferred outflows of resources and deferred inflows of resources related to pensions from the following sources:

	Cost - Sharing Plan		PFDR
September 30, 2017	**Deferred Outflows of Resources**	**Deferred Inflows of Resources**	**Deferred Outflows of Resources**
Differences between expected and actual experience	$ 614,051	$ 311,868	$ -
Changes of assumptions	949,970	72,830	-
Net difference between projected and actual earnings on investments	-	624,246	563,375
Changes in proportion and differences between employer contributions and proportionate share of contribution	3,431,999	-	-
Employer contributions subsequent to the measurement date	974,967	-	109,247
Total	$ 5,970,987	$ 1,008,944	$ 672,622

Deferred outflows of resources related to the Cost-Sharing Plan and PFDR resulting from City contributions subsequent to June 30, 2017 (the measurement date) were $974,967 and $109,247, respectively, and will be recognized as a reduction of the net pension liability in the year ending September 30, 2018. Other amounts reported as deferred outflows of resources and deferred inflows of resources related to pensions will be recognized as an addition to (reduction of) pension expense as follows:

(See Table on Next Page)

CITY OF HATTIESBURG, MISSISSIPPI

NOTES TO FINANCIAL STATEMENTS
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YEAR ENDED SEPTEMBER 30, 2017

NOTE 20 - DEFINED BENEFIT PENSION PLANS (Cont.)

	Cost - Sharing Plan		PFDR
Year Ending September 30,	Deferred Outflows of Resources	Deferred Inflows of Resources	Deferred Outflows of Resources
2018	$ 1,678,321	$ (318,381)	$ 312,485
2019	1,678,321	(318,381)	312,485
2020	1,262,970	(216,119)	80,309
2021	376,808	(156,063)	(141,904)
Total	$ 4,996,420	$ (1,008,944)	$ 563,375

Recognition of pension-related deferred inflows and deferred outflows is reflected in changes in unrestricted net position.

Actuarial Assumptions - For determining employer contribution rates, the actuary evaluates the assets of the plans based on a five-year smoothed expected return with 20% of a year's excess or shortfall of expected return recognized each year for five years. The TPL was determined using the following actuarial assumptions, applied to all periods included in the measurement:

	Cost - Sharing Plan	PFDR Plan
Inflation	3.00%	3.75%
Investment rate of return (net of plan investment expense and inflation)	7.75%	7.75%
Projected salary increases, including inflation	3.25% - 18.50%	4.00% - 5.50%

The actuarial assumptions used in the Cost-Sharing Plan actuarial valuation were based on the results of an actuarial experience study for the period July 1, 2012 to June 30, 2016. The experience report was dated April 18, 2017.

Mortality rates for the Cost-Sharing Plan were based on the RP-2014 Healthy Annuitant Blue Collar Table projected with mortality improvements based on Scale BB projected to 2022 and set forward one year for males.

CITY OF HATTIESBURG, MISSISSIPPI

NOTES TO FINANCIAL STATEMENTS
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YEAR ENDED SEPTEMBER 30, 2017

NOTE 20 - DEFINED BENEFIT PENSION PLANS (Cont.)

The long-term expected rate of return on Cost-sharing pension plan investments was determined using a log-normal distribution analysis in which best-estimate ranges of expected future real rates of return (expected returns, net of pension plan investment expense and the assumed rate of inflation) are developed for each major asset class. These ranges are combined to produce the long-term expected rate of return by weighting the expected future real rates of return by the target asset allocation percentage and by adding expected inflation.

The target asset allocation and best estimates of geometric real rates of return for each major asset class in the Cost-Sharing Plan are as follows:

Investment Asset Class	Target Allocation	Long-Term Expected Rate of Return
U.S. Broad	27.00%	4.60%
International equity	18.00%	4.50%
Emerging markets equity	4.00%	4.75%
Global	12.00%	4.75%
Fixed income	18.00%	0.75%
Real estate	10.00%	3.50%
Private equity	8.00%	5.10%
Emerging debt	2.00%	2.25%
Cash	1.00%	0.00%
Total	100.00%	

Discount Rate - The discount rate used to measure the total pension liability was 7.75% for both pension plans. The projection of cash flows used to determine the discount rate for the Cost-Sharing Plan assumed that plan member contributions will be made at the current contribution rate (9.00%) and that the employer contributions will be made at the current employer contribution rate (15.75%). Based on those assumptions, components of the pension plans' fiduciary net position were projected to be available to make all projected future benefit payments of current plan members. Therefore, the long-term expected rate of return on pension plan investments was applied to all periods of projected benefit payments to determine the TPL.

CITY OF HATTIESBURG, MISSISSIPPI

NOTES TO FINANCIAL STATEMENTS
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YEAR ENDED SEPTEMBER 30, 2017

NOTE 21 - DISCRETELY PRESENTED COMPONENT UNIT

Capital asset activity for the Hattiesburg Convention Commission (Commission) for the year ended September 30, 2017 was as follows:

	Beginning Balances	Additions	Retirements	Ending Balances
Governmental activities:				
Capital assets not being depreciated:				
Land	$ 1,315,877	$ 3,436	$ -	$ 1,319,313
Construction in progress - Eureka	2,668,225	1,128,590	-	3,796,815
Construction in progress - Saenger Theater	-	24,705		24,705
Construction in progress - Zoo projects	-	43,719	-	43,719
Construction in progress - Osceola McCarty House Museum	-	55,910		55,910
Total capital assets not being depreciated	3,984,102	1,256,360	-	5,240,462
Capital assets being depreciated:				
Buildings, parking lot, etc.	18,133,585	-	-	18,133,585
Furniture and fixtures	474,945	-	-	474,945
Equipment and vehicles	1,596,199	24,733	(24,733)	1,596,199
Assets acquired under capital lease	34,737	-	-	34,737
Total capital assets being depreciated	20,239,466	24,733	(24,733)	20,239,466
Less accumulated depreciation for:				
Buildings, parking lot, etc.	7,296,468	406,890	-	7,703,358
Furniture and fixtures	434,266	1,574	-	435,840
Equipment and vehicles	1,487,622	19,586	-	1,507,208
Assets acquired under capital lease	34,737	-	-	34,737
Total accumulated depreciated	9,253,093	428,050	-	9,681,143
Total capital assets being depreciated, net	10,986,373	(403,317)	(24,733)	10,558,323
Governmental activity capital assets, net	$ 14,970,475	$ 853,043	$ (24,733)	$ 15,798,785

CITY OF HATTIESBURG, MISSISSIPPI

NOTES TO FINANCIAL STATEMENTS
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YEAR ENDED SEPTEMBER 30, 2017

NOTE 21 - DISCRETELY PRESENTED COMPONENT UNIT (Cont.)

The City entered into a contract with the Commission and the Hattiesburg Tourism Commission during fiscal year 2010 for the management of the Hattiesburg Zoo at Kamper Park. In May 2012, a new agreement was entered into with the Commission that allowed for the Commission to accept full financial responsibility for any subsidy requirement necessary for operations of the Hattiesburg Zoo, thus ending the monthly management fee as contained in the original contract. Six months prior to the end date of the contract (September 30, 2020), all parties agree to review the financial status of the Zoo operations to consider whether any revisions to the financial plan are necessary.

During the year ended September 30, 2017, the Commission contracted for certain capital projects. The Commission transferred completed construction projects totaling $24,733 to the City, which are reflected in capital assets of the City as of September 30, 2017.

NOTE 22 - SUBSEQUENT EVENTS

Management has evaluated subsequent events after the financial statement date of September 30, 2017 through November 15, 2018, which is the date the financial statements were available to be issued. Significant subsequent events are described below.

Commitments for Additional Debt

In August 2018, the City approved the defeasance of the Taxable General Obligation Bonds, Series 2010 in the amount of $2,560,000.

In April 2018, the City approved an Interlocal Cooperation Agreement with Forrest County in connection with the Hardy Street South Project. In September 2015, the City approved a Development Agreement that included the issuance of limited obligation tax increment financing (TIF) bonds in an amount not to exceed $1,000,000 for a term of up to 20 years for this project. These TIF bonds have not yet been issued.

In October 2018, the City adopted the intent resolution for the issuance of general obligation bonds to be sold by the Mississippi Development Authority of the State of Mississippi in an aggregate amount not to exceed $45,000,000. These bonds are to be used to provide funding for various infrastructure projects, municipal building and improvement projects, and other purposes authorized under Mississippi Code Ann. Sections 21-33-301et seq. and Sections 31-25-1 et seq.

CITY OF HATTIESBURG, MISSISSIPPI

NOTES TO FINANCIAL STATEMENTS
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YEAR ENDED SEPTEMBER 30, 2017

NOTE 22 - SUBSEQUENT EVENTS (Cont.)

Annexation

The City is in the process of expanding its corporate limits through the process of annexation which, pursuant to State law, requires Chancery Court ratification of the City's adopted ordinance. In conjunction with its annexation activities, the City is party to various litigation with Lamar County, the City of Petal, and Bellevue incorporators. The outcome of these cases and effects on annexation endeavors is not determinable due to the early stages of the matters.

Ad Valorem Tax Exemption

The City was named as a defendant, along with Forrest County, in an action by Kohler Co. seeking significant tax exemptions beyond the ten-year exemptions permitted by statute. The case is in its early stages and therefore no probability of outcome can be predicted.

Matters Related to Funding

Subsequent to September 30, 2017, certain Federal and State grant reimbursements were delayed because of delinquency in submission of the City’s annual financial reports. In addition, the City's credit rating was suspended in November 2016.

SUPPLEMENTARY INFORMATION

SCHEDULE 1
PAGE 1 OF 3

CITY OF HATTIESBURG, MISSISSIPPI

SCHEDULE OF EXPENDITURES OF FEDERAL AWARDS
YEAR ENDED SEPTEMBER 30, 2017

Federal Grantor/Pass-Through Grantor/Program or Cluster Title	Federal CFDA Number	Pass-Through Entity Identifying Number	Federal Expenditures
U.S. Department of Housing and Urban Development			
Pass-Through Programs From:			
Governor's Department of Housing and Urban Development			
CDBG Entitlement Grants - Cluster:			
Community Development Block Grants/Entitlement Grants	14.218	MC-28-0006	$ 263,707
Community Development Block Grants/Entitlement Grants	14.218	B15-MC-28-0006	65,685
Community Development Block Grants/Entitlement Grants	14.218	B16-MC-28-0006	187,400
Total - *CDBG Entitlement Grants Cluster*			516,792
HOME Investment Partnerships Program	14.239	MC-28-0201	72,941
HOME Investment Partnerships Program	14.239	M15-MC-28-0201	134,689
HOME Investment Partnerships Program	14.239	M16-MC-28-0201	13,878
			221,508
Total U.S. Department of Housing and Urban Development Pass-Through Programs			738,300
U.S. Department of Justice			
Pass-Through Programs From:			
Office of Justice Programs			
OVW Technical Assistance Initiative	16.526	15-WF-AX-0028	15,218
OVW Technical Assistance Initiative	16.526	STOP-2016-078	5,959
			21,177
Bulletproof Vest Partnership Program	16.607	2015 Award	11,929
Bulletproof Vest Partnership Program	16.607	2016 Award	6,219
			18,148
Edward Byrne Memorial Justice Assistance Grant Program	16.738	2015-DJ-BX-0829	17,435
Criminal and Juvenile Justice and Mental Health Collaboration Program - Jail Diversion Project Grant	16.745	2014-MO-BX-0030	58,641
Total U.S. Department of Justice Pass-Through Programs			115,401

The accompanying notes are an integral part of this schedule.

SCHEDULE 1
PAGE 2 OF 3

CITY OF HATTIESBURG, MISSISSIPPI

SCHEDULE OF EXPENDITURES OF FEDERAL AWARDS
YEAR ENDED SEPTEMBER 30, 2017

Federal Grantor/Pass-Through Grantor/Program or Cluster Title	Federal CFDA Number	Pass-Through Entity Identifying Number	Federal Expenditures
U.S. Department of Transportation			
Federal Aviation Administration			
Airport Improvement Program	20.106	3-28-0031-0020-2013	$ 1,033
Airport Improvement Program	20.106	3-28-0031-0023-2016	34,120
Airport Improvement Program	20.106	3-28-0031-0024-2017	507,771
Total - Federal Aviation Administration Direct Programs			542,924
Federal Transit Administration			
Federal Transit Cluster:			
Mass Transit Capital	20.507	MS-90-X086	216,700
Mass Transit Capital	20.507	MS-90-X090	40,134
Mass Transit - JARC	20.507	MS-90-X093	31,870
Mass Transit - Capital	20.507	MS-90-X095	88,176
Mass Transit Operating	20.507	MS-90-4095	399,306
Mass Transit Preventative	20.507	MS-90-0095	154,842
Mass Transit Preventative	20.507	MS-90-0102	25,715
Total - Federal Transit Formula Grants			956,743
Total - *Federal Transit Cluster*			956,743
Total U.S. Department of Transportation Direct Programs			1,499,667
Federal Highway Administration			
Pass-Through Programs From:			
Mississippi Department of Transportation			
Highway Planning and Construction Cluster:			
Metropolitan Planning Organization	20.205	107326-101000	203,721
Fourth Street Improvements Phase II	20.205	HPP-7194-00(003)/105845/801000	5,459
Long Leaf Trace Phase III	20.205	HPP-0210-00(015) LPA/105214-801000	179,466
Tuscan Avenue Sidewalk Project	20.205	STP-7197-00(002) LPA/106879-701000	240,699
Safe Routes to School - Hawkins	20.205	SRSP-7207-00(004) LPA/106877-104000	163,187
Transportation Enhancement - Various Streets, Landscape, and Pedestrian Improvements	20.205	STP-0018-00(029)/106346-701000	71,907
Western Beltway Phase II	20.205	STPD-8776-00(004)LPA/105844/812000	118,029
Total - *Highway Planning and Construction Cluster*			982,468

The accompanying notes are an integral part of this schedule.

SCHEDULE 1
PAGE 3 OF 3

CITY OF HATTIESBURG, MISSISSIPPI

SCHEDULE OF EXPENDITURES OF FEDERAL AWARDS
YEAR ENDED SEPTEMBER 30, 2017

Federal Grantor/Pass-Through Grantor/Program or Cluster Title	Federal CFDA Number	Pass-Through Entity Identifying Number	Federal Expenditures
U.S. Department of Transportation (Cont.)			
National Highway Traffic Safety Administration			
Pass-Through Programs From:			
Mississippi Department of Public Safety - Office of Highway Safety			
402 Police Traffic Services	20.600	PT-2017-PT21-51	$ 9,650
Alcohol Open Container Requirements	20.607	154AL-2017-ST-21-51	41,204
Total U.S. Department of Transportation Pass-Through Programs			1,033,322
U.S. Department of Health and Human Services			
Pass-Through Program From:			
Mississippi Bureau of Narcotics			
HIDTA-High Intensity Drug Trafficking Areas Program	95.001	G16GC0003A	7,817
			7,817
Total U.S. Department of Health and Human Services Pass-Through Programs			7,817
U.S. Department of Homeland Security			
Pass-Through Programs From:			
Mississippi Emergency Management Agency			
Disaster Grants - Public Assistance (Presidentially Declared Disasters)	97.036	FEMA-4295-DR-MS	3,464,989
Total U.S. Department of Homeland Security Pass-Through Programs			3,464,989
Total Expenditures of Federal Awards			$ 6,859,496

The accompanying notes are an integral part of this schedule.

CITY OF HATTIESBURG

NOTES TO SCHEDULE OF EXPENDITURES OF FEDERAL AWARDS
YEAR ENDED SEPTEMBER 30, 2017

NOTE 1 - BASIS OF PRESENTATION

The accompanying schedule of expenditures of federal awards (the Schedule) includes the federal grant expenditure activity of the City of Hattiesburg under programs of the federal government for the year ended September 30, 2017. Because the Schedule presents only a selected portion of the operations of the City of Hattiesburg, it is not intended to and does not present the financial position, changes in net assets, or cash flows of the City of Hattiesburg.

NOTE 2 - SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES

Expenditures

Expenditures on the Schedule are reported on the accrual basis of accounting. Such expenditures are recognized following the cost principles contained in the Uniform Guidance, wherein certain types of expenditures are not allowable or are limited as to reimbursement. Therefore, some amounts presented in this schedule may differ from amounts presented in, or used in the preparation of, the basic financial statements.

Pass-Through Entity Identifying Numbers

Pass-through entity identifying numbers are presented when available.

NOTE 3 - PAYMENTS MADE TO SUBRECIPIENTS

Federal funds provided to subrecipients from the Community Development Block Grants/State's Program and from the Home Investment Partnerships Program during the year ended September 30, 2017 totaled $141,447 and $56,625, respectively.

NOTE 4 - DE MINIMIS COST RATE

The City elected not to recover indirect costs for federal programs using the 10% de minimis cost rate allowed by the Uniform Guidance in Section 414.

Schedule 2

INDEPENDENT AUDITOR'S REPORT ON INTERNAL CONTROL OVER FINANCIAL REPORTING AND ON COMPLIANCE AND OTHER MATTERS BASED ON AN AUDIT OF FINANCIAL STATEMENTS PERFORMED IN ACCORDANCE WITH *GOVERNMENT AUDITING STANDARDS*

To the Honorable Mayor and Members of the City Council
City of Hattiesburg, Mississippi

We have audited, in accordance with the auditing standards generally accepted in the United States of America and the standards applicable to financial audits contained in *Government Auditing Standards* issued by the Comptroller General of the United States, the financial statements of the governmental activities, the business-type activities, the discretely presented component unit, each major fund, and the aggregate remaining fund information of the City of Hattiesburg, Mississippi, as of and for the year ended September 30, 2017, and the related notes to the financial statements, which collectively comprise the City of Hattiesburg, Mississippi's basic financial statements, and have issued our report thereon dated November 15, 2018.

Internal Control over Financial Reporting

In planning and performing our audit of the financial statements, we considered the City of Hattiesburg, Mississippi's internal control over financial reporting (internal control) to determine the audit procedures that are appropriate in the circumstances for the purpose of expressing our opinions on the financial statements, but not for the purpose of expressing an opinion on the effectiveness of the City of Hattiesburg, Mississippi's internal control. Accordingly, we do not express an opinion on the effectiveness of the City of Hattiesburg, Mississippi's internal control.

Our consideration of internal control over financial reporting was for the limited purpose described in the preceding paragraph and was not designed to identify all deficiencies in internal control over financial reporting that might be material weaknesses or significant deficiencies and therefore, material weaknesses or significant deficiencies may exist that were not identified. However, as described in the accompanying schedule of findings and questioned costs, we identified certain deficiencies in internal control that we consider to be material weaknesses and significant deficiencies.

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To the Honorable Mayor and Members of the City Council
City of Hattiesburg, Mississippi

A *deficiency in internal control* exists when the design or operation of a control does not allow management or employees, in the normal course of performing their assigned functions, to prevent, or detect and correct misstatements on a timely basis. A *material weakness* is a deficiency, or a combination of deficiencies, in internal control such that there is a reasonable possibility that a material misstatement of the entity's financial statements will not be prevented, or detected and corrected on a timely basis. We consider the deficiencies described in the accompanying schedule of findings and questioned costs as items 2017-001 through 2017-012, 2017-014, and 2017-015 to be material weaknesses.

A *significant deficiency* is a deficiency, or a combination of deficiencies, in internal control that is less severe than a material weakness, yet important enough to merit attention by those charged with governance. We consider the deficiency as described in the accompanying schedule of findings and questioned costs as item 2017-013 to be a significant deficiency.

Compliance and Other Matters

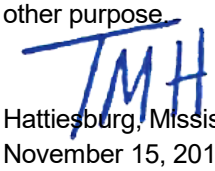
As part of obtaining reasonable assurance about whether the City of Hattiesburg, Mississippi's financial statements are free from material misstatement, we performed tests of its compliance with certain provisions of laws, regulations, contracts, and grant agreements, noncompliance with which could have a direct and material effect on the determination of financial statement amounts. However, providing an opinion on compliance with those provisions was not an objective of our audit, and accordingly, we do not express such an opinion. The results of our tests disclosed instances of noncompliance or other matters that are required to be reported under *Government Auditing Standards* and which are described in the accompanying schedule of findings and questioned costs as items 2017-010 through 2017-015.

City of Hattiesburg's Response to Findings

The City of Hattiesburg, Mississippi's response to the findings identified in our audit is described in Appendix A to the accompanying schedule of findings and questioned costs. The City of Hattiesburg, Mississippi's response was not subjected to the auditing procedures applied in the audit of the financial statements and, accordingly, we express no opinion on it.

Purpose of this Report

The purpose of this report is solely to describe the scope of our testing of internal control and compliance and the results of that testing, and not to provide an opinion on the effectiveness of the entity's internal control or on compliance. This report is an integral part of an audit performed in accordance with *Government Auditing Standards* in considering the entity's internal control and compliance. Accordingly, this communication is not suitable for any other purpose.



Hattiesburg, Mississippi
November 15, 2018

Schedule 3

INDEPENDENT AUDITOR'S REPORT ON COMPLIANCE FOR EACH MAJOR PROGRAM AND ON INTERNAL CONTROL OVER COMPLIANCE REQUIRED BY THE UNIFORM GUIDANCE

To the Honorable Mayor and Members of the City Council
City of Hattiesburg, Mississippi

Report on Compliance for Each Major Federal Program

We have audited the City of Hattiesburg, Mississippi's compliance with the types of compliance requirements described in the *OMB Compliance Supplement* that could have a direct and material effect on each of the City of Hattiesburg, Mississippi's major federal programs for the year ended September 30, 2017. The City of Hattiesburg, Mississippi's major federal programs are identified in the summary of auditor's results section of the accompanying schedule of findings and questioned costs.

Management's Responsibility

Management is responsible for compliance with federal statutes, regulations, and terms and conditions of federal awards applicable to its federal programs.

Auditor's Responsibility

Our responsibility is to express an opinion on compliance for each of the City of Hattiesburg, Mississippi's major federal programs based on our audit of the types of compliance requirements referred to above. We conducted our audit of compliance in accordance with auditing standards generally accepted in the United States of America; the standards applicable to financial audits contained in *Government Auditing Standards*, issued by the Comptroller General of the United States; and the audit requirements of Title 2 U.S. *Code of Federal Regulations* (CFR) Part 200, *Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards* (Uniform Guidance). Those standards and the Uniform Guidance require that we plan and perform the audit to obtain reasonable assurance about whether noncompliance with the types of compliance requirements referred to above that could have a direct and material effect on a major federal program occurred. An audit includes examining, on a test basis, evidence about the City of Hattiesburg, Mississippi's compliance with those requirements and performing such other procedures as we considered necessary in the circumstances.

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To the Honorable Mayor and Members of the City Council
City of Hattiesburg, Mississippi

We believe that our audit provides a reasonable basis for our qualified opinion on compliance for the major federal program. However, our audit does not provide a legal determination of the City of Hattiesburg, Mississippi's compliance.

Basis for Qualified Opinion on the Highway Planning and Construction Program

As described in the accompanying schedule of findings and questioned costs, the City of Hattiesburg, Mississippi did not comply with requirements regarding CFDA 20.205 Highway Planning and Construction Program as described in Finding 2017-010 for Procurement and Suspension and Debarment. Compliance with such requirement is necessary, in our opinion, for the City of Hattiesburg, Mississippi to comply with the requirements applicable to that program.

Qualified Opinion on the Highway Planning and Construction Program

In our opinion, except for the noncompliance described in the Basis for Qualified Opinion paragraph, the City of Hattiesburg, Mississippi complied, in all material respects, with the types of compliance requirements referred to above that could have a direct and material effect on the Highway Planning and Construction Program for the year ended September 30, 2017.

Basis for Qualified Opinion on the Disaster Grants-Public Assistance Program

As described in the accompanying schedule of findings and questioned costs, the City of Hattiesburg, Mississippi did not comply with requirements regarding CFDA 97.036 Disaster Grants – Public Assistance Program as described in Finding 2017-015 for Reporting. Compliance with such requirement is necessary, in our opinion, for the City of Hattiesburg, Mississippi to comply with the requirements applicable to that program.

Qualified Opinion on the Disaster Grants-Public Assistance Program

In our opinion, except for the noncompliance described in the Basis for Qualified Opinion paragraph, the City of Hattiesburg, Mississippi complied, in all material respects, with the types of compliance requirements referred to above that could have a direct and material effect on the Highway Planning and Construction Program for the year ended September 30, 2017.

Unmodified Opinion on the Community Development Block Grants/Entitlement Grants Program

In our opinion, the City of Hattiesburg, Mississippi complied, in all material respects, with the types of compliance requirements referred to above that could have a direct and material effect on the Community Development Block Grants/Entitlement Grants Program identified in the summary of auditor’s results section of the accompanying schedule of findings and questioned costs for the year ended September 30, 2017.

To the Honorable Mayor and Members of the City Council
City of Hattiesburg, Mississippi

Other Matters

The results of our auditing procedures disclosed other instances of noncompliance, which are required to be reported in accordance with the Uniform Guidance and which are described in the accompanying schedule of findings and questioned costs as Findings 2017-011 through 2017-014. Our opinion on each major federal program is not modified with respect to these matters.

The City of Hattiesburg Mississippi's response to the noncompliance findings identified in our audit is described in Appendix A to the accompanying schedule of findings and questioned costs. The City of Hattiesburg, Mississippi's response was not subjected to the auditing procedures applied in the audit of compliance and, accordingly, we express no opinion on the response.

Report on Internal Control over Compliance

Management of the City of Hattiesburg, Mississippi is responsible for establishing and maintaining effective internal control over compliance with the types of compliance requirements referred to above. In planning and performing our audit of compliance, we considered the City of Hattiesburg, Mississippi's internal control over compliance with the types of requirements that could have a direct and material effect on the major federal program to determine the auditing procedures that are appropriate in the circumstances for the purpose of expressing an opinion on compliance for each major federal program and to test and report on internal control over compliance in accordance with the Uniform Guidance, but not for the purpose of expressing an opinion on the effectiveness of internal control over compliance. Accordingly, we do not express an opinion on the effectiveness of the City of Hattiesburg, Mississippi's internal control over compliance.

Our consideration of internal control over compliance was for the limited purposes described in the preceding paragraph and was not designed to identify all deficiencies in internal control over compliance that might be material weaknesses or significant deficiencies and therefore, material weaknesses or significant deficiencies may exist that have not been identified. However, as discussed below, we identified certain deficiencies in internal control over compliance that we consider to be material weaknesses and significant deficiencies.

A *deficiency in internal control over compliance* exists when the design or operation of a control over compliance does not allow management or employees, in the normal course of performing their assigned functions, to prevent, or detect and correct, noncompliance with a type of compliance requirement of a federal program on a timely basis. A *material weakness in internal control over compliance* is a deficiency, or combination of deficiencies, in internal control over compliance, such that there is a reasonable possibility that material noncompliance with a type of compliance requirement of a federal program will not be prevented, or detected and corrected on a timely basis. We consider the deficiencies in internal control over compliance described in the accompanying schedule of findings and questioned costs as Findings 2017-010 through 2017-012, 2017-014, and 2017-015 to be material weaknesses.

To the Honorable Mayor and Members of the City Council
City of Hattiesburg, Mississippi

A *significant deficiency in internal control over compliance* is a deficiency, or a combination of deficiencies, in internal control over compliance with a type of compliance requirement of a federal program that is less severe than a material weakness in internal control over compliance, yet important enough to merit attention by those charged with governance. We consider the deficiency in internal control over compliance described in the accompanying schedule of findings and questioned costs as Finding 2017-013 to be a significant deficiency.

The City of Hattiesburg, Mississippi's response to the internal control over compliance findings identified in our audit is described in Appendix A to the accompanying schedule of findings and questioned costs. The City of Hattiesburg, Mississippi's response was not subjected to the auditing procedures applied in the audit of compliance and, accordingly, we express no opinion on the response.

The purpose of this report on internal control over compliance is solely to describe the scope of our testing of internal control over compliance and the results of that testing based on the requirements of the Uniform Guidance. Accordingly, this report is not suitable for any other purpose.

TMH

Hattiesburg, Mississippi
November 15, 2018

SCHEDULE 4
PAGE 1 OF 22

CITY OF HATTIESBURG, MISSISSIPPI

SCHEDULE OF FINDINGS AND QUESTIONED COSTS
YEAR ENDED SEPTEMBER 30, 2017

Section I - Summary of Auditor's Results

Financial Statements

Type of auditor's report issued on the financial statements:

Opinion Unit	Opinion
Governmental Activities	Unmodified
Business-type Activities	Unmodified
Discretely Presented Component Unit	Unmodified
General Fund	Unmodified
Aggregate Remaining Governmental Funds	Unmodified
Combined Water and Sewer System	Unmodified

Internal control over financial reporting:	
Material weakness identified?	Yes
Significant deficiency identified not considered to be a material weakness?	Yes
Noncompliance material to financial statements noted?	Yes

Federal Awards

Internal control over the major federal program:	
Material weaknesses identified?	Yes
Significant deficiencies identified?	Yes
Type of auditor's report issued on compliance for the major program:	
Community Development Block Grants/Entitlement Grants	Unmodified
Highway Planning and Construction	Qualified
Disaster Grants – Public Assistance (Presidentially Declared Disasters)	Qualified
Any audit findings disclosed that are required to be reported in accordance with 2 CFR 200.516(a)?	Yes

SCHEDULE 4
PAGE 2 OF 22

CITY OF HATTIESBURG, MISSISSIPPI

SCHEDULE OF FINDINGS AND QUESTIONED COSTS
YEAR ENDED SEPTEMBER 30, 2017

Section I - Summary of Auditor's Results (Cont.)

Identification of the major federal program:

CFDA Number	Name of Federal Program or Cluster
14.218	Community Development Block Grants/Entitlement Grants
20.205	Highway Planning and Construction
97.036	Disaster Grants – Public Assistance (Presidentially Declared Disasters)

Dollar threshold used to distinguish between Type A and Type B programs: $750,000

Auditee qualified as low-risk auditee? No

Section II - Financial Statement Findings

Finding:

Finding # 2017-001 Entity-Level Control Environment and Risk Assessment Processes

Finding Type: Material Weakness

Criteria - The Committee of Sponsoring Organizations of the Treadway Commission (COSO) model has been adopted as the generally accepted framework for evaluating internal controls framework, organizational structure, assignment of authority and responsibility, estimating the potential significance of risks relevant to achievement of financial reporting objectives, and responding to such risks represent elements of entity-level internal controls.

Condition - The City did not timely initiate or make substantial progress in implementation of corrective actions in response to material weaknesses and significant deficiencies in internal control identified in its financial statement audit for the year ended September 30, 2015.

Context - The City has previously developed a comprehensive plan in response to certain material entity-level control weaknesses related to financial reporting, but the City had not yet implemented corrective actions during fiscal year 2016.

Cause - The City's organizational structure, depth of resources of personnel with suitable knowledge and skill in financial reporting, and process for evaluating and addressing risks related to financial reporting result in entity-level control weaknesses.

CITY OF HATTIESBURG, MISSISSIPPI

SCHEDULE OF FINDINGS AND QUESTIONED COSTS
YEAR ENDED SEPTEMBER 30, 2017

Section II - Financial Statement Findings (Cont.)

Finding # 2017-001 Entity-Level Control Environment and Risk Assessment Processes (Cont.)

Effect - Previously identified material weaknesses and significant deficiencies in internal control, along with other deficiencies, continued unmitigated in fiscal year 2017.

Identification of Repeat Finding 2016-001

Recommendation - The Administration should take steps to implement corrective actions for identified material weaknesses and significant deficiencies in internal controls and assess its overall control environment and risk assessment processes.

Views of Responsible Officials - The City's Corrective Action Plan is presented on Appendix A.

Finding:

Finding # 2017-002 Entity-Level Information, Communication and Monitoring

Finding Type: Material weakness

Criteria - The City must maintain effective internal accounting procedures over information, communication, and monitoring functions that relate to financial reporting and legal compliance.

Condition - The City's financial reporting system and monitoring processes lack sufficient depth and structure to ensure that all relevant information is timely identified, communicated to appropriate financial and accounting personnel, assessed for financial reporting impact, and assimilated into the financial reporting process.

Context - The City’s centralized accounting system does not have a structured and cohesive process to obtain, maintain, and analyze data from varied sources as part of its information management and financial reporting system or to communicate and educate departmental personnel regarding criteria and responsibilities for conveyance of information.

CITY OF HATTIESBURG, MISSISSIPPI

SCHEDULE OF FINDINGS AND QUESTIONED COSTS
YEAR ENDED SEPTEMBER 30, 2017

Section II - Financial Statement Findings (Cont.)

Finding # 2017-002 Entity-Level Information, Communication and Monitoring (Cont.)

Cause - The City's entity-wide controls and procedures do not effectively ensure that all relevant information is timely incorporated into the financial reporting process. In addition, lines of authority and responsibility under the City's organizational structure are incompatible with the structure of its financial reporting process. Further, the City has experienced significant turnover of management personnel in recent years. Staff turnover has caused loss of knowledge base, including familiarity with informal and undocumented procedures performed in prior years.

Effect - Deficiencies in information and communication processes cause delays in completion of the annual financial reporting process thus limiting the City's ability to meet legal, regulatory, and contractual deadlines for submission of annual financial statements.

Identification of Repeat Finding 2016-002

Recommendation - The City should immediately develop and implement procedures to enhance its process for timely identifying, maintaining, conveying, and reporting information relevant to financial reporting. Procedures should be formally documented and incorporated into the financial reporting process on an ongoing basis, and personnel responsible for financial reporting monitoring and oversight should have appropriate levels of authority in order to enforce accountability of personnel responsible for accumulating, maintaining, and communicating data.

Views of Responsible Officials - The City's Corrective Action Plan is presented on Appendix A.

Finding:

Finding # 2017-003 Timeliness of Financial Reporting

Finding Type: Material Weakness

Criteria - Title 2 U.S. Code of Federal Regulations (CFR) Part 200 *Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards* (Uniform Guidance), Mississippi law, and terms of various bonds, grants, contracts, and agreements impose financial reporting requirements and deadlines for submission by the City of annual financial statements presented in accordance with U.S. generally accepted accounting principles.

CITY OF HATTIESBURG, MISSISSIPPI

SCHEDULE OF FINDINGS AND QUESTIONED COSTS
YEAR ENDED SEPTEMBER 30, 2017

Section II - Financial Statement Findings (Cont.)

Finding # 2017-003 Timeliness of Financial Reporting (Cont.)

Condition - During the year ended September 30, 2017, the City failed to meet financial reporting deadlines for its financial statements for the fiscal year ended September 30, 2016. Also, the city failed to meet financial reporting deadlines for submitting its financial statements for the year ended September 30, 2017.

Context - The City did not complete its financial reporting process before financial reporting deadlines had passed.

Cause - The financial reporting system of the City was not adequate for timely production of financial statements. See also Finding 2017-004.

Effect - Failure to maintain compliance with financial reporting requirements and deadlines exposes the City to risk of delay or curtailment of funding. Costs of funds may also increase because of liquidity drains or noncompliance with reporting requirements.

Identification of Repeat Finding 2016-003

Recommendation - The City should implement procedures that will allow for timely financial reporting in accordance with all applicable reporting deadlines.

Views of Responsible Officials - The City's Corrective Action Plan is presented on Appendix A.

Finding:

Finding # 2017-004 Financial Statement Adjustment, Close, and Disclosure

Finding Type: Material weakness

Criteria - The City's internal accounting controls, including year-end procedures, should be sufficient to ensure that amounts are properly classified, that accounts are properly valued, and that pertinent rights and obligations are properly reflected in the financial statements in accordance with U.S. generally accepted accounting principles.

CITY OF HATTIESBURG, MISSISSIPPI

SCHEDULE OF FINDINGS AND QUESTIONED COSTS
YEAR ENDED SEPTEMBER 30, 2017

Section II - Financial Statement Findings (Cont.)

Finding # 2017-004 Financial Statement Adjustment, Close, and Disclosure (Cont.)

Condition - The City does not routinely maintain data necessary to prepare required conversions from its cash basis accounting records to the modified accrual and/or accrual bases of accounting required for financial reporting purposes. Additionally, City's accounting system does not consistently ensure proper cut-off and valuation or completeness of transactions and balances at year-end for reporting purposes.

Context - The City's financial reporting system centers on its budgetary cash basis accounting processes and this typically requires extensive manual processes after the end of the fiscal year for financial reporting purposes. These year-end processes have become increasingly difficult due to the complexity of governmental financial reporting requirements. In particular, the City does not routinely capture and maintain data necessary for conversion of cash basis to appropriate fund and accrual basis financial presentation or for preparation of necessary disclosures and supplementary information reported in its financial statements. Further, the City does not routinely perform valuation assessments, such as estimates of impairment of carrying value of its long-term assets or estimates of net realizable values of receivables, in order to determine whether financial statement adjustments are appropriate.

Cause - The City's reliance on its budgetary cash basis general ledger system and year-end conversion processes to provide financial reporting information does not allow for the timely preparation of its basic financial statements along with the necessary disclosures and supplemental schedules.

Effect - The City cannot readily prepare conversion adjustments required for financial reporting purposes and cannot readily produce necessary disclosures and supplemental schedules and increases the risk of omission of information which should be reported under U.S. generally accepted accounting principles.

Identification of Repeat Finding 2016-004

Recommendation - The City should develop a plan to address deficiencies in its financial statement adjustment, close, and disclosure processes.

Views of Responsible Officials - The City's Corrective Action Plan is presented on Appendix A.

CITY OF HATTIESBURG, MISSISSIPPI

SCHEDULE OF FINDINGS AND QUESTIONED COSTS
YEAR ENDED SEPTEMBER 30, 2017

Section II - Financial Statement Findings (Cont.)

Finding:

Finding # 2017-005 Municipal Court Fines

Finding Type: Material weakness

Criteria - Internal accounting controls should be sufficient to ensure that recorded Municipal Court fines and related accounts receivable and assessments payable balances are complete, accurate, properly valued, and reported in the proper period. In addition, State law requires maintenance of permanent Court dockets and minute records, as well as an accounts receivable system which is reconciled monthly and periodically aged and analyzed.

Condition - The City lacks sufficient internal controls over Municipal Court fines to ensure that all amounts are properly recorded, that only authorized transactions are accurately recorded in the proper period, that gross balances outstanding represent valid underlying amounts, that State assessments are properly applied, that nonmonetary credits and adjustments are properly authorized and recorded, and that estimates of net realizable value take into account collection activity, nonmonetary credits and other pertinent data. City procedures related to Municipal Court fines are not adequate to achieve compliance with requirements of Mississippi law or to ensure integrity of recorded amounts.

The City does not exercise appropriate oversight of the Municipal Court accounting process. Case management activities, including both manual procedures and software application processes, are not adequate to ensure completeness or accuracy of data or to assure that errors and irregularities are prevented or detected and corrected on a timely basis. In addition, system-generated reports are not adequate to support reconciliation and roll-forward of case balances or to facilitate effective review. Periodic analyses are neither prepared nor reported to management for review, and the City lacks formal procedures and methodology to support its estimated net realizable value of outstanding fines.

Context - The Municipal Court department is responsible for maintaining detail case data, including original estimated fines, adjusted fines as legally imposed, payments and nonmonetary credits applied against fines, mandated State assessments, and various data related to each citation and offense. The City utilizes specialized peripheral software systems to record and maintain case information and related activity.

SCHEDULE 4
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CITY OF HATTIESBURG, MISSISSIPPI

SCHEDULE OF FINDINGS AND QUESTIONED COSTS
YEAR ENDED SEPTEMBER 30, 2017

Section II - Financial Statement Findings (Cont.)

Finding # 2017-005 Municipal Court Fines (Cont.)

Amounts of fines receivable and State assessments payable for each case are maintained in the separate peripheral system but are not recorded in the City's general ledger system. Instead, the general ledger reflects only daily cash receipt amounts, summarized by account, and detail of expenditures, which consist primarily of payments of State assessments. Recorded cash receipts and disbursements are the only information routinely reported to or reviewed by management. However, since the cash basis excludes amounts of fines imposed, related State assessment obligations, adjustments to case amounts, nonmonetary credits, and balances outstanding, it is insufficient to allow effective monitoring of case balances or activity related to fines.

Receivables and payables are recognized only for annual financial reporting purposes and are not reconciled or reviewed periodically. Year-end recognition of these balances, net of the allowance for uncollectible accounts, is based upon retrospective review of data available after fiscal year-end.

Subsidiary software does not effectively maintain accounting period cut-off data and there are system design and limitations that result in the reports that do not accurately reflect accounting period cut-off since records do not consistently or effectively capture dates upon which case fines legally attach or base balance calculations on dates of underlying transactions. This lack of proper accounting period information also distorts the aging analyses of outstanding balances that are required by law and are essential support for estimating collectability.

The City did not timely or effectively monitor data recorded into the subsidiary system or reports generated therefrom to ensure completeness, accuracy, or agreement to underlying records. Further, access to subsidiary computer system functions was not effectively restricted, and personnel duties were not adequately segregated to ensure that employees could not commit and conceal errors or irregularities. No procedures are routinely performed to monitor accuracy or completeness of cases initially recorded into the subsidiary records maintained in specialized application software or to reconcile or monitor recorded activity in those cases. The City did not prepare analyses or reconciliations of nonmonetary credits applied against fines for jail time served, community service, or house arrest, and other account adjustments were not monitored or reconciled.

CITY OF HATTIESBURG, MISSISSIPPI

SCHEDULE OF FINDINGS AND QUESTIONED COSTS
YEAR ENDED SEPTEMBER 30, 2017

Section II - Financial Statement Findings (Cont.)

Finding # 2017-005 Municipal Court Fines (Cont.)

Cause - The City has not established appropriate procedures for accounting for Municipal Court fines in accordance with U.S. generally accepted accounting principles or to comply with Mississippi law. City personnel responsible for Municipal Court accounting and case management lack sufficient skill, knowledge, and expertise to administer the process and lack an understanding of basic requirements for accounting for Court fines in accordance with U.S. generally accepted accounting principles and Mississippi law.

The City has not established and enforced effective segregation of duties for case management processes, including limiting access to information technology system functions, and the current application software used for case management and accounting is not adequate to meet requirements of State law or to produce sufficient financial reports. The City did not prepare interim or annual reconciliations or analyses of Municipal Court fines receivable or related assessments payable, compare recorded fines to underlying Court documents, or maintain an effective audit trail of account adjustments for the year ended September 30, 2017.

Effect - The City's systems and procedures for accounting for Municipal Court fines do not achieve effective control over completeness, accuracy, or cut-off of recorded amounts and do not meet applicable requirements of State law. Data deficiencies, system limitations, absence of effective procedures, and lack of effective oversight impede the City's ability to properly account for its fines revenues and assess collectability of its related receivable balances and State assessment obligations.

Identification of Repeat Finding 2016-005

Recommendation - The City should develop a comprehensive plan for addressing deficiencies in its Municipal Court accounting systems and procedures that allows for daily verification of case data entry and daily roll-forward of balances in fines and assessments. The City should also develop procedures to capture dates of legal attachment for all fines, as well as procedures to monitor that such data is timely and properly maintained. Additionally, the City should prepare, reconcile, review, and retain monthly case detail and summary reports, including account aging reports that are reported to appropriate City management for review and approval.

Views of Responsible Officials - The City's Corrective Action Plan is presented on Appendix A.

CITY OF HATTIESBURG, MISSISSIPPI

SCHEDULE OF FINDINGS AND QUESTIONED COSTS
YEAR ENDED SEPTEMBER 30, 2017

Section II - Financial Statement Findings (Cont.)

Finding:

Finding # 2017-006 Water and Sewer Customer Accounts Receivable

Finding Type: Material weakness

Criteria - Internal accounting controls should be sufficient to ensure that recorded Water and Sewer System customer accounts receivable are complete, accurate, properly valued, and reported in the proper period.

Condition - The City's internal controls for recording and reconciling Water and Sewer customer account balances outstanding are not sufficient to ensure that account balances are accurate and does not allow for the proper evaluation of collectability. The City does not routinely perform reconciliations or analyses of customer receivable detail records. Additionally, aged receivable reports do not segregate finance charges from service fees, thereby distorting brackets and limiting effectiveness for monitoring propriety of service cut-off and assessing overall collectability. The City is also unable to produce reliable reports of subsequent collections on year-end outstanding balances for proper assessment of collectability and has no formal documentation of methodology or calculations supporting its estimated allowance for doubtful accounts.

Context - The City utilizes a separate module of its general ledger accounting software for its Water and Sewer billing functions that does not include an interface with the City's general ledger accounting system, and the City does not routinely review, reconcile, or analyze aggregate Water and Sewer customer account receivables.

Cause - While the City routinely processes and reviews billing route reports and reports of unpaid accounts subject to service cut-off, City procedures do not require periodic generation, reconciliation, and retention of detail accounts receivable and activity reports.

Effect - Without timely reconciliations and proper aging of its customer account balances and related activity, the City cannot readily determine net realizable value of outstanding Water and Sewer customer accounts receivable at fiscal year-end. This lack of timely review and reconciliation of subsidiary account balances could allow significant errors to go undetected.

CITY OF HATTIESBURG, MISSISSIPPI

SCHEDULE OF FINDINGS AND QUESTIONED COSTS
YEAR ENDED SEPTEMBER 30, 2017

Section II - Financial Statement Findings (Cont.)

Finding # 2017-006 Water and Sewer Customer Accounts Receivable (Cont.)

Identification of Repeat Finding 2016-006

Recommendation - The City should implement procedures to routinely prepare and reconcile Water and Sewer customer accounts receivable activity and balances at each interim period, and a formal analysis of collectability of outstanding balances should be performed on at least an annual basis in order to estimate the related allowance for doubtful accounts.

Views of Responsible Officials - The City's Corrective Action Plan is presented on Appendix A.

Finding:

Finding # 2017-007 Water and Sewer Billings

Finding Type: Material weakness

Criteria - Effective internal accounting controls should ensure that recorded transactions pursuant to billings for all Water and Sewer services are complete and accurate.

Condition - The City's internal controls do not include analysis of accounting data in conjunction with the Water and Sewer volumes that are processed and billed. The City also does not formally document, reconcile, or monitor adjustments to customer billings to ensure propriety and accuracy.

Context - The City was unable to explain increases in unaccounted for water volume or to readily provide amounts attributable to usage by City facilities.

Cause - Certain City facilities are not metered for Water and Sewer volume, and no periodic review of volumes not billed, also known as "unaccounted for" volumes, is performed.

Effect - As a result of ineffective control procedures, there is a risk that the City could fail to detect Water and Sewer usage at unmetered locations or significant leaks in City infrastructure. Unmetered usage would not be routinely billed by the City, resulting in failure to realize related revenues.

Identification of Repeat Finding 2016-007

CITY OF HATTIESBURG, MISSISSIPPI

SCHEDULE OF FINDINGS AND QUESTIONED COSTS
YEAR ENDED SEPTEMBER 30, 2017

Section II - Financial Statement Findings (Cont.)

Finding # 2017-007 Water and Sewer Billings (Cont.)

Recommendation - We recommend that the City install meters at all City facilities to monitor Water and Sewer system internal usage. In addition, we recommend that the City generate periodic reports of volumes used in order to monitor economic resources and system usage to facilitate effective management of "unaccounted for" volumes.

Views of Responsible Officials - The City's Corrective Action Plan is presented on Appendix A.

Finding:

Finding # 2017-008 Water and Sewer Customer Meter Deposits

Finding Type: Material Weakness

Criteria - Effective internal accounting controls should ensure that recorded liabilities for customer meter deposits accurately reflect detail balances and that activity in such accounts is properly recorded and reported.

Condition - The City's liability for customer meter deposits does not agree to its customer detail records, and no effective reconciliation has been performed. Additionally, meter deposits applied against customer account balances are not timely reconciled.

Context - The City does not routinely generate, reconcile, or review reports of Water & Sewer System customer meter deposit balances. Additionally, meter deposit rates vary by nature of customer and meter, and rates change from time to time pursuant to City Council action. However, the City has no effective procedures to ensure that amounts reflected in subsidiary account detail are reasonable.

Cause - The City's procedures for reviewing customer meter deposit balances are not adequate to ensure that recorded amounts are reasonable and consistent with established rates. In addition, reconciliations of balances and periodic activity are not routinely performed.

Effect - The City has been unable to ascertain the cumulative amount of unrecorded applied meter deposits or to identify the nature and amounts of other errors.

CITY OF HATTIESBURG, MISSISSIPPI

SCHEDULE OF FINDINGS AND QUESTIONED COSTS
YEAR ENDED SEPTEMBER 30, 2017

Section II - Financial Statement Findings (Cont.)

Finding # 2017-008 Water and Sewer Customer Meter Deposits (Cont.)

Identification of Repeat Finding 2016-008

Recommendation - The City should perform a review of its subsidiary records of customer meter deposits, and any errors that are identified should be corrected. The City should also implement procedures to routinely prepare and reconcile customer meter deposit activity and balances.

Views of Responsible Officials - The City's Corrective Action Plan is presented on Appendix A.

Finding:

Finding # 2017-009 Capital Assets

Finding Type: Material weakness

Criteria - Internal controls over capital assets should be sufficient to ensure that assets are properly recorded, depreciated, assessed for impairment, and reported. Detail subsidiary ledgers should be reconciled on a timely basis, and disposals should be timely recognized and reported. Rights and obligations related to ownership and pledges of capital assets should also be properly reported.

Condition - The City's procedures and controls are not sufficient to ensure that all City-owned assets are properly recorded. Additionally, the City's procedures related to construction projects are not sufficient to ensure that all project costs are identified and captured in the proper period.

Context - Existing accounting procedures do not ensure inclusion of contributed assets received or transfers of infrastructure from developers or other governmental entities, and the City does not routinely reconcile capital outlay expenditures to additions to fixed assets and additional inventoried items. The City does not routinely monitor assets acquired with grants or other restricted funds to ensure that any disposition of those assets is in accordance with terms of agreements and/or regulations and to ensure proper disclosure of commitments relating to those assets. Also, the City does not periodically assess its long-term assets for impairment nor does the City have an adequate system of accounting for its construction project activity.

SCHEDULE 4
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CITY OF HATTIESBURG, MISSISSIPPI

SCHEDULE OF FINDINGS AND QUESTIONED COSTS
YEAR ENDED SEPTEMBER 30, 2017

Section II - Financial Statement Findings (Cont.)

Finding # 2017-009 Capital Assets (Cont.)

Cause - The City did not routinely and formally reconcile capital asset subsidiary detail to its financial statements, and the City does not maintain a comprehensive schedule of construction projects sufficient to support financial reporting.

Effect - The City's procedures are not adequate to ensure that capital outlay expenditures are reported in the proper period, properly classified as capital expenditure or expense, or that interest is properly capitalized for proprietary fund projects. Detail records are not timely reconciled to detect errors or irregularities, or to ensure that required disclosures are accurate and complete.

The City's deficiencies in procedures related to construction projects and capital assets indicate material weaknesses in internal controls over financial reporting.

Identification of Repeat Finding 2016-009

Recommendation - The City should take immediate steps to develop and implement a comprehensive system for accounting for capital assets, including construction projects. Subsidiary records should include adequate descriptions and should be periodically reviewed to identify any assets no longer in service or those with indicated impairment.

Views of Responsible Officials - The City's Corrective Action Plan is presented on Appendix A.

Section III - Federal Awards Findings and Questioned Costs

Finding:

Finding: # 2017-010 Procurement and Suspension and Debarment (I)

Finding Type: Material Weakness

Program Tested: CFDA No. 20.205: Highway Planning and Construction

CITY OF HATTIESBURG, MISSISSIPPI

SCHEDULE OF FINDINGS AND QUESTIONED COSTS
YEAR ENDED SEPTEMBER 30, 2017

Section III - Federal Awards Findings and Questioned Costs (Cont.)

Finding: # 2017-010 Procurement and Suspension and Debarment (I) (Cont.)

Criteria - According to the Uniform Guidance, Section 200.212 of 2 CFR, Subpart C - Pre-Federal Award Requirements, non-federal entities and contractors are subject to the non-procurement debarment and suspension regulations implementing Executive Orders 12549 and 12689, 2 CFR part 180. These regulations restrict awards, subawards, and contracts with certain parties that are debarred, suspended, or otherwise excluded from or ineligible for participation in Federal assistance programs or activities.

Condition - The City does not have adequate internal control procedures in place to monitor compliance with the federal debarment and suspension regulations for contracts and subawards.

Questioned Costs - Undetermined

Effect - The City could contract with parties that have been debarred or suspended by the federal government.

Cause - The City has experienced substantial turnover of personnel assigned to perform these procedures and has not monitored compliance with these provisions.

Identification of Repeat Finding 2016-010

Recommendation - The City should implement procedures to ensure compliance with the debarment and suspension regulations for contracts related to federal programs.

Views of responsible officials - The City's Corrective Action Plan is presented on Appendix A.

Finding:

Finding # 2017-011 Federal Expenditure Management (A/B, C, G, H, L)

Finding Type: Material Weakness

Program Tested: CFDA No. 20.205: Highway Planning and Construction

CITY OF HATTIESBURG, MISSISSIPPI

SCHEDULE OF FINDINGS AND QUESTIONED COSTS
YEAR ENDED SEPTEMBER 30, 2017

Section III - Federal Awards Findings and Questioned Costs (Cont.)

Finding # 2017-011 Federal Expenditure Management (A/B, C, G, H, L) (Cont.)

Criteria - Section 200.300 of 2 CFR, Subpart D - Post Federal Award Requirements, requires Federal costs to be identified in accordance with cost principles and grant requirements. Financial management systems, including records documenting compliance with Federal statutes, regulations, and the terms and conditions of the Federal award, must be sufficient to permit the preparation of reports required by general and program specific terms and conditions and the tracing of funds to a level of expenditures adequate to establish that such funds have been used according to the Federal statutes, regulations, and the terms and conditions of the Federal award. The financial management system must provide for identification of the Federal program, CFDA title and number, award identification number and year, name of the Federal agency and any pass-through entity, as well as accurate, current, and complete disclosure of financial results of each Federal award program. Records must adequately identify the source and application of funds for federally-funded activities and must contain information pertaining to Federal awards, authorizations, obligations, unobligated balances, assets, expenditures, income and interest, and such information must be supported by source documentation.

Condition - Federal and non-Federal expenditures were not readily identifiable from grant records maintained by the City for the year ended September 30, 2017. Costs allowable and not allowable are not specifically identified in financial records or reconciled to reimbursement requests. Category of cost, such as program delivery or administrative cost, is not initially captured upon recording expenditures in the City's financial records, and adjustments to classifications are not timely reconciled to underlying accounts or submitted reimbursement requests. Transaction dates are based on cash payment processing, and payment release dates and service periods for underlying costs are not readily determinable.

Questioned Costs - Undetermined

Context - The City utilizes fund accounts in its general ledger system to capture, maintain, and report activity related to its grant programs. The City also utilizes peripheral manual and electronic applications in its grant administration process. However, these procedures do not readily provide data necessary to distinguish Federal expenditures from non-Federal costs incurred. Total program cost is not segregated between allowable and unallowable costs, and expenditures of Federal funds are not segregated from costs funded by matching funds or other funds. Further, expenditures are captured solely on a cash basis, and dates of underlying activity are not contemporaneously captured to identify expenditure date for Federal purposes.

SCHEDULE 4
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CITY OF HATTIESBURG, MISSISSIPPI

SCHEDULE OF FINDINGS AND QUESTIONED COSTS
YEAR ENDED SEPTEMBER 30, 2017

Section III - Federal Awards Findings and Questioned Costs (Cont.)

Finding # 2017-011 Federal Expenditure Management (A/B, C, G, H, L) (Cont.)

Cause - The City's general ledger system structure lacks complexity necessary to capture all accounting data related to Federal program expenditures, and peripheral systems and procedures are not sufficient to readily fill the gap in that data so that all categories of costs of Federal programs may be readily identified and reported.

Effect - The City was unable to readily segregate Federal from non-Federal program expenditures or reconcile reimbursement requests to specific Federal expenditures.

Identification of Repeat Finding 2016-011

Recommendation - The City should immediately implement procedures to maintain comprehensive schedules of program expenditures that distinguish Federal and non-Federal expenditures and identify matching funds provided. Reconciliations of Federal expenditures to allowable costs and total program expenditures should be timely performed and monitored. Reimbursement requests should be reconciled to supporting schedules of Federal expenditures, and appropriate cut-off should be established for periodic reporting.

Views of Responsible Officials - The City's Corrective Action Plan is presented on Appendix A.

Finding:

Finding # 2017-012 Non-compliance resulting from deficiencies in financial statement internal control over timeliness of financial reporting (L)

Finding Type: Material Weakness

Program Tested: CFDA No. 20.205: Highway Planning and Construction

Criteria - According to the Uniform Guidance, 2 CFR 200.501(a), non-Federal entities that expend $750,000 or more in a year in Federal awards shall have a single or program specific audit conducted for that year in accordance with the provisions of these parts. Guidance on determining Federal awards expended is provided in §_.205 and 2 CFR 200.502. The audit package and the data collection form shall be submitted 30 days after receipt of the auditor's report(s), or 9 months after the end of the fiscal year - whichever comes first - pursuant to Uniform Guidance 2 CFR 200.512(a).

SCHEDULE 4
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CITY OF HATTIESBURG, MISSISSIPPI

SCHEDULE OF FINDINGS AND QUESTIONED COSTS
YEAR ENDED SEPTEMBER 30, 2017

Section III - Federal Awards Findings and Questioned Costs (Cont.)

Finding # 2017-012 Non-compliance resulting from deficiencies in financial statement internal control over timeliness of financial reporting (L) (Cont.)

Condition - The City's audit package for the fiscal year ended September 30, 2017 was not timely submitted to the Federal Audit Clearinghouse.

Questioned Costs - Undetermined

Context - See Financial Statement Finding # 2017-003.

Cause - See Financial Statement Finding # 2017-003.

Effect - The City did not comply with Federal Single Audit requirements for timely submission of its audit package.

Identification of Repeat Finding 2016-012

Recommendation - See Financial Statement Finding # 2017-003.

Views of Responsible Officials - The City's Corrective Action Plan is presented on Appendix A.

Finding:

Finding # 2017-013 Non-compliance resulting from deficiencies in financial statement internal control over financial statement adjustment close, and disclosure (A/B, C, G, H, L)

Finding Type: Significant Deficiency/Significant Noncompliance

Program Tested: CFDA No. 20.205: Highway Planning and Construction

CITY OF HATTIESBURG, MISSISSIPPI

SCHEDULE OF FINDINGS AND QUESTIONED COSTS
YEAR ENDED SEPTEMBER 30, 2017

Section III - Federal Awards Findings and Questioned Costs (Cont.)

Finding # 2017-013 Non-compliance resulting from deficiencies in financial statement internal control over financial statement adjustment close, and disclosure (A/B, C, G, H, L) (Cont.)

Criteria - According to the Uniform Guidance, the auditee shall identify, in its accounts, all Federal awards received and expended and the Federal programs under which they were received. Federal program and award identification shall include, as applicable, the CFDA title and number, award number and year, name of the Federal agency, and name of the pass-through entity. The auditee shall also maintain internal control over Federal programs that provides reasonable assurance that the auditee is managing Federal awards in compliance with laws, regulations, and the provisions of contracts or grant agreements that could have a material effect on each of its Federal programs and prepare appropriate financial statements, including the schedule of expenditures of Federal awards. In addition, Title 2: Grants and Agreements, Part 200 - *Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards*, Subpart D - Post Federal Award Requirements section 200.302(b), each non-Federal entity's financial management system must provide accurate, current, and complete disclosure of the financial results of each Federal award or program in accordance with the appropriate reporting requirements, including distinguishing allowable costs from costs not allowable, direct costs from indirect costs, and Federal expenditures from costs paid to meet match requirements or paid from other non-Federal funds.

Condition - The City did not contemporaneously distinguish allowable Federal program costs from ineligible costs, distinguish Federal expenditures from non-Federal expenditures, or specifically identify costs used to meet match and cost-sharing requirements. In addition, the City had no effective processes to ensure that direct and indirect costs were treated consistently among all Federal awards administered by various City departments.

Questioned Costs - Undetermined

Context - See Financial Statement Finding # 2017-004.

Cause - See Financial Statement Finding # 2017-004.

Effect - The City could not readily produce schedules of its Federal program costs, obligated funds, or funds receivable. Further, the City could not reconcile obligated, expended, received, and available Federal funds to its accounting records.

CITY OF HATTIESBURG, MISSISSIPPI

SCHEDULE OF FINDINGS AND QUESTIONED COSTS
YEAR ENDED SEPTEMBER 30, 2017

Section III - Federal Awards Findings and Questioned Costs (Cont.)

Finding # 2017-013 Non-compliance resulting from deficiencies in financial statement internal control over financial statement adjustment close, and disclosure (A/B, C, G, H, L) (Cont.)

Identification of Repeat Finding 2016-013

Recommendation - See Financial Statement Finding # 2017-004.

Views of Responsible Officials - The City's Corrective Action Plan is presented on Appendix A.

Finding:

Finding 2017-014 Non-compliance resulting from deficiencies in financial statement internal control over capital assets (A/B, F)

Finding Type: Material Weakness

Program Tested: CFDA No. 20.205: Highway Planning and Construction

Criteria - Costs incurred for capital assets are subject to property standards prescribed in the Uniform Guidance 2 CFR, Subpart D - Post Federal Award Requirements.

Condition - The City does not adequately account for its capital projects funded by Federal awards. Project detail records do not adequately identify allowable and unallowable costs or matching fund obligations, and Federal and non-Federal expenditures are not effectively segregated or reconciled to reimbursement requests. The City does not effectively monitor its capital project cost reimbursement requests prepared by third party service providers or recalculate and reconcile Federal costs to those reimbursement requests. The City does not critically evaluate the terms of its Federal awards and agreements related to property ownership and reversionary provisions in order to assess its rights and obligations under such agreements and to ensure that capital assets and commitments are properly monitored.

In addition, the City could not readily provide a list of assets subject to reversionary provisions if not continually used for appropriate program purposes and therefore could not demonstrate effective monitoring of ongoing use of such Federally-funded assets.

CITY OF HATTIESBURG, MISSISSIPPI

SCHEDULE OF FINDINGS AND QUESTIONED COSTS
YEAR ENDED SEPTEMBER 30, 2017

Section III - Federal Awards Findings and Questioned Costs (Cont.)

Finding 2017-014 Non-compliance resulting from deficiencies in financial statement internal control over capital assets (A/B, F) (Cont.)

Questioned Costs - Undetermined

Context - See Financial Statement Finding # 2017-009.

Cause - See Financial Statement Finding # 2017-009.

Effect - The City may be subject to disallowed costs or obligations under reversionary provisions for assets acquired or constructed using Federal funds, and the amounts of potential disallowed costs could be material.

Identification of Repeat Finding 2016-014

Recommendation - See Financial Statement Finding # 2017-009.

Views of Responsible Officials - The City's Corrective Action Plan is presented on Appendix A.

Finding:

Finding 2017-015 Non-compliance resulting from (L) grant reporting requirements

Finding Type: Material Weakness

Program Tested: CFDA No. 97.036: Disaster Grants – Public Assistance (Presidentially Declared Disasters)

Criteria - Progress status reports are required quarterly in accordance with 2 CFR 200 policy requirements.

Condition - Quarterly progress reports for disaster-related expenditures were found to be inaccurate or unavailable. These quarterly reports are prescribed in the City's executed State-Local Disaster Assistance Agreement and, pursuant to that agreement, the City is required to document the anticipated completion date for each project, together with any other circumstance that may affect the completion date, the scope of the work, the project costs, and any other factors that many affect compliance with the Agreement.

CITY OF HATTIESBURG, MISSISSIPPI

SCHEDULE OF FINDINGS AND QUESTIONED COSTS
YEAR ENDED SEPTEMBER 30, 2017

Section III - Federal Awards Findings and Questioned Costs (Cont.)

Finding 2017-015 Non-compliance resulting from (L) grant reporting requirements (Cont.)

Questioned Costs - Undetermined

Context - The City contracted with independent consultants in order to obtain assistance in the processing of disaster-related expenditures and to meet administrative requirements. The City did not effectively monitor the timely filings of accurate quarterly progress reports.

Cause - The City experienced significant administrative staff turnover in the months preceding the disaster, and whereas the City did obtain independent assistance of the processing of disaster-related transactions, there were no reliable monitoring procedures in place over the quarterly reporting requirements.

Effect - The City may be subject to disallowed costs or deobligation of funds as a result of non-compliance with failure to submit prescribed quarterly progress reports on a timely basis.

Recommendation - The City should immediately implement procedures that will result in the filing of all required quarterly progress reports.

Views of Responsible Officials - The City's Corrective Action Plan is presented on Appendix A.

CITY OF HATTIESBURG, MISSISSIPPI

AUDITEE CORRECTIVE ACTION PLAN

Year Ended September 30, 2017

APPENDIX A

Mayor

Toby Barker

COUNCIL - WARD ONE	COUNCIL - WARD TWO	COUNCIL - WARD THREE	COUNCIL - WARD FOUR	COUNCIL - WARD FIVE
Jeffrey George	*Deborah Denard Delgado*	*Carter Carroll*	*Mary Dryden*	*Nicholas Brown*

Auditee Corrective Action Plan

The City of Hattiesburg respectfully submits the following corrective action plan

Audit Period: September 30, 2017

The findings discussed below are numbered consistently with the numbers assigned in the schedule of findings and questioned costs.

Corrective Action Plan for Financial Statement Findings

2017-001 Entity-Level Control Environment and Risk Assessment Processes

The City's Administration acknowledges the importance of the control environment and, in particular, the organizational structure, with the assignment of authority and responsibility in addressing risks relevant to the achievement of financial reporting objectives. The incoming Administration has initiated an entity-wide assessment of the existing organizational structure, and establishment and monitoring of internal controls will be an inherent component of this assessment. We expect this process to be completed by late fall, 2018.

Name of Responsible Person:	Ann Jones, Chief Administrative Officer; Connie Everett, Interim Chief Financial Officer
Name of Department Contact:	Ann Jones, Chief Administrative Officer
Expected Date of Completion:	Fall 2018

2017-002 Entity-Level Information, Communication and Monitoring

Please note in the section "Views of Responsible Officials": The City agrees with this finding in general, but with certain qualifications.

Auditee Corrective Action Plan (Cont.)

As noted in Finding 2017-002, the City "utilizes a centralized system of accounting for its budgetary cash basis transactions." This accounting system has consistently allowed for the accurate and timely financial reports that provide, at all times, a reliable monitoring of the City's compliance with its legally adopted budgets. There will typically be significant conversion procedures at year-end that are necessary for financial reporting purposes, and this will, we believe, be the norm for most local governments as opposed to the periodic accounting cut-off data for conversion from budgetary cash basis to financial reporting basis.

The Administration's efforts to promptly assess the existing internal control structure will incorporate the identification of opportunities to improve upon the production of financial information pursuant to specific items noted in Finding 2016-002. Some Items, such as list of active Federal awards, will be implemented immediately. Other items, such as a list of debt compliance, have always been readily available.

Name of Responsible Person:	Connie Everett, Interim Chief Financial Officer
Name of Department Contact:	Lisa Hanson, Comptroller
Expected Date of Completion:	Fall 2018

2017-003 Timeliness of Financial Reporting

As noted in the City's response to Finding 2016-002, the City's accounting system does provide reliable and timely budgetary basis financial reporting. The Administration is committed to facilitating procedures that will allow for the financial reporting accounting conversion process at year-end to be completed on a timely basis in order to allow for the City to meet all financial reporting deadlines.

The Administration acknowledges that there are important reporting deadlines for the 2017 audit that have already not been met. It is our firm commitment to complete the 2017 audit as quickly and efficiently as possible. The Administration will ascertain that the 2018 audit reporting process meets all applicable deadlines.

Name of Responsible Person:	Connie Everett, Interim Chief Financial Officer
Name of Department Contact:	Lisa Hanson, Comptroller
Expected Date of Completion:	Fall 2018

2017-004 Financial Statement Adjustment, Close, and Disclosure

In 2017, the City's Comptroller was allowed to add a CPA to her existing staff. Finding 2017-004 emphasizes the “increasing complexity of financial reporting requirements", and it includes other notations that generally describe the difficulties encountered by the City in its financial accounting functions. Other points, including the need for a formal process for ensuring the accuracy and completeness of various peripheral systems and reconciliation procedures, are, in the opinion of the Administration, valid concerns.

Auditee Corrective Action Plan (Cont.)

As noted in our response to findings 2017-002 and 2017-003, the City will continue to produce reliable and timely budgetary basis accounting reports, and the Accounting Department will facilitate improved conversion procedures that are needed in order for the financial statements to be prepared in accordance with generally accepted accounting principles. We anticipate substantial improvements will be made in conjunction with the 2018 audit in the fall months of 2018.

Name of Responsible Person:	Lisa Hanson, Comptroller
Expected Date of Completion:	Fall 2018

2017-005 Municipal Court Fines

The Administration will assess the ongoing difficulties experienced pursuant to the court fines recordkeeping function. If the determination is made that additional training and/or independent Information Technology services are necessary, the City will immediately take corrective measures to allow for reliable financial statement reporting as well as compliance with applicable state law. This assessment began in August 2017 and is ongoing; other measures, if required, will be implemented in fall 2018.

Name of Responsible Person:	Ann Jones, Chief Administrative Officer
Name of Department Contact:	Ann Jones, Chief Administrative Officer; Greg Ladner, Assistant to Mayor
Estimated Date of Completion:	Will depend upon Information Technology assessment

2017-006 Water and Sewer Customer Accounts Receivable

The Administration will implement procedures to routinely prepare and reconcile Water and Sewer customer accounts receivable activity and balances periodically, along with a formal analysis of the collectability of outstanding balances in order to estimate the related allowances for doubtful accounts. The centralized accounting department does provide a daily tracking of recorded receipts in conjunction with the daily deposits at the bank, and this has provided a reliable internal control procedure. There may be a need, however, for the water and sewer billing office staff to assist in the maintenance of important subsidiary records that are subject to routine oversight by the accounting department.

Assessment of operations may reveal the need for additional training of personnel on accounting procedures, and the Information Technology staff may need to assist in facilitation of these shared responsibilities. Implementation began in fall 2017 and is ongoing.

Name of Responsible Person:	Allen Howe, Director of Water and Sewer
Name of Department Contact:	Wanda Turner, Office Manager
Estimated Date of Completion:	Fall 2018

Auditee Corrective Action Plan (Cont.)

2017-007 Water and Sewer Billings

The Administration will assess the current organizational structure as it relates to the water and sewer billing function. In particular, the Administration will emphasize the need for periodic analysis procedures to be performed. We have initiated our efforts to ascertain any problems that may need to be addressed in order to implement these reports and agree that an enhanced role by the Customer Accounts staff may be appropriate. These initial efforts were began in May 2018 and are ongoing.

Name of Responsible Person:	Allen Howe, Director of Water and Sewer
Name of Department Contact:	Wanda Turner, Office Manager
Estimated Date of Completion:	Fall 2018

2017-008 Water and Sewer Customer Meter Deposits

As noted in Finding 2017-007, the City will assess the current water and sewer organizational structure as a component of the Administration's entity-wide study of the existing assignment of responsibilities and personnel assessment. The improvements needed for meter deposit subsidiary records may require a reassignment of duties, improved reporting procedures and/or cross-training with existing accounting and Information Technology personnel. The importance of routine reconciliation procedures will be emphasized, and we anticipate these procedures to be implemented in fall 2018.

Name of Responsible Person:	Allen Howe, Director of Water and Sewer
Name of Department Contact:	Wanda Turner, Office Manager; Angie Sanford, Information Technology Manager
Estimated Date of Completion:	Fall 2018

2017-009 Capital Assets

The City will implement a comprehensive system of policies and procedures for accounting for capital assets. This system will accommodate both approved construction projects and acquisitions of assets achieved outside the routine cash disbursement process, as well as any contributions or transfers of fixed assets to the City. Additionally, fixed asset subsidiary records will include adequate descriptions to allow management to identify specific asset items, and the system will allow for periodic review by the City's management team for the identification of impaired assets or assets no longer in service. As noted, these procedures should allow for adequate training of employees for proper coding as well as ascertaining that capitalization policies and procedures are followed. The Administration will schedule capitalization policies and procedures training sessions for the various operating departments in fall 2018 to update responsible employees and answer any questions they may have.

Name of Responsible Person:	Connie Everett, Interim Chief Financial Officer; Ann Jones, Chief Administrative Officer
Name of Department Contact:	Lamar Rutland, Director of Engineering; Lisa Hanson, Comptroller
Estimated Date of Completion:	Fall 2018

Auditee Corrective Action Plan (Cont.)

2017-010 Procurement and Suspension and Debarment (I)
CFDA No. 20.205: Highway Planning and Construction

The City's Purchasing Department has the designated responsibility of monitoring compliance with the federal debarment and suspension regulations for contracts and subawards. Due to staffing changes over the past two years of department managers, as well as subordinate staff, this function was not assigned to a new staff person. This procedure should be conducted in the Purchasing Department, and current staff will be advised to reinstate this procedure.

Name of Responsible Person:	Connie Everett, Interim Chief Financial Officer
Name of Department Contacts:	Sylvester London, Assistant Division Manager and Michael Pope, Purchasing Assistant
Expected Date of Completion:	Fall 2018

2017-011 Federal Expenditure Management (A/B, C, G, H, L)
CFDA No. 20.205: Highway Planning and Construction

The City acknowledges that detailed information distinguishing federal and non-federal expenditures is not easily identified within the current accounting structure. The ability to track expenditures in this manner does exist and will be implemented in the current accounting system. Supporting spreadsheets can be developed within the departments responsible for documenting federal and non-federal expenditures to provide added documentation.

Name of Responsible Person:	Lamar Rutland, City Engineer
Expected Date of Completion:	Fall 2018

2017-012 Non-Compliance Resulting from Deficiencies in Financial Statement Internal Control over Timeliness of Financial Reporting (L)

The Administration acknowledges that there are important reporting deadlines for submission of completed audits to the Federal Audit Clearinghouse. The City's position concerning current financial statement reporting abilities has been addressed in the response to Finding 2017-002 and Finding 2017-003. It is the incoming Administration's intent to explore updating financial software in order to more easily comply with financial reporting requirements. In the interim, efforts will be made to for timely completion of the 2018 audit.

Name of Responsible Persons:	Lisa Hanson, Comptroller; Connie Everett, Interim Chief Financial Officer
Name of Department Contact:	Ann Jones, Chief Administrative Officer
Expected Date of Completion:	Fall 2018 and ongoing

Auditee Corrective Action Plan (Cont.)

2017-013 Non-Compliance Resulting from Deficiencies in Financial Statement Internal Control over Financial Statement Adjustment, Close, and Disclosure (A/B, C, G, H L)

As discussed in the City's response to Financial Statement Finding 2017-004, the City has added to its Accounting Department staff an individual who has the capability of undertaking the more complex aspects of financial statement reporting, in order to ensure compliance with guidelines. In addition, as stated above, the City intends to explore updating the financial software in order to more easily comply with financial reporting requirements. In the interim, supplementary schedules can be developed to better track federal program costs and funds received and expended.

Name of Responsible Person: Lisa Hanson, Comptroller
Expected Date of Completion: Fall 2018 and ongoing

2017-014 Non-Compliance Resulting From Deficiencies in Financial Statement Internal Control over Capital Assets (A/B, F)

The City acknowledges that deficiencies exist in current procedure as to detailed accounting procedure for recording capital assets and accounting for federal grant monies associated with capital assets. The capability exists within the current accounting system for better segregation of federal and non-federal expenditures and allowable and unallowable costs. Supplementary schedules can be maintained in the City Engineer's office for projects that department oversees, in order to provide an additional level of detail and accountability.

Name of Responsible Persons: Lamar Rutland, City Engineer; Lisa Hanson, Comptroller; Connie Everett, Interim Chief Financial Officer
Name of Department Contact: Ann Jones, Chief Administrative Officer
Expected Date of Completion: Fall 2018 and ongoing

Finding 2017-015 Non-compliance resulting from reporting requirements (L)

The City acknowledges that deficiencies existed in procedures related to timely reporting of quarterly project status records. Subsequent to the change in the municipal election in 2017, the city administration experienced several staffing changes and reassignment of responsibilities. The designation of Applicant-Agent for federal disaster reporting was reassigned, and this individual was unaware of the quarterly reporting requirements. During fiscal year 2018, this individual was trained as to the responsibilities of the Applicant-Agent with respect to the reporting requirements, and the deficiency has been corrected.

Name of Responsible Person: Kermas Eaton, City Clerk
Name of Department Contact: Ann Jones, Chief Administrative Officer
Expected Date of Completion: Fall 2018

CITY OF HATTIESBURG, MISSISSIPPI

SUMMARY SCHEDULE OF PRIOR AUDIT FINDINGS

Year Ended September 30, 2017

Mayor
Toby Barker

COUNCIL - WARD ONE *Jeffrey George*
COUNCIL - WARD TWO *Deborah Denard Delgado*
COUNCIL - WARD THREE *Carter Carroll*
COUNCIL - WARD FOUR *Mary Dryden*
COUNCIL - WARD FIVE *Nicholas Brown*

Summary Schedule of Prior Audit Findings
Year Ended September 30, 2017

The following is an update of the prior audit findings and is prepared in accordance with Title 2 *U.S. Code of Federal Regulations* Part 200, *Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards.*

2016-001 Entity-Level Control Environment and Risk Assessment Process

Condition **-** This finding was a material weakness stating that entity-wide controls and procedures were not effectively initiated or implemented for corrective actions in response to material weaknesses and significant deficiencies in internal control identified in its financial statement audit for the year ended September 30, 2014.

Recommendation **-** The auditor recommended that the City take steps to implement corrective actions for identified material weaknesses and significant deficiencies in internal controls.

Current Status **-** In early 2018, the Administration implemented changes to the organizational structure, adding a Department of Finance and Procurement, and assigning responsibility for this function to the Chief Financial Officer. The change has provided improved communication and oversight for financial functions with the City Clerk and the Department of Administration. An additional accountant was hired in early 2017, and that position serves as liaison with the various city departments to ensure greater accountability and documentation of ongoing projects.

2016-002 Entity-Level Information, Communication and Monitoring

Condition **-** This finding was a material weakness stating that entity-wide controls and procedures did not effectively ensure that all information relevant to the financial reporting process was timely identified and communicated for assessment of financial reporting impact and for assimilation into the financial reporting process.

Recommendation **-** The auditor recommended that the City formalize its information, communications, and monitoring processes to ensure that data from external and internal sources is timely captured, retained, and available for financial reporting purposes. Management concurred with the recommendation and indicated that the procedures would be implemented.

Summary Schedule of Prior Audit Findings Year Ended September 30, 2017 (Cont.)

Current Status - As mentioned in the current status to Finding 2016-001, the additional accountant hired in 2017 has been assigned the responsibility of communicating with various city departments to ensure proper capture and documentation of financial information on various projects. This position is responsible for compiling and documenting information for federal awards, and preparation and maintenance of supplementary spreadsheets has been developed and is being utilized at this time. City Administration acknowledges that updating the financial software is necessary in order to properly report financial information in accordance with generally accepted accounting principles, and the Administration has engaged a consultant to perform a needs assessment. Evaluation of available software will be paired with the results of the needs assessment to determine the software best suited to the City's needs. Selection and implementation of updated financial software will follow. In the interim, greater emphasis is being placed on capture and documentation of required information, as stated above.

2016-003 Timeliness of Financial Reporting

Condition - This finding was a material weakness stating the City failed to meet financial reporting deadlines for submitting its financial statements for the year ended September 30, 2016.

Recommendation - The auditor recommended that the City should take steps to overhaul its financial reporting process to enable it to meet its legal, regulatory, and contractual financial reporting requirements.

Current Status - As stated in the current status to Finding 2016-002, the City has engaged a consultant to conduct a needs assessment to determine the appropriate financial software, as well as supplementary software for other city departments which can integrate with the financial software, to ensure the City's ability to meet the required reporting requirements. Upon selection of an audit firm to perform the 2016 and 2017 audits, the City officials stressed the importance of expeditious completion of the audits. As a result, the 2016 audit was completed in six months, and the 2017 audit is expected to be complete in November 2018. The 2018 audit will begin immediately thereafter.

2016-004 Financial statement Adjustment, Close, and Disclosure

Condition - This finding was a material weakness stating that the City's internal accounting controls were not sufficient to ensure that transactions and account balances were properly reported in conformity with bases of accounting required by generally accepted accounting principles .

Recommendation - The auditor recommended that the City assess the quality of existing peripheral processes and implement effective control procedures to ensure that data maintained therein is accurate and that errors or irregularities are prevented or timely detected and corrected. Management concurred with the recommendation and indicated that the procedures would be implemented.

Summary Schedule of Prior Audit Findings Year Ended September 30, 2017 (Cont.)

Current Status - As stated in the current status to Finding 2016-002, a needs assessment and subsequent selection and implementation of updated financial software is underway. The Administration acknowledges that during the period 2014 – 2017, staffing changes due to retirements resulted in loss of institutional knowledge which had, in the past, afforded timely and accurate production of financial information at year-end. The Administration has taken steps to provide the needed support and institutional knowledge to ensure improvement in this area through the hiring process and subsequent training of current staff.

2016-005 Municipal Court Fines

Condition - This finding was a material weakness stating that the City's internal controls are not adequate to ensure that Municipal Court fines are properly valued and reported.

Recommendation - The auditor recommended that the City generate, reconcile, review, and retain monthly receivable detail and summary reports, including agings of outstanding fines account balances and that the City analyze periodic reports and related trends in assessing collectability and in estimating the allowance for doubtful accounts. Management concurred with the recommendation and indicated that the procedures would be implemented.

Current Status - . The Administration reorganized the Municipal Court system in 2018, with selection of new judges and support personnel. The staff has been analyzing the court software and obtaining training in order to assess modifications necessary to meet reporting requirements. The City has engaged auditors to work with Court personnel to assess prior years' data to determine outstanding fines account balances to correct reporting deficiencies. It is believed that, with additional staff training and assessment of software modifications needed, that the Court software will be adequate to provide accurate data presentation. The needs assessment being conducted, as mentioned in the current status to Finding 2016-002, will serve to determine whether the current Court software will be compatible with future selection of financial reporting software.

2016-006 Water and Sewer Customer Accounts Receivable

Condition - This finding was a material weakness stating that the City's internal controls for recording and reconciling customer account balances outstanding are not sufficient to ensure that account balances are accurate and reflect valid amounts receivable and that collectability is properly evaluated.

Recommendation - The auditor recommended that the City develop and implement procedures to routinely prepare and reconcile Water and Sewer customer accounts receivable activity and balances at each interim period and that formal analysis of collectability of outstanding balances should be prepared to estimate the related allowance for doubtful accounts. Management concurred with the recommendation and indicated that the procedures would be implemented.

Summary Schedule of Prior Audit Findings Year Ended September 30, 2017 (Cont.)

Current Status - . The Administration adjusted the organization structure of the Water & Sewer Department by placing responsibility for the Billing Office with the Water & Sewer Director. (It was previously the responsibility of the Director of Administration.) Review of current procedures has been completed, and adjustments have been made for better accountability and communication with the service departments. An outside company has been contracted with to aid in evaluation of water meter performance in order to assess lost revenue. Non-functioning meters are being replaced. New procedures are assessed after implementation to determine their viability, and adjustments are made as needed.

2016-007 Water and Sewer Billings

Condition - This finding was a material weakness stating that the City's internal controls do not include analysis of accounting data in conjunction with underlying operations data for Water and Sewer volumes processed and billed, and that the City does not formally document, reconcile, and monitor adjustments to customer billings to ensure propriety and accuracy.

Recommendation - The auditor recommended that the City install meters at all City facilities to monitor volumes used and to generate periodic reports of City usage in order to monitor economic resources sand system usage to facilitate effective management of unaccounted for volumes.

Current Status - Adjustments to the use of a work order system in conjunction with the method by which problems, such as water leaks, are reported has resulted in shorter response time in addressing problem areas. Engineering analysis of areas where aging infrastructure could contribute to unaccounted for water losses has been conducted and priority for repairs established. Feasibility of metering city properties to measure unbilled water usage has been reviewed, and the formula by which unaccounted for water loss has also been reviewed for accuracy.

2016-008 Water and Sewer Customer Meter Deposits

Condition - This finding was a material weakness stating that the City's liability for customer meter deposits does not agree to its customer detail records, and that meter deposits are not timely and effectively reconciled.

Recommendation - The auditor recommended that the City perform a review of its subsidiary records of customer meter deposits and perform timely reconciliations at interim periods.

Current Status - The Billing Office, with the assistance of the Information Technology department, has begun the process of reconciling outstanding meter deposits. Each account is reviewed to determine whether the deposit was returned and, if so, that account is removed from the outstanding balance list. Additionally, meter deposits are now applied to the final bill when a customer closes an account, thereby reducing or eliminating a deposit balance. Once the review is complete, the Billing Office will develop the procedures necessary to reconcile and account for the meter deposits on hand.

Summary Schedule of Prior Audit Findings Year Ended September 30, 2017 (Cont.)

2016-009 Capital assets

Condition - This finding was a material weakness stating that the City did not appropriately identify and accurately capture, maintain, and report activity and balances relating to capital assets.

Recommendation - The auditor recommended that the City implement policies and procedures to initially identify capital asset transactions, enhance detail data maintained, perform periodic reconciliations of detail, review propriety of account coding, and recommendation and indicated that the procedures would be implemented.

Current Status - The Accounting Department has obtained additional training for and has implemented use of a subsidiary asset management system, which will capture asset information and provide the needed reports. The Chief Financial Officer will provide additional oversight to ensure that this subsidiary system is updated throughout the year. The City's staff engineer, as well as engineer consultants, will be included when assessing potential impairment as well as reporting construction in progress.

2016-010 Procurement and Suspension and Debarment (I)
CFDA No. 20.205: Highway Planning and Construction

Condition - This finding was a material weakness stating that the City did not have adequate internal controls in place to monitor compliance with the federal debarment and suspension regulations for contracts and subawards.

Recommendation - The Auditor recommended that the City implement procedures to ensure compliance with debarment and suspension regulations for contracts related to federal programs.

Current Status - Not corrected. In September 2018, the City Council adopted an amendment to the City's procurement manual establishing procedures for monitoring compliance with federal debarment and suspension regulations when selecting vendors for materials or services which are funded in whole or in part with federal grants. Implementation of this procedure began immediately.

2016-011 Federal Expenditure Management (A/B, C, G, H, L)
CFDA No. 20.205: Highway Planning and Construction

Condition - This finding was a material weakness stating that federal and non-federal expenditures were not readily identifiable from grant records maintained by the City for the year ended September 30, 2015.

Recommendation - The auditor recommended that the City should implement procedures to maintain comprehensive schedules of program expenditures that distinguish Federal and non-federal expenditures and identifying matching funds provided. Management concurred with the recommendation and indicated that the procedures would be implemented.

Summary Schedule of Prior Audit Findings Year Ended September 30, 2017 (Cont.)

Current Status - As stated in the current status to Finding 2016-002, the accountant hired in 2017 has been assigned the responsibility federal expenditure management. Spreadsheets have been developed and are being utilized for each project, identifying expenditures as federal and non-federal, as well as identifying matching funds received.

With respect to capture of administrative costs on federally funded programs, the Metropolitan Planning Organization department charges a 10% administrative overhead on eligible expenditures (personnel and travel). This is the de minimis rate allowable by the Uniform Guidance. The Guidance indicates that if/when using the de minimis rate, no negotiation is necessary. The City does not charge an overhead rate on other grants because, in many cases, it is impractical and in some cases it may not be allowed. The MPO serves other jurisdictions besides the City of Hattiesburg, and charging the de minimis rate is the least the MPO can do to ensure that ancillary services rendered for the benefit of those other jurisdictions are at least minimally recouped.

2016-012 Non-compliance resulting from deficiencies in the financial statement internal control over timeliness of financial reporting (L)

Condition - This finding was a material weakness stating that the City did not timely submit the required annual reporting package to the Federal Audit Clearinghouse.

Recommendation - The auditor recommended that the City implement procedures to overhaul the financial reporting process to enable it to meet its legal, regulatory and contractual financial reporting requirements. Management concurred with the recommendation and indicated that the procedures would be implemented.

Current Status - As stated in current status to Findings 2016-002 and 2016-003, the City has retained a consultant to conduct a needs assessment for the purpose of updating the financial software, as well as determining the software needs of other city departments. The City officials have also engaged an alternate audit firm to conduct the 2016 and 2017 audits, and stressed the importance of expeditiously producing the audits. The 2016 audits is complete, and the 2017 audit is very near completion. It is expected that the 2018 audit will begin in November 2018.

2016-013 Non-compliance resulting from deficiencies in financial statement internal control over financial statement adjustment, close and disclosure (A/B, C, G, H, L)

Condition - This finding was a material weakness for the CDBG and Airport Improvement projects and a significant deficiency for the Highway Planning and Construction project stating that the City did not distinguish allowable federal program costs from ineligible costs, distinguish federal expenditures from non-federal expenditures or specifically identify costs used to meet match and cost-sharing requirements.

Recommendation - The auditor recommended that the City implement procedures to address deficiencies in its financial statement adjustment, close and disclosure processes, specifically to address procedures related to the annual conversion process from budgetary cash basis accounting records to the bases of financial reporting required under U.S. GAAP. Management concurred with the recommendation and indicated that the procedures would be implemented.

Summary Schedule of Prior Audit Findings Year Ended September 30, 2017 (Cont.)

Current Status - As stated in the current status to Finding 2016-002, the Accounting Department now has an accountant assigned with the task of developing spreadsheets to document expenditures on federally funded projects and properly segregate federal and non-federal expenditure amounts. These procedures have been implemented and are currently in use.

With respect to capture of administrative costs on federally funded programs, the Metropolitan Planning Organization department charges a 10% administrative overhead on eligible expenditures (personnel and travel). This is the de minimis rate allowable by the Uniform Guidance. The Guidance indicates that if/when using the de minimis rate, no negotiation is necessary. The City does not charge an overhead rate on other grants because, in many cases, it is impractical and in some cases it may not be allowed. The MPO serves other jurisdictions besides the City of Hattiesburg, and charging the de minimis rate is the least the MPO can do to ensure that ancillary services rendered for the benefit of those other jurisdictions are at least minimally recouped.

2016-014 Non-compliance resulting from deficiencies in financial statement internal control over capital assets (A/B, F)

Condition - This finding was a material weakness stating that the City did not adequately account for its capital projects funded by Federal awards and that project detail records do not adequately identify allowable and unallowable costs or matching funds.

Recommendation - The auditor recommended that the City implement procedures to develop and implement a comprehensive system for accounting for capital assets, including construction projects, that will incorporate policies and procedures for recording and valuing capital asset additions, with segregation for those purchased or constructed with federal funds. Management concurred with this recommendation and indicated that the procedures would be implemented.

Current Status - The Accounting Department is now using a subsidiary asset management software, which will track capital assets, including construction projects. This system, in conjunction with other subsidiary spreadsheets can also identify expenditures which purchased or constructed with federal funds. Communication with the City Engineer to ascertain that all such projects are appropriately documented will be part of the process.

Schedule 5

INDEPENDENT AUDITOR'S REPORT ON COMPLIANCE WITH STATE LAWS AND REGULATIONS

To the Honorable Mayor and City Council
City of Hattiesburg, Mississippi

We have audited the basic financial statements of the City of Hattiesburg, Mississippi as of and for the year ended September 30, 2017, and have issued our report dated November 15, 2018. We have conducted our audit in accordance with auditing standards generally accepted in the United States of America and the standards applicable to financial audits contained in *Governmental Auditing Standards*.

As required by the state legal compliance audit program prescribed by the Office of the State Auditor, we have also performed procedures to test compliance with certain state laws and regulations. However, providing an opinion on compliance with state laws and regulations was not the objective of our audit and, accordingly, we do not express such an opinion.

The results of those procedures and our audit of the general purpose financial statements disclosed material instances of noncompliance with State laws and regulations. Our findings and recommendations and your responses are as follows:

Finding 1 - Fixed Asset Accounting

The City's procedures for determining the total acquisition cost of fixed assets and maintaining fixed asset detail did not comply with accounting system procedures prescribed by the Municipal Auditing and Accounting Guide.

Criteria, Context, and Condition

The property accounting system must follow prescribed procedures for recording acquisition cost of fixed assets, and certain professional fees, such as appraisal, architectural, engineering, and legal fees, should also be capitalized into fixed asset records. Additionally, the City's property accounting system must maintain the required fixed asset data elements as listed in the Municipal Auditing and Accounting Guide.

HATTIESBURG
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Hattiesburg, MS 39401-8025

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Hattiesburg, MS 39404-5099

COLUMBIA
150 Old Highway 98 E
Columbia, MS 39429-6447

P. O. Box 609
Columbia, MS 39429-0609

GULFPORT
2019 23rd Avenue
Gulfport, MS 39501-2968

P. O. Box 1842
Gulfport, MS 39502-1842

To the Honorable Mayor and City Council
City of Hattiesburg, Mississippi

Recommendation

The Administration should implement procedures to properly capture and maintain fixed asset detail, including the required data elements, in accordance with prescribed procedures.

Response

The City Administration agrees with this finding, and management is in the process of implementing a corrective action plan to address all fixed asset recordkeeping requirements.

Finding 2 - City Court Accounting Procedures

The City's accounting procedures for Municipal Court fines receivable are not in compliance with accounting system procedures prescribed by the State Auditor under Mississippi law. Noncompliance with prescribed Court accounting procedures is a recurring finding. See also related Findings 3 and 4.

Criteria, Context, and Condition

Pursuant to Mississippi Code Section 21-23-11 and the Municipal Auditing and Accounting Guide issued by the Office of the State Auditor. The City must maintain separate accounting records for the Municipal Court; the Court records must include an accounts receivable system that allows for balancing receivable accounts monthly, and periodic analysis of aging data. Relevant reports should be made to the judge and City Council as those parties may require. In addition, pursuant to Mississippi Code Section 99-19-73 and the Municipal Auditing and Accounting Guide, State-imposed Court assessments collected by the Municipal Court must be settled monthly with the Department of Finance and Administration.

Although the City routinely records fines by case and posts collections against those fines in a subsidiary ledger system, it was unable to generate an accurate summary or aging of outstanding accounts as of September 30, 2017 or during the year then ended. Further, the City did not provide related reports to the judge and City Council during the year ended September 30, 2017.

City procedures do not include reconciliation or roll-forward of gross case activity. In addition, subsidiary account records do not include complete information from which to generate reports of fines which have met criteria for accounting recognition. Further, subsidiary account records are not adequately controlled to ensure completeness, accuracy, and integrity of data. Allocation of cash collections among City fines and various State-imposed assessments is not verified for accuracy or reconciled to periodic changes in balances of underlying detail.

To the Honorable Mayor and City Council
City of Hattiesburg, Mississippi

The City undertook a project to assess deficiencies in its Court accounting and reporting system in order to develop a corrective action plan. However, development of an appropriate corrective action plan had not been completed as of the date of this report.

Recommendation

The Administration should immediately implement procedures to ensure completeness and integrity of Court data. The City should implement procedures to produce periodic detail reports of outstanding balances and case fine activity, as well as to timely reconcile related balances. Ongoing assessment of the adequacy of the case management software applications utilized by the Municipal Court should be completed, and the City's corrective action plan should address any noted accounting or reporting limitations. Use of peripheral applications and procedures should be commenced immediately to address and contain identified deficiencies in existing systems. Periodic reports should be made to the judge and the City Council and should include balances of outstanding fines, aging of outstanding accounts, and related roll-forwards and analyses of activity. Activity roll-forwards should include, at a minimum, beginning balances, new case dispositions, collections, nonmonetary credits, other adjustments, and ending balances. In addition, reports of corresponding assessments payable on fines should be periodically produced, reconciled, analyzed, and provided to the judge and the City Council.

Response

The City Administration agrees with this finding. As of July 2017, the newly elected Administration has undertaken the task of assessment of the Municipal Court operations. All aspects of operations will be assessed, from current software to personnel. If current software is deemed inadequate to satisfy the City's Court functions, as well as those required by State of Mississippi reporting, the City's Information Technology Department will assist Municipal Court personnel with reviewing and procuring new software. Additionally, personnel will be evaluated during this process to determine what training may be necessary to ensure optimal functioning of the department.

Finding 3 - Municipal Court Docket and Minutes

For the year ended September 30, 2017, the City did not maintain permanent dockets or minute records of Municipal Court actions as required by State law.

To the Honorable Mayor and City Council
City of Hattiesburg, Mississippi

Criteria, Context, and Condition

Mississippi Code Section 21-23-11 requires the clerk of the Municipal Court to keep permanent dockets of all cases, as well as a minute record of all orders and judgments. Pursuant to that Code section, one record may serve as both the docket record and the minute record. However, for the year ended September 30, 2017, the City did not maintain a permanent, unalterable docket of cases or minute record of Court actions on those cases. Instead, physical dockets used in Court were discarded upon data entry into application software. Internal controls over case entry and adjustment were not adequate to ensure completeness or accuracy of data. Further, since dockets and case activity maintained electronically could be subsequently altered, such records did not meet the standard of permanence required for dockets or provide a reliable minute record as required by Mississippi law.

Recommendation

The Administration should immediately implement procedures to retain physical Municipal Court dockets, upon the face of which all orders and judgments of the Court are entered, to serve as the combined permanent docket and minute record. Those permanent records should be reconciled periodically to case data recorded in subsidiary systems, and differences or exceptions should be timely investigated and resolved.

Response

The City Administration agrees with this finding, and management has developed a corrective action plan for addressing this issue. Initial phases of the corrective action plan, which ensure that all physical Court dockets are permanently retained, are being implemented. Additional phases for reconciling permanent docket detail to recorded case data are in the process of implementation and are expected to be fully implemented by fall 2018. In addition, the City's Administration will be assessing current software to determine if conversion to a new system is warranted. The Information Technology Department will assist in assessment efforts to determine corrective measures necessary to address reporting deficiencies.

Finding 4 - Control over Police Tickets

For the year ended September 30, 2017, the City did not maintain effective control over issued and unissued Police ticket books in accordance with the Municipal Auditing and Accounting Guide.

To the Honorable Mayor and City Council
City of Hattiesburg, Mississippi

Criteria, Context, and Condition

Pursuant to Mississippi Code Section 63-9-21 and the Municipal Auditing and Accounting Guide require that the City must maintain certain records related to uniform traffic tickets used by police officers. The clerk of the Municipal Court is required to keep a record of all traffic ticket books issued, including to whom those books are issued, and is required to maintain and account for all such ticket books in accordance with prescribed procedures.

During the year ended September 30, 2017, the City did not maintain complete records of ticket books, issue them consecutively, or account for tickets issued and returned.

Recommendation

The City should immediately implement procedures to control issuance, recordkeeping, and monitoring of uniform traffic ticket books in accordance with procedures prescribed by State law and the Office of the State Auditor.

Response

The City Administration agrees with this finding and will be performing a full assessment of current software and department procedures to determine necessary changes. Implementation may necessitate additional training of personnel and/or procurement of new or additional software to implement a corrective action plan related to Municipal Court accounting records, which will incorporate procedures related to control over Police tickets.

Finding 5 - Vehicle Markings

During fiscal year 2017, not all City vehicles were appropriately marked pursuant to Mississippi Code of 1972, Annotated. Noncompliance with vehicle marking procedures is a recurring finding.

Criteria, Context, and Condition

Section 25-1-87, Mississippi Code of 1972, Annotated, requires that all municipal vehicles, except police vehicles used for undercover operation and authorized by governing authorities, be marked in accordance with specified standards regarding nature, size and color contrast.

Determination was made that not all City-owned vehicles have proper markings as required under State law.

To the Honorable Mayor and City Council
City of Hattiesburg, Mississippi

Recommendation

The City should take necessary steps to ensure that all of their vehicles have proper markings as required by law, and that the Administration assign responsibility for the continued compliance with these requirements to appropriate official(s).

Response

The City Administration agrees with this finding and has implemented procedures under which all purchased vehicles will be marked with standard signage applied by the Public Works department mechanical shop.

Finding 6 - Annual Inventory of Assets

The City did not conduct an annual inventory of its assets in accordance with the guidelines established by the Office of the State Auditor.

Criteria, Context, and Condition

The Municipal Audit and Accounting Guide published by the State of Mississippi Office of the State Auditor requires municipalities to conduct a “thorough inventory of all fixed assets” at the end of each fiscal year in order to verify the existence of all fixed assets. The Municipal Audit and Accounting Guide also prescribes inventory procedures to be followed, including the assignment of the general oversight of the inventory process to an appropriate municipal officer, the use of inventory forms and a tagging system, and the investigation of discrepancies and missing inventory tags.

Recommendation

The City should follow the specific instructions of the Municipal Audit and Accounting Guide in order to update the City inventory records. This process, as prescribed by the Office of the State Auditor, must be considered to be an important legal compliance procedure that must be performed at the end of each fiscal year.

Response

The City Administration agrees with this finding and has implemented procedures to update the City’s detailed fixed asset inventory records. Additionally, the prescribed update of inventory records will be completed at the end of each fiscal year on a timely basis.

To the Honorable Mayor and City Council
City of Hattiesburg, Mississippi

Finding 7 - Municipal Compliance Questionnaire

The City did not complete the Municipal Compliance Questionnaire for fiscal year 2017 on a timely basis as prescribed by the Municipal Audit and Accounting Guide.

Criteria, Context, and Condition

The Municipal Audit and Accounting Guide published by the State of Mississippi Office of the State Auditor requires that the Municipal Compliance Questionnaire be completed at the end of the municipality's fiscal year and be entered onto the official minutes of the governing authorities at their next regular meeting. The City did not complete the fiscal year 2017 questionnaire in the manner prescribed in the Guide.

Recommendation

The City should complete the Municipal Compliance Questionnaire each year at its first regularly scheduled City Council meeting in October and the questionnaire should be recorded into the official minutes.

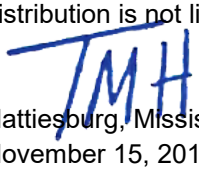
Response

The City Administration did prepare the fiscal year 2017 Municipal Compliance Questionnaire for inclusion into the official minutes in March 2018. The City will ascertain that future Municipal Compliance Questionnaires will be completed at the end of each fiscal year for inclusion in the minutes of the first scheduled October City Council meeting.

[See also Schedule 4 - Schedule of Findings and Questioned Costs.]

The Office of the State Auditor or a public accounting firm will review, on a subsequent year's audit engagement, the findings in this report to ensure that corrective action has been taken.

This report is intended for the information of the City of Hattiesburg, Mississippi's management, Honorable Mayor and the City Council, and the Mississippi Office of the State Auditor and is not intended to be and should not be used by anyone other than these specified parties. However, this report is a matter of public record and its distribution is not limited.



Hattiesburg, Mississippi
November 15, 2018

City of Hattiesburg, MS

200 Forrest St.
P.O. Box 1898
Hattiesburg, MS 39401

Master

File Number: 2018-978

File ID: 2018-978 **Type:** Regular Agenda Item **Status:** Approved

Version: 1 **Reference:** **In Control:** City Council

Requester: Andrew Ellard **File Created:** 11/16/2018

Brief Title: Release of Deed of Trust - Community Connections - 620 Barkley Rd. **Final Action:** 11/20/2018

Minute Book Number: MB 2018-292-293

Title:

Approve and authorize Mayor to execute Release of Lien of Deed of Trust from Community Connections, Inc., Grantor, for property at 620 Barkley Road, to City of Hattiesburg, Beneficiary, recorded in the Deed of Trust Book 1939 at Page 0225-0229 in the office of the Chancery Clerk of Forrest County, Mississippi, in conjunction with the sale of the property to a HOME-eligible buyer. {Entitlement}

Notes:

Agenda Date: 11/20/2018

Indexes: **Agenda Number:** V.-23

Sponsors: **Enactment Date:**

Attachments: Release of Deed of Trust 620 Barkley Rd - 11-16-18, Executed Release of Deed of Trust 520 Barkley Road **Enactment Number:**

Contact: **Meeting Date:** 11/20/2018

Drafter: **Effective Date:**

History of Legislative File

Version:	Acting Body:	Date:	Action:	Sent To:	Due Date:	Return Date:	Result:
1	City Council - Agenda Review	11/19/2018					
1	City Council	11/20/2018	Approve and Authorize				Pass

Action Text: A MOTION was made by Council Member Delgado and seconded by Council Member Brown to Approve and authorize Mayor to execute Release of Lien of Deed of Trust from Community Connections, Inc., Grantor, for property at 620 Barkley Road, to City of Hattiesburg, Beneficiary, recorded in the Deed of Trust Book 1939 at Page 0225-0229 in the office of the Chancery Clerk of Forrest County, Mississippi, in conjunction with the sale of the property to a HOME-eligible buyer. {Entitlement}

There being no discussion, the Motion received the affirmative vote of the Council as follows:

Yeas: 5 - George, Delgado, Carroll, Dryden and Brown

Nays: 0

Yea:	5	Council Member George
		Council Member Delgado
		Council President Carroll
		Council Vice President Dryden
		Council Member Brown

Text of Legislative File 2018-978

Title

Approve and authorize Mayor to execute Release of Lien of Deed of Trust from Community Connections, Inc., Grantor, for property at 620 Barkley Road, to City of Hattiesburg, Beneficiary, recorded in the Deed of Trust Book 1939 at Page 0225-0229 in the office of the Chancery Clerk of Forrest County, Mississippi, in conjunction with the sale of the property to a HOME-eligible buyer. {Entitlement}

Summary

Release of Deed of Trust - Community Connections - 620 Barkley Rd.

Budget Information

Expenditure Type

Purchasing Item

Publication Information

RELEASE OF DEED OF TRUST

Prepared by:
Andrew Ellard
City of Hattiesburg – Urban Development
200 Forrest Street
Hattiesburg, Mississippi 39401
(601) 554-1006

Return to:
Andrew Ellard
City of Hattiesburg – Urban Development
200 Forrest Street
Hattiesburg, Mississippi 39401
(601) 554-1006

Trustee:
Charles E. Lawrence, Jr.
Attorney and Counselor at Law
Post Office Box 1624
Hattiesburg, Mississippi 39403-1624
(601) 582-4157

Grantor/Mortgagor: Community Connections
215 Mobile Street
Hattiesburg, Mississippi 39401
(601) 261-0820

Grantee/Mortgagee: City of Hattiesburg – Community Development
200 Forrest Street
Hattiesburg, Mississippi 39401
(601) 554-1006

Abbreviated Legal Description: PARCEL NO. 5: A part and parcel of the NE ¼ of the NE ¼ of Section 27, Township 4 North, Range 13 West, Forrest County, Mississippi.

STATE OF MISSISSIPPPI

COUNTY OF FORREST

RELEASE OF LIEN OF DEED OF TRUST

KNOW ALL MEN BY THESE PRESENT: That the **CITY OF HATTIESBURG,** the beneficiary in that certain lien of deed of trust executed by **Community Connections** as follows:

FILED:	January 2, 2014
BOOK:	1939
PAGE:	0225-0229
GRANTOR:	Community Connections
TRUSTEE:	Charles E. Lawrence, Jr.
BENEFICIARY:	City of Hattiesburg
AMOUNT:	$50,000.00

in the office of the Chancery Clerk of Forrest County, Mississippi, is hereby released; and the Clerk of Chancery Court of Forrest County, Mississippi, is hereby authorized to enter satisfaction and certificate of payment in full upon said instrument and that this order be recorded in the records of said County as is provided by law.

Legal Description:
PARCEL NO. 5: A part and parcel of the NE ¼ of the NE ¼ of Section 27, Township 4 North, Range 13 West, Forrest County, Mississippi, more particularly described as follows: Commence at the Northeast corner of the NE ¼ of the NE ¼ of sold Section 27; thence run S0018'32"E and along the East line of the said NE ¼ of the NE ¼ for 20.00 feet; thence run S89DEG 58'40"W and along the South margin line of Barkley Road for 117.92 feet to an iron pin and to the Point of Beginning; thence run South margin line of Barkley Road for 117.92 feet to an iron pin and to the Point of Beginning; thence run S00DEG 16'42"E for 150.00 feet to an Iron pin; thence run S89DEG 58'139"W for 98.00 feet to an Iron pin; thence run N00DEG 14'52"W for 150.00 feet to an Iron pin on the South margin line of Barkley Road; thence run NE89DEG 58'40"E and along the South margin line of Barkley Road for 97.92 feet to the Point of Beginning; containing 0.34 acre, more or less.

IN WITNESS WHEREOF, this instrument is executed on this the 4th day of December, 2018.

CITY OF HATTIESBURG

BY: _____
TOBY BARKER, MAYOR

ATTEST:

_____
KERMAS EATON

STATE OF MISSISSIPPPI

COUNTY OF FORREST

Personally appeared before me, the undersigned authority in and for said county and state, on this the 4th day of December, 2018., the within named **TOBY BARKER**, who acknowledged that he is the **MAYOR OF THE CITY OF HATTIESBURG**, and that for and on behalf of said corporation, and as its act and deed he executed the above and foregoing instrument, after first having been duly authorized by said corporation so to do.

_____

NOTARY PUBLIC

MY COMMISSION EXPIRES:

_____

RELEASE OF DEED OF TRUST

Prepared by:
Andrew Ellard
City of Hattiesburg – Urban Development
200 Forrest Street
Hattiesburg, Mississippi 39401
(601) 554-1006

Return to:
Andrew Ellard
City of Hattiesburg – Urban Development
200 Forrest Street
Hattiesburg, Mississippi 39401
(601) 554-1006

Trustee:
Charles E. Lawrence, Jr.
Attorney and Counselor at Law
Post Office Box 1624
Hattiesburg, Mississippi 39403-1624
(601) 582-4157

Grantor/Mortgagor: Community Connections
215 Mobile Street
Hattiesburg, Mississippi 39401
(601) 261-0820

Grantee/Mortgagee: City of Hattiesburg – Community Development
200 Forrest Street
Hattiesburg, Mississippi 39401
(601) 554-1006

Abbreviated Legal Description: PARCEL NO. 5: A part and parcel of the NE ¼ of the NE ¼ of Section 27, Township 4 North, Range 13 West, Forrest County, Mississippi.

STATE OF MISSISSIPPPI

COUNTY OF FORREST

RELEASE OF LIEN OF DEED OF TRUST

KNOW ALL MEN BY THESE PRESENT: That the **CITY OF HATTIESBURG,** the beneficiary in that certain lien of deed of trust executed by **Community Connections** as follows:

FILED:	January 2, 2014
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GRANTOR:	Community Connections
TRUSTEE:	Charles E. Lawrence, Jr.
BENEFICIARY:	City of Hattiesburg
AMOUNT:	$50,000.00

in the office of the Chancery Clerk of Forrest County, Mississippi, is hereby released; and the Clerk of Chancery Court of Forrest County, Mississippi, is hereby authorized to enter satisfaction and certificate of payment in full upon said instrument and that this order be recorded in the records of said County as is provided by law.

Legal Description:
PARCEL NO. 5: A part and parcel of the NE ¼ of the NE ¼ of Section 27, Township 4 North, Range 13 West, Forrest County, Mississippi, more particularly described as follows: Commence at the Northeast corner of the NE ¼ of the NE ¼ of sold Section 27; thence run S0018'32"E and along the East line of the said NE ¼ of the NE ¼ for 20.00 feet; thence run S89DEG 58'40"W and along the South margin line of Barkley Road for 117.92 feet to an iron pin and to the Point of Beginning; thence run South margin line of Barkley Road for 117.92 feet to an iron pin and to the Point of Beginning; thence run S00DEG 16'42"E for 150.00 feet to an Iron pin; thence run S89DEG 58'139"W for 98.00 feet to an Iron pin; thence run N00DEG 14'52"W for 150.00 feet to an Iron pin on the South margin line of Barkley Road; thence run NE89DEG 58'40"E and along the South margin line of Barkley Road for 97.92 feet to the Point of Beginning; containing 0.34 acre, more or less.

IN WITNESS WHEREOF, this instrument is executed on this the 4th day of December, 2018.

CITY OF HATTIESBURG

BY: _____
TOBY BARKER, MAYOR

ATTEST:

_____
KERMAS EATON

STATE OF MISSISSIPPPI

COUNTY OF FORREST

Personally appeared before me, the undersigned authority in and for said county and state, on this the 4th day of December, 2018., the within named **TOBY BARKER**, who acknowledged that he is the **MAYOR OF THE CITY OF HATTIESBURG**, and that for and on behalf of said corporation, and as its act and deed he executed the above and foregoing instrument, after first having been duly authorized by said corporation so to do.



NOTARY PUBLIC

MY COMMISSION EXPIRES:

City of Hattiesburg, MS

200 Forrest St.
P.O. Box 1898
Hattiesburg, MS 39401

Master

File Number: 2018-977

File ID:	2018-977	**Type:**	Regular Agenda Item	**Status:**	Passed
Version:	1	**Reference:**		**In Control:**	City Council
Requester:	Andrew Ellard			**File Created:**	11/16/2018
Brief Title:	CHDO Agreement Amendment - Community Connections - 620 Barkley Rd.			**Final Action:**	11/20/2018
				Minute Book Number:	MB 2018-293

Title:

Approve Amendment to the CHDO contract with Community Connections (found at MB 2010-3 / 28-38), including all amendments through October 8, 2013 (found at MB 2013 / 303-304), changing the scope of the agreement from "Rental" to "Homebuyer" (no change to total proposed expenditure) and authorize Mayor to execute agreement in triplicate for same. {Entitlement - HOME}

Notes:			
		Agenda Date:	11/20/2018
Indexes:		**Agenda Number:**	V.-24
Sponsors:		**Enactment Date:**	
Attachments:	Homeownership Agreement - Amended 11-2018, Executed Homeownership Agreement Amendment with Community Connections	**Enactment Number:**	
Contact:		**Meeting Date:**	11/20/2018
Drafter:		**Effective Date:**	

History of Legislative File

Version:	Acting Body:	Date:	Action:	Sent To:	Due Date:	Return Date:	Result:
1	City Council - Agenda Review	11/19/2018					
1	City Council	11/20/2018	Approve				Pass

Action Text: A MOTION was made by Council Member Delgado and seconded by Council Member George to Approve Amendment to the CHDO contract with Community Connections (found at MB 2010-3 / 28-38), including all amendments through October 8, 2013 (found at MB 2013 / 303-304), changing the scope of the agreement from "Rental" to "Homebuyer" (no change to total proposed expenditure) and authorize Mayor to execute agreement in triplicate for same. {Entitlement - HOME}

There being no discussion, the Motion received the affirmative vote of the Council as follows:

Yeas: 5 - George, Delgado, Carroll, Dryden and Brown

Nays: 0

Yea:	5	Council Member George
		Council Member Delgado
		Council President Carroll
		Council Vice President Dryden
		Council Member Brown

Text of Legislative File 2018-977

Title

Approve Amendment to the CHDO contract with Community Connections (found at MB 2010-3 / 28-38), including all amendments through October 8, 2013 (found at MB 2013 / 303-304), changing the scope of the agreement from "Rental" to "Homebuyer" (no change to total proposed expenditure) and authorize Mayor to execute agreement in triplicate for same. {Entitlement - HOME}

Summary

CHDO Agreement Amendment - Community Connections - 620 Barkley Rd.

Budget Information

Expenditure Type

Purchasing Item

Publication Information

AMENDMENT TO AGREEMENT

HOMEOWNERSHIP AGREEMENT BETWEEN THE CITY OF HATTIESBURG AND COMMUNITY CONNECTIONS

THIS AGREEMENT, entered into this 4th day of May, 2010, by and between the City of Hattiesburg (hereinafter referred to as the "CITY"), and **Community Connections, Inc.**, a nonprofit corporation (hereinafter referred to as the "DEVELOPER") whose principal office is located at **215 Mobile Street, Hattiesburg, MS.**

WHEREAS, on the 4th day of December, 2018, the CITY and the DEVELOPER wish to change the scope of the May 4, 2010 agreement as well as all subsequent amendments prior to the 4th day of December, 2018 to allow the DEVELOPER to operate the developed property as a HOME-funded homebuyer development project;

WHEREAS, the CITY is a recipient of HOME Investment Partnerships grant funds from the United States Department of Housing and Urban Development (HUD) pursuant to 24 CFR 92; and

WHEREAS, the CITY wishes to engage the DEVELOPER to assist the City in utilizing such funds;

WHEREAS, the DEVELOPER has been selected to utilize HOME funds to develop and sell **One (1)** single-family home(s) to income eligible household(s) as outlined in this agreement;

NOW, THEREFORE in consideration of the mutual covenants and obligations herein contained, including the Exhibits, and subject to the terms and conditions hereinafter stated, the parties hereto understand and agree as follows:

Section I – Definitions

a. **CITY** – is hereby defined as the Department of Federal and State Programs the agency administering the HOME Program for the CITY of Hattiesburg. For the purpose of this Agreement and all administration of HOME funds, the CITY shall execute fiscal and programmatic control of this agreement. The term "Approval by the CITY" or like term used in this Agreement shall in no way relieve the DEVELOPER from any duties or responsibilities under the terms of this Agreement, or obligation under State or local law or regulation.

b. **CHDO** – Community Housing Development Organization as defined in 92.2 of the HOME rule.

c. **DIRECTOR** – is hereby defined as the Director of the Department of Urban Development of the CITY of Hattiesburg.

d. **DEVELOPER FEE** – is hereby defined as the amount of money the CITY agrees to pay and the DEVELOPER agrees to accept as payment in full for the professional, technical and construction services rendered pursuant to this Agreement.

e. **WORK** – is hereby defined as all the professional, technical and construction services to be rendered or provided by the DEVELOPER as described herein.

f. **HOME** – is hereby defined as the HOME Investment Partnerships Program as described in 24 CFR Part 92, under the authority of 42 U.S.C. 3535 (d) and 12701 - 12839.

g. **IDIS** – Integrated Disbursement and Information System.

h. **PROJECT COMPLETION** – the project has received a certificate of occupancy or other local certification indicating that construction or rehabilitation has been completed, the CITY has signed off on all work and the work has been performed to the satisfaction of the CITY, the CITY has received all required documents from the DEVELOPER and the project is fully occupied by income eligible households. All documents that enforce the affordability period must be recorded.

Section II – Term of Agreement

The term of this Agreement shall commence on **May 4, 2010, having thereafter been amended for changes in scope and herein further amended** and shall end on or before the Project Completion deadline of **January 31, 2019**;

The CITY shall provide HOME funds in an amount not to exceed **$59, 318.80 ($50,000 in CHDO Reserve Funding and $9,318.80 in CHDO Operating Funding)**, in accordance with the attached budget hereby attached as Exhibit **(n/a as funds were expended according to a budget under a previously executed agreement related to this project site). It is acknowledged by the CITY and the DEVELOPER, however, that these funds were disbursed under the terms of a previously existing agreement which is herein amended, and that this agreement is hereby established solely as an administrative tool prescribed to see through the completion of the project and the fulfillment of the affordability period. No additional HOME funds will be expended in completing this project.**

Interim Milestones/Deadlines (list below):

Milestones	***Deadline***
All related development having been complete prior to this amendment, the only	
Remaining benchmark is the sale of the home to an eligible buyer, expected as follows:	
Home sold by Community Connections and reported to City by January 31, 2019.	

1. This project is subject to ongoing affordability requirements of the HOME program for 15 years from the date of project completion. During this compliance period, DEVELOPER

will assure continued compliance with HOME requirements for HOME-assisted homebuyer project. This includes monitoring units for principal residency and recapture of funds if the property is sold and is no longer the primary residence of the homebuyer.

2. Timely completion of the work specified in this agreement is an integral and essential part of performance.

3. The expenditure of HOME funds is subject to Federal deadlines and could result in the loss of the Federal funds. By the acceptance and execution of this Agreement, it is understood and agreed by the DEVELOPER that the PROJECT will be completed as expeditiously as possible and that the DEVELOPER will make every effort to ensure that the project will not be delayed.

4. Failure to meet these deadlines can result in cancellation of this Agreement and the revocation of HOME funds.

5. Since it is mutually agreed that time is of the essence in regard to this Agreement, the DEVELOPER shall cause appropriate provisions to be inserted in all contracts or subcontracts relative to the work tasks required by this Agreement, in order to ensure that the PROJECT will be completed according to the timetable set forth. It is intended that such provisions inserted in any subcontracts be, to the fullest extent permitted by law and equity, binding for the benefit of the CITY and enforceable by the CITY against the DEVELOPER and its successors and assigns to the project or any part thereof or any interest therein.

6. In the event the DEVELOPER is unable to meet the above schedule or complete the above services because of delays resulting from Acts of God, untimely review and approval by the CITY and other governmental authorities having jurisdiction over the PROJECT, or other delays that are not caused by the DEVELOPER; the CITY shall grant a reasonable extension of time for completion of the WORK. It shall be the responsibility of the DEVELOPER to notify the CITY promptly in writing whenever a delay is anticipated or experienced, and to inform the CITY of all facts and details related to the delay.

Section III – Scope of Work

A detailed scope of work is attached as exhibit **(n/a – as development-related scope of work was fulfilled prior to the establishment of this amendment, the remaining scope of work is to sell the unit to a HOME qualified homebuyer and to see to the fulfillment of the affordability period.).** The DEVELOPER, in close coordination with the CITY, shall perform all professional services (the "WORK") necessary to complete the development and occupancy of the following project in full compliance with the terms of this Agreement:

Project Description:
The project at 620 Barkley Road, having been constructed under the terms of the agreement prior to this amendment is to be converted into a homebuyer project for an income-eligible

household. The project will remain as an affordable unit for the duration of the affordability period. HOME funds having been used prior to this amendment, no additional HOME funds will be expended in the completion of this activity.

Project Addresses:
620 Barkley Road, Hattiesburg, MS 39401

Legal Description:
PARCEL NO. 5: A part and parcel of the NE ¼ of the NE ¼ of Section 27, Township 4 North, Range 13 West, Forrest County, Mississippi, more particularly described as follows: Commence at the Northeast corner of the NE ¼ of the NE ¼ of sold Section 27; thence run S0018'32"E and along the East line of the said NE ¼ of the NE ¼ for 20.00 feet; thence run S89DEG 58'40"W and along the South margin line of Barkley Road for 117.92 feet to an iron pin and to the Point of Beginning; thence run South margin line of Barkley Road for 117.92 feet to an iron pin and to the Point of Beginning; thence run S00DEG 16'42"E for 150.00 feet to an Iron pin; thence run S89DEG 58'139"W for 98.00 feet to an Iron pin; thence run N00DEG 14'52"W for 150.00 feet to an Iron pin on the South margin line of Barkley Road; thence run NE89DEG 58'40"E and along the South margin line of Barkley Road for 97.92 feet to the Point of Beginning; containing 0.34 acre, more or less.

Section IV – Reimbursement of Expenses

1. ***No additional HOME funds will be expended or reimbursed as part of this agreement – as specified previously in Sections II and III. Under the agreement, prior to this amendment, $59,318.80 in HOME funds is already expended.**

2. The CITY reserves the right to inspect records and Project sites to determine that reimbursement and compensation requests are reasonable. The CITY also reserves the right to hold payment until adequate documentation has been provided and reviewed.

3. The CITY shall have the right to review and audit all records of the DEVELOPER pertaining to any payment by the CITY. Said records shall be maintained for a period of five years after the affordability period ends.

Section V – Project Requirements

The DEVELOPER agrees to comply with all requirements of the HOME Program as stated in 24 CFR Part 92. In addition, the DEVELOPER must comply with the following requirements specific to this project, including but not limited to, the following:

1. No HOME project funds will be advanced, and no costs can be incurred, until the CITY has conducted an environmental review of the proposed project site as required under 24 CFR Part 58. The environmental review may result in a decision to proceed with, modify or cancel the project. **(n/a – no additional funds are being expended. The environmental review was conducted appropriately at an earlier stage.).**

2. Notwithstanding any provision of this Agreement, the parties hereto agree and acknowledge that this Agreement does not constitute a commitment of funds or site approval, and that such commitment of funds or approval may occur only upon satisfactory completion of an environmental review and receipt by the CITY of a release of funds from HUD under 24 CFR Part 58.

3. Further, the DEVELOPER will not undertake or commit any funds to physical or choice-limiting actions, including property acquisition, demolition, rehabilitation, conversion, repair or construction prior to the environmental clearance, and must indicate that the violation of this provision may result in the denial of any funds under the Agreement.

4. HOME funds advanced to the project will be secured by a note and mortgage, and a land covenant as required by 24 CFR Part 92.

5. The DEVELOPER will ensure that any expenditure of HOME funds will be in compliance with the requirements at 92.206, and acknowledges that HOME funds will only be provided as reimbursement for eligible costs incurred, including actual expenditures or invoices for work completed.

6. The DEVELOPER will not acquire property that is occupied. All properties acquired under this program must be vacant or occupied by the seller. All acquisitions under this program are voluntary acquisitions. If the project is occupied at the time of this commitment, the DEVELOPER, using non-HOME funds, will comply with the relocation requirements of 24 CFR 92.353. The DEVELOPER will provide the seller with a voluntary acquisition notice if the property is being purchased with HOME funds.

7. The DEVELOPER shall assure compliance with 24 CFR 92.251 as relates to Property Standards and local codes, Accessibility Standards under 24 CFR 92.251(a)(3), Model Energy Code standards, as applicable, and Lead Based Paint Requirements as found in 24 CFR 92.355 and 24 CFR Part 35.

8. The DEVELOPER will be monitored by the CITY for compliance with the regulations of 24 CFR 92 for the compliance period specified above. The DEVELOPER will provide reports and access to project files and the project site as requested by the CITY during the project term and for five (5) years after the affordability period ends.

9. The DEVELOPER shall ensure that any contractor, subcontractor or participant awarded work under this contract has not been debarred, suspended or determined ineligible to perform work funded by HUD. To determine if a contractor, subcontractor or participant has been debarred, suspended or determined ineligible go to: https://www.epls.gov/.

10. The DEVELOPER (as a CHDO) may retain proceeds as defined in 24 CFR 92.2 from the grant funds provided under this Agreement. The proceeds are to be used for eligible affordable housing activities to benefit low-income families.

11. The DEVELOPER agrees that any news release, article, public service announcement or advertisement or any other type of publicity pertaining to this Project (program literature, brochures, project sign and letterhead) must recognize the City of Hattiesburg and the U.S. Department of Housing and Urban Development HOME Investment Partnerships Program as providing funds for this Project.

12. Subsidy layering. Before committing funds to a Project, the CITY or the DEVELOPER must evaluate the project and will not invest any more HOME funds, in combination with other governmental assistance, than is necessary to provide affordable housing. The cost of this review will be borne by the CITY or the DEVELOPER and this expense may be eligible for reimbursement by HOME funds provided under this Agreement. The DEVELOPER is responsible to ensure that the costs are reasonable.

13. The Developer will include green features, universal design features in its projects to greatest extent feasible and will ensure that all appliances are energy star rated appliances.

14. The CITY will take a 2nd or higher position on its mortgage if required by other funding sources to ensure the feasibility and development of the Project.

15. All claims, disputes and other matters in question arising out of, or relating to, the construction Agreement or the breech thereof, and except for the claims which have been waived by the making or acceptance of the final payment shall be decided by arbitration in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association, unless the parties mutually agree otherwise. This agreement to arbitrate shall be specifically enforceable under the prevailing arbitration law.

16. The maximum per unit subsidy that may be invested on a per-unit basis in affordable housing may not exceed the per-unit dollar limitations established under section 221(d)(3)(ii) of the National Housing Act (12 U.S.C. 17151(d)(3)(ii)) for elevator-type projects that apply to the area in which the housing is located.

17. Affordability period.

Homeownership assistance HOME amount per-unit	**Minimum period of affordability in years**
Under $15,000	5
$15,000 to $40,000	10
Over $40,000	15

The funds provided to eligible households to make the unit affordable under this program are subject to affordability requirements in accordance with 92.254. During the affordability period the homebuyer must maintain the home as his/her principal place of residence at all times. The assistance is forgiven 20%, 10% or 7% a year over the

affordability period. At the end of the affordability period the mortgage lien is released in full if the owner has complied with all of the terms of the program.

18. The DEVELOPER will also comply with the CITY of Hattiesburg's minority outreach WBE/MBE program to ensure the inclusion, to the maximum extent possible, of minorities and women, and entities owned by minorities and women, including, without limitation, real estate firms, construction firms, appraisal firms, management firms, financial institutions, investment banking firms, underwriters, accountants, and providers of legal services, in all contracts entered into with such persons or entities, public and private, in order to facilitate the activities of the CITY to provide affordable housing.

19. The CITY has the right to reject participation in the project from any contractor that has done previous business with the CITY and has failed to comply with the requirements of the program or who has been involved in litigation with the CITY.

20. All housing assisted with HOME funds is subject to the Lead-Based Paint Poisoning Prevention Act (42 U.S.C. 4821-4846), the Residential Lead-Based Paint Hazard Reduction Act of 1992 (42 U.S.C. 4851-4856), and implementing regulations at Part 35, Subparts A, B, J, K, M and R of this title outlined in 92.355.
21. The DEVELOPER must have developed a waiting list of buyers that are determined eligible by the CHDO under the HOME program requirements. There shall be no less than one (1) eligible buyer for each unit to be sold.

22. The DEVELOPER will ensure that occupancy complies with the requirements of 92.254(a)(6). The DEVELOPER will ensure that the project is eligible under 92.214, and that it will meet the applicable standards of 24 CFR 92.252-253 at occupancy and for the minimum compliance period. The project must meet the State of Mississippi building Construction Codes and the City of Hattiesburg local building codes.

23. The designated HOME-assisted project will meet the affordability requirements as found in 24 CFR 92.252. The DEVELOPER shall collect and maintain project beneficiary information pertaining to household size, income levels, racial characteristics, and the presence of Female Households in order to determine low and moderate-income benefit in a cumulative and individual manner. Income documentation shall be in a form consistent with HOME requirements as stated in the HUD ***"Technical Guide for Determining Income and Allowances Under the HOME Program"*** in accordance with the requirements under 24 CFR Part 5 found at: http://www.hud.gov/offices/cpd/affordablehousing/library/modelguides/2005/1780.cfm.

24. The homebuyer will maintain adequate hazard and flood insurance coverage, if applicable, on the property acquired, during the affordability period and will name the City of Hattiesburg as an additional insured.

25. The DEVELOPER will ensure that all HOME assisted units meet the following requirements:

a) The housing must be single-family housing or condominiums. No manufactured housing is allowed to be purchased under this program.

b) The housing must be modest housing as follows:

1. In the case of acquisition of newly constructed housing or standard housing, the housing has a purchase price for the type of single-family housing that does not exceed $148,000; based on HOME Affordable Homeownership limits for the area. The most current HUD limits can be found at:

http://www.hud.gov/offices/cpd/affordablehousing/programs/home/limits/maxprice.cfm

26. Type of Ownership: The property must be acquired in fee simple title by both the DEVELOPER and, subsequently, the HOMEBUYER.

27. The housing must meet the accessibility requirements at 24 CFR part 8, which implements Section 504 of the Rehabilitation Act of 1973 (29 U.S.C. 794) and covered multifamily dwellings, as defined at 24 CFR 100.205, which implement the Fair Housing Act (42 U.S.C. 3601-3619).

28. Should the HOMEBUYER sells his or her property, during the affordability period, HUD resale provisions shall apply as outlined in 92.254 (a)(5)(i): 1) The property is sold to another low-income homebuyer shall use the property as his or her principal residence; 2) The original homebuyer shall receive a fair return on investment, (i.e., the homebuyer's downpayment plus capital improvements made to the house); and 3) The property is sold at a price that is "affordable to a reasonable range of low-income buyers.

In the event that a HOMEBUYER, rents the home, or fails to keep the home as their primary residence, or foreclosed by any mortgage holder during the affordability period the CITY will be forced to foreclose on the entire loan amount less any amount forgiven based on a prorate portion of the affordability period fulfilled.

The housing must be acquired by a HOMEBUYER whose household qualifies as a low-income household and the housing must be the principal residence of the household throughout the affordability period. Low income is defined as households whose income does not exceed 80% of the area median income as defined by HUD and adjusted for household size. The household will be determined income eligible in accordance with IRS 1040 adjusted gross income as outlined in 92.203 (b) (3). The DEVELOPER is responsible for qualifying the household as income eligible for assistance. Income documentation shall be in a form consistent with HOME requirements as stated in the HUD "Technical Guide for Determining Income and Allowances under the HOME Program found at: http://www.hud.gov/offices/cpd/affordablehousing/library/modelguides/2005/1780.cfm.

Consequently, if the proceeds exceed the loan amount as set forth herein, the HOMEBUYER will be entitled to retain any remaining proceeds of the sale. If there are no net proceeds, then no repayment will be required. The net proceeds due for HOME Repayment must be returned to the CITY immediately upon receipt.

29. Once initial eligibility of the HOMEBUYER is determined, the DEVELOPER is required to:

    a) Submit the income verification information to the CITY for review. The CITY will notify the DEVELOPER that it concurs with the applicant's eligibility for the program and the CITY will provide written approval for the DEVELOPER to issue an award letter to the applicant.

    Income verifications under the HOME program must be dated no earlier than six (6) months prior to receipt of assistance. After six months, applicant verifications must be redone and household income must be recalculated to determine that the household still meets the income requirements.

    b) Collect and maintain project beneficiary information pertaining to household size, income levels, racial characteristics, and the presence of Female Headed Households in order to determine low and moderate-income benefit in a cumulative and individual manner.

30. The CITY retains the right to withhold payment if the DEVELOPER fails to carry out the activities authorized under this Agreement in accordance with the timeline and schedule provided. Time is of the essence under this Agreement and the HOME program sets specific deadlines for reporting of expenditure of funds. The DEVELOPER must comply with the timeframes stipulated under this Agreement and in the event that the project cannot be completed on schedule, the DEVELOPER must immediately notify the CITY. Refer to Section II (6) for factors beyond the DEVELOPER'S control. Specific penalties for non-performance are outlined in Section VI (8) of this Agreement.

31. In the selection of occupants for Project units, the DEVELOPER shall comply with all nondiscrimination requirements of 24 CFR 92.350.

32. The DEVELOPER will comply with the City of Hattiesburg's Affirmative Fair Housing Policy in marketing the homes for sale.

    a. The DEVELOPER will use the Fair Housing and Equal Opportunity Logo in all of its advertising for properties built with HOME funds.

    b. The DEVELOPER will post a Fair Housing poster in its office in a location that is visible to the public being served under the HOME program. For a Spacing copy of the poster go to: http://portal.hud.gov/hudportal/documents/huddoc?id=DOC_7802.pdf

c. All advertising, applications and marketing tools prepared by the DEVELOPER for the sale of HOME assisted units shall include the following language "We comply with the Fair Housing Law. Our office does not discriminate on the basis of race, color, national origin, religion, sex, familial status or disability".

d. The DEVELOPER will provide all program participants with a copy of the "Fair Housing Equal Opportunity for All" brochure. A copy of the brochure can be found at: http://portal.hud.gov/hudportal/documents/huddoc?id=DOC_12146.pdf

33. The CITY shall record a mortgage and note on the property when sold for the affordability period in compliance with 24 CFR 92.254 and that the CITY will monitor each unit for principal residency on an annual basis.

34. Each year, the DEVELOPER will mail a form letter to the HOMEBUYER requesting that they confirm their continued occupancy of the property for the term of the affordability period. The form shall be retained in a file by the DEVELOPER as documentation that the unit remains occupied by the original HOMEBUYER. These files shall be available to the CITY upon request.

Section VI - Funding and Method of Payment

1. The DEVELOPER may be obtaining funding for the project from various sources. The maximum amount payable by CITY under this Agreement shall be **Zero and 00/100 ($0.00) – having invested $59,318.80 under the agreement prior to this amendment.** The City's payment shall always be a proportionate share of all funds invested in the project. The HOME Funds provided by CITY to the DEVELOPER shall be in the form of a deferred payment forgivable loan, 0% interest, forgiven pro rata over the course of the affordability period. At Loan closing, the DEVELOPER shall execute and CITY shall record, at the DEVELOPER's expense, in the Public Records of Forrest County, Mississippi, a Deed of Trust to ensure that the HOME assisted units are sold to income eligible buyers. This mortgage, note and restrictive covenant will be released as units are sold to income eligible buyers, which will be required to accept a similar Deed of Trust for an appropriate affordability period.

2. Project expenses (excluding DEVELOPER Fees) shall be paid on a reimbursement basis based on vouchers for actual expenses incurred or paid by the DEVELOPER. Requests for payment must be submitted by the DEVELOPER on forms specified by the CITY **(see Chapter 5.3 of the CHDO Policies & Procedures)** with adequate and proper documentation of eligible costs incurred in compliance with 92.206 and necessary for reporting to HUD in IDIS. All such expenses shall be in conformance with the approved Project budget. Budget revision and approval by the CITY shall be required prior to payment of any expenses not conforming to the approved project budget.

3. Payment request shall not exceed one payment per month and payments must be submitted along with any progress reports required by the CITY. The CITY retains the right to withhold payment for missing and incomplete progress reports.

4. The CITY will retain 10% of each payment draw until Project completion. When the DEVELOPER submits all required documentation for final payment including; but not limited to, a project completion report, receipts, final invoices and HOMEBUYER information, releases of liens, final inspection and Certificate of Completion from the building department, the CITY will release the final 10% withheld.

5. The CITY reserves the right to inspect records and the Project site to determine that reimbursement and compensation requests are reasonable. The CITY also reserves the right to hold payment until adequate documentation has been provided and reviewed.

6. The CITY shall have the right to review and audit all records of the DEVELOPER pertaining to any payment by the CITY. Said records shall be maintained for a period of five (5) years after the affordability period ends.

7. DEVELOPER Fee

   A DEVELOPER'S Fee is compensation to the developer for the time and risk involved to develop the project. It is typically based on the size of the project, the total development cost and the risk associated with the project. The DEVELOPER's fee is expressed as a percentage of the total **HOME-investment portion of** the development cost. DEVELOPERS who perform work in a timely fashion and comply with the timelines outlined in the Agreement will receive a DEVELOPER's fee of no more than 10% of the total HOME funds awarded under the Agreement.

   The DEVELOPER fee will be paid as follows:

   (Inapplicable to this activity, CHDO Operating Funds having been included in the scope of the agreement prior to this amendment and are referenced in Section II, herein.)

8. Project Penalties

   Time is of the essence in the completion of all projects under the HOME program. DEVELOPERs who do not perform in accordance with the timeline and budget stipulated in the Agreement will be subject to penalties for lack of performance. The CITY will closely monitor performance and will enforce the following penalties when the CHDO fails to carry out its contractual obligations under the Agreement.

   a) For new construction projects that involve site acquisition:
      1. Failure by the DEVELOPER to provide a warranty deed showing ownership and title to property according to the timeline stipulated in the Agreement will result in the cancellation of the Agreement. The Agreement will be null and void and no compensation will be paid to the DEVELOPER for expenses incurred related to the acquisition of the property.

b) For existing properties already owned by the DEVELOPER
    1. Failure by the DEVELOPER to provide an active building permit issued by the City of Hattiesburg building department within the timeline stipulated in the Agreement will result in the cancellation of the Agreement. The contract will be null and void and no compensation will be paid to the DEVELOPER for expenses incurred up to the date that the Agreement is cancelled or thereafter.

c) Failure by the DEVELOPER to meet the 50% completion timeline outlined in the Agreement will result in a loss of 50% of the total DEVELOPER fee approved under the Agreement.

d) Failure of the DEVELOPER to complete 100% of the project within the timeline specified in the Agreement will result in:
    1. A 50% reduction of the DEVELOPER fee authorized under the terms of the Agreement **and**
    2. Suspension of the CHDO from participation under the HOME program for not less than one (1) year after the date the project is completed, or the next CHDO reservation funding cycle, whichever occurs later.

e) The CITY retains the right to require a CHDO who has failed to comply with the terms outlined in the Agreement, to transfer title and ownership of the property to the CITY or an agency designated by the CITY to carry out the terms and conditions of the contract in a timely manner. The CITY will consider the CITY's total investment in the property, the stage of project construction, the feasibility that the project will be completed by the HOME program deadlines by the current developer, the date the project will be completed by the new developer and the timing for meeting a national objective up to and including occupancy of the unit. The decision to transfer the title of the property will be based on the decision that is in the best interest of the HOME program, the City of Hattiesburg and its residents. The final decision to transfer title of the property will require approval by the City of Hattiesburg City Council.

f) Developers that experience delays caused by reasons beyond their control in accordance with Section II (6) of this Agreement must submit the reasons for delay and supporting documentation in writing to the Program Director. Extensions will be reviewed by the Director in consultation with City staff. The DEVELOPER will be notified in writing of the department decision to approve the Project delay.

g) At the time that the CITY approves project delay, new timelines will be established for the Project in the form of an amendment to the existing contract. The DEVELOPER must comply with the new timelines. Failure by the DEVELOPER to comply with the new timeliness will trigger the penalties stated above.

9. The DEVELOPER shall have standards of financial accountability that conform to 24 CFR 84.21, "Standards for Financial Management Systems;"

10. HOME Funds shall not be reimbursed by the CITY until the funds are needed for the payment of Eligible Costs. All HOME Funds not expended within the term of this Agreement shall remain in the custody and control of the CITY. The CITY may reallocate unexpended HOME Funds to other HOME Program projects if approved for funding by the Governing Body.

11. The DEVELOPER shall pay its subcontractors and suppliers within thirty (30) days following receipt of payment from CITY for such subcontracted work or supplies, if all required and supporting documentation is provided and the work is completed in accordance with the contract documents.

12. For purposes of this section, Requests for Payment, reports and other documentation required under this Agreement, must be submitted within sixty (60) days of project completion. Reports submitted after that date may not be honored by the CITY, at the discretion of the CITY.

13. The DEVELOPER shall furnish to the CITY all reports required by HUD and such additional reports as may be necessary to comply with all applicable laws, regulations, guidelines, and conditions specified in this Agreement and further, the DEVELOPER and any contractors or subcontractors shall provide any other reports deemed necessary by the CITY.

14. The CITY, HUD or the Comptroller General of the United States or any of their duly authorized representatives shall at all times have the right and option to monitor, inspect, audit, and review the Developer's performance and operation of the HOME program to be performed under this Agreement; and in connection therewith, all of the above mentioned entities shall have the right to inspect any and all records, books, documents, or papers of the DEVELOPER, Contractor and the subcontractors of Contractor, for the purpose of making audit examination, excerpts and transcriptions.

Section VII - CHDO Proceeds

The City of Hattiesburg will allow CHDOs that utilize CHDO reservation funds to develop, rehabilitate, sell or rent housing benefiting income eligible households to retain project proceeds.

Definition of Project Proceeds:

Project proceeds are funds generated by the project and paid to the DEVELOPER from activities carried out with HOME funds. Projects proceeds include:

1. Proceeds from the disposition by sale or long-term lease of real property acquired, rehabilitated, or constructed with HOME funds or matching contributions;

2. Payments of principal and interest on loans made using HOME funds;

3. Proceeds from the sale of loans made with HOME funds;

4. Proceeds from the sale of obligations secured by loans made with HOME funds;

5. Interest earned on program income pending its disposition; and

6. Any other interest or return on the investment permitted under § 92.205(b) of HOME funds

All project proceeds received by the CHDO must be used for affordable housing activities to benefit low-income households.

The CHDO will be required to track the investment of project proceeds for housing activities to benefit low-income households. The CHDO must maintain supporting documentation related to the use of these funds for monitoring purposes.

Eligible Uses of Project Proceeds:

CHDOs allowed to retain project proceeds must use the funds for housing activities to benefit low-income families as required by 24 CFR 92.300(a)(2). Low-income households are defined as those that do not exceed 80% of the Area Median Income as established by HUD on an annual basis.

Affordable housing activities which may be funded with CHDO proceeds include, but are not limited to: emergency repairs, project operating costs and reserves, housing refinancing costs, CHDO operating expenses, and homebuyer counseling.

CHDO proceeds which are retained by a CHDO are not subject to the requirements of the HOME regulations, except for 24 CFR 92.300(a)(2). Thus, the Davis-Bacon Act, National Environmental Policies Act and Uniform Relocation Assistance and Real Property Acquisition Policies Act do not apply to the use of CHDO proceeds. However, because CHDO proceeds are derived from the expenditure of HOME funds, any activities which are funded with CHDO proceeds may not be contributed as match.

Section VIII – Repayment of Loan

1. All HOME funds are subject to repayment in the event the project does not meet the project requirements as outlined in this Agreement.

2. It is understood that upon the completion of the project, any HOME funds reserved, but not expended under this Agreement, will revert to the CITY.

3. Sale of the property to another party may occur only with the approval of the CITY. Provisions in those documents will provide for the extinguishment of the requirements only in the event of a third-party foreclosure or deed in lieu of foreclosure. The CITY will be a

third party to the agreement between the DEVELOPER and the HOMEBUYER to ensure enforcement of the affordability requirements.

4. The DEVELOPER shall lend the HOME funds to the individual buyers as a subsidy in an amount sufficient to make the purchase affordable. Any HOME funds that reduce the price of the property below the fair market value of the property shall be secured by a HOME note and mortgage as required in 92.254(a)(5)(ii), using the note and mortgage prescribed or approved by the CITY and consistent with the method identified in the CITY's Consolidated Plan.

    a. Prior to each closing with each HOMEBUYER, the DEVELOPER will provide to the CITY the preliminary settlement statement, along with the reconciliation statement and the draft note and mortgage. The reconciliation statement shall account for the pro-ration of HOME project funds to the individual unit, and identify those funds that are to be loaned to the buyer as "Buyer subsidies" secured by the HOME note, the pro-rated HOME development funds that are to be forgiven as "Development subsidies", and the amount of DEVELOPER fee or sales proceeds to be retained from settlement funds.

Section IX – CHDO Provisions

1. If the DEVELOPER is a CHDO, the requirements in this section apply to CHDO developers, sponsors and owners. It is understood that the DEVELOPER has certified that it is and will maintain CHDO status for the term of the AGREEMENT in accordance with 24 CFR 92. DEVELOPER agrees to provide information as may be requested by the CITY to document its continued compliance, including but not limited to an annual board roster and certification of continued compliance.

2. Any funds advanced as the CHDO as pre-development funds must be in compliance with 92.301, and are forgivable only under the terms in 92.301.

3. Any funds advanced to the CHDO as CHDO Operating Expenses must be expended in compliance with 24 CFR 92.208. The City of Hattiesburg can provide up to five (5) percent of its fiscal year HOME allocation for operating expenses to the CHDO. These funds may not be used to pay operating expenses incurred by a CHDO acting as a subrecipient or contractor under the HOME Program. Operating expenses means reasonable and necessary costs for the operation of the CHDO. Such costs include salaries, wages, and other employee compensation and benefits; employee education, training, and travel; rent; utilities; communication costs; taxes; insurance; equipment; materials and supplies. The requirements and limitations on the receipt of these funds by CHDOs are set forth in 92.300(e) and (f).

Section X – Procurement Standards

1. The DEVELOPER shall establish procurement procedures to ensure that materials and services are obtained in a cost-effective manner. The DEVELOPER's procurement

procedures must be approved by the CITY. All costs will be reviewed by the CITY to assure reasonableness.

2. In addition, it is understood that any DEVELOPER that can be considered to be a religious or faith-based organization shall abide by all portions of 24 CFR 92.257.

Section XI – Conflict of Interest Provisions

1. The DEVELOPER warrants and covenants that it presently has no interest and shall not acquire any interest, directly or indirectly, which could conflict in any manner or degree with the performance of its services hereunder. The DEVELOPER further warrants and covenants that in the performance of this contract, no person having such interest shall be employed.

2. No persons who exercise or have exercised any functions or responsibilities with respect to activities assisted with HOME funds or who are in a position to participate in a decision making process or gain inside information with regard to these activities, may obtain a financial interest or benefit from a HOME-assisted activity, or have an interest in any contract, subcontract or agreement with respect thereto, or the proceeds thereunder, either for themselves or those with whom they have family or business ties, during their tenure or for one (1) year thereafter.

3. The conflict of interest provisions applies to any person, employee, agent, consultant, officer, or elected official or appointed official of the CITY. If it is determined that a conflict of interest exists, the CITY will be immediately notified. The CITY will follow the process outlined in 32.356 and request an opinion from HUD to determine if a conflict of interest exists.

4. No owner, developer or sponsor of a project assisted with HOME funds (or officer, employee, agent or consultant of the owner, developer or sponsor) whether private, for profit or non-profit, including CHDOs when acting as an owner, developer or sponsor may occupy a HOME-assisted affordable housing unit in a project. This provision does not apply to an individual who receives HOME funds to acquire or rehabilitate his or her principal residence or to an employee or agent of the owner or developer of a rental housing project who occupies a housing unit as the project manager or maintenance worker.

5. The CITY may grant exceptions or forward the requests to HUD as permitted by24 CFR 92.356, 85.36 and 84.42, as they apply.

Section XII – City Responsibilities

The CITY shall furnish the DEVELOPER with the following services and information from existing CITY records and CITY files:

1. The CITY shall provide to the DEVELOPER information regarding its requirements for the Project.

2. The CITY will provide the DEVELOPER with any changes in HOME regulations or program limits that affect the project, including but not limited to, income limits, property value limits and rent limits.

3. The CITY will conduct progress inspections of work completed to protect its interests as lender and regulatory authority for the project, and will provide information to the DEVELOPER regarding any progress inspections or monitoring to assist it in ensuring compliance.

4. The CITY's review and approval of the WORK will relate only to overall compliance with the general requirements of this Agreement and HOME regulations, and all CITY regulations and ordinances.

5. The CITY shall monitor, review, and evaluate the financial procedures of the DEVELOPER through documents submitted to the CITY and on-site monitoring. The DEVELOPER shall provide to the CITY such reports, and make available to the CITY such records that will be necessary for a proper financial evaluation. With reasonable notice (generally ten (10) working days) being given to the DEVELOPER, the CITY shall schedule at least one on-site visit during the term of said Agreement and other visits that may be needed.

6. The CITY shall monitor, review, and evaluate the DEVELOPER. Fiscal reports will be reviewed and evaluated in terms of the total budget and accomplishments in relationship to expenditures. With reasonable notice (generally ten (10) working days) being given to the DEVELOPER, the Department shall schedule at least one (1) on-site visit and other visits that may be needed during the course of said Agreement. At such times and in such forms as the CITY may require, there shall be furnished to the CITY such statements, records, data, and information as may be necessary.

7. Within a reasonable period of time (generally 45 days) after the monitoring visit, the CITY shall furnish to the DEVELOPER a letter and any necessary reports summarizing the monitoring visit. Such letters and reports will include any findings or concerns and recommendations for improvement.

8. The DEVELOPER shall have 30 days from the receipt of a financial or programmatic monitoring letter to address any findings or concerns. Should the concerns not be addressed in a manner acceptable to the CITY, this Agreement shall be terminated in accordance with the provisions for termination outlined in this Agreement.

9. Nothing contained herein shall relieve the DEVELOPER of any responsibility as provided under this Agreement.

Section XIII – Equal Employment Opportunity

During the performance of this contract, the DEVELOPER agrees as follows:

1. The DEVELOPER will not discriminate against any employee or applicant for employment because of race, color, religion, sex, handicap, familial status, or national origin. The DEVELOPER will take affirmative action to ensure the applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, familial status, or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer, recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The DEVELOPER agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the contracting officer of the CITY setting forth the provisions of this nondiscrimination clause.

2. The DEVELOPER will, in all solicitations or advertisements for employees placed by or on behalf of the DEVELOPER, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

3. The DEVELOPER will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided by the CITY's contracting officer, advising the labor union or worker's representative of the DEVELOPER's commitments under Section 202 of Executive Order No. 11246 of September 24, 1965, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

4. The DEVELOPER will comply with all provisions of Executive Order 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.

5. The DEVELOPER will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by the rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to its books, records, and accounts by the CITY and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and order.

6. In the event the DEVELOPER is found to be in noncompliance with the nondiscrimination clauses of this contract or with any of such rules, regulations or orders, this contract may be canceled, terminated or suspended in whole or in part and the DEVELOPER may be declared ineligible for further government contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965 or by rule, regulations, or order of the Secretary of Labor or as otherwise provided by law.

7. The DEVELOPER will include the provisions of this Agreement in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24,1965, so that such provisions will be binding upon each subcontractor or vendor. The DEVELOPER will take such action with respect to any subcontract or purchase order as the CITY may direct as a means of enforcing such provisions, including sanctions for noncompliance**.**

Section XIV – Section 3 Compliance

The DEVELOPER agrees to comply with the federal regulations governing training, employment and business opportunities as follows:

1. The work to be performed under this contract is subject to the requirements of Section3 of the Housing and Urban Development Act of 1968, as amended, 12 U.S.C. 1701u (Section 3). The purpose of ~~S~~section 3 is to ensure that employment and other economic opportunities generated by HUD assistance or HUD-assisted projects covered by Section 3, shall, to the greatest extent feasible, be directed to low- and very low-income persons, particularly persons who are recipients of HUD assistance for housing.

2. The DEVELOPER will comply with HUD's regulations in 24 CFR Part 135, which implement Section 3. As evidenced by the execution of this Agreement, the DEVELOPER certifies that they are under no contractual or other impediment that would prevent them from complying with 24 CFR Part 135 of the regulations.

3. The DEVELOPER, its contractors and subcontractors, if applicable agree to send to each labor organization or representative of workers with which the DEVELOPER, its contractors and subcontractors has a collective bargaining agreement or other understanding, if any, a notice advising the labor organization or workers' representative of the DEVELOPER, its contractors and subcontractors commitments under this Section 3 clause, and will post copies of the notice in conspicuous places at the work site where both employees and applicants for training and employment positions can see the notice. The notice shall describe the Section 3 preference, shall set forth minimum number and job titles subject to hire, availability of apprenticeship and training positions, the qualifications for each; and the name and location of the person(s) taking applications for each of the positions; and the anticipated date the work shall begin.

4. The DEVELOPER, its contractors and subcontractors agree to include this Section 3 clause in every subcontract subject to compliance with regulations in 24 CFR part 135, and agrees to take appropriate action, as provided in an applicable provision of the subcontract or in this Section 3 clause, upon a finding that the subcontractor is in violation of the regulations in 24 CFR part 135. The DEVELOPER and its contractors will not subcontract with any subcontractor where the DEVELOPER or its contractors has notice or knowledge that the subcontractor has been found in violation of the regulations in 24 CFR part 135.

5. The DEVELOPER, its contractors and subcontractors will certify that any vacant employment positions, including training positions, that are filled (1) after the

DEVELOPER, its contractors and subcontractors are selected but before the contract is executed, and (2) with persons other than those to whom the regulations of 24 CFR Part 135 require employment opportunities to be directed, were not filled to circumvent the DEVELOPER or contractor's obligations under 24 CFR part 135.

6. Noncompliance with HUD's regulations in 24 CFR Part 135 may result in sanctions, termination of this Agreement for default, and debarment or suspension from future HUD assisted contracts.

Section XV – Compliance with Federal, State & Local Laws

1. The DEVELOPER covenants and warrants that it will comply with all applicable laws, ordinances, codes, rules and regulations of the state, local, and Federal governments, and all amendments thereto, including, but not limited to; Title 8 of the Civil Rights Act of 1968 PL.90-284; Executive Order 11063 on Equal Opportunity and Housing, Section 3 of the Housing and Urban Development Act of 968; Housing and Community Development Act of 1974, as well as all requirements set forth in 24 CFR 92 of the HOME INVESTMENT PARTNERSHIP PROGRAM. The DEVELOPER covenants and warrants that it will indemnify and hold the City forever free and harmless with respect to any and all damages whether directly or indirectly arising out of the provisions and maintenance of this contract.

2. The DEVELOPER agrees to comply with all applicable standards, orders, or requirements issued under section 306 of the Clean Air Act (42 U.S.C. 1857(h)), Section 508 of the Clean Water Act (33 U.S.C. 1368), Executive Order 11738, and Environmental Protection CITY regulations (40 CFR Part 15).

3. The DEVELOPER further warrants and agrees to include or cause to be included the criteria and requirements of this section in every non-exempt subcontract in excess of $100,000. The DEVELOPER also agrees to take such action as the Federal, state or local government may direct to enforce aforesaid provisions.

4. Minority/Women's Businesses, Executive Orders 11625, 12432, and 12138 Under Executive Orders 11625, 12432, and 12138, the CITY must prescribe procedures acceptable to HUD for minority outreach programs to ensure that they are making concerted efforts to attract minority groups to the procurement process. The Developer agrees to assist the City to the greatest extent possible to meet the goals and objectives of this section. The DEVELOPER will submit, on an annual basis, a listing of all MBE/WBE contracts awarded including dollar amount of the contract and how the business qualifies.

   The regulations require that the following minimum affirmative steps are taken to ensure MBE/WBE is afforded every opportunity to participate in generated contracts.

   a) Placing minorities and women on solicitation lists;
   b) Assuring that MBE and WBE firms are solicited whenever they are potential sources;

c) Dividing the total requirements, when economically feasible, into smaller tasks or quantities to permit maximum participation by small and minority business enterprises, and women business enterprises;
d) Where the requirement permits, establishing delivery schedules that encourage participation by small and minority business enterprises, and women business enterprises;
e) Using the services and assistance of the Small Business Administration and the Minority Business Development Agency of the Department of Commerce; and
f) Requiring the prime contractor, if subcontractors are to be let, to take all the same.

5. Drug-Free Workplace: The Drug-Free Workplace Act of 1988 (41 U.S.C. 701, *et seq.)* and HUD's implementing regulations at 24 CFR Part 21.

   DEVELOPERS are required to provide a drug-free workplace by taking the following steps. DEVELOPER and third-party contractor/consultants failing to meet these requirements will be subject to penalties:

   a) Publish and give a policy statement to all covered employees informing them that the unlawful manufacture, distribution, dispensation, possession or use of a controlled substance is prohibited in the covered workplace and specifying the actions that will be taken against employees who violate the policy.
   b) Establish a drug-free awareness program to make employees aware of: a) the dangers of drug abuse in the workplace; b) the policy of maintaining a drug-free workplace; c) any available drug counseling, rehabilitation, and employee assistance programs; and d) the penalties that may be imposed upon employees for drug abuse violations.
   c) Notify employees that as a condition of employment on a Federal contract or grant, the employee must: a) abide by the terms of the policy statement; and b) notify the employer, within five (5) calendar days, if he or she is convicted of a criminal drug violation in the workplace.
   d) Notify the contracting or granting agency within ten (10) days after receiving notice that a covered employee has been convicted of a criminal drug violation in the workplace.
   e) Impose a penalty on or require satisfactory participation in a drug abuse assistance or rehabilitation program by any employee who is convicted of a reportable workplace drug conviction.
   f) Make an ongoing, good faith effort to maintain a drug-free workplace by meeting the requirements of the Act.

Section XVI – Enforcement, Suspension and Termination

In accordance with 24 CFR 85.43, suspension or termination may occur if the DEVELOPER materially fails to comply with any term of the award.

If, through any cause, the DEVELOPER shall fail to fulfill in timely and proper manner its obligations under this contract, or if the DEVELOPER shall violate any of the covenants, agreements, or stipulations of this contract, the CITY shall thereupon have the right to terminate

this contract by giving written notice to the DEVELOPER of such termination and specifying the effective date thereof, at least five (5) days before the effective date of such termination. In such event, the DEVELOPER shall be entitled to receive just and equitable compensation for any work satisfactorily completed hereunder to the date of said termination.

Notwithstanding the above, the DEVELOPER shall not be relieved of liability to the CITY for damages sustained by the CITY by virtue of any breach of the contract by the DEVELOPER and the CITY may withhold any payments to the DEVELOPER until such time as the exact amount of damages due the CITY from the DEVELOPER is determined whether by court of competent jurisdiction or otherwise.

24 CFR 92.504(c)(13) contains provisions for the enforcement of this Agreement. In accordance with 24 CFR 85.43, this Agreement may be suspended or terminated prior to the expiration of the term by unanimous written Agreement by the parties to this Agreement. The CITY may also unilaterally terminate or suspend this Agreement, in whole or in part, upon ten (10) day written notice from the CITY to the DEVELOPER including, but not limited to the following reasons:

1. Failure to perform the services set forth in the scope of services and requirements incident thereto.
2. Failure to comply with the provisions of this Agreement.
3. Making unauthorized or improper use of funds provided under this Agreement.
4. Submission of an application, report or other documents pertaining to this Agreement which contains misrepresentation of any material aspect.
5. The carrying out of the Scope of Services or the objectives of this Agreement is rendered improvable, unfeasible, impossible, or illegal.
6. Failure of the U.S. Department of Housing and Urban Development (HUD) to make funds available or if HUD suspends funds for any reason.
7. Upon the determination of the CITY that the Agreement be suspended or terminated, without cause.
8. Termination or suspension shall not affect otherwise valid and allowable obligations incurred in good faith prior to receipt of a notice of termination or suspension.

Section XVII – Termination for Convenience of the CITY

In accordance with 24 CFR 85.44 the CITY may terminate for its convenience this Agreement at any time by giving at least thirty (30) day's notice in writing to the DEVELOPER. If the contract is terminated by the CITY, as provided herein, the City will reimburse for any actual and approved expenses incurred, including those costs involved in terminating the contracts and shutting down the work as of the date of notice, and the DEVELOPER will be paid as a FEE an amount which bears the same ratio to the total compensation as the services actually performed to the total service of the DEVELOPER covered by this Agreement, less payments of compensation previously made. Claims and disputes between the parties will be submitted to the American Arbitration Association for resolution. Award or judgment may be entered in any court having jurisdiction thereof.

Section XVIII – Default-Loss of Grant Funds

If the DEVELOPER fails in any manner to fully perform and carry out any of the terms, covenants, and conditions of the Agreement, and more particularly if the DEVELOPER refuses or fails to proceed with the work with such diligence as will insure its completion within the time fixed by the schedule set forth in this Agreement, the DEVELOPER shall be in default and notice in writing shall be given to the DEVELOPER of such default by the CITY or an agent of the CITY. If the DEVELOPER fails to cure such default within such time as may be required by such notice, the CITY, may at its option terminate and cancel the contract.

In the event of such termination, all grant funds awarded to the DEVELOPER pursuant to this agreement shall be immediately revoked and any approvals related to the PROJECT shall immediately be deemed revoked and canceled. In such event, the DEVELOPER will no longer be entitled to receive any compensation for work undertaken after the date of the termination of this Agreement, as the grant funds will no longer be available for this project.

Such termination shall not effect or terminate any of the rights of the CITY as against the DEVELOPER then existing, or which may thereafter accrue because of such default, and the foregoing provision shall be in addition to all other rights and remedies available to the CITY under the law and the note and mortgage (if in effect), including but not limited to compelling the DEVELOPER to complete the project in accordance with the terms of this Agreement, in a court of equity. The waiver of a breach of any term, covenant or condition hereof shall not operate as a waiver of any subsequent breach of the same or any other term, covenant, or condition hereof.

Section XIX – Reporting Responsibilities

The DEVELOPER agrees to submit monthly reports to the CITY on the progress of the project. Reports are due the 15th of each month and will cover activities for the prior month. The CITY retains the right to request additional documentation to comply with HUD's reporting requirements. If the DEVELOPER fails to submit the monthly progress reports by the due date, no payments will be made to the DEVELOPER under this Agreement until all outstanding reports have been submitted.

The CITY will send the DEVELOPER one (1) reminder notice if the report has not been received fourteen (14) days after the due date. If the DEVELOPER has not submitted a report fourteen (14) days after the date on the reminder notice, the CITY will have the option to terminate the contract as described in this agreement. In addition, the DEVELOPER agrees to provide the CITY information as required to determine program eligibility, and financial records pertinent to the project.

At project completion, the DEVELOPER will provide a Project Progress Report signifying completion, with all data and supporting documentation for project closeout as may be required by the CITY.

Section XX – Inspection, Monitoring & Access to Records

1. All records will be maintained by the DEVELOPER for five (5) years after the affordability of the homebuyer ends.

2. The CITY reserves the right to inspect, monitor, and observe work and services performed by the DEVELOPER at any and all reasonable times.

3. The CITY reserves the right to audit the records of the DEVELOPER any time during the performance of this Agreement and for a period of five (5) years after final payment is made under this Agreement.

4. The DEVELOPER will provide the CITY with a certified audit of the Developer's records representing the Fiscal Year during which the PROJECT becomes complete pursuant to the requirements of OMB Circular A-133.

5. Access shall be immediately granted to the CITY, HUD, the Comptroller General of the United States, or any of their duly authorized representatives to any books, documents, papers, project site access, and records of the DEVELOPER or its contractors which are directly pertinent to that specific contract for the purpose of making audit, examination, excerpts, and transcriptions.

6. The DEVELOPER shall maintain all records required by the Federal regulations specified in 92.508 that are pertinent to the activities to be funded under this Agreement. Such records include but are not limited to:

    a) A full description of each project assisted with HOME funds, including the location, form of HOME assistance, and tenants assisted with HOME funds.

    b) The source and application of funds for each project, including supporting documentation in accordance with 24 CFR 85.20.

    c) Records demonstrating that each rental housing project meets the minimum per-unit subsidy amount of § 92.205(c), the maximum per-unit subsidy amount of § 92.250(a) and the subsidy layering guidelines adopted in accordance with § 92.250(b).

    d) Records demonstrating that each project meets the property standards of § 92.251 and the lead-based paint requirements of § 92.355.

    e) Records demonstrating that each family is income eligible in accordance with § 92.203.

    f) Records demonstrating that each rental housing project meets the affordability and income targeting requirements of § 92.252 for the required period. Records must be kept for each family assisted.

    g) Records demonstrating that each multifamily rental housing project involving rehabilitation with refinancing complies with the refinancing guidelines established in accordance with § 92.206(b).

h) Records demonstrating that any pre-award costs charged to the HOME allocation meet the requirements of § 92.212.

i) Records demonstrating that a site and neighborhood standards review was conducted for each project which includes new construction of rental housing assisted under this part to determine that the site meets the requirements of 24 CFR 983.6(b), in accordance with § 92.202.

Section XXI – General Conditions

1. All notices or other communication which shall or may be given pursuant to this Agreement shall be in writing and shall be delivered by personal service, or by registered mail addressed to the other party at the address indicated herein or as the same may be changed from time to time. Such notice shall be deemed given on the day on which personally served; or, if by mail, on the fifth day after being posted or the date of actual receipt, whichever is earlier. Notices shall be mailed to the following address:

CITY address: **City of Hattiesburg, Department of Urban Development, P.O. Box 1898, Hattiesburg, MS 39403-1898**

DEVELOPER address: **Community Connections, Attn: Demetria Farve, P.O. Box 18612, Hattiesburg, MS 39404**

2. Title and paragraph headings are for convenient reference and are not a part of this Agreement.

3. In the event of conflict between the terms of this Agreement and any terms or conditions contained in any attached documents, the terms in this Agreement shall rule.

4. No waiver or breach of any provision of this Agreement shall constitute a waiver of a subsequent breach of the same or any other provision hereof, and no waiver shall be effective unless made in writing.

5. The parties hereto agree that this Agreement shall be construed and enforced according to the laws of the State of Mississippi.

6. Should any provisions, paragraphs, sentences, words or phrases contained in this Agreement be determined by a court of competent jurisdiction to be invalid, illegal or otherwise unenforceable under the laws of the State of Mississippi or the City of Hattiesburg, such provisions, paragraphs, sentences, words or phrases shall be deemed modified to the extent necessary in order to conform with such laws, or if not modifiable to conform with such laws, then same shall be deemed severable, and in either event, the remaining terms and provisions of this Agreement shall remain unmodified and in full force and effect.

7. The DEVELOPER shall comply with the provisions of the Copeland Anti-Kick-Back Act (18 U.S.C. 874) as supplemented in the AGENCY of Labor Regulations (29 CFR Part 3), as amended.

8. The DEVELOPER shall comply with the provisions of sections 103 and 107 of the Contract Work Hours and Safety Standard Act (40 U.S.C. 327-330) as supplemented by AGENCY of Labor regulations (29 CFR, Part 5), as amended.

9. The DEVELOPER further warrants and agrees to include or cause to be included the criteria and requirements of this section in every nonexempt subcontract. The DEVELOPER also agrees to take such action as the Federal, state or local government may direct to enforce aforesaid provisions.

10. The obligations undertaken by the DEVELOPER pursuant to this Agreement shall not be delegated or assigned to any other person or agency unless the CITY shall first consent to the performance or assignment of such service or any part thereof by another person or agency.

11. The Agreement shall be binding upon the parties hereto, their heirs, executors, legal representative, successors and assigns.

12. DEVELOPER and its employees and agents shall be deemed to be independent contractors, and not agents or employees of the CITY, and shall not attain any rights or benefits under the civil service or pension ordinances of the CITY, or any rights generally afforded classified or unclassified employee; further they shall not be deemed entitled to state Compensation benefits as an employee of the CITY.

13. Funding for this Agreement is contingent on the availability of funds and continued authorization for program activities and is subject to amendment or termination due to lack of funds, or authorization, reduction of funds, and/or change in regulations.

Section XXII – Insurance

1. The DEVELOPER during the construction period shall keep the property acquired under this Agreement insured against loss by fire, extended flood coverage, vandalism and malicious mischief, hazards, and such may require and in such amounts as CITY may require. The insurance requirements shall remain in effect until the property is sold to an income eligible buyer. The CITY shall be named as an additional insured.

2. A Commercial General Liability Insurance Policy shall be provided which shall contain minimum limits of one million dollars ($1,000,000.00) per occurrence combined single limit for bodily injury liability and property damage liability. Coverage must be afforded on a form no more restrictive than the latest edition of the Commercial General Liability Policy, without restrictive endorsements, as filed by the Insurance Services Office and shall include Premises and/or operations, independent contractors, Broad Form Contractual

Coverage applicable to this specific Contract, including any hold harmless and/or indemnification agreement.

3. Personal Injury Coverage with Employee and Contractual Exclusions removed, with minimum limits of coverage equal to those required for Bodily Injury Liability and Property Damage Liability. The DEVELOPER shall carry Workers' Compensation insurance for all employees in compliance with the "Workers' Compensation Law" of the State of Mississippi and all applicable federal laws.

4. The DEVELOPER shall require its General Contractor to provide Builder's Risk Insurance in the amount of one hundred percent (100%) of replacement value of the completed structure until Project completion. Such Builder's Risk policy shall be an all risk form with a deductible not to exceed ten thousand ~~d~~ollars ($10,000.00) each claim and shall contain a loss payable clause to include the CITY. The DEVELOPER shall furnish to the CITY Certificates of Insurance or endorsements evidencing the insurance coverage specified by this Article prior to beginning performance of work under this Agreement. Coverage shall not cease and is to remain in force until all performance required work is completed.

5. The DEVELOPER shall furnish copies of all licenses and certifications of Public Liability Insurance for all HOME projects upon request by the CITY.

XXIII - Indemnification

1. The DEVELOPER shall at all times hereafter indemnify, hold harmless and defend the CITY, its officers, agents, servants, and employees against any and all claims, losses, liabilities, and expenditures of any kind, including attorney fees, court costs, and expenses, caused by any intentional, reckless, or negligent act or omission of the DEVELOPER, its employees, agents, servants, or officers, or accruing, resulting from, or related to the subject matter of this Agreement including, without limitation, any and all claims, demands, or causes of action of any nature whatsoever resulting from injuries or damages sustained by any person or property. The provisions of this section shall survive the expiration or earlier termination of this Agreement. To the extent considered necessary by the CITY, any sums due to the DEVELOPER under this Agreement may be retained by the CITY until all of the CITY's claims for indemnification pursuant to this Agreement have been settled or otherwise resolved; and any amount withheld shall not be subject to payment of interest by the CITY.

2. In the event that the DEVELOPER contracts with a third party ("Contractor") to provide the construction related services set forth herein, any contract with such third party shall include the following provisions:

    a. Indemnification: To the fullest extent permitted by law, Contractor shall indemnify and hold harmless CITY, its officers and employees, from liabilities, damages, losses, and costs, including, but not limited to, reasonable attorney's fees, to the extent caused by the negligence, recklessness, or intentionally wrongful conduct of

Contractor and persons employed or utilized by Contractor in the performance of this Contract. These indemnifications shall survive the term of this Contract.

3. The DEVELOPER shall comply with the anti-lobbying legislation set forth in 24 CFR 91.225 in the CITY's Consolidated Plan submitted to HUD for the HOME Program; both incorporated herein by reference.

4. The DEVELOPER shall indemnify and hold the CITY harmless from and against any negligent claims, liabilities, losses and causes of action which may arise out of DEVELOPER's activities under this Agreement, including all other acts or omissions to act on the part of DEVELOPER, including any person acting for or on its behalf, and, from and against any orders, judgments, or decrees which may be entered, and from and against all costs, attorney's fees, expenses and liabilities incurred in the defense of any such claims, or in the investigation thereof.

IN WITNESS THEREOF,

The City of Hattiesburg and the AWARDEE have caused their signatures to be hereunto affixed and duly attested:

City of Hattiesburg, Mississippi

By: _____
Toby Barker, Mayor

Date: _____

Attest: _____
Kermas Eaton, City Clerk

Date: _____

Community Connections

By: _____
Print: _____

Date: _____

Attest: _____

Date: _____

AMENDMENT TO AGREEMENT

HOMEOWNERSHIP AGREEMENT BETWEEN THE CITY OF HATTIESBURG AND COMMUNITY CONNECTIONS

THIS AGREEMENT, entered into this 4th day of May, 2010, by and between the City of Hattiesburg (hereinafter referred to as the "CITY"), and **Community Connections, Inc.**, a nonprofit corporation (hereinafter referred to as the "DEVELOPER") whose principal office is located at **215 Mobile Street, Hattiesburg, MS.**

WHEREAS, on the 4th day of December, 2018, the CITY and the DEVELOPER wish to change the scope of the May 4, 2010 agreement as well as all subsequent amendments prior to the 4th day of December, 2018 to allow the DEVELOPER to operate the developed property as a HOME-funded homebuyer development project;

WHEREAS, the CITY is a recipient of HOME Investment Partnerships grant funds from the United States Department of Housing and Urban Development (HUD) pursuant to 24 CFR 92; and

WHEREAS, the CITY wishes to engage the DEVELOPER to assist the City in utilizing such funds;

WHEREAS, the DEVELOPER has been selected to utilize HOME funds to develop and sell **One (1)** single-family home(s) to income eligible household(s) as outlined in this agreement;

NOW, THEREFORE in consideration of the mutual covenants and obligations herein contained, including the Exhibits, and subject to the terms and conditions hereinafter stated, the parties hereto understand and agree as follows:

Section I – Definitions

a. **CITY** – is hereby defined as the Department of Federal and State Programs the agency administering the HOME Program for the CITY of Hattiesburg. For the purpose of this Agreement and all administration of HOME funds, the CITY shall execute fiscal and programmatic control of this agreement. The term "Approval by the CITY" or like term used in this Agreement shall in no way relieve the DEVELOPER from any duties or responsibilities under the terms of this Agreement, or obligation under State or local law or regulation.

b. **CHDO** – Community Housing Development Organization as defined in 92.2 of the HOME rule.

c. **DIRECTOR** – is hereby defined as the Director of the Department of Urban Development of the CITY of Hattiesburg.

d. **DEVELOPER FEE** – is hereby defined as the amount of money the CITY agrees to pay and the DEVELOPER agrees to accept as payment in full for the professional, technical and construction services rendered pursuant to this Agreement.

e. **WORK** – is hereby defined as all the professional, technical and construction services to be rendered or provided by the DEVELOPER as described herein.

f. **HOME** – is hereby defined as the HOME Investment Partnerships Program as described in 24 CFR Part 92, under the authority of 42 U.S.C. 3535 (d) and 12701 - 12839.

g. **IDIS** – Integrated Disbursement and Information System.

h. **PROJECT COMPLETION** – the project has received a certificate of occupancy or other local certification indicating that construction or rehabilitation has been completed, the CITY has signed off on all work and the work has been performed to the satisfaction of the CITY, the CITY has received all required documents from the DEVELOPER and the project is fully occupied by income eligible households. All documents that enforce the affordability period must be recorded.

Section II – Term of Agreement

The term of this Agreement shall commence on **May 4, 2010, having thereafter been amended for changes in scope and herein further amended** and shall end on or before the Project Completion deadline of **January 31, 2019**;

The CITY shall provide HOME funds in an amount not to exceed **$59, 318.80 ($50,000 in CHDO Reserve Funding and $9,318.80 in CHDO Operating Funding)**, in accordance with the attached budget hereby attached as Exhibit **(n/a as funds were expended according to a budget under a previously executed agreement related to this project site). It is acknowledged by the CITY and the DEVELOPER, however, that these funds were disbursed under the terms of a previously existing agreement which is herein amended, and that this agreement is hereby established solely as an administrative tool prescribed to see through the completion of the project and the fulfillment of the affordability period. No additional HOME funds will be expended in completing this project.**

Interim Milestones/Deadlines (list below):

Milestones	***Deadline***
All related development having been complete prior to this amendment, the only remaining benchmark is the sale of the home to an eligible buyer, expected as follows:	
Home sold by Community Connections and reported to City by January 31, 2019.	

1. This project is subject to ongoing affordability requirements of the HOME program for 15 years from the date of project completion. During this compliance period, DEVELOPER

will assure continued compliance with HOME requirements for HOME-assisted homebuyer project. This includes monitoring units for principal residency and recapture of funds if the property is sold and is no longer the primary residence of the homebuyer.

2. Timely completion of the work specified in this agreement is an integral and essential part of performance.

3. The expenditure of HOME funds is subject to Federal deadlines and could result in the loss of the Federal funds. By the acceptance and execution of this Agreement, it is understood and agreed by the DEVELOPER that the PROJECT will be completed as expeditiously as possible and that the DEVELOPER will make every effort to ensure that the project will not be delayed.

4. Failure to meet these deadlines can result in cancellation of this Agreement and the revocation of HOME funds.

5. Since it is mutually agreed that time is of the essence in regard to this Agreement, the DEVELOPER shall cause appropriate provisions to be inserted in all contracts or subcontracts relative to the work tasks required by this Agreement, in order to ensure that the PROJECT will be completed according to the timetable set forth. It is intended that such provisions inserted in any subcontracts be, to the fullest extent permitted by law and equity, binding for the benefit of the CITY and enforceable by the CITY against the DEVELOPER and its successors and assigns to the project or any part thereof or any interest therein.

6. In the event the DEVELOPER is unable to meet the above schedule or complete the above services because of delays resulting from Acts of God, untimely review and approval by the CITY and other governmental authorities having jurisdiction over the PROJECT, or other delays that are not caused by the DEVELOPER; the CITY shall grant a reasonable extension of time for completion of the WORK. It shall be the responsibility of the DEVELOPER to notify the CITY promptly in writing whenever a delay is anticipated or experienced, and to inform the CITY of all facts and details related to the delay.

Section III – Scope of Work

A detailed scope of work is attached as exhibit **(n/a – as development-related scope of work was fulfilled prior to the establishment of this amendment, the remaining scope of work is to sell the unit to a HOME qualified homebuyer and to see to the fulfillment of the affordability period.).** The DEVELOPER, in close coordination with the CITY, shall perform all professional services (the "WORK") necessary to complete the development and occupancy of the following project in full compliance with the terms of this Agreement:

Project Description:
The project at 620 Barkley Road, having been constructed under the terms of the agreement prior to this amendment is to be converted into a homebuyer project for an income-eligible

household. The project will remain as an affordable unit for the duration of the affordability period. HOME funds having been used prior to this amendment, no additional HOME funds will be expended in the completion of this activity.

Project Addresses:
620 Barkley Road, Hattiesburg, MS 39401

Legal Description:
See Forrest County parcel PPIN # 42483

Section IV – Reimbursement of Expenses

1. ***No additional HOME funds will be expended or reimbursed as part of this agreement – as specified previously in Sections II and III. Under the agreement, prior to this amendment, $59,318.80 in HOME funds is already expended.**

2. The CITY reserves the right to inspect records and Project sites to determine that reimbursement and compensation requests are reasonable. The CITY also reserves the right to hold payment until adequate documentation has been provided and reviewed.

3. The CITY shall have the right to review and audit all records of the DEVELOPER pertaining to any payment by the CITY. Said records shall be maintained for a period of five years after the affordability period ends.

Section V – Project Requirements

The DEVELOPER agrees to comply with all requirements of the HOME Program as stated in 24 CFR Part 92. In addition, the DEVELOPER must comply with the following requirements specific to this project, including but not limited to, the following:

1. No HOME project funds will be advanced, and no costs can be incurred, until the CITY has conducted an environmental review of the proposed project site as required under 24 CFR Part 58. The environmental review may result in a decision to proceed with, modify or cancel the project. **(n/a – no additional funds are being expended. The environmental review was conducted appropriately at an earlier stage.).**

2. Notwithstanding any provision of this Agreement, the parties hereto agree and acknowledge that this Agreement does not constitute a commitment of funds or site approval, and that such commitment of funds or approval may occur only upon satisfactory completion of an environmental review and receipt by the CITY of a release of funds from HUD under 24 CFR Part 58.

3. Further, the DEVELOPER will not undertake or commit any funds to physical or choice-limiting actions, including property acquisition, demolition, rehabilitation, conversion, repair or construction prior to the environmental clearance, and must indicate that the violation of this provision may result in the denial of any funds under the Agreement.

4. HOME funds advanced to the project will be secured by a note and mortgage, and a land covenant as required by 24 CFR Part 92.

5. The DEVELOPER will ensure that any expenditure of HOME funds will be in compliance with the requirements at 92.206, and acknowledges that HOME funds will only be provided as reimbursement for eligible costs incurred, including actual expenditures or invoices for work completed.

6. The DEVELOPER will not acquire property that is occupied. All properties acquired under this program must be vacant or occupied by the seller. All acquisitions under this program are voluntary acquisitions. If the project is occupied at the time of this commitment, the DEVELOPER, using non-HOME funds, will comply with the relocation requirements of 24 CFR 92.353. The DEVELOPER will provide the seller with a voluntary acquisition notice if the property is being purchased with HOME funds.

7. The DEVELOPER shall assure compliance with 24 CFR 92.251 as relates to Property Standards and local codes, Accessibility Standards under 24 CFR 92.251(a)(3), Model Energy Code standards, as applicable, and Lead Based Paint Requirements as found in 24 CFR 92.355 and 24 CFR Part 35.

8. The DEVELOPER will be monitored by the CITY for compliance with the regulations of 24 CFR 92 for the compliance period specified above. The DEVELOPER will provide reports and access to project files and the project site as requested by the CITY during the project term and for five (5) years after the affordability period ends.

9. The DEVELOPER shall ensure that any contractor, subcontractor or participant awarded work under this contract has not been debarred, suspended or determined ineligible to perform work funded by HUD. To determine if a contractor, subcontractor or participant has been debarred, suspended or determined ineligible go to: https://www.epls.gov/.

10. The DEVELOPER (as a CHDO) may retain proceeds as defined in 24 CFR 92.2 from the grant funds provided under this Agreement. The proceeds are to be used for eligible affordable housing activities to benefit low-income families.

11. The DEVELOPER agrees that any news release, article, public service announcement or advertisement or any other type of publicity pertaining to this Project (program literature, brochures, project sign and letterhead) must recognize the City of Hattiesburg and the U.S. Department of Housing and Urban Development HOME Investment Partnerships Program as providing funds for this Project.

12. Subsidy layering. Before committing funds to a Project, the CITY or the DEVELOPER must evaluate the project and will not invest any more HOME funds, in combination with other governmental assistance, than is necessary to provide affordable housing. The cost of this review will be borne by the CITY or the DEVELOPER and this expense may be

eligible for reimbursement by HOME funds provided under this Agreement. The DEVELOPER is responsible to ensure that the costs are reasonable.

13. The Developer will include green features, universal design features in its projects to greatest extent feasible and will ensure that all appliances are energy star rated appliances.

14. The CITY will take a 2nd or higher position on its mortgage if required by other funding sources to ensure the feasibility and development of the Project.

15. All claims, disputes and other matters in question arising out of, or relating to, the construction Agreement or the breech thereof, and except for the claims which have been waived by the making or acceptance of the final payment shall be decided by arbitration in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association, unless the parties mutually agree otherwise. This agreement to arbitrate shall be specifically enforceable under the prevailing arbitration law.

16. The maximum per unit subsidy that may be invested on a per-unit basis in affordable housing may not exceed the per-unit dollar limitations established under section 221(d)(3)(ii) of the National Housing Act (12 U.S.C. 17151(d)(3)(ii)) for elevator-type projects that apply to the area in which the housing is located.

17. Affordability period.

Homeownership assistance HOME amount per-unit	Minimum period of affordability in years
Under $15,000	5
$15,000 to $40,000	10
Over $40,000	15

The funds provided to eligible households to make the unit affordable under this program are subject to affordability requirements in accordance with 92.254. During the affordability period the homebuyer must maintain the home as his/her principal place of residence at all times. The assistance is forgiven 20%, 10% or 7% a year over the affordability period. At the end of the affordability period the mortgage lien is released in full if the owner has complied with all of the terms of the program.

18. The DEVELOPER will also comply with the CITY of Hattiesburg's minority outreach WBE/MBE program to ensure the inclusion, to the maximum extent possible, of minorities and women, and entities owned by minorities and women, including, without limitation, real estate firms, construction firms, appraisal firms, management firms, financial institutions, investment banking firms, underwriters, accountants, and providers of legal services, in all contracts entered into with such persons or entities, public and private, in order to facilitate the activities of the CITY to provide affordable housing.

19. The CITY has the right to reject participation in the project from any contractor that has done previous business with the CITY and has failed to comply with the requirements of the program or who has been involved in litigation with the CITY.

20. All housing assisted with HOME funds is subject to the Lead-Based Paint Poisoning Prevention Act (42 U.S.C. 4821-4846), the Residential Lead-Based Paint Hazard Reduction Act of 1992 (42 U.S.C. 4851-4856), and implementing regulations at Part 35, Subparts A, B, J, K, M and R of this title outlined in 92.355.

21. The DEVELOPER must have developed a waiting list of buyers that are determined eligible by the CHDO under the HOME program requirements. There shall be no less than one (1) eligible buyer for each unit to be sold.

22. The DEVELOPER will ensure that occupancy complies with the requirements of 92.254(a)(6). The DEVELOPER will ensure that the project is eligible under 92.214, and that it will meet the applicable standards of 24 CFR 92.252-253 at occupancy and for the minimum compliance period. The project must meet the State of Mississippi building Construction Codes and the City of Hattiesburg local building codes.

23. The designated HOME-assisted project will meet the affordability requirements as found in 24 CFR 92.252. The DEVELOPER shall collect and maintain project beneficiary information pertaining to household size, income levels, racial characteristics, and the presence of Female Households in order to determine low and moderate-income benefit in a cumulative and individual manner. Income documentation shall be in a form consistent with HOME requirements as stated in the HUD ***"Technical Guide for Determining Income and Allowances Under the HOME Program"*** in accordance with the requirements under 24 CFR Part 5 found at: http://www.hud.gov/offices/cpd/affordablehousing/library/modelguides/2005/1780.cfm.

24. The homebuyer will maintain adequate hazard and flood insurance coverage, if applicable, on the property acquired, during the affordability period and will name the City of Hattiesburg as an additional insured.

25. The DEVELOPER will ensure that all HOME assisted units meet the following requirements:
    a) The housing must be single-family housing or condominiums. No manufactured housing is allowed to be purchased under this program.

    b) The housing must be modest housing as follows:

        1. In the case of acquisition of newly constructed housing or standard housing, the housing has a purchase price for the type of single-family housing that does not exceed $148,000; based on HOME Affordable Homeownership limits for the area. The most current HUD limits can be found at:

http://www.hud.gov/offices/cpd/affordablehousing/programs/home/limits/maxprice.cfm

26. Type of Ownership: The property must be acquired in fee simple title by both the DEVELOPER and, subsequently, the HOMEBUYER.

27. The housing must meet the accessibility requirements at 24 CFR part 8, which implements Section 504 of the Rehabilitation Act of 1973 (29 U.S.C. 794) and covered multifamily dwellings, as defined at 24 CFR 100.205, which implement the Fair Housing Act (42 U.S.C. 3601-3619).

28. Should the HOMEBUYER sells his or her property, during the affordability period, HUD resale provisions shall apply as outlined in 92.254 (a)(5)(i): 1) The property is sold to another low-income homebuyer shall use the property as his or her principal residence; 2) The original homebuyer shall receive a fair return on investment, (i.e., the homebuyer's downpayment plus capital improvements made to the house); and 3) The property is sold at a price that is "affordable to a reasonable range of low-income buyers.

    In the event that a HOMEBUYER, rents the home, or fails to keep the home as their primary residence, or foreclosed by any mortgage holder during the affordability period the CITY will be forced to foreclose on the entire loan amount less any amount forgiven based on a prorate portion of the affordability period fulfilled.

    The housing must be acquired by a HOMEBUYER whose household qualifies as a low-income household and the housing must be the principal residence of the household throughout the affordability period. Low income is defined as households whose income does not exceed 80% of the area median income as defined by HUD and adjusted for household size. The household will be determined income eligible in accordance with IRS 1040 adjusted gross income as outlined in 92.203 (b) (3). The DEVELOPER is responsible for qualifying the household as income eligible for assistance. Income documentation shall be in a form consistent with HOME requirements as stated in the HUD "Technical Guide for Determining Income and Allowances under the HOME Program found at: http://www.hud.gov/offices/cpd/affordablehousing/library/modelguides/2005/1780.cfm.

    Consequently, if the proceeds exceed the loan amount as set forth herein, the HOMEBUYER will be entitled to retain any remaining proceeds of the sale. If there are no net proceeds, then no repayment will be required. The net proceeds due for HOME Repayment must be returned to the CITY immediately upon receipt.

29. Once initial eligibility of the HOMEBUYER is determined, the DEVELOPER is required to:

    a) Submit the income verification information to the CITY for review. The CITY will notify the DEVELOPER that it concurs with the applicant's eligibility for the program and the CITY will provide written approval for the DEVELOPER to issue an award letter to the applicant.

Income verifications under the HOME program must be dated no earlier than six (6) months prior to receipt of assistance. After six months, applicant verifications must be redone and household income must be recalculated to determine that the household still meets the income requirements.

b) Collect and maintain project beneficiary information pertaining to household size, income levels, racial characteristics, and the presence of Female Headed Households in order to determine low and moderate-income benefit in a cumulative and individual manner.

30. The CITY retains the right to withhold payment if the DEVELOPER fails to carry out the activities authorized under this Agreement in accordance with the timeline and schedule provided. Time is of the essence under this Agreement and the HOME program sets specific deadlines for reporting of expenditure of funds. The DEVELOPER must comply with the timeframes stipulated under this Agreement and in the event that the project cannot be completed on schedule, the DEVELOPER must immediately notify the CITY. Refer to Section II (6) for factors beyond the DEVELOPER'S control. Specific penalties for non-performance are outlined in Section VI (8) of this Agreement.

31. In the selection of occupants for Project units, the DEVELOPER shall comply with all nondiscrimination requirements of 24 CFR 92.350.

32. The DEVELOPER will comply with the City of Hattiesburg's Affirmative Fair Housing Policy in marketing the homes for sale.

a. The DEVELOPER will use the Fair Housing and Equal Opportunity Logo in all of its advertising for properties built with HOME funds.

b. The DEVELOPER will post a Fair Housing poster in its office in a location that is visible to the public being served under the HOME program. For a Spacing copy of the poster go to: http://portal.hud.gov/hudportal/documents/huddoc?id=DOC_7802.pdf

c. All advertising, applications and marketing tools prepared by the DEVELOPER for the sale of HOME assisted units shall include the following language "We comply with the Fair Housing Law. Our office does not discriminate on the basis of race, color, national origin, religion, sex, familial status or disability".

d. The DEVELOPER will provide all program participants with a copy of the "Fair Housing Equal Opportunity for All" brochure. A copy of the brochure can be found at: http://portal.hud.gov/hudportal/documents/huddoc?id=DOC_12146.pdf

33. The CITY shall record a mortgage and note on the property when sold for the affordability period in compliance with 24 CFR 92.254 and that the CITY will monitor each unit for principal residency on an annual basis.

34. Each year, the DEVELOPER will mail a form letter to the HOMEBUYER requesting that they confirm their continued occupancy of the property for the term of the affordability period. The form shall be retained in a file by the DEVELOPER as documentation that the unit remains occupied by the original HOMEBUYER. These files shall be available to the CITY upon request.

Section VI - Funding and Method of Payment

1. The DEVELOPER may be obtaining funding for the project from various sources. The maximum amount payable by CITY under this Agreement shall be **Zero and 00/100 ($0.00) – having invested $59,318.80 under the agreement prior to this amendment.** The City's payment shall always be a proportionate share of all funds invested in the project. The HOME Funds provided by CITY to the DEVELOPER shall be in the form of a deferred payment forgivable loan, 0% interest, forgiven pro rata over the course of the affordability period. At Loan closing, the DEVELOPER shall execute and CITY shall record, at the DEVELOPER's expense, in the Public Records of Forrest County, Mississippi, a Deed of Trust to ensure that the HOME assisted units are sold to income eligible buyers. This mortgage, note and restrictive covenant will be released as units are sold to income eligible buyers, which will be required to accept a similar Deed of Trust for an appropriate affordability period.

2. Project expenses (excluding DEVELOPER Fees) shall be paid on a reimbursement basis based on vouchers for actual expenses incurred or paid by the DEVELOPER. Requests for payment must be submitted by the DEVELOPER on forms specified by the CITY **(see Chapter 5.3 of the CHDO Policies & Procedures)** with adequate and proper documentation of eligible costs incurred in compliance with 92.206 and necessary for reporting to HUD in IDIS. All such expenses shall be in conformance with the approved Project budget. Budget revision and approval by the CITY shall be required prior to payment of any expenses not conforming to the approved project budget.

3. Payment request shall not exceed one payment per month and payments must be submitted along with any progress reports required by the CITY. The CITY retains the right to withhold payment for missing and incomplete progress reports.

4. The CITY will retain 10% of each payment draw until Project completion. When the DEVELOPER submits all required documentation for final payment including; but not limited to, a project completion report, receipts, final invoices and HOMEBUYER information, releases of liens, final inspection and Certificate of Completion from the building department, the CITY will release the final 10% withheld.

5. The CITY reserves the right to inspect records and the Project site to determine that reimbursement and compensation requests are reasonable. The CITY also reserves the right to hold payment until adequate documentation has been provided and reviewed.

6. The CITY shall have the right to review and audit all records of the DEVELOPER pertaining to any payment by the CITY. Said records shall be maintained for a period of five (5) years after the affordability period ends.

7. DEVELOPER Fee

   A DEVELOPER'S Fee is compensation to the developer for the time and risk involved to develop the project. It is typically based on the size of the project, the total development cost and the risk associated with the project. The DEVELOPER's fee is expressed as a percentage of the total **HOME-investment portion of** the development cost. DEVELOPERS who perform work in a timely fashion and comply with the timelines outlined in the Agreement will receive a DEVELOPER's fee of no more than 10% of the total HOME funds awarded under the Agreement.

   The DEVELOPER fee will be paid as follows:

   (Inapplicable to this activity, CHDO Operating Funds having been included in the scope of the agreement prior to this amendment and are referenced in Section II, herein.)

8. Project Penalties

   Time is of the essence in the completion of all projects under the HOME program. DEVELOPERs who do not perform in accordance with the timeline and budget stipulated in the Agreement will be subject to penalties for lack of performance. The CITY will closely monitor performance and will enforce the following penalties when the CHDO fails to carry out its contractual obligations under the Agreement.

   a) For new construction projects that involve site acquisition:
      1. Failure by the DEVELOPER to provide a warranty deed showing ownership and title to property according to the timeline stipulated in the Agreement will result in the cancellation of the Agreement. The Agreement will be null and void and no compensation will be paid to the DEVELOPER for expenses incurred related to the acquisition of the property.

   b) For existing properties already owned by the DEVELOPER
      1. Failure by the DEVELOPER to provide an active building permit issued by the City of Hattiesburg building department within the timeline stipulated in the Agreement will result in the cancellation of the Agreement. The contract will be null and void and no compensation will be paid to the DEVELOPER for expenses incurred up to the date that the Agreement is cancelled or thereafter.

   c) Failure by the DEVELOPER to meet the 50% completion timeline outlined in the Agreement will result in a loss of 50% of the total DEVELOPER fee approved under the Agreement.

d) Failure of the DEVELOPER to complete 100% of the project within the timeline specified in the Agreement will result in:
    1. A 50% reduction of the DEVELOPER fee authorized under the terms of the Agreement **and**
    2. Suspension of the CHDO from participation under the HOME program for not less than one (1) year after the date the project is completed, or the next CHDO reservation funding cycle, whichever occurs later.

e) The CITY retains the right to require a CHDO who has failed to comply with the terms outlined in the Agreement, to transfer title and ownership of the property to the CITY or an agency designated by the CITY to carry out the terms and conditions of the contract in a timely manner. The CITY will consider the CITY's total investment in the property, the stage of project construction, the feasibility that the project will be completed by the HOME program deadlines by the current developer, the date the project will be completed by the new developer and the timing for meeting a national objective up to and including occupancy of the unit. The decision to transfer the title of the property will be based on the decision that is in the best interest of the HOME program, the City of Hattiesburg and its residents. The final decision to transfer title of the property will require approval by the City of Hattiesburg City Council.

f) Developers that experience delays caused by reasons beyond their control in accordance with Section II (6) of this Agreement must submit the reasons for delay and supporting documentation in writing to the Program Director. Extensions will be reviewed by the Director in consultation with City staff. The DEVELOPER will be notified in writing of the department decision to approve the Project delay.

g) At the time that the CITY approves project delay, new timelines will be established for the Project in the form of an amendment to the existing contract. The DEVELOPER must comply with the new timelines. Failure by the DEVELOPER to comply with the new timeliness will trigger the penalties stated above.

9. The DEVELOPER shall have standards of financial accountability that conform to 24 CFR 84.21, "Standards for Financial Management Systems;"

10. HOME Funds shall not be reimbursed by the CITY until the funds are needed for the payment of Eligible Costs. All HOME Funds not expended within the term of this Agreement shall remain in the custody and control of the CITY. The CITY may reallocate unexpended HOME Funds to other HOME Program projects if approved for funding by the Governing Body.

11. The DEVELOPER shall pay its subcontractors and suppliers within thirty (30) days following receipt of payment from CITY for such subcontracted work or supplies, if all required and supporting documentation is provided and the work is completed in accordance with the contract documents.

12. For purposes of this section, Requests for Payment, reports and other documentation required under this Agreement, must be submitted within sixty (60) days of project completion. Reports submitted after that date may not be honored by the CITY, at the discretion of the CITY.

13. The DEVELOPER shall furnish to the CITY all reports required by HUD and such additional reports as may be necessary to comply with all applicable laws, regulations, guidelines, and conditions specified in this Agreement and further, the DEVELOPER and any contractors or subcontractors shall provide any other reports deemed necessary by the CITY.

14. The CITY, HUD or the Comptroller General of the United States or any of their duly authorized representatives shall at all times have the right and option to monitor, inspect, audit, and review the Developer's performance and operation of the HOME program to be performed under this Agreement; and in connection therewith, all of the above mentioned entities shall have the right to inspect any and all records, books, documents, or papers of the DEVELOPER, Contractor and the subcontractors of Contractor, for the purpose of making audit examination, excerpts and transcriptions.

Section VII - CHDO Proceeds

The City of Hattiesburg will allow CHDOs that utilize CHDO reservation funds to develop, rehabilitate, sell or rent housing benefiting income eligible households to retain project proceeds.

Definition of Project Proceeds:

Project proceeds are funds generated by the project and paid to the DEVELOPER from activities carried out with HOME funds. Projects proceeds include:

1. Proceeds from the disposition by sale or long-term lease of real property acquired, rehabilitated, or constructed with HOME funds or matching contributions;

2. Payments of principal and interest on loans made using HOME funds;

3. Proceeds from the sale of loans made with HOME funds;

4. Proceeds from the sale of obligations secured by loans made with HOME funds;

5. Interest earned on program income pending its disposition; and

6. Any other interest or return on the investment permitted under § 92.205(b) of HOME funds

All project proceeds received by the CHDO must be used for affordable housing activities to benefit low-income households.

The CHDO will be required to track the investment of project proceeds for housing activities to benefit low-income households. The CHDO must maintain supporting documentation related to the use of these funds for monitoring purposes.

Eligible Uses of Project Proceeds:

CHDOs allowed to retain project proceeds must use the funds for housing activities to benefit low-income families as required by 24 CFR 92.300(a)(2). Low-income households are defined as those that do not exceed 80% of the Area Median Income as established by HUD on an annual basis.

Affordable housing activities which may be funded with CHDO proceeds include, but are not limited to: emergency repairs, project operating costs and reserves, housing refinancing costs, CHDO operating expenses, and homebuyer counseling.

CHDO proceeds which are retained by a CHDO are not subject to the requirements of the HOME regulations, except for 24 CFR 92.300(a)(2). Thus, the Davis-Bacon Act, National Environmental Policies Act and Uniform Relocation Assistance and Real Property Acquisition Policies Act do not apply to the use of CHDO proceeds. However, because CHDO proceeds are derived from the expenditure of HOME funds, any activities which are funded with CHDO proceeds may not be contributed as match.

Section VIII – Repayment of Loan

1. All HOME funds are subject to repayment in the event the project does not meet the project requirements as outlined in this Agreement.

2. It is understood that upon the completion of the project, any HOME funds reserved, but not expended under this Agreement, will revert to the CITY.

3. Sale of the property to another party may occur only with the approval of the CITY. Provisions in those documents will provide for the extinguishment of the requirements only in the event of a third-party foreclosure or deed in lieu of foreclosure. The CITY will be a third party to the agreement between the DEVELOPER and the HOMEBUYER to ensure enforcement of the affordability requirements.

4. The DEVELOPER shall lend the HOME funds to the individual buyers as a subsidy in an amount sufficient to make the purchase affordable. Any HOME funds that reduce the price of the property below the fair market value of the property shall be secured by a HOME note and mortgage as required in 92.254(a)(5)(ii), using the note and mortgage prescribed or approved by the CITY and consistent with the method identified in the CITY's Consolidated Plan.

    a. Prior to each closing with each HOMEBUYER, the DEVELOPER will provide to the CITY the preliminary settlement statement, along with the reconciliation

statement and the draft note and mortgage. The reconciliation statement shall account for the pro-ration of HOME project funds to the individual unit, and identify those funds that are to be loaned to the buyer as "Buyer subsidies" secured by the HOME note, the pro-rated HOME development funds that are to be forgiven as "Development subsidies", and the amount of DEVELOPER fee or sales proceeds to be retained from settlement funds.

Section IX – CHDO Provisions

1. If the DEVELOPER is a CHDO, the requirements in this section apply to CHDO developers, sponsors and owners. It is understood that the DEVELOPER has certified that it is and will maintain CHDO status for the term of the AGREEMENT in accordance with 24 CFR 92. DEVELOPER agrees to provide information as may be requested by the CITY to document its continued compliance, including but not limited to an annual board roster and certification of continued compliance.

2. Any funds advanced as the CHDO as pre-development funds must be in compliance with 92.301, and are forgivable only under the terms in 92.301.

3. Any funds advanced to the CHDO as CHDO Operating Expenses must be expended in compliance with 24 CFR 92.208. The City of Hattiesburg can provide up to five (5) percent of its fiscal year HOME allocation for operating expenses to the CHDO. These funds may not be used to pay operating expenses incurred by a CHDO acting as a subrecipient or contractor under the HOME Program. Operating expenses means reasonable and necessary costs for the operation of the CHDO. Such costs include salaries, wages, and other employee compensation and benefits; employee education, training, and travel; rent; utilities; communication costs; taxes; insurance; equipment; materials and supplies. The requirements and limitations on the receipt of these funds by CHDOs are set forth in 92.300(e) and (f).

Section X – Procurement Standards

1. The DEVELOPER shall establish procurement procedures to ensure that materials and services are obtained in a cost-effective manner. The DEVELOPER's procurement procedures must be approved by the CITY. All costs will be reviewed by the CITY to assure reasonableness.

2. In addition, it is understood that any DEVELOPER that can be considered to be a religious or faith-based organization shall abide by all portions of 24 CFR 92.257.

Section XI – Conflict of Interest Provisions

1. The DEVELOPER warrants and covenants that it presently has no interest and shall not acquire any interest, directly or indirectly, which could conflict in any manner or degree with the performance of its services hereunder. The DEVELOPER further warrants and

covenants that in the performance of this contract, no person having such interest shall be employed.

2. No persons who exercise or have exercised any functions or responsibilities with respect to activities assisted with HOME funds or who are in a position to participate in a decision making process or gain inside information with regard to these activities, may obtain a financial interest or benefit from a HOME-assisted activity, or have an interest in any contract, subcontract or agreement with respect thereto, or the proceeds thereunder, either for themselves or those with whom they have family or business ties, during their tenure or for one (1) year thereafter.

3. The conflict of interest provisions applies to any person, employee, agent, consultant, officer, or elected official or appointed official of the CITY. If it is determined that a conflict of interest exists, the CITY will be immediately notified. The CITY will follow the process outlined in 32.356 and request an opinion from HUD to determine if a conflict of interest exists.

4. No owner, developer or sponsor of a project assisted with HOME funds (or officer, employee, agent or consultant of the owner, developer or sponsor) whether private, for profit or non-profit, including CHDOs when acting as an owner, developer or sponsor may occupy a HOME-assisted affordable housing unit in a project. This provision does not apply to an individual who receives HOME funds to acquire or rehabilitate his or her principal residence or to an employee or agent of the owner or developer of a rental housing project who occupies a housing unit as the project manager or maintenance worker.

5. The CITY may grant exceptions or forward the requests to HUD as permitted by24 CFR 92.356, 85.36 and 84.42, as they apply.

Section XII – City Responsibilities

The CITY shall furnish the DEVELOPER with the following services and information from existing CITY records and CITY files:

1. The CITY shall provide to the DEVELOPER information regarding its requirements for the Project.

2. The CITY will provide the DEVELOPER with any changes in HOME regulations or program limits that affect the project, including but not limited to, income limits, property value limits and rent limits.

3. The CITY will conduct progress inspections of work completed to protect its interests as lender and regulatory authority for the project, and will provide information to the DEVELOPER regarding any progress inspections or monitoring to assist it in ensuring compliance.

4. The CITY's review and approval of the WORK will relate only to overall compliance with the general requirements of this Agreement and HOME regulations, and all CITY regulations and ordinances.

5. The CITY shall monitor, review, and evaluate the financial procedures of the DEVELOPER through documents submitted to the CITY and on-site monitoring. The DEVELOPER shall provide to the CITY such reports, and make available to the CITY such records that will be necessary for a proper financial evaluation. With reasonable notice (generally ten (10) working days) being given to the DEVELOPER, the CITY shall schedule at least one on-site visit during the term of said Agreement and other visits that may be needed.

6. The CITY shall monitor, review, and evaluate the DEVELOPER. Fiscal reports will be reviewed and evaluated in terms of the total budget and accomplishments in relationship to expenditures. With reasonable notice (generally ten (10) working days) being given to the DEVELOPER, the Department shall schedule at least one (1) on-site visit and other visits that may be needed during the course of said Agreement. At such times and in such forms as the CITY may require, there shall be furnished to the CITY such statements, records, data, and information as may be necessary.

7. Within a reasonable period of time (generally 45 days) after the monitoring visit, the CITY shall furnish to the DEVELOPER a letter and any necessary reports summarizing the monitoring visit. Such letters and reports will include any findings or concerns and recommendations for improvement.

8. The DEVELOPER shall have 30 days from the receipt of a financial or programmatic monitoring letter to address any findings or concerns. Should the concerns not be addressed in a manner acceptable to the CITY, this Agreement shall be terminated in accordance with the provisions for termination outlined in this Agreement.

9. Nothing contained herein shall relieve the DEVELOPER of any responsibility as provided under this Agreement.

Section XIII – Equal Employment Opportunity

During the performance of this contract, the DEVELOPER agrees as follows:

1. The DEVELOPER will not discriminate against any employee or applicant for employment because of race, color, religion, sex, handicap, familial status, or national origin. The DEVELOPER will take affirmative action to ensure the applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, familial status, or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer, recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation;

and selection for training, including apprenticeship. The DEVELOPER agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the contracting officer of the CITY setting forth the provisions of this nondiscrimination clause.

2. The DEVELOPER will, in all solicitations or advertisements for employees placed by or on behalf of the DEVELOPER, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

3. The DEVELOPER will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided by the CITY's contracting officer, advising the labor union or worker's representative of the DEVELOPER's commitments under Section 202 of Executive Order No. 11246 of September 24, 1965, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

4. The DEVELOPER will comply with all provisions of Executive Order 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.

5. The DEVELOPER will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by the rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to its books, records, and accounts by the CITY and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and order.

6. In the event the DEVELOPER is found to be in noncompliance with the nondiscrimination clauses of this contract or with any of such rules, regulations or orders, this contract may be canceled, terminated or suspended in whole or in part and the DEVELOPER may be declared ineligible for further government contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965 or by rule, regulations, or order of the Secretary of Labor or as otherwise provided by law.

7. The DEVELOPER will include the provisions of this Agreement in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24,1965, so that such provisions will be binding upon each subcontractor or vendor. The DEVELOPER will take such action with respect to any subcontract or purchase order as the CITY may direct as a means of enforcing such provisions, including sanctions for noncompliance.

Section XIV – Section 3 Compliance

The DEVELOPER agrees to comply with the federal regulations governing training, employment and business opportunities as follows:

1. The work to be performed under this contract is subject to the requirements of Section3 of the Housing and Urban Development Act of 1968, as amended, 12 U.S.C. 1701u (Section 3). The purpose of Section 3 is to ensure that employment and other economic opportunities generated by HUD assistance or HUD-assisted projects covered by Section 3, shall, to the greatest extent feasible, be directed to low- and very low-income persons, particularly persons who are recipients of HUD assistance for housing.

2. The DEVELOPER will comply with HUD's regulations in 24 CFR Part 135, which implement Section 3. As evidenced by the execution of this Agreement, the DEVELOPER certifies that they are under no contractual or other impediment that would prevent them from complying with 24 CFR Part 135 of the regulations.

3. The DEVELOPER, its contractors and subcontractors, if applicable agree to send to each labor organization or representative of workers with which the DEVELOPER, its contractors and subcontractors has a collective bargaining agreement or other understanding, if any, a notice advising the labor organization or workers' representative of the DEVELOPER, its contractors and subcontractors commitments under this Section 3 clause, and will post copies of the notice in conspicuous places at the work site where both employees and applicants for training and employment positions can see the notice. The notice shall describe the Section 3 preference, shall set forth minimum number and job titles subject to hire, availability of apprenticeship and training positions, the qualifications for each; and the name and location of the person(s) taking applications for each of the positions; and the anticipated date the work shall begin.

4. The DEVELOPER, its contractors and subcontractors agree to include this Section 3 clause in every subcontract subject to compliance with regulations in 24 CFR part 135, and agrees to take appropriate action, as provided in an applicable provision of the subcontract or in this Section 3 clause, upon a finding that the subcontractor is in violation of the regulations in 24 CFR part 135. The DEVELOPER and its contractors will not subcontract with any subcontractor where the DEVELOPER or its contractors has notice or knowledge that the subcontractor has been found in violation of the regulations in 24 CFR part 135.

5. The DEVELOPER, its contractors and subcontractors will certify that any vacant employment positions, including training positions, that are filled (1) after the DEVELOPER, its contractors and subcontractors are selected but before the contract is executed, and (2) with persons other than those to whom the regulations of 24 CFR Part 135 require employment opportunities to be directed, were not filled to circumvent the DEVELOPER or contractor's obligations under 24 CFR part 135.

6. Noncompliance with HUD's regulations in 24 CFR Part 135 may result in sanctions, termination of this Agreement for default, and debarment or suspension from future HUD assisted contracts.

Section XV – Compliance with Federal, State & Local Laws

1. The DEVELOPER covenants and warrants that it will comply with all applicable laws, ordinances, codes, rules and regulations of the state, local, and Federal governments, and all amendments thereto, including, but not limited to; Title 8 of the Civil Rights Act of 1968 PL.90-284; Executive Order 11063 on Equal Opportunity and Housing, Section 3 of the Housing and Urban Development Act of 968; Housing and Community Development Act of 1974, as well as all requirements set forth in 24 CFR 92 of the HOME INVESTMENT PARTNERSHIP PROGRAM. The DEVELOPER covenants and warrants that it will indemnify and hold the City forever free and harmless with respect to any and all damages whether directly or indirectly arising out of the provisions and maintenance of this contract.

2. The DEVELOPER agrees to comply with all applicable standards, orders, or requirements issued under section 306 of the Clean Air Act (42 U.S.C. 1857(h)), Section 508 of the Clean Water Act (33 U.S.C. 1368), Executive Order 11738, and Environmental Protection CITY regulations (40 CFR Part 15).

3. The DEVELOPER further warrants and agrees to include or cause to be included the criteria and requirements of this section in every non-exempt subcontract in excess of $100,000. The DEVELOPER also agrees to take such action as the Federal, state or local government may direct to enforce aforesaid provisions.

4. Minority/Women's Businesses, Executive Orders 11625, 12432, and 12138 Under Executive Orders 11625, 12432, and 12138, the CITY must prescribe procedures acceptable to HUD for minority outreach programs to ensure that they are making concerted efforts to attract minority groups to the procurement process. The Developer agrees to assist the City to the greatest extent possible to meet the goals and objectives of this section. The DEVELOPER will submit, on an annual basis, a listing of all MBE/WBE contracts awarded including dollar amount of the contract and how the business qualifies.

   The regulations require that the following minimum affirmative steps are taken to ensure MBE/WBE is afforded every opportunity to participate in generated contracts.

   a) Placing minorities and women on solicitation lists;
   b) Assuring that MBE and WBE firms are solicited whenever they are potential sources;
   c) Dividing the total requirements, when economically feasible, into smaller tasks or quantities to permit maximum participation by small and minority business enterprises, and women business enterprises;
   d) Where the requirement permits, establishing delivery schedules that encourage participation by small and minority business enterprises, and women business enterprises;
   e) Using the services and assistance of the Small Business Administration and the Minority Business Development Agency of the Department of Commerce; and
   f) Requiring the prime contractor, if subcontractors are to be let, to take all the same.

5. Drug-Free Workplace: The Drug-Free Workplace Act of 1988 (41 U.S.C. 701, *et seq.)* and HUD's implementing regulations at 24 CFR Part 21.

   DEVELOPERS are required to provide a drug-free workplace by taking the following steps. DEVELOPER and third-party contractor/consultants failing to meet these requirements will be subject to penalties:

   a) Publish and give a policy statement to all covered employees informing them that the unlawful manufacture, distribution, dispensation, possession or use of a controlled substance is prohibited in the covered workplace and specifying the actions that will be taken against employees who violate the policy.
   b) Establish a drug-free awareness program to make employees aware of: a) the dangers of drug abuse in the workplace; b) the policy of maintaining a drug-free workplace; c) any available drug counseling, rehabilitation, and employee assistance programs; and d) the penalties that may be imposed upon employees for drug abuse violations.
   c) Notify employees that as a condition of employment on a Federal contract or grant, the employee must: a) abide by the terms of the policy statement; and b) notify the employer, within five (5) calendar days, if he or she is convicted of a criminal drug violation in the workplace.
   d) Notify the contracting or granting agency within ten (10) days after receiving notice that a covered employee has been convicted of a criminal drug violation in the workplace.
   e) Impose a penalty on or require satisfactory participation in a drug abuse assistance or rehabilitation program by any employee who is convicted of a reportable workplace drug conviction.
   f) Make an ongoing, good faith effort to maintain a drug-free workplace by meeting the requirements of the Act.

Section XVI – Enforcement, Suspension and Termination

In accordance with 24 CFR 85.43, suspension or termination may occur if the DEVELOPER materially fails to comply with any term of the award.

If, through any cause, the DEVELOPER shall fail to fulfill in timely and proper manner its obligations under this contract, or if the DEVELOPER shall violate any of the covenants, agreements, or stipulations of this contract, the CITY shall thereupon have the right to terminate this contract by giving written notice to the DEVELOPER of such termination and specifying the effective date thereof, at least five (5) days before the effective date of such termination. In such event, the DEVELOPER shall be entitled to receive just and equitable compensation for any work satisfactorily completed hereunder to the date of said termination.

Notwithstanding the above, the DEVELOPER shall not be relieved of liability to the CITY for damages sustained by the CITY by virtue of any breach of the contract by the DEVELOPER and the CITY may withhold any payments to the DEVELOPER until such time as the exact amount of damages due the CITY from the DEVELOPER is determined whether by court of competent jurisdiction or otherwise.

24 CFR 92.504(c)(13) contains provisions for the enforcement of this Agreement. In accordance with 24 CFR 85.43, this Agreement may be suspended or terminated prior to the expiration of the term by unanimous written Agreement by the parties to this Agreement. The CITY may also unilaterally terminate or suspend this Agreement, in whole or in part, upon ten (10) day written notice from the CITY to the DEVELOPER including, but not limited to the following reasons:

1. Failure to perform the services set forth in the scope of services and requirements incident thereto.
2. Failure to comply with the provisions of this Agreement.
3. Making unauthorized or improper use of funds provided under this Agreement.
4. Submission of an application, report or other documents pertaining to this Agreement which contains misrepresentation of any material aspect.
5. The carrying out of the Scope of Services or the objectives of this Agreement is rendered improvable, unfeasible, impossible, or illegal.
6. Failure of the U.S. Department of Housing and Urban Development (HUD) to make funds available or if HUD suspends funds for any reason.
7. Upon the determination of the CITY that the Agreement be suspended or terminated, without cause.
8. Termination or suspension shall not affect otherwise valid and allowable obligations incurred in good faith prior to receipt of a notice of termination or suspension.

Section XVII – Termination for Convenience of the CITY

In accordance with 24 CFR 85.44 the CITY may terminate for its convenience this Agreement at any time by giving at least thirty (30) day's notice in writing to the DEVELOPER. If the contract is terminated by the CITY, as provided herein, the City will reimburse for any actual and approved expenses incurred, including those costs involved in terminating the contracts and shutting down the work as of the date of notice, and the DEVELOPER will be paid as a FEE an amount which bears the same ratio to the total compensation as the services actually performed to the total service of the DEVELOPER covered by this Agreement, less payments of compensation previously made. Claims and disputes between the parties will be submitted to the American Arbitration Association for resolution. Award or judgment may be entered in any court having jurisdiction thereof.

Section XVIII – Default-Loss of Grant Funds

If the DEVELOPER fails in any manner to fully perform and carry out any of the terms, covenants, and conditions of the Agreement, and more particularly if the DEVELOPER refuses or fails to proceed with the work with such diligence as will insure its completion within the time fixed by the schedule set forth in this Agreement, the DEVELOPER shall be in default and notice in writing shall be given to the DEVELOPER of such default by the CITY or an agent of the CITY. If the DEVELOPER fails to cure such default within such time as may be required by such notice, the CITY, may at its option terminate and cancel the contract.

In the event of such termination, all grant funds awarded to the DEVELOPER pursuant to this agreement shall be immediately revoked and any approvals related to the PROJECT shall

immediately be deemed revoked and canceled. In such event, the DEVELOPER will no longer be entitled to receive any compensation for work undertaken after the date of the termination of this Agreement, as the grant funds will no longer be available for this project.

Such termination shall not effect or terminate any of the rights of the CITY as against the DEVELOPER then existing, or which may thereafter accrue because of such default, and the foregoing provision shall be in addition to all other rights and remedies available to the CITY under the law and the note and mortgage (if in effect), including but not limited to compelling the DEVELOPER to complete the project in accordance with the terms of this Agreement, in a court of equity. The waiver of a breach of any term, covenant or condition hereof shall not operate as a waiver of any subsequent breach of the same or any other term, covenant, or condition hereof.

Section XIX – Reporting Responsibilities

The DEVELOPER agrees to submit monthly reports to the CITY on the progress of the project. Reports are due the 15th of each month and will cover activities for the prior month. The CITY retains the right to request additional documentation to comply with HUD's reporting requirements. If the DEVELOPER fails to submit the monthly progress reports by the due date, no payments will be made to the DEVELOPER under this Agreement until all outstanding reports have been submitted.

The CITY will send the DEVELOPER one (1) reminder notice if the report has not been received fourteen (14) days after the due date. If the DEVELOPER has not submitted a report fourteen (14) days after the date on the reminder notice, the CITY will have the option to terminate the contract as described in this agreement. In addition, the DEVELOPER agrees to provide the CITY information as required to determine program eligibility, and financial records pertinent to the project.

At project completion, the DEVELOPER will provide a Project Progress Report signifying completion, with all data and supporting documentation for project closeout as may be required by the CITY.

Section XX – Inspection, Monitoring & Access to Records

1. All records will be maintained by the DEVELOPER for five (5) years after the affordability of the homebuyer ends.

2. The CITY reserves the right to inspect, monitor, and observe work and services performed by the DEVELOPER at any and all reasonable times.

3. The CITY reserves the right to audit the records of the DEVELOPER any time during the performance of this Agreement and for a period of five (5) years after final payment is made under this Agreement.

4. The DEVELOPER will provide the CITY with a certified audit of the Developer's records representing the Fiscal Year during which the PROJECT becomes complete pursuant to the requirements of OMB Circular A-133.

5. Access shall be immediately granted to the CITY, HUD, the Comptroller General of the United States, or any of their duly authorized representatives to any books, documents, papers, project site access, and records of the DEVELOPER or its contractors which are directly pertinent to that specific contract for the purpose of making audit, examination, excerpts, and transcriptions.

6. The DEVELOPER shall maintain all records required by the Federal regulations specified in 92.508 that are pertinent to the activities to be funded under this Agreement. Such records include but are not limited to:

    a) A full description of each project assisted with HOME funds, including the location, form of HOME assistance, and tenants assisted with HOME funds.

    b) The source and application of funds for each project, including supporting documentation in accordance with 24 CFR 85.20.

    c) Records demonstrating that each rental housing project meets the minimum per-unit subsidy amount of § 92.205(c), the maximum per-unit subsidy amount of § 92.250(a) and the subsidy layering guidelines adopted in accordance with § 92.250(b).

    d) Records demonstrating that each project meets the property standards of § 92.251 and the lead-based paint requirements of § 92.355.

    e) Records demonstrating that each family is income eligible in accordance with § 92.203.

    f) Records demonstrating that each rental housing project meets the affordability and income targeting requirements of § 92.252 for the required period. Records must be kept for each family assisted.

    g) Records demonstrating that each multifamily rental housing project involving rehabilitation with refinancing complies with the refinancing guidelines established in accordance with § 92.206(b).

    h) Records demonstrating that any pre-award costs charged to the HOME allocation meet the requirements of § 92.212.

    i) Records demonstrating that a site and neighborhood standards review was conducted for each project which includes new construction of rental housing assisted under this part to determine that the site meets the requirements of 24 CFR 983.6(b), in accordance with § 92.202.

h) Records demonstrating that any pre-award costs charged to the HOME allocation meet the requirements of § 92.212.

i) Records demonstrating that a site and neighborhood standards review was conducted for each project which includes new construction of rental housing assisted under this part to determine that the site meets the requirements of 24 CFR 983.6(b), in accordance with § 92.202.

Section XXI – General Conditions

1. All notices or other communication which shall or may be given pursuant to this Agreement shall be in writing and shall be delivered by personal service, or by registered mail addressed to the other party at the address indicated herein or as the same may be changed from time to time. Such notice shall be deemed given on the day on which personally served; or, if by mail, on the fifth day after being posted or the date of actual receipt, whichever is earlier. Notices shall be mailed to the following address:

CITY address: **City of Hattiesburg, Department of Urban Development, P.O. Box 1898, Hattiesburg, MS 39403-1898**

DEVELOPER address: **Community Connections, Attn: Demetria Farve, P.O. Box 18612, Hattiesburg, MS 39404**

2. Title and paragraph headings are for convenient reference and are not a part of this Agreement.

3. In the event of conflict between the terms of this Agreement and any terms or conditions contained in any attached documents, the terms in this Agreement shall rule.

4. No waiver or breach of any provision of this Agreement shall constitute a waiver of a subsequent breach of the same or any other provision hereof, and no waiver shall be effective unless made in writing.

5. The parties hereto agree that this Agreement shall be construed and enforced according to the laws of the State of Mississippi.

6. Should any provisions, paragraphs, sentences, words or phrases contained in this Agreement be determined by a court of competent jurisdiction to be invalid, illegal or otherwise unenforceable under the laws of the State of Mississippi or the City of Hattiesburg, such provisions, paragraphs, sentences, words or phrases shall be deemed modified to the extent necessary in order to conform with such laws, or if not modifiable to conform with such laws, then same shall be deemed severable, and in either event, the remaining terms and provisions of this Agreement shall remain unmodified and in full force and effect.

9. The DEVELOPER further warrants and agrees to include or cause to be included the criteria and requirements of this section in every nonexempt subcontract. The DEVELOPER also agrees to take such action as the Federal, state or local government may direct to enforce aforesaid provisions.

10. The obligations undertaken by the DEVELOPER pursuant to this Agreement shall not be delegated or assigned to any other person or agency unless the CITY shall first consent to the performance or assignment of such service or any part thereof by another person or agency.

11. The Agreement shall be binding upon the parties hereto, their heirs, executors, legal representative, successors and assigns.

12. DEVELOPER and its employees and agents shall be deemed to be independent contractors, and not agents or employees of the CITY, and shall not attain any rights or benefits under the civil service or pension ordinances of the CITY, or any rights generally afforded classified or unclassified employee; further they shall not be deemed entitled to state Compensation benefits as an employee of the CITY.

13. Funding for this Agreement is contingent on the availability of funds and continued authorization for program activities and is subject to amendment or termination due to lack of funds, or authorization, reduction of funds, and/or change in regulations.

Section XXII – Insurance

1. The DEVELOPER during the construction period shall keep the property acquired under this Agreement insured against loss by fire, extended flood coverage, vandalism and malicious mischief, hazards, and such may require and in such amounts as CITY may require. The insurance requirements shall remain in effect until the property is sold to an income eligible buyer. The CITY shall be named as an additional insured.

2. A Commercial General Liability Insurance Policy shall be provided which shall contain minimum limits of one million dollars ($1,000,000.00) per occurrence combined single limit for bodily injury liability and property damage liability. Coverage must be afforded on a form no more restrictive than the latest edition of the Commercial General Liability Policy, without restrictive endorsements, as filed by the Insurance Services Office and shall include Premises and/or operations, independent contractors, Broad Form Contractual Coverage applicable to this specific Contract, including any hold harmless and/or indemnification agreement.

3. Personal Injury Coverage with Employee and Contractual Exclusions removed, with minimum limits of coverage equal to those required for Bodily Injury Liability and Property Damage Liability. The DEVELOPER shall carry Workers' Compensation insurance for all employees in compliance with the "Workers' Compensation Law" of the State of Mississippi and all applicable federal laws.

4. The DEVELOPER shall require its General Contractor to provide Builder's Risk Insurance in the amount of one hundred percent (100%) of replacement value of the completed structure until Project completion. Such Builder's Risk policy shall be an all risk form with a deductible not to exceed ten thousand dollars ($10,000.00) each claim and shall contain a loss payable clause to include the CITY. The DEVELOPER shall furnish to the CITY Certificates of Insurance or endorsements evidencing the insurance coverage specified by this Article prior to beginning performance of work under this Agreement. Coverage shall not cease and is to remain in force until all performance required work is completed.

5. The DEVELOPER shall furnish copies of all licenses and certifications of Public Liability Insurance for all HOME projects upon request by the CITY.

XXIII - Indemnification

1. The DEVELOPER shall at all times hereafter indemnify, hold harmless and defend the CITY, its officers, agents, servants, and employees against any and all claims, losses, liabilities, and expenditures of any kind, including attorney fees, court costs, and expenses, caused by any intentional, reckless, or negligent act or omission of the DEVELOPER, its employees, agents, servants, or officers, or accruing, resulting from, or related to the subject matter of this Agreement including, without limitation, any and all claims, demands, or causes of action of any nature whatsoever resulting from injuries or damages sustained by any person or property. The provisions of this section shall survive the expiration or earlier termination of this Agreement. To the extent considered necessary by the CITY, any sums due to the DEVELOPER under this Agreement may be retained by the CITY until all of the CITY's claims for indemnification pursuant to this Agreement have been settled or otherwise resolved; and any amount withheld shall not be subject to payment of interest by the CITY.

2. In the event that the DEVELOPER contracts with a third party ("Contractor") to provide the construction related services set forth herein, any contract with such third party shall include the following provisions:

    a. Indemnification: To the fullest extent permitted by law, Contractor shall indemnify and hold harmless CITY, its officers and employees, from liabilities, damages, losses, and costs, including, but not limited to, reasonable attorney's fees, to the extent caused by the negligence, recklessness, or intentionally wrongful conduct of Contractor and persons employed or utilized by Contractor in the performance of this Contract. These indemnifications shall survive the term of this Contract.

3. The DEVELOPER shall comply with the anti-lobbying legislation set forth in 24 CFR 91.225 in the CITY's Consolidated Plan submitted to HUD for the HOME Program; both incorporated herein by reference.

4. The DEVELOPER shall indemnify and hold the CITY harmless from and against any negligent claims, liabilities, losses and causes of action which may arise out of DEVELOPER's activities under this Agreement, including all other acts or omissions to

Contractor and persons employed or utilized by Contractor in the performance of this Contract. These indemnifications shall survive the term of this Contract.

3. The DEVELOPER shall comply with the anti-lobbying legislation set forth in 24 CFR 91.225 in the CITY's Consolidated Plan submitted to HUD for the HOME Program; both incorporated herein by reference.

4. The DEVELOPER shall indemnify and hold the CITY harmless from and against any negligent claims, liabilities, losses and causes of action which may arise out of DEVELOPER's activities under this Agreement, including all other acts or omissions to act on the part of DEVELOPER, including any person acting for or on its behalf, and, from and against any orders, judgments, or decrees which may be entered, and from and against all costs, attorney's fees, expenses and liabilities incurred in the defense of any such claims, or in the investigation thereof.

IN WITNESS THEREOF,

The City of Hattiesburg and the AWARDEE have caused their signatures to be hereunto affixed and duly attested:

City of Hattiesburg, Mississippi

By: _____
Toby Barker, Mayor

Date: 11-22-18

Attest: _____
Kermas Eaton, City Clerk

Date: 11/22/18

Community Connections

By: _____
Print: Terrance Thigpen

Date: 2/6/19

Attest: _____

Date: 2/6/19

City of Hattiesburg, MS

200 Forrest St.
P.O. Box 1898
Hattiesburg, MS 39401

Master

File Number: 2018-980

File ID: 2018-980 **Type:** Regular Agenda Item **Status:** Routine Agenda

Version: 1 **Reference:** **In Control:** City Council

Requester: Lamar Rutland **File Created:** 11/16/2018

Brief Title: Approve Plans and Specifications for the Public Safety Complex Historic Hospital Building, Police and Court Building Project; Authorize advertisement for bids for same.

Final Action:

Minute Book Number: MB 2018-295

Title:

Approve Plans and Specifications for the Public Safety Complex Historic Hospital Building, Police and Court Building Project; Authorize advertisement for bids for same.

Notes:

Agenda Date: 11/20/2018

Indexes:

Agenda Number: VI.-14

Sponsors:

Enactment Date:

Attachments: 2018_11_19 HPSC Civil Drawings 100%, 2018_11_19 HPSC Hospital Drawings 100%, 2018_11_19 HPSC Police + Court Drawings (Vol 1) 100%, 2018_11_19 HPSC Police + Court Drawings (Vol 2) 100%, 2018_11_19 HPSC South Site Drawings 100%, 2018_11_19 HPSC Specifications 100% (Vol 1), 2018_11_19 HPSC Specifications 100% (Vol 2), 2018_11_19 HPSC Specifications 100% (Vol 3), ADVERTISEMENT FOR BIDS 2018 Hattiesburg Public Safety Complex

Enactment Number:

Contact:

Meeting Date: 11/20/2018

Drafter: Sharon Waits

Effective Date:

History of Legislative File

Version:	Acting Body:	Date:	Action:	Sent To:	Due Date:	Return Date:	Result:
1	City Council - Agenda Review	11/19/2018					
1	City Council	11/20/2018					

Text of Legislative File 2018-980

Title

Approve Plans and Specifications for the Public Safety Complex Historic Hospital Building, Police and Court Building Project; Authorize advertisement for bids for same.

Summary

Approve Plans and Specifications for the Public Safety Complex Historic Hospital Building, Police and Court Building Project; Authorize advertisement for bids for same.

Publication Information

The Post and Clarion Ledger
November 22, 2018
November 29, 2018

PUBLIC UTILITIES

CABLE
COMCAST
2100 LINCOLN ROAD
HATTIESBURG, MS 39402
(601) 264-1188

POWER
MISSISSIPPI POWER, CO.
6356 U.S. HIGHWAY 49
HATTIESBURG, MS 39401
(601) 544-6511

TELEPHONE
AT&T
P.O. BOX 1191
HATTIESBURG, MS 39401
(601) 545-6424

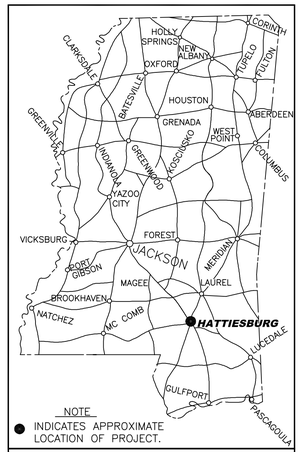
TRAFFIC
CITY OF HATTIESBURG
TRAFFIC DEPT.
125 WALNUT STREET
HATTIESBURG, MS 39401
(601) 545-4626

GAS
SPIRE INC.
315 MAIN STREET
HATTIESBURG, MS 39401
(601) 544-6001

SEWER
CITY OF HATTIESBURG
WATER & SEWER DEPT.
900 JAMES STREET
HATTIESBURG, MS 39403
(601) 545-4530

WATER
CITY OF HATTIESBURG
WATER & SEWER DEPT.
900 JAMES STREET
HATTIESBURG, MS 39403
(601) 545-4530

HATTIESBURG PUBLIC SAFETY COMPLEX
CIVIL SITE PLAN



GEODETIC REFERENCE (NAD83) FOR THE APPROXIMATE MIDDLE OF THE PROJECT:
LATITUDE: N 31°18'58.5"
LONGITUDE: W 89°17'09.0"

DETAILED CIVIL SHEET INDEX:

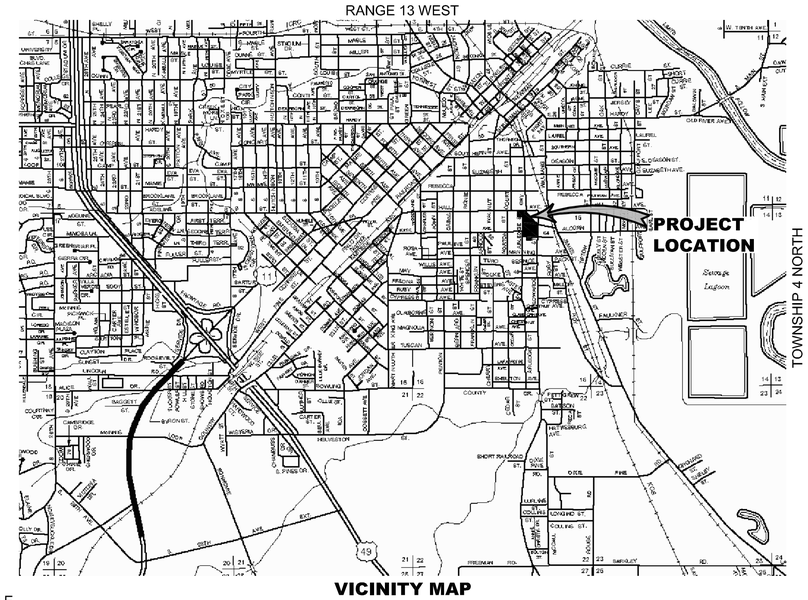
C0.1 CIVIL COVER SHEET, SHEET INDEX, VICINITY MAP, LOCATION MAP & UTILITIES LIST
C0.2 GENERAL NOTES
C0.3 GENERAL NOTES CONT'D, CONSTRUCTION PHASES, ABBREVIATION SCHEDULE & SYMBOL LEGENDS
C0.4 EXISTING TOPOGRAPHIC MAP – NORTH BLOCK
C0.5 EXISTING TOPOGRAPHIC MAP – SOUTH BLOCK
C0.6 DEMOLITION PLAN – NORTH BLOCK
C0.7 DEMOLITION PLAN – NORTH BLOCK
C0.8 DEMOLITION PLAN – SOUTH BLOCK

C1.0 MASTER SITE PLAN
C1.1 SITE & UTILITY PLAN – NORTH BLOCK
C1.2 SITE & UTILITY PLAN – NORTH BLOCK
C1.3 SITE & UTILITY PLAN – SOUTH BLOCK
C1.4 SITE PLAN DETAIL – MEMORIAL PARK
C1.5 SITE PLAN DETAILS – INSERTS
C1.6 SITE PLAN DETAILS – INSERTS
C1.7 SITE PLAN DETAILS – INSERTS
C1.8 SITE PLAN DETAILS – INSERTS
C1.9 SITE PLAN DETAILS – INSERTS
C1.10 GENERAL SITE DETAILS – PAVING
C1.11 GENERAL SITE DETAILS – MARKINGS & RAISED CROSSWALK
C1.12 GENERAL SITE DETAILS – CURB RAMPS
C1.13 GENERAL SITE DETAILS – RETAINING WALLS & STEPS
C1.14 GENERAL SITE DETAILS – STEPS
C1.15 GENERAL SITE DETAILS – COURTYARD PLAN & SECTIONS
C1.16 GENERAL SITE DETAILS – COURTYARD SECTIONS & ELEVATIONS
C1.17 GENERAL SITE DETAILS – COURTYARD SECTIONS & ELEVATIONS
C1.18 GENERAL SITE DETAILS – FENCE & GATE DETAILS
C1.19 GENERAL SITE DETAILS – FENCE & GATE DETAILS
C1.20 WATER INSTALLATION DETAILS
C1.21 SEWER INSTALLATION DETAILS
C1.22 TRACER WIRE DETAILS

C2.0 BUILDING A SEWER MAIN – PLAN & PROFILE
C2.1 BUILDING C SEWER MAIN – PLAN & PROFILE

C3.0 MASTER GRADING PLAN
C3.1 GRADING & DRAINAGE PLAN
C3.2 GRADING & DRAINAGE PLAN
C3.3 GRADING & DRAINAGE PLAN
C3.4 GRADING & DRAINAGE PLAN
C3.5 GRADING & DRAINAGE PLAN
C3.6 GRADING & DRAINAGE PLAN
C3.7 GRADING & DRAINAGE PLAN
C3.8 GRADING & DRAINAGE PLAN
C3.9 GRADING & DRAINAGE PLAN
C3.10 DRAINAGE STRUCTURE SCHEDULES
C3.11 CONCRETE STORMWATER STRUCTURE DETAILS
C3.12 CONCRETE STORMWATER STRUCTURE DETAILS
C3.13 CONCRETE STORMWATER STRUCTURE DETAILS
C3.14 CONCRETE STORMWATER STRUCTURE DETAILS
C3.15 HDPE STORMWATER STRUCTURE DETAILS

C4.0 STORM WATER POLLUTION PREVENTION PLAN – PHASES 1
C4.1 STORM WATER POLLUTION PREVENTION PLAN – PHASES 2 & 3
C4.2 TEMPORARY VEGETATION SCHEDULE
C4.3 EROSION CONTROL DETAILS
C4.4 EROSION CONTROL DETAILS
C4.5 EROSION CONTROL DETAILS



VICINITY MAP

Know what's **below.**
Call before you dig.

SPECIAL UTILITY NOTES:

1. ALL UTILITIES THAT LOCATED DURING THE FIELD DATA COLLECTION ARE SHOWN ON THESE PLANS. ALL CONFLICTS WITH EXISTING UTILITIES ENCOUNTERED DURING CONSTRUCTION SHALL BE COORDINATED WITH THE UTILITY OWNER, THE ENGINEER AND THE PROJECT OWNER PRIOR TO INSTALLATION OF THE PROPOSED WATER SYSTEM. (NO SEPARATE PAY FOR COORDINATION)
2. THE CONTRACTOR SHALL DOCUMENT THE EXISTENCE OF ANY MISSING AND/OR OVERLAPPING UNDERGROUND UTILITIES AND STORM DRAINAGE NOT SHOWN ON THESE CONSTRUCTION DRAWINGS.

NOVEMBER 2018

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX
HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

BID DOCUMENTS

Drawing Issued:

Date	Rev.	Description
10-31-2015		65% Check Set
12-18-2015		95% Check Set
11-19-2018		Bid Documents

Drawn By: RES
Checked By: SEM
Client No: ——
Albert & Associates: 12575

STATE OF MISSISSIPPI · SHANE E. MCCLESKEY · LICENSED ARCHITECT · ENGINEER · 16793 · 11/19/18

C0.1

PREPARED BY:
sdw Engineering Progress
105 Second Ave. | Hattiesburg, MS 39401 | p | 601.544.1821 | f | 601.543.2501 | sdw.com
SDW Project No.: 15819 SDW Working No.: CVR

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com
Albert & McCleskey Associates Architects

CIVIL INFORMATION & DETAILED INDEX

G:\PROJECTS\Albert and Associates\15819 - Hattiesburg Public Safety Complex\15819CAD Files\15819_Cover_Notes_v1.dwg, CVR, 9/24/2018 11:02:59 AM

GENERAL NOTES:

1. THE CONTRACTOR SHALL HAVE A COMPETENT AND EXPERIENCED SUPERINTENDENT ON THE PROJECT SITE AT ALL TIMES. THE SUPERINTENDENT SHALL NOT OPERATE EQUIPMENT WHILE ON THE PROJECT SITE. WORK ON THE PROJECT SHALL STOP IF THE ASSIGNED PROJECT SUPERINTENDENT IS NOT ON SITE.
2. ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH ALL LOCAL, STATE AND FEDERAL CODES.
3. THE PROJECT SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE "MISSISSIPPI STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, 2004 EDITION" (OR LATEST), EXCEPT AS NOTED OTHERWISE ON THESE PLANS AND/OR THE SPECIFICATIONS.
4. DEVIATIONS FROM THESE PLANS AND NOTES WITHOUT PRIOR WRITTEN CONSENT OF THE OWNER, HIS REPRESENTATIVE OR THE ENGINEER/ARCHITECT MAY CAUSE THE WORK TO BE UNACCEPTABLE.
5. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL CONSTRUCTION STAKING AND THE LOCATION OF THE PROJECT. CONTROL COORDINATE SYSTEM AVAILABLE THROUGH THE ARCHITECT.
6. THE CONTRACTOR SHALL VERIFY AND/OR REESTABLISH ALL CENTERLINES AS DEFINED ON THESE PLANS AND SPECIFICATIONS.
7. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL MATERIAL TESTING BY AN INDEPENDENT LABORATORY APPROVED BY THE ENGINEER/ARCHITECT.
8. CONTRACTOR SHALL BEAR FULL RESPONSIBILITY FOR FINISHING THE CONSTRUCTION PLAN.
9. MATERIAL SUBMITTALS SHALL BE MADE TO OWNER THROUGH THE ENGINEER/ARCHITECT PRIOR TO USE, FOR APPROVAL. ALL MATERIALS SHALL BE MADE IN U.S.A.
10. CONCRETE STRENGTH: 3,000 P.S.I., UNLESS OTHERWISE NOTED.
11. ASPHALT MIX DESIGN SHALL BE SUBMITTED FOR THE ENGINEER'S APPROVAL.
12. THE CONTRACTOR SHALL SUBMIT A CONCRETE JOINT PLAN FOR ALL CONCRETE PAVING FOR WRITTEN APPROVAL BY THE ENGINEER, PRIOR TO CONSTRUCTION.
13. MAINTENANCE OF TRAFFIC WILL BE IN ACCORDANCE WITH THE CURRENT EDITION OF THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES.
14. ALL EXISTING STREET SIGNAGE CONFLICTING WITH CONSTRUCTION SHALL BE REMOVED DURING CONSTRUCTION, CLEANED, REPLACED AFTER CONSTRUCTION AND SHALL BE CONSIDERED PART OF MAINTENANCE OF TRAFFIC.
15. FLUORESCENT ORANGE SHEETING SHALL BE USED ON ALL CONSTRUCTION AND TRAFFIC CONTROL SIGNS EXCEPT FOR THOSE DESIGNATED IN PLANS TO BE BLACK LEGEND AND BORDER ON WHITE BACKGROUND.
16. THE CONTRACTOR SHALL PROVIDE PROPER TRAFFIC CONTROL SIGNS AND FLAGGERS TO MAINTAIN ONE LANE TRAFFIC DURING CONSTRUCTION, WHERE LANE CLOSURES ARE NEEDED, UNLESS OTHERWISE NOTED BY THE ENGINEER. ANY ROAD CLOSURES SHALL BE SUBMITTED TO THE ENGINEER FOR APPROVAL PRIOR TO IMPLEMENTATION.
17. ALL PLASTIC DRUMS SHALL HAVE A BALLASTING COLLAR MADE FROM RECYCLED TRUCK TIRES OR OTHER SUITABLE MATERIAL.
18. CONES SHALL BE NARROW PROFILE WITH A MINIMUM HEIGHT OF 28 INCHES AND A MINIMUM WEIGHT OF TEN (10) POUNDS. CONES USED IN SPEED ZONES EQUAL TO OR GREATER THAN 45 MPH SHALL BE NARROW PROFILE WITH A MINIMUM HEIGHT OF 28 INCHES AND A MINIMUM WEIGHT OF FIFTEEN (15) POUNDS. ALL CONES SHALL BE APPROVED BY THE ENGINEER PRIOR TO USE.
19. ALL POST LENGTHS FOR SIGNS SHALL BE FIELD VERIFIED PRIOR TO FABRICATION.
20. THE CONTRACTOR SHALL PROVIDE SHOP DRAWINGS OF ALL GATES FOR WRITTEN APPROVAL BY THE ENGINEER, PRIOR TO CONSTRUCTION. THE CONTRACTOR SHALL FIELD VERIFY ALL GATE LENGTHS PRIOR TO INSTALLATION. ALL LENGTHS SHOWN ON THESE PLANS, IF ANY, ARE OPENING LENGTHS AND MAY NOT REFLECT THE TOTAL LENGTH REQUIRED.
21. CONTRACTOR SHALL BE RESPONSIBLE FOR THE VERIFICATION OF ALL EXISTING TOPOGRAPHIC DATA, LOCATION AND PROTECTION OF ALL EXISTING UTILITIES WITHIN THE WORK AREA AND ALL OTHER SITE CONDITIONS PRIOR TO THE BEGINNING OF CONSTRUCTION. ANY CONFLICT SHALL BE COORDINATED WITH THE CONTRACTOR, OWNER AND ENGINEER/ARCHITECT. THE ENGINEER CANNOT AND DOES NOT WARRANT THAT THIS INFORMATION IS COMPLETE OR ACCURATE.
22. EXISTING UNDERGROUND UTILITY LINES ARE SHOWN ON THE DRAWINGS BASED UPON THE BEST INFORMATION PROVIDED TO THE ENGINEER. THE ENGINEER CANNOT AND DOES NOT WARRANT THAT THIS INFORMATION IS COMPLETE OR ACCURATE. THE CONTRACTOR MUST COORDINATE DIRECTLY WITH THE INVOLVED UTILITY OWNERS TO HAVE UNDERGROUND UTILITY LINES FIELD LOCATED IN ADVANCE OF CONSTRUCTION.
23. UTILITIES SHALL BE RELOCATED BY THE UTILITY OWNERS, WHERE CONFLICT WITH CONSTRUCTION OCCURS, UNLESS NOTED OTHERWISE. CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATION WITH, APPLICATIONS, PERMITS AND FEES THAT MAY BE REQUIRED BY THE UTILITY OWNERS.
24. ANY DISTURBANCE TO EXISTING STREETS AND DRIVEWAYS SHALL BE REPAIRED IN KIND, UNLESS OTHERWISE NOTED.
25. PRIOR TO THE BEGINNING OF ANY EXCAVATION IN PAVED AREAS, ALL EXISTING PAVEMENT SHALL BE SAW CUT TO FULL DEPTH SUCH THAT A STRAIGHT AND UNIFORM VERTICAL EDGE CAN BE ESTABLISHED PRIOR TO REMOVAL OF SAID PAVEMENT FROM THE PROJECT. IF VERTICAL EDGE IS DISTURBED, THEN A SECOND CUT SHALL BE REQUIRED PRIOR TO ASPHALT OR CONCRETE PATCHING. ALL ASPHALT OR CONCRETE SHALL BE REMOVED FROM THE PROJECT SITE PRIOR TO EXCAVATION PROCEDURES. THE PAVEMENT SHALL BE REPAIRED AS DETAILED.
26. WORK FOR THIS PROJECT REQUIRES EXCAVATION IN THE IMMEDIATE VICINITY OF TRAFFIC AND ADJACENT PROPERTIES. THEREFORE, THE RISK OF A FAILURE OCCURRING DURING THE EXCAVATION REQUIRES THAT EXTREME CAUTION BE EXERCISED. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PLACING WHAT BRACING, SHORING OR GROUND SUPPORT SYSTEM THAT IS DEEMED NECESSARY TO PREVENT A FAILURE AND PROTECT THE PERSONS WORKING NEAR THE EXCAVATION, THE PUBLIC THAT MAY BE ABOVE THE EXCAVATION, OR ANY STRUCTURE ADJACENT TO THE EXCAVATION. ALL COSTS FOR ANY PROTECTIVE MEASURES INCLUDING THE MATERIALS AND LABOR FOR DESIGNING, DRAWING AND CONSTRUCTING THE FACILITY SHALL BE INCLUDED IN THE BID PRICE FOR CONTRACT ITEMS.
27. ALL CONDUITS SHALL BE MADE OF COLORED MATERIAL (REGARDLESS OF MATERIAL TYPE) OR INSTALLED IN COLORED PLASTIC SLEEVES. THE CONTRACTOR MAY SUBMIT ALTERNATIVES FOR APPROVAL PRIOR TO CONSTRUCTION. COLORS SHALL BE AS FOLLOWS: GAS – YELLOW; FIRE WATER – WHITE; IRRIGATION WATER – PURPLE; POTABLE WATER – BLUE; POWER – RED; TEL/COMM – WHITE; SEWER – GREEN; SPARE – GRAY.
28. ALL SERVICE CONNECTIONS (FOR ALL UTILITY TYPES) WHICH ARE TEMPORARILY DISCONNECTED DUE TO CONSTRUCTION REQUIREMENTS, DAMAGED OR OTHERWISE DISCONNECT, SHALL BE REPAIRED IN KIND AT THE CONTRACTOR'S EXPENSE, UNLESS OTHERWISE DIRECTED. (NO SEPARATE PAY). SERVICE INTERRUPTIONS SHALL BE COORDINATED WITH THE UTILITY OWNER AND THE AFFECTED STRUCTURE OWNER. EXCEPTION 1: WATER SERVICE CONNECTIONS WHICH ARE DEGRADED BEYOND REPAIR, LEAKING, BROKEN, ETC. PRIOR TO CONSTRUCTION, SHALL BE DOCUMENTED, REPORTED TO THE ENGINEER, REPAIRED AND PAID AS OUTLINED IN THE BID PROPOSAL (SIZE TO MATCH EXISTING). EXCEPTION 2: ANY OTHER SERVICE CONNECTIONS, EXCEPT WATER & SEWER, WHICH ARE DEGRADED BEYOND REPAIR, LEAKING, BROKEN, ETC. PRIOR TO CONSTRUCTION, SHALL BE DOCUMENTED, REPORTED TO THE ENGINEER AND REPORTED TO THE UTILITY OWNER.
29. ALL TRENCHES IN PAVED AREAS SHALL BE REPAIR AS DETAILED. CRUSHED AGGREGATE SHALL ALSO BE INSTALLED AND USED FOR A TEMPORARY SURFACE UNTIL SUCH TIME THAT THE OWNER DECIDES TO ALLOW INSTALLATION OF PAVEMENT (SEE DETAIL). ALL CRUSHED AGGREGATE MAY BE LIMESTONE AND SHALL BE SIZE 825. CONTRACTOR SHALL BE RESPONSIBLE FOR REMOVAL OF EXISTING PAVEMENT PRIOR TO PLACEMENT OF PAVEMENT IN PATCHED AREAS TO MAKE A SMOOTH JOINT WITH THE EXISTING PAVEMENT. SAW CUT TO FULL DEPTH OF EXISTING PAVEMENT SHALL BE REQUIRED ON ALL PAVEMENT REPAIR, UNLESS OTHERWISE DIRECTED. CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING SURFACE IN AN ACCEPTABLE CONDITION UNTIL SUCH TIME AS FINAL PAVEMENT IS INSTALLED.
30. ALL EXISTING MAILBOXES, STREET SIGNS, FENCES, AND OTHER STRUCTURES LOCATED WITHIN THE CONSTRUCTION LIMITS SHALL BE REMOVED AND REPLACED IN KIND AS DICTATED BY CONSTRUCTION ACTIVITIES, UNLESS OTHERWISE NOTED.
31. THE CONTRACTOR SHALL PROVIDE ACCESS TO ALL BUSINESSES AND RESIDENCES AT ALL TIMES DURING CONSTRUCTION.

GRADING NOTES:

1. COST OF ANY CLEARING AND GRUBBING/REMOVAL AND DISPOSAL OF CLEARING AND GRUBBING MATERIAL SHALL BE INCLUDED IN THE PRICE OF THE DEMOLITION REQUIRED FOR THIS PROJECT. OFF SITE DISPOSAL AREAS ARE TO BE CONTRACTOR FURNISHED. THE SITE SHALL BE CLEARED OF ANY RUBBLE AND DEBRIS. CONTRACTOR SHALL BE FAMILIAR WITH THE EXTENT OF THE CLEARING AND GRUBBING PRIOR TO BIDDING.
2. FILL, IF ANY, NEEDED TO BRING THE SUBGRADE TO THE REQUIRED ELEVATION SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR AND SHALL BE AS RECOMMENDED IN THE GEOTECHNICAL REPORTS. EXCESS MATERIAL RESULTING FROM GRADING OPERATIONS SHALL BECOME THE PROPERTY OF THE CONTRACTOR. THE CONTRACTOR SHALL DISPOSE OF ALL SUCH MATERIAL AT AN OFF SITE LOCATION PROVIDED BY THE CONTRACTOR.
3. EARTHWORK REQUIRED BENEATH PROPOSED STRUCTURES AND PAVEMENTS SHALL BE AS RECOMMENDED IN THE GEOTECHNICAL REPORTS.
4. THE CONTRACTOR SHALL STRIP THE TOP SOIL PRIOR TO GRADING. TOP SOIL SHALL BE STOCK PILED ON SITE FOR USE DURING THE LANDSCAPING OPERATIONS. THE TOP SOIL DEPTH IS TYPICALLY 6"–12" ACROSS THE SITE BUT COULD AND DOES VARY. COORDINATE WITH THE GEOTECHNICAL REPORTS.
5. THE SITE SHALL BE GRADED TO DRAIN AS NOTED ON THE GRADING PLAN. ALL GRADES NOTED ON THE GRADING PLAN ARE FINISHED GRADE.
6. GRADE ALL LANDSCAPE AREAS TO DRAIN. ALL PLANTERS AND LANDSCAPE AREAS WILL BE FILLED TO TOP OF CONCRETE CURB, SIDEWALK OR OTHER ADJACENT PAVEMENT WITH TOPSOIL AND SHALL BE FREE OF DEBRIS. TYPICAL DEPTH OF PLACED TOPSOIL SHALL BE 4"–6". VERIFY LOCATIONS THAT WILL REQUIRE GREATER DEPTHS OF TOPSOIL WITH THE LANDSCAPING PLANS.
7. ALL CULVERT CROSS DRAINS AND SIDE DRAINS SHALL BE PROTECTED. NO SEPARATE PAYMENT WILL BE MADE FOR REMOVAL AND REPLACEMENT. ALL CULVERTS AND SIDE DRAINS (EXISTING OR PROPOSED) SHALL BE CLEANED OF ALL FOREIGN MATTER, INCLUDING SILT, PRIOR TO COMPLETION OF THE PROJECT.
8. THE CONTRACTOR SHALL COORDINATE THE INSTALLATION OF ALL SUB–SURFACE UTILITIES AND DRAINAGE STRUCTURES WITH THE GRADING OPERATIONS. ABSOLUTELY NO CUTS OR TRENCHING SHALL BE ALLOWED ONCE FINAL COMPACTION AND GRADES HAVE BEEN ACHIEVED. IF ANY TYPE OF CONDUITS ARE REQUIRED AFTER FINAL COMPACTION IS ACHIEVED, THE CONTRACTOR SHALL INSTALL SAID CONDUITS BY BORING, AT THE CONTRACTOR'S EXPENSE.
9. ALL RCP AND RCAP SHALL BE CLASS III, UNLESS NOTED OTHERWISE.
10. ALL CONCRETE PIPE JOINTS SHALL BE WRAPPED IN TYPE V GEOTEXTILE FABRIC, 24" WIDTH. ALL PICKUP HOLES SHALL BE PLUGGED WITH EPOXY GROUT AND COVERED WITH TYPE V GEOTEXTILE FABRIC TO THE SATISFACTION OF THE ENGINEER.
11. ALL HDPE, CPP AND CPP PIPE AND FITTING SHALL BE DUAL WALL HDPE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY AND ALL FITTINGS REQUIRED TO MAKE ALL CONNECTIONS. ALL HDPE PIPE AND/OR CPP SHALL BE INSTALLED AND BEDDED AS DETAILED, UNLESS OTHERWISE SPECIFIED BY THE MANUFACTURER.
12. THE TOPS OF ALL CLEAN–OUTS SHALL BE INSTALLED AT LEAST 6" ABOVE GRADE AND INSTALLED WITH PRECAST CONCRETE RING TO PROTECT CLEAN–OUT, UNLESS CLEAN–OUT IS LOCATED IN A PAVED AREA. CLEAN–OUTS IN PAVED AREAS SHALL BE INSTALLED BELOW GRADE AND HOUSED IN A TRAFFIC GRADE BOX INSTALLED FLUSH WITH THE FINISH GRADE.
13. ALL STRUCTURE EXCAVATION SHALL BE INCLUDED IN THE COST OF ANY STRUCTURE REQUIRING STRUCTURE EXCAVATION.
14. ALL BEDDING MATERIAL FOR ALL PIPE SHALL BE ABSORBED IN THE PRICE OF THE PIPE LAYING OPERATION.
15. ALL JUNCTION BOXES AND INLETS SHALL BE CONSTRUCTED PER DETAILS. THE CONTRACTOR SHALL SUBMIT SHOP DRAWINGS PRIOR TO CONSTRUCTION FOR APPROVAL BY THE ENGINEER. PRECAST INLET BOTTOMS AND WALLS SHALL BE ALLOWED, IF APPROVED BY THE ENGINEER. ALL INLET TOPS SHALL BE CAST IN PLACE, NO EXCEPTIONS. ALL INLET TOPS SHALL BE CAST TO MATCH THE SLOPE OR GRADE OF THE SURROUNDING PAVEMENT OR CURB, COORDINATE WITH THE GRADING PLAN. PRECAST SUBSURFACE JUNCTION BOXES ARE ALLOWED. ALL LIFT HOLES IN PRECAST STRUCTURES SHALL BE FILLED WITH EPOXY GROUT.
16. NO PIPE SHALL BE LAID IN THE PRESENCE OF WATER.
17. UTILITIES SHALL BE RELOCATED BY THE UTILITY OWNERS, WHERE CONFLICT WITH CONSTRUCTION OCCURS, UNLESS NOTED OTHERWISE. CONTRACTOR IS RESPONSIBLE FOR COORDINATION WITH THE UTILITY OWNER.

WATER NOTES:

1. WHERE SEWER MAIN IS WITHIN 10 FEET OF WATER MAIN HORIZONTALLY. THE BOTTOM OF WATER MAIN SHALL BE AT LEAST 18" FROM THE TOP OF THE SEWER MAIN, UNLESS NOTED OTHERWISE.
2. ALL EXISTING PAVED ROADS SHALL BE BORED WITH CASING, UNLESS OTHERWISE NOTED. ANY DAMAGE TO PAVED ROADS SHALL BE REPAIRED AS DETAILED AT THE CONTRACTOR'S EXPENSE.
3. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL CITY OF HATTIESBURG PERMITS, APPLICATIONS AND CONNECTION FEES.
4. PRESSURE TESTS WILL BE REQUIRED ON ALL WATER MAIN INSTALLED.
5. ALL BACTI–SAMPLES SHALL BE TAKEN BY THE SYSTEM OPERATOR OR HIS REPRESENTATIVES. ANY AND ALL SAMPLING FEE SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
6. ALL FITTINGS AND VALVES SHALL BE MECHANICAL JOINT WITH CONCRETE THRUST BLOCK AT ALL BENDS ALONG WITH MEGA LUG JOINT RESTRAINT CONNECTIONS.
7. FULL LENGTH PIPE SECTIONS ARE REQUIRED BEFORE AND AFTER ALL FITTINGS.
8. ALL WATER MAINS SHALL BE DUCTILE IRON, CLASS 350, NO EXCEPTIONS. ALL FIRE WATER SERVICE PIPE (BETWEEN MAIN & PIV) SHALL BE DUCTILE IRON, CLASS 350, NO EXCEPTION. ALL FIRE WATER SERVICE PIPE (BETWEEN PIV & BUILDING) SHALL BE DUCTILE IRON, CLASS 350 OR C–900, 150 PSI PVC, NO EXCEPTIONS. ALL DOMESTIC WATER SERVICE PIPE (BETWEEN MAIN & BUILDING) SHALL BE SCHEDULE 80 PVC, 150 PSI OR APPROVED EQUAL.
9. ALL WATER PIPE INSTALLATION SHALL INCLUDE A TRACER WIRE SYSTEM, AS DETAILED.
10. NO PIPE SHALL BE PLACED IN THE PRESENCE OF WATER.
11. WELL POINTS SHALL BE INCLUDED IN THE PRICE OF THE PIPE LAYING OPERATION (IF REQUIRED).
12. ALL ROAD BORES SHALL BE IN ACCORDANCE WITH THE DETAILS.
13. ALL CASING SHALL BE OF THE SIZE AND TYPE AS NOTED ON THESE PLANS.
14. UNLESS OTHERWISE NOTED, THE DOMESTIC SERVICE CONNECTIONS SHALL INCLUDE A PVC ADAPTER, DOUBLE CHECK VALVE, (FORD BRAND ONLY), CURB STOP (FORD BRAND ONLY), CTS (200) SERVICE TUBING, YOKE (FORD BRAND ONLY) AND PLASTIC ENCLOSURE AS INDICATED ON THE DETAIL. THE CONTRACTOR SHALL COORDINATE WITH THE CITY OF HATTIESBURG TO OBTAIN AND INSTALL A WATER METER.
15. ALL BENDS SHOWN IN THE PROPOSED WATERLINE SHALL BE ACCOMPLISHED THROUGH THE USE OF THE REQUIRED FITTINGS (22.5°, 30°, 45°....). SINGLE 90° BEND FITTINGS SHALL NOT BE PERMITTED UNLESS SPECIFICALLY NOTED ON THE PLANS AND/OR APPROVED BY THE ENGINEER. 90° BENDS SHALL BE ACCOMPLISHED BY USING MULTIPLE SMALLER BEND FITTINGS. BENDS SHOWN ON THE PLAN SHEETS SHALL BE VERIFIED BY THE CONTRACTOR PRIOR TO BIDDING AND CONSTRUCTION. ONLY MAJOR BENDS ARE SHOWN ON THE PLANS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL FITTINGS NECESSARY TO INSTALL THE PROPOSED WATER LINE.

SEWER NOTES:

1. WHERE SEWER MAIN IS WITHIN 10 FEET OF WATER MAIN HORIZONTALLY. THE BOTTOM OF WATER MAIN SHALL BE AT LEAST 18" FROM THE TOP OF THE SEWER MAIN, UNLESS NOTED OTHERWISE.
2. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL CITY OF HATTIESBURG PERMITS, APPLICATIONS AND CONNECTION FEES.
3. INFILTRATION/EXFILTRATION AND MANDREL TESTS WILL BE REQUIRED ON ALL SEWER MAINS INSTALLED UNDER THIS PROJECT.
4. ALL MANHOLES SHALL BE 48" IN DIAMETER, WITH ECCENTRIC TOP CONE SECTIONS, UNLESS OTHERWISE NOTED.
5. MANHOLES SHALL HAVE 20 MIL. COAL TAR EPOXY COATING ON THE INSIDE, OR APPROVED EQUAL, UNLESS OTHERWISE NOTED.
6. THE FINISHED ELEVATION OF ALL MANHOLE TOPS FOR MANHOLES TO BE CONSTRUCTED IN PAVED AREAS SHALL BE AT EXISTING PAVEMENT ELEVATION OR AS DIRECTED BY THE ENGINEER. ELEVATIONS SHALL BE TAKEN FROM CUT SHEETS FURNISHED BY THE CONTRACTOR FOR APPROVAL BY THE ENGINEER AT LEAST SEVEN (7) DAYS PRIOR TO CONSTRUCTION.
7. ALL SINGLE DROPS FOR SEWER PIPE 8" AND UNDER IN DIAMETER SHALL BE PLACED INSIDE THE MANHOLE AS DETAILED. ALL MULTIPLE DROPS OR DROPS FOR SEWER PIPE OVER 8" IN DIAMETER SHALL BE PLACED OUTSIDE OF THE MANHOLE AS DETAILED, UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
8. ALL NEW PVC SEWER PIPE, SERVICES AND FITTINGS SHALL BE SDR 26, OF SIZE NOTED ON THE PLAN SHEETS AND SHALL BE GREEN IN COLOR. ALL NEW SEWER PIPE SHALL BE INSTALLED AT A MINIMUM GRADE OF 0.50%, UNLESS OTHERWISE DIRECTED BY THE ENGINEER. (SEE PLAN SHEETS FOR DESIGN GRADES)
9. ALL SEWER INSTALLATION SHALL INCLUDE A TRACER WIRE SYSTEM, AS DETAILED.
10. ALL BEDDING MATERIAL FOR ALL PIPE SHALL BE ABSORBED IN THE PRICE OF THE PIPE LAYING OPERATION.
11. ALL SELECT FILL MATERIAL SHALL MEET THE SPECIFICATIONS FOR CLASS 9, GROUP C AND MODIFIED FOR TO CONSIST OF A PLASTICITY INDEX (PI) BETWEEN 5 AND 15. SAND SHALL NOT BE ALLOWED. THE SELECT FILL MATERIAL SHALL BE INSTALLED AT THE DIRECTION OF THE ENGINEER OR HIS REPRESENTATIVE.
12. NO PIPE SHALL BE PLACED IN THE PRESENCE OF WATER.
13. WELL POINTS SHALL BE INCLUDED IN THE PRICE OF THE PIPE LAYING OPERATION (IF REQUIRED).
14. THE CONTRACTOR SHALL COORDINATE ALL NEW SEWER SERVICE LOCATIONS WITH BUILDING CONTRACTOR.
15. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING BRACING, SHORING OR ANY GROUND SUPPORT SYSTEM REQUIRED TO PREVENT A FAILURE FROM OCCURRING DURING EXCAVATION. ALL COST FOR ANY PROTECTIVE MEASURES, INCLUDING THE MATERIALS AND LABOR FOR DESIGNING AND CONSTRUCTING THE SUPPORT SYSTEM, SHALL BE INCLUDED IN THE BID PRICE FOR CONTRACT ITEMS.
16. ALL CLEAN–OUTS SHALL BE INSTALLED AS DETAILED, NO EXCEPTIONS.
17. ALL FITTINGS REQUIRED FOR DUCTILE IRON OR PVC PIPE SHALL BE INCLUDED IN THE APPROPRIATE BID ITEM FOR THE PIPE AND AT NO ADDITIONAL COST TO THE PROJECT EXCEPT SERVICE TEE'S AND CLEANOUTS. CLEANOUTS SHALL INCLUDE TEE, SERVICE CAP, TRAFFIC COVER IF NEEDED, AND ANY PIPE LENGTH TO BRING CLEANOUT TO SURFACE GRADE.

EROSION CONTROL NOTES:

1. PROTECTING THE SITE FROM EROSION SHALL BE A REQUIREMENT OF THIS CONTRACT. THE EROSION CONTROL DEVICES REFERENCED IN THESE PLANS ARE A MINIMUM REQUIREMENT. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO INSURE THAT SILT DOES NOT LEAVE THE CONSTRUCTION SITE OR CONTAMINATE WATERS OF THE U.S. DURING CONSTRUCTION. THE CONTRACTOR SHALL MAINTAIN THE PLAN DURING CONSTRUCTION. MAINTENANCE SHALL BE PERFORMED A MAXIMUM OF 24 HOURS AFTER SILT ACCUMULATION. THE CONTRACTOR SHALL MAINTAIN THE PLAN DAILY DURING CONSTRUCTION.
2. PROPER MAINTENANCE OF STREETS, INCLUDING DUST CONTROL, SHALL BE STRICTLY ADHERED TO.
3. UNLESS OTHERWISE NOTED ON THE PLAN SHEETS, ALL DISTURBED AREAS SHALL BE FERTILIZED AND SEEDED WITH PER THE VEGETATION SCHEDULE FOR TEMPORARY GRASSING. PERMANENT CENTIPEDE SOLID SOD SHALL BE INSTALLED IN ALL LANDSCAPED AREAS, UNLESS OTHERWISE NOTED. THE CONTRACTOR SHALL BE REQUIRED TO ESTABLISH A FULL COVERAGE OF PERMANENT GRASS GROWTH PRIOR TO COMPLETION OF THE PROJECT.
4. THE EROSION CONTROL MEASURES SHOWN ON THESE PLANS SHALL BE REQUIRED UNTIL GRASSING IS ESTABLISHED AND LANDSCAPING HAS BEEN PROPERLY INSTALLED TO THE SATISFACTION OF THE ARCHITECT/OWNER.
5. THE TYPICAL TEMPORARY EROSION CONTROL MEASURES AND TYPICAL DITCH TREATMENTS REFERENCED IN THESE PLANS ARE A MINIMUM REQUIREMENT. TEMPORARY EROSION CONTROL MEASURES SHALL BE INSTALLED IN LOCATIONS BASED ON THE SWPPP PLANS IN THESE DOCUMENTS AND AS DIRECTED BY THE ENGINEER.
6. THE CONTRACTOR SHALL ADHERE TO ALL CURRENT MISSISSIPPI DEPARTMENT OF ENVIRONMENTAL QUALITY GUIDELINES.

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HATTIESBURG PUBLIC SAFETY COMPLEX
HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

BID DOCUMENTS

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GENERAL NOTES

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DEMOLITION NOTES (FOR INFORMATION PURPOSES ONLY):

1. THE CONTRACTOR SHALL COORDINATE ALL ITEMS MARKED FOR DEMOLITION WITH THE OWNER AND THE ARCHITECT.
2. THE SAFETY OF THE GENERAL PUBLIC WITHIN THE VICINITY OF THE CONSTRUCTION AREA IS EXTREMELY IMPORTANT. THE CONTRACTOR SHALL POST AND MAINTAIN, TO THE OWNER'S SATISFACTION, SIGNS THAT DIRECT THE GENERAL PUBLIC AROUND THE CONSTRUCTION AREAS. THE CONTRACTOR SHALL COORDINATE WITH THE OWNER PRIOR TO CONSTRUCTION.
3. THE CONTRACTOR SHALL TAKE CARE NOT TO DAMAGE ANY EXISTING STRUCTURES, PAVEMENTS OR ANY OTHER SITE COMPONENTS NOT DESIGNATED FOR DEMOLITION AND REMOVAL. ANY SUCH ITEMS WHICH ARE DAMAGED SHALL BE REPAIRED SOLELY AT THE CONTRACTOR'S EXPENSE.
4. VOIDS CREATED BY THE REMOVAL OF POSTS, CONCRETE ANCHORS, FOOTINGS, ETC., SHALL BE BACKFILLED AND TAMPED IN ACCORDANCE WITH SECTION 203 OF THE MISSISSIPPI STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION (LATEST EDITION).
5. THE CONTRACTOR SHALL BE REQUIRED TO INSTALL ORANGE CONSTRUCTION FENCE AROUND ALL CONSTRUCTION AREAS ON CAMPUS WITH A CLEARLY DESIGNATED CONSTRUCTION ENTRANCE AND EXIT. THE CONTRACTOR SHALL PROVIDE SUBSTANTIAL PROTECTION AROUND EXCAVATION SITES. COORDINATION WITH THE ARCHITECT SHALL BE REQUIRED.
6. UTILITIES DESIGNATED FOR DEMOLITION HAVE A DIRECT AFFECT ON THE EXISTING STRUCTURES ON THE PROJECT SITE. THE CONTRACTOR SHALL COORDINATE ALL SITE UTILITY DEMOLITION AND SITE UTILITY INSTALLATION WITH THE UTILITY OWNERS IN ORDER TO MINIMIZE DISRUPTION OF THE UTILITY SERVICES TO EXISTING STRUCTURES.
7. ALL BUILDINGS NOTED FOR DEMOLITION, SHALL BE RAZED TO 24" BELOW EXISTING GRADE OR PROPOSED FINISHED GRADE, WHICH EVER IS LOWER. ALL BUILDINGS NOTED FOR DEMOLITION SHALL BE DE-ENERGIZED PRIOR TO THE START OF DEMOLITION.
9. ALL EXISTING SUBSURFACE STRUCTURES (INLETS, MANHOLES, FOUNDATIONS, ETC) AND PIPES WITHIN 5 FEET OF A PROPOSED BUILDING SHALL BE REMOVED. OTHERWISE, SAID STRUCTURES AND PIPES SHALL BE RAZED TO 24" BELOW EXISTING GRADE OR PROPOSED FINISHED GRADE, WHICH EVER IS LOWER AND ABANDONED AS NOTED ON THE DEMOLITION PLAN.
10. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE REMOVAL OF EXISTING MANHOLES AND SEWER PIPES, AS NOTED ON THE PLAN SHEETS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE DISPOSAL OF ANY AND ALL WASTE TO AN APPROVED WASTE FACILITY BY AN APPROVED WASTE HANDLER. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE DISPOSAL OF ALL REMOVED MANHOLES AND SEWER PIPES AT AN APPROVED DISPOSAL SITE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL HAZARDOUS MATERIALS FEES, APPLICATIONS AND PERMITS REQUIRED TO DISPOSE OF ALL WASTE AND REMOVED MATERIALS.
11. THE CONTRACTOR SHALL COORDINATE WITH OWNER PRIOR TO DEMOLITION REGARDING SALVAGED EQUIPMENT AND MATERIALS. THE OWNER SHALL PROVIDE A COMPLETE AND ITEMIZED LIST OF EQUIPMENT AND MATERIALS TO BE SALVAGED FROM THE SITE DURING DEMOLITION. SALVAGED EQUIPMENT AND MATERIALS SHALL BE SHRINK WRAPPED, ON PALLETS AND DELIVERED TO THE OWNER IN A MANNER AND AT A LOCATION DESIGNATED BY THE OWNER. ALL REMAINING EQUIPMENT AND MATERIALS SHALL BE PROPERTY OF THE CONTRACTOR AND SHALL BE DISPOSED OF AT THE LOCATION SUITABLE TO MATERIAL SUCH MATERIALS. ALL SALVAGE, TRANSPORTATION, DEMOLITION AND DISPOSAL OPERATIONS REGARDING THE DEMOLITION PLAN SHALL BE THE CONTRACTOR'S RESPONSIBILITY AND DONE AT THE CONTRACTOR'S EXPENSE.

CONSTRUCTION PHASING NOTES:

1. DUE TO THE LARGE AND INVOLVED NATURE OF THIS PROJECT, THE CONTRACTOR SHALL PROVIDE A DETAILED 'PHASES OF CONSTRUCTION', TO THE ENGINEER/ARCHITECT PRIOR TO THE START OF CONSTRUCTION.
2. THE CONTRACTOR SHALL FULLY COOPERATE WITH THE MULTIPLE CONTRACTORS WHICH WILL BE ON SITE TO CONSTRUCT THE VARIOUS PROPOSED STRUCTURES. COORDINATION TO AVOID DELAYS SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
3. ALL PROPOSED INFRASTRUCTURE IMPROVEMENTS SHALL BE INSTALLED TO THE SATISFACTION OF THE ENGINEER, THE CITY ENGINEER & THE DIRECTOR OF THE WATER & SEWER DEPARTMENT PRIOR TO THE CONNECTION OF ANY SERVICES TO THE PROPOSED BUILDINGS.

ABBREVIATION LEGEND:

A/C	–	AIR CONDITIONER
ADA	–	AMERICAN DISABILITY ACT
&	–	AND
APPURT	–	APPURTENANCES
ARCH	–	ARCHITECTURAL
ASPLT	–	ASPHALT
BLDG	–	BUILDING
℄	–	CENTERLINE
CL	–	CLASS
CONC	–	CONCRETE
CRNR	–	CORNER
CPP	–	CORRUGATED PLASTIC PIPE
CSI	–	CRIME SCENE INVESTIGATION
DBL	–	DOUBLE
DIA	–	DIAMETER
DRV	–	DRIVE
DI	–	DUCTILE IRON
E	–	EAST
ETC	–	ETCETERA
EXIST	–	EXISTING
EXP	–	EXPANSION
FFE	–	FINISH FLOOR ELEVATION
FIG	–	FIGURE
FL	–	FLOW LINE
GP	–	GROUP
GRVL	–	GRAVEL
HC	–	HANDICAP
HDPE	–	HIGH DENSITY POLYETHYLENE
HDPE	–	HIGH DENSITY POLYETHYLENE PIPE
HYD	–	HYDRANT
INCL	–	INCLUDING
INV	–	INVERT
JNT	–	JOINT
LF	–	LINEAR FEET
LVM	–	LOOSE VOLUME MEASURE
MAT'L	–	MATERIAL
MAX	–	MAXIMUM
MECH	–	MECHANICAL
MH	–	MANHOLE
MIN	–	MINIMUM
MM	–	MILLIMETER
MOD	–	MODIFIED
N	–	NORTH
NE	–	NORTHEAST
NW	–	NORTHWEST
NTP	–	NOT THIS PROJECT
No.	–	NUMBER
OC	–	ON CENTER
PVMNT	–	PAVEMENT
PLUMB	–	PLUMBING
PIV	–	POST INDICATOR VALVE
PIV	–	POUNDS PER SQUARE INCH
PVC	–	POLYVINYL CHLORIDE PIPE
P℄	–	PROPERTY LINE
R	–	RADIUS
RCAP	–	REINFORCED CONCRETE ARCHED PIPE
RCP	–	REINFORCED CONCRETE PIPE
REQ'D	–	REQUIRED
RET	–	RETAINING
ROW	–	RIGHT OF WAY
S	–	SOUTH
SAN	–	SANITARY
SCH	–	SCHEDULE
SE	–	SOUTHEAST
SEC	–	SECTION
SDR	–	STANDARD DIAMETER RATIO
SPECS	–	SPECIFICATIONS
SQ	–	SQUARE
SS	–	STAINLESS STEEL
SUPP	–	SUPPLEMENTAL
SW	–	SOUTHWEST
SWR	–	SEWER
SY	–	SQUARE YARD
TYP	–	TYPICAL
W	–	WEST
W/	–	WITH
W/O	–	WITHOUT

SYMBOL LEGEND:

—— — ——	– CENTER LINE
ELP	– ELECTRICAL PANEL/BOX
— — (155.5) — —	– CONTOURS (EXIST) (6" INTERVALS)
— — (155) — —	– CONTOURS (EXIST) (1' INTERVALS)
—— (155.5) ——	– CONTOURS (PROPOSED) (6" INTERVALS)
—— (155) ——	– CONTOURS (PROPOSED) (1' INTERVALS)
—o——o——	– FENCE
•FP	– FENCE POST
FOB	– FIBER OPTIC BOX
FP	– FIBER OPTIC PEDESTAL
•FID	– FIBER OPTIC INDICATOR POST
FH	– FIRE HYDRANT
•GID	– GAS INDICATOR POST
— — G — — G —	– GAS LINE (EXIST)
—G——G——	– GAS LINE (PROPOSED)
GM	– GAS METER
GV	– GAS VALVE
•GT	– GATE POST
GEN	– GENERATOR
•GP	– GUARD POST
LP	– LIGHT ON POLE
P℄	– PROPERTY LINE
CO	– SAN SWR CLEAN-OUT
— — SS — — SS—	– SAN SWR LINE (EXIST)
—SS——SS——	– SAN SWR LINE (PROPOSED)
S	– SAN SWR MANHOLE
SIGN	– SIGN
×157.13	– SPOT GRADE
—SD——SD——	– STORM DRAIN
D	– STORM DRAIN MANHOLE
T	– TELEPHONE PEDESTAL
TF	– TRANSFORMER
—UD——UD——	– UNDER DRAIN
— — — P — — — P —	– UTILITY LINES (UNDERGROUND)
—P——P——	– UTILITY LINES (OVERHEAD)
—T——T——	– UTILITY LINES (OVERHEAD)
UP	– UTILITY POLE
UP	– UTILITY POLE
	– UTILITY POLE GUY WIRE
USP	– UTILITY SERVICE POLE
— — — W — — — W —	– WATER LINE (EXIST)
—W——W——	– WATER LINE (PROPOSED)
WM	– WATER METER
WV	– WATER VALVE

SPECIAL ABBREVIATION LEGEND:

ADD ALT1	- ADDITIVE ALTERNATE #1
ADD ALT2	- ADDITIVE ALTERNATE #2
CBO	- CONSTRUCTED BY OTHERS
NIC	- NOT IN CONTRACT

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

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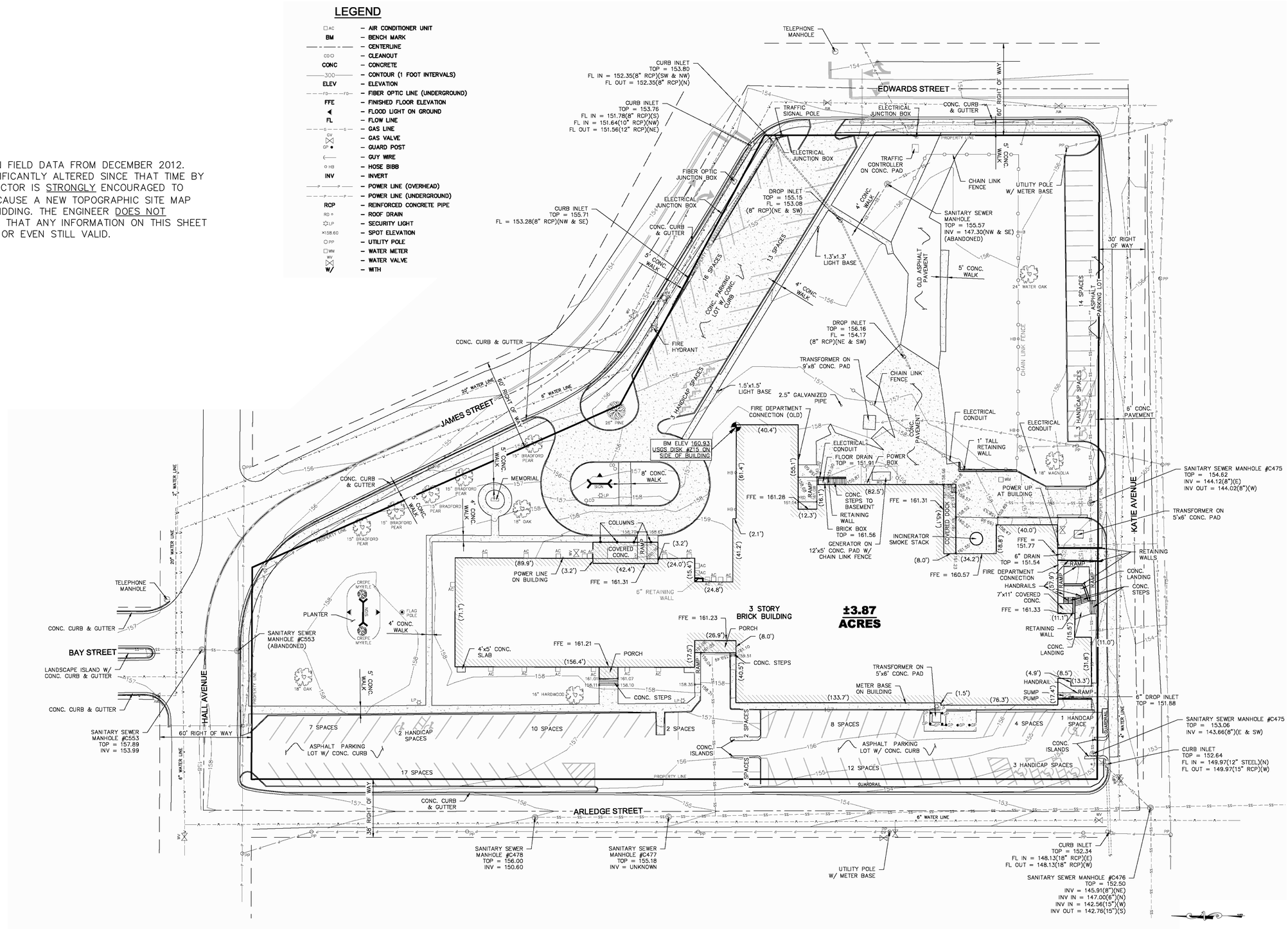
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GEN NOTES, CONST PHASES
ABBR SCHED & SYM LEGEND

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SPECIAL NOTE:

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SOURCE INFORMATION:
THE MAP SHOWN HEREON IS BASED ON THE TOPOGRAPHIC MAP PERFORM BY SDW ENGINEERS ON 12-11-2012 (DWG No. 1235-060)

GRAPHIC SCALE
30 0 15 30 60 120
(IN FEET)

TOPOGRAPHIC MAP

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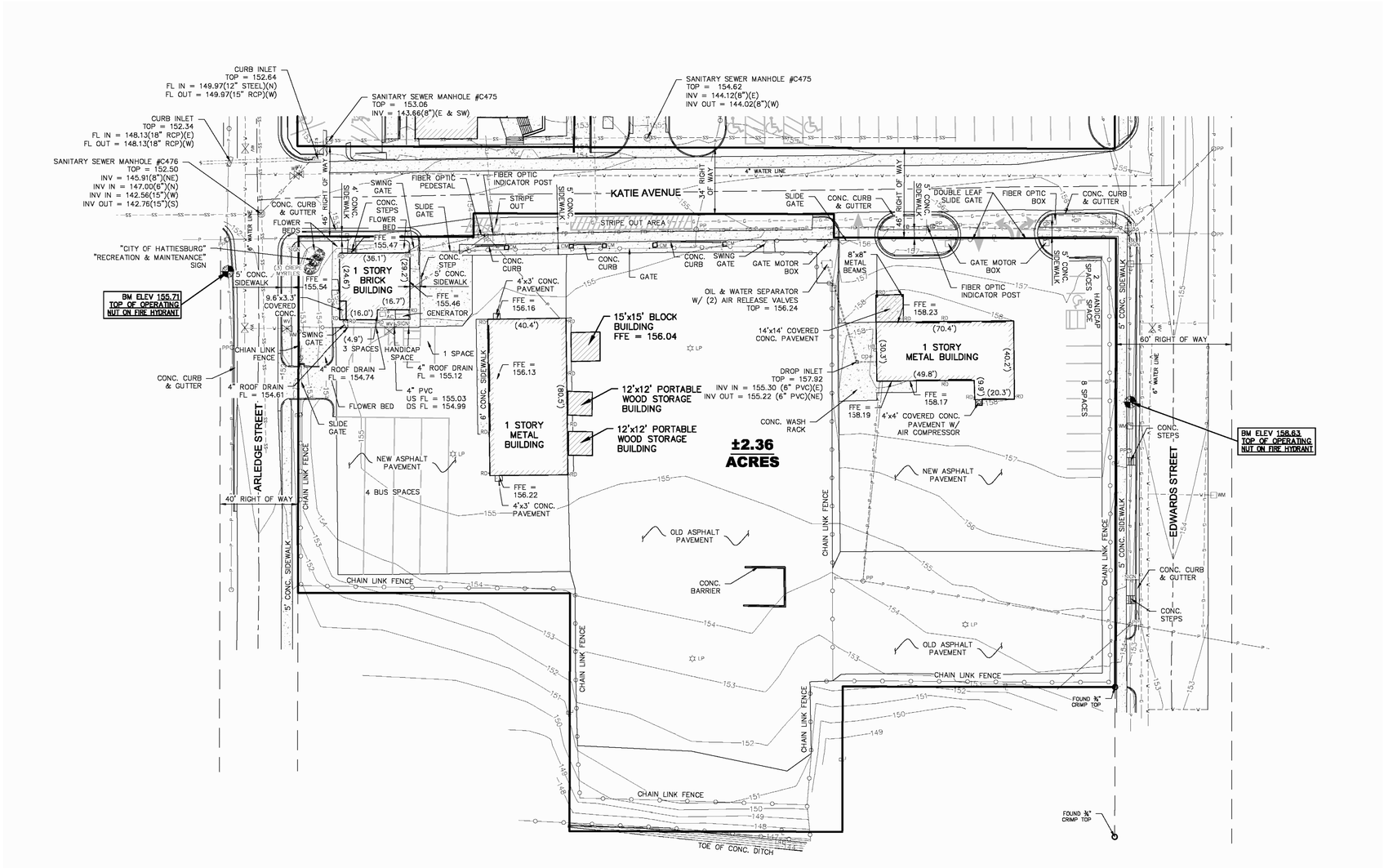
EXISTING TOPOGRAPHIC MAP - NORTH BLOCK

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LEGEND

AC	– AIR CONDITIONER UNIT
BM	– BENCH MARK
CM	– BRICK COLUMN
	– CENTERLINE
CO	– CLEANOUT
CONC	– CONCRETE
300	– CONTOUR (1 FOOT INTERVALS)
ELEV	– ELEVATION
FO FO	– FIBER OPTIC LINE (UNDERGROUND)
FFE	– FINISHED FLOOR ELEVATION
FL	– FLOW LINE
G G	– GAS LINE
GP	– 4"x4" CONC. GUARD POST
	– GUY WIRE
HB	– HOSE BIBB
INV	– INVERT
PVC	– POLYVINYL CHLORIDE PIPE
P P	– POWER LINE (OVERHEAD)
P P	– POWER LINE (UNDERGROUND)
PL	– PROPERTY LINE
RD	– ROOF DRAIN
LP	– SECURITY LIGHT
T T	– TELEPHONE LINE (UNDERGROUND)
TP	– TELEPHONE PEDESTAL
PP	– UTILITY POLE
WM	– WATER METER
WV	– WATER VALVE
W/	– WITH

SOURCE INFORMATION:
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GRAPHIC SCALE
30 0 15 30 60 120
(IN FEET)

TOPOGRAPHIC MAP

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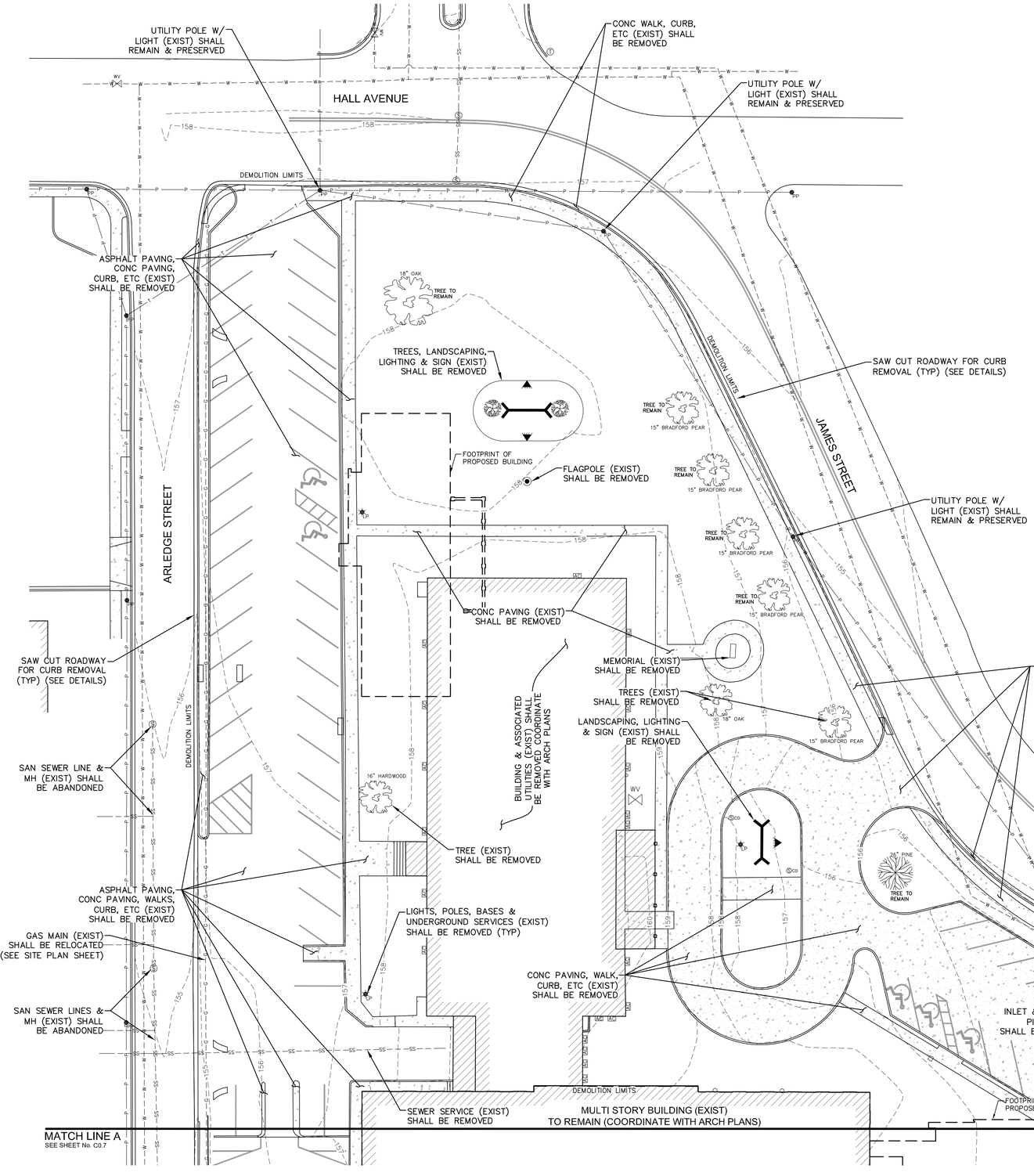
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EXISTING TOPOGRAPHIC MAP - SOUTH BLOCK

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ABANDONMENT / REMOVAL NOTES:

1. ALL EXISTING SUBSURFACE STRUCTURES (SUCH AS MANHOLES & INLETS) NOTED TO BE REMOVED SHALL BE REMOVED ENTIRELY. REMOVED ITEMS SHALL BE DISPOSED OF APPROPRIATELY.

2. ALL EXISTING SUBSURFACE STRUCTURES (SUCH AS MANHOLES & INLETS) NOTED TO BE ABANDONED SHALL BE MODIFIED AS FOLLOWS:
   - 2.1. REMOVE AND DISPOSE OF ANY SANITARY WASTE.
   - 2.2. REMOVE COVER, FRAME AND THE TOP 24" (36" IF LOCATED IN ROADWAY) OF THE STRUCTURE. DISPOSE OF REMOVED ITEMS.
   - 2.3. FILL THE STRUCTURE WITH SAND.
   - 2.4. CAP THE STRUCTURE WITH 2500 PSI, NON-REINFORCED CONCRETE (6" DEPTH).
   - 2.5. BACKFILL WITH NATIVE SOIL MATERIAL AND/OR FILL MATERIAL (CL B9) AND COMPACT. GRADE TO DRAIN AS REQUIRED. GRASS DISTURBED AREA OR REPAIR PAVEMENT AREAS.
3. ALL EXISTING PIPES NOTED TO BE REMOVED, SHALL BE REMOVED ENTIRELY. REMOVED ITEMS SHALL BE DISPOSED OF APPROPRIATELY.
4. ALL EXISTING PIPES NOTED TO BE ABANDONED, SHALL BE MODIFIED AS FOLLOWS:
   - 4.1. REMOVE AND DISPOSE OF ANY SANITARY WASTE.
   - 4.2. FILL THE PIPE WITH FLOWABLE FILL.
   - 4.3. PLUG ENDS.
5. WHERE ABANDONED PIPES AND/OR SUBSURFACE STRUCTURES CONFLICT WITH THE NEW CONSTRUCTION, THE EXISTING PIPES AND/OR SUBSURFACE STRUCTURES SHALL BE REMOVED, UNLESS OTHERWISE DIRECTED BY THE ENGINEER OR NOTED.

SPECIAL UTILITY NOTES:

1. PRIOR TO ANY DEMOLITION OPERATIONS, THE CONTRACTOR SHALL VERIFY THE EXISTING ELECTRICAL POWER SYSTEM TO DETERMINE IF MODIFICATIONS ARE REQUIRED TO ENSURE CONTINUED ELECTRICAL POWER SERVICE TO THE ADJACENT STRUCTURES. THE CONTRACTOR SHALL SUBMIT A PLAN OF ACTION TO THE PROJECT ENGINEER FOR APPROVAL AND COORDINATE ANY INTERRUPTIONS WITH THE PROJECT OWNER AND THE STRUCTURES OWNER(S). THE CONTRACTOR SHALL GIVE THE OWNER(S) 24 HOURS NOTICE (MIN) OF ANY INTERRUPTIONS IN SERVICE.
2. PRIOR TO ANY DEMOLITION OPERATIONS, THE CONTRACTOR SHALL VERIFY THE EXISTING WATER AND SEWER SYSTEM TO DETERMINE IF MODIFICATIONS ARE REQUIRED TO ENSURE CONTINUED SERVICE TO THE ADJACENT STRUCTURES. THE CONTRACTOR SHALL SUBMIT A PLAN OF ACTION TO THE PROJECT ENGINEER FOR APPROVAL AND COORDINATE ANY INTERRUPTIONS WITH THE PROJECT OWNER AND THE STRUCTURES OWNER(S). THE CONTRACTOR SHALL GIVE THE OWNER(S) 24 HOURS NOTICE (MIN) OF ANY INTERRUPTIONS IN SERVICE.

SPECIAL NOTE:

THIS PLAN WAS BASED ON THE EXISTING FIELD CONDITIONS AS OF DECEMBER 2012. THE SITE DEMOLITION HAS BEEN COMPLETED BY THE OWNER PRIOR TO THE ADVERTISEMENT OF THIS PROJECT. THIS SHEET IS FOR INFORMATIONAL USE ONLY. THE CONTRACTOR IS STRONGLY ENCOURAGED TO VERIFY THE STATUS OF THE DEMOLITION PRIOR TO CONSTRUCTION. THE ENGINEER DOES NOT WARRANT OR GUARANTEE THAT THE DEMOLITION IS COMPLETE BASED ON THE REQUIREMENTS OF THIS SHEET.

INFORMATIONAL USE ONLY

GRAPHIC SCALE
20 0 10 20 40 80
(IN FEET)

DEMOLITION PLAN

PREPARED BY:
SDW Engineering Progress
SDW Project No.: 15819 SDW Working No.: DEMO1

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

BID DOCUMENTS

Drawing Issued:		
Date	Rev.	Description
10-31-2015		65% Check Set
12-18-2015		95% Check Set
11-19-2018		Bid Documents

Drawn By:	RES\BT
Checked By:	SEM
Client No:	------
Albert & Associates: 12575	

C0.6

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com
Albert & McCleskey Associates Architects

DEMOLITION PLAN
NORTH BLOCK

G:\PROJECTS\Albert and Associates\15819 - Hattiesburg Public Safety Complex\15819CAD Files\15819_Demo_plh_v1.dwg, DEMO1, 9/21/2018 3:45:06 PM

ABANDONMENT / REMOVAL NOTES:

1. ALL EXISTING SUBSURFACE STRUCTURES (SUCH AS MANHOLES & INLETS) NOTED TO BE REMOVED SHALL BE REMOVED ENTIRELY. REMOVED ITEMS SHALL BE DISPOSED OF APPROPRIATELY.

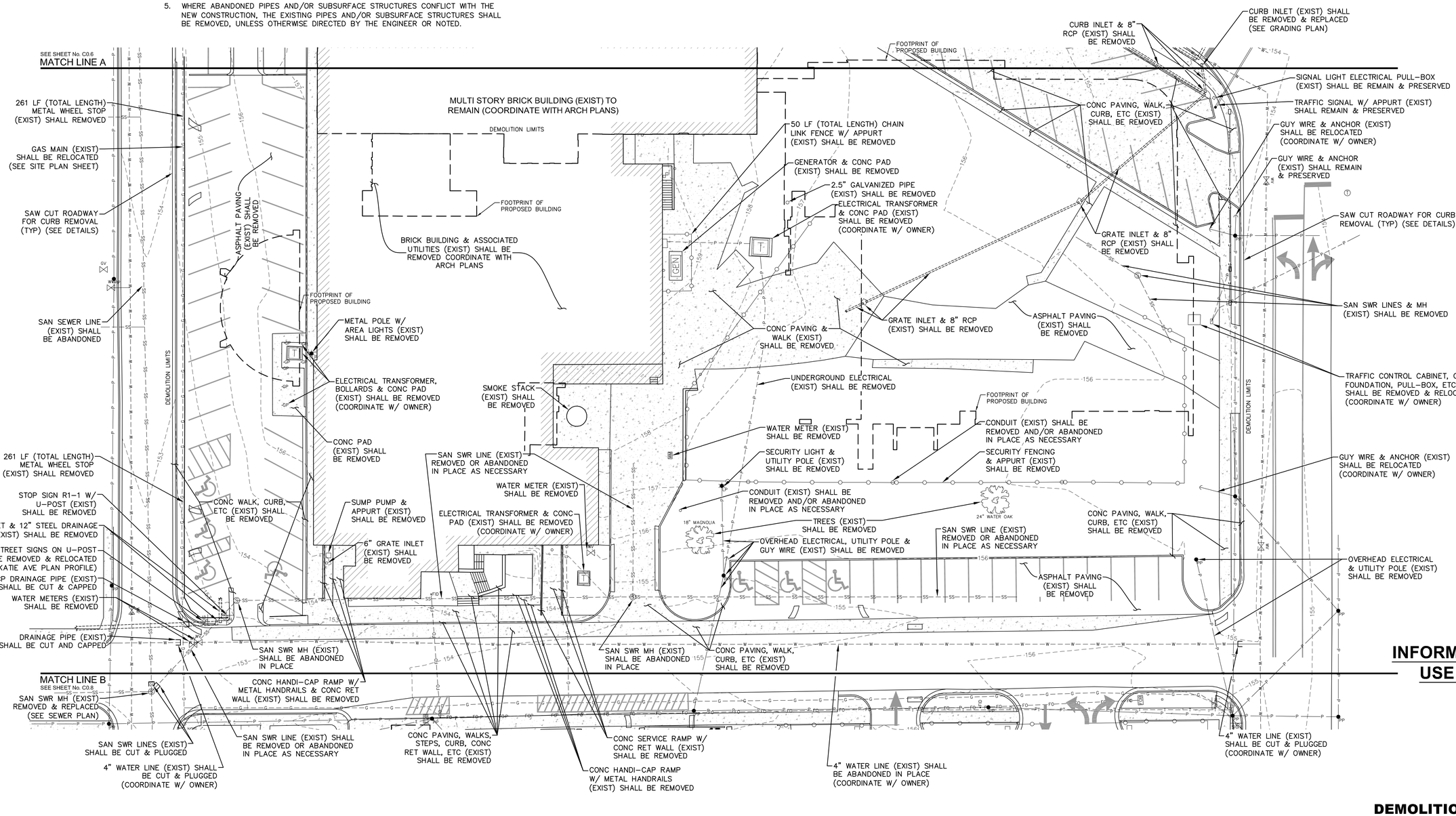
2. ALL EXISTING SUBSURFACE STRUCTURES (SUCH AS MANHOLES & INLETS) NOTED TO BE ABANDONED SHALL BE MODIFIED AS FOLLOWS:
   - 2.1. REMOVE AND DISPOSE OF ANY SANITARY WASTE.
   - 2.2. REMOVE COVER, FRAME AND THE TOP 24" (36" IF LOCATED IN ROADWAY) OF THE STRUCTURE. DISPOSE OF REMOVED ITEMS.
   - 2.3. FILL THE STRUCTURE WITH SAND.
   - 2.4. CAP THE STRUCTURE WITH 2500 PSI, NON-REINFORCED CONCRETE (6" DEPTH).
   - 2.5. BACKFILL WITH NATIVE SOIL MATERIAL AND/OR FILL MATERIAL (CL B9) AND COMPACT. GRADE TO DRAIN AS REQUIRED. GRASS DISTURBED AREA OR REPAIR PAVEMENT AREAS.
3. ALL EXISTING PIPES NOTED TO BE REMOVED, SHALL BE REMOVED ENTIRELY. REMOVED ITEMS SHALL BE DISPOSED OF APPROPRIATELY.
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SPECIAL UTILITY NOTES:

1. PRIOR TO ANY DEMOLITION OPERATIONS, THE CONTRACTOR SHALL VERIFY THE EXISTING ELECTRICAL POWER SYSTEM TO DETERMINE IF MODIFICATIONS ARE REQUIRED TO ENSURE CONTINUED ELECTRICAL POWER SERVICE TO THE ADJACENT STRUCTURES. THE CONTRACTOR SHALL SUBMIT A PLAN OF ACTION TO THE PROJECT ENGINEER FOR APPROVAL AND COORDINATE ANY INTERRUPTIONS WITH THE PROJECT OWNER AND THE STRUCTURES OWNER(S). THE CONTRACTOR SHALL GIVE THE OWNER(S) 24 HOURS NOTICE (MIN) OF ANY INTERRUPTIONS IN SERVICE.
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SPECIAL NOTE:

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INFORMATIONAL USE ONLY

GRAPHIC SCALE
20 0 10 20 40 80
(IN FEET)

DEMOLITION PLAN

PREPARED BY:
sdw Engineering Progress
309 Second Ave. | Hattiesburg, MS 39401 | p | 601.544.1821 | f | 601.544.2601 | sdw.com
SDW Project No.: 15819 SDW Working No.: DEMO2

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

BID DOCUMENTS

Drawing Issued:

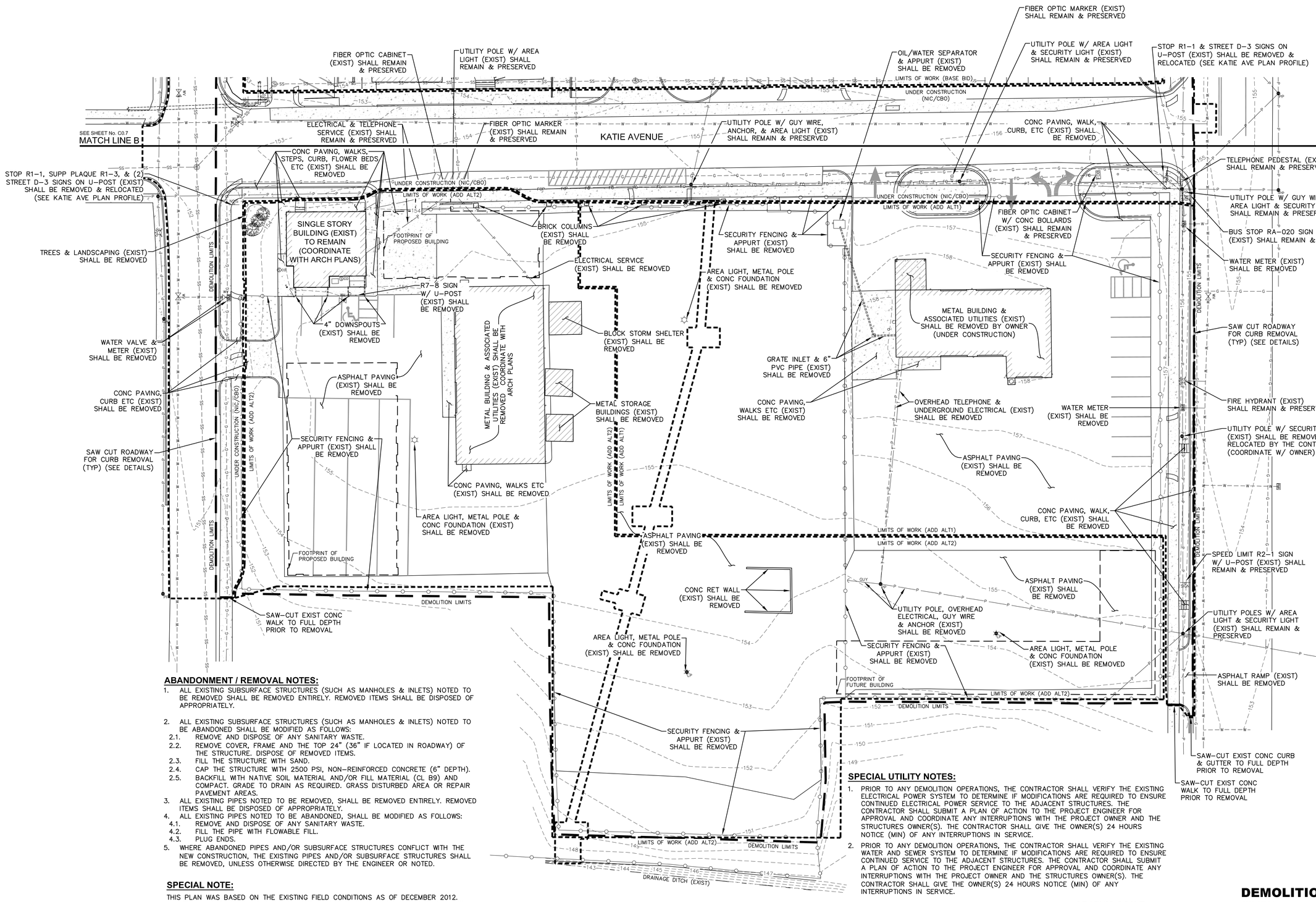
Date	Rev.	Description
10-31-2015		65% Check Set
12-18-2015		95% Check Set
11-19-2018		Bid Documents

Drawn By: RES\BT
Checked By: SEM
Client No: ------
Albert & Associates: 12575

C0.7

DEMOLITION PLAN NORTH BLOCK

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ABANDONMENT / REMOVAL NOTES:

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   - 2.5. BACKFILL WITH NATIVE SOIL MATERIAL AND/OR FILL MATERIAL (CL B9) AND COMPACT. GRADE TO DRAIN AS REQUIRED. GRASS DISTURBED AREA OR REPAIR PAVEMENT AREAS.
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GRAPHIC SCALE
20 0 10 20 40 80
(IN FEET)

DEMOLITION PLAN

PREPARED BY:
sdw Engineering Progress
309 Second Ave. | Hattiesburg, MS. 39401 | p.) 601.544.1821 | f.) 601.544.1925 | sdw.com
SDW Project No.: 15819 SDW Working No.:DEMO3

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

BID DOCUMENTS

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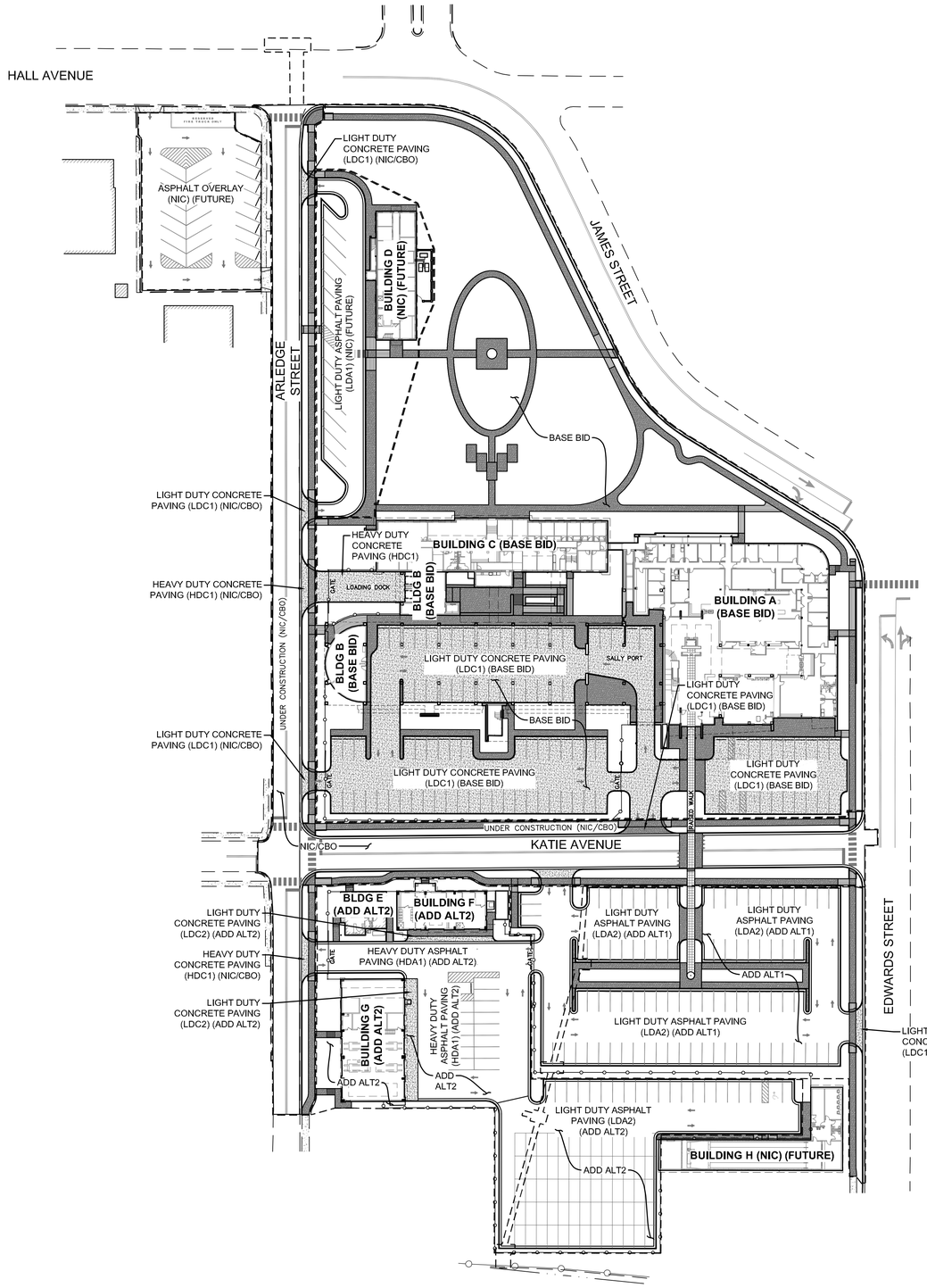
Drawn By:	RES\BT
Checked By:	SEM
Client No:	------
Albert & Associates:	12575

C0.8

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com
Albert & McCleskey Associates Architects

DEMOLITION PLAN SOUTH BLOCK

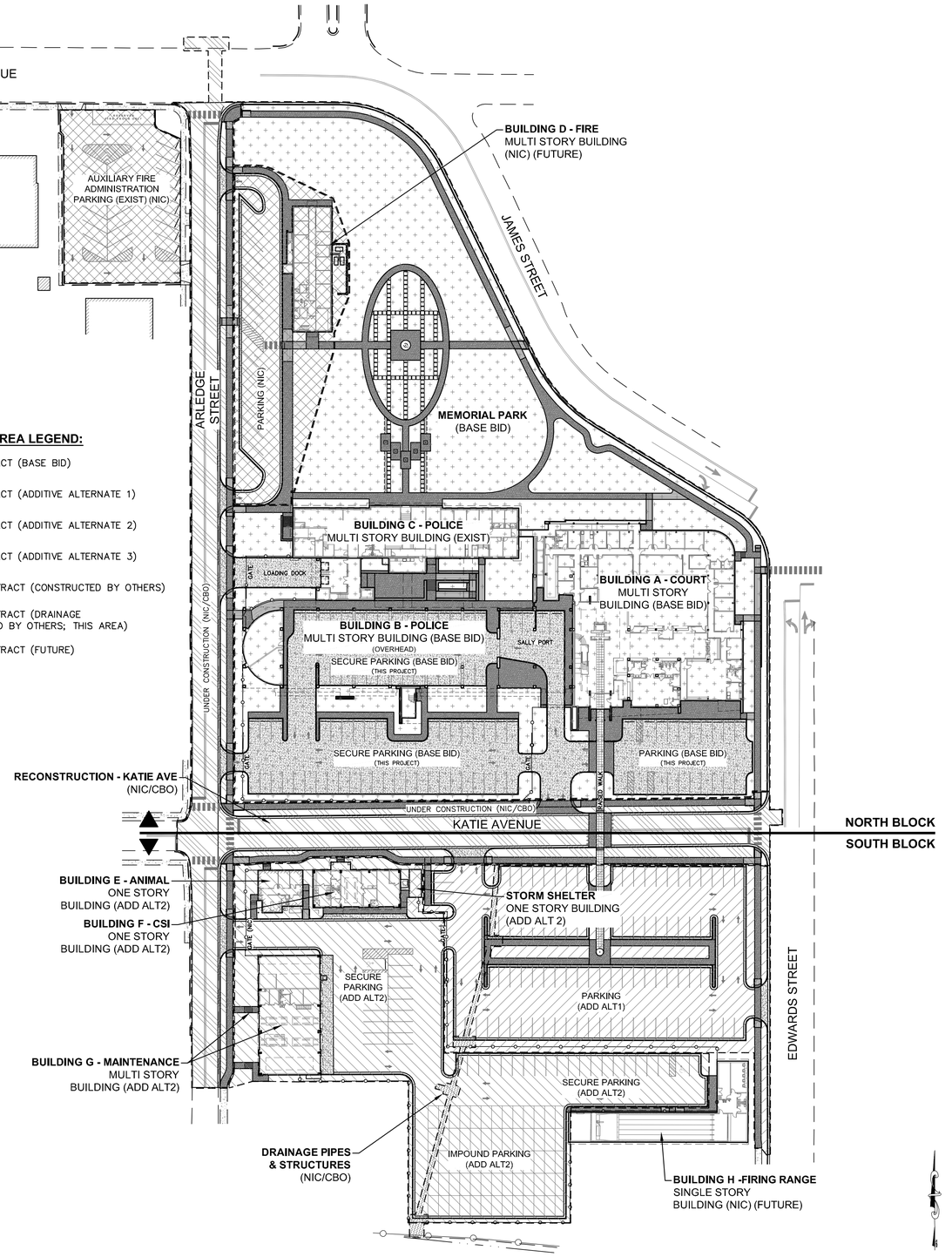
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HATCH AREA LEGEND:

- – THIS CONTRACT (BASE BID)
- – THIS CONTRACT (ADDITIVE ALTERNATE 1)
- – THIS CONTRACT (ADDITIVE ALTERNATE 2)
- – THIS CONTRACT (ADDITIVE ALTERNATE 3)
- – NOT IN CONTRACT (CONSTRUCTED BY OTHERS)
- – NOT IN CONTRACT (DRAINAGE CONSTRUCTED BY OTHERS; THIS AREA)
- – NOT IN CONTRACT (FUTURE)

MASTER PAVING PLAN



MASTER SITE PLAN

GRAPHIC SCALE

50 0 25 50 100 200

(IN FEET)

PREPARED BY:

SDW Engineering Progress

309 Second Ave. | Hattiesburg, MS | 39401 | p | 601.544.3521 | f | 601.544.3501 | sdw.com

SDW Project No.: 15819 SDW Working No.: SP1

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

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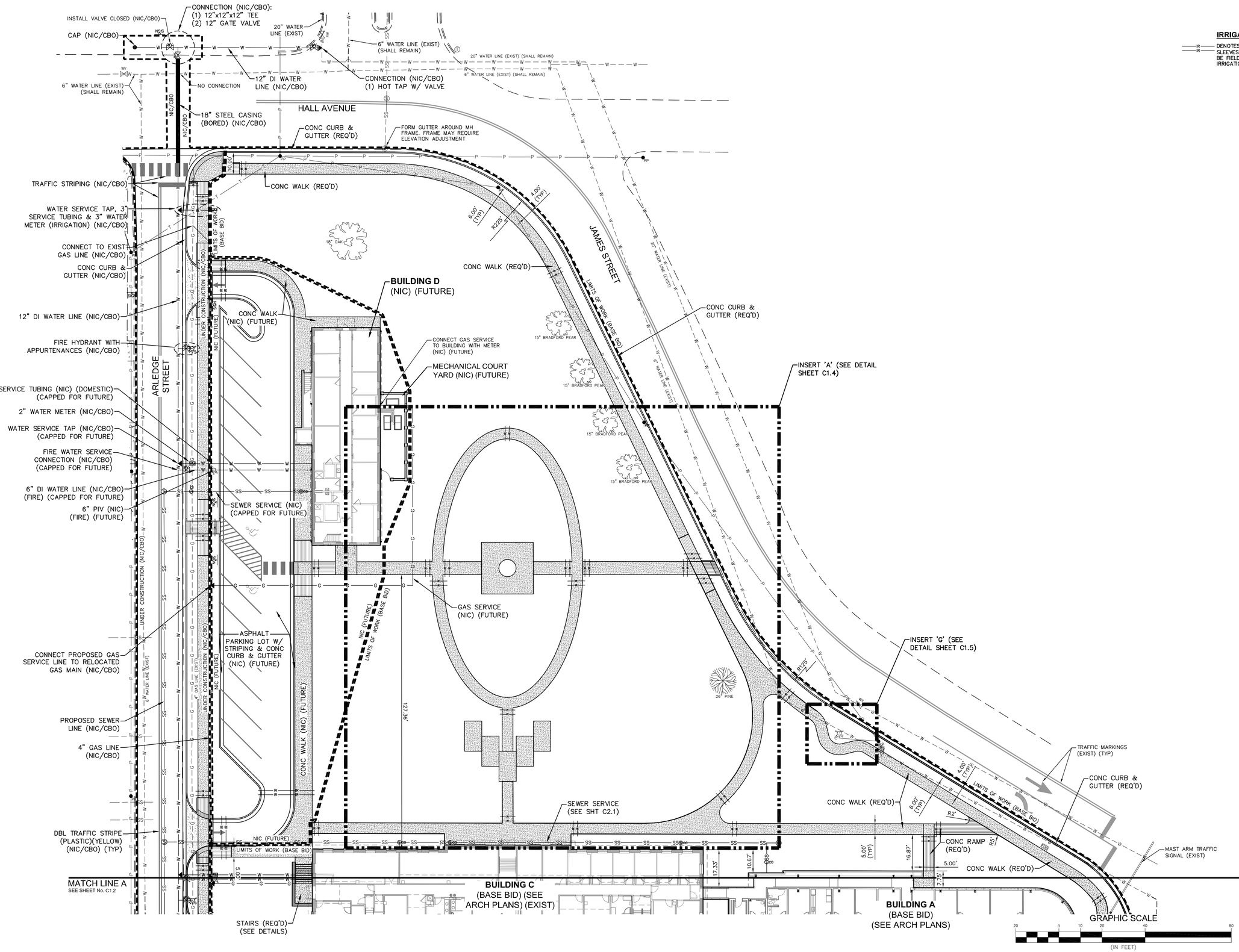
Drawn By:	RES
Checked By:	SEM
Client No:	------
Albert & Associates:	12575

C1.0

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com | Albert & McCleskey Associates Architects

MASTER SITE & PAVING PLAN

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IRRIGATION SLEEVE NOTE:

IR —— IR —— DENOTES THE LOCATION THAT AN EMPTY PAIR OF IRRIGATION SLEEVES SHALL BE INSTALLED. (SEE DETAILS) LOCATIONS MAY BE FIELD ADJUSTED TO AVOID CONFLICTS WITH OTHER UTILITIES. IRRIGATION SYSTEM IS NOT A PART OF THIS PROJECT.

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

BID DOCUMENTS

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12-18-2015		95% Check Set
11-19-2018		Bid Documents

Drawn By:	RES
Checked By:	SEM
Client No:	------
Albert & Associates: 12575	

SITE & UTILITY PLAN

PREPARED BY:

SDW Engineering Progress
301 Second Ave. | Hattiesburg, MS 39401 | p (601.544.1821) | f (601.544.1823) | sdwi.com

SDW Project No.: 15819 SDW Working No.: SP2

C1.1

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com

Albert & McCleskey Associates Architects

SITE & UTILITY PLAN - NORTH BLOCK

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SIGN LEGEND		
KEY	DESCRIPTION	SIZE
A	AUTHORIZED PERSONNEL ONLY	12"x18"
B	PEDESTRIAN TRAFFIC (W11-2)	30"x30"
C	DO NOT ENTER (R5-1)	30"x30"

IRRIGATION SLEEVE NOTE:

IR IR — DENOTES THE LOCATION THAT AN EMPTY PAIR OF IRRIGATION SLEEVES SHALL BE INSTALLED. (SEE DETAILS) LOCATIONS MAY BE FIELD ADJUSTED TO AVOID CONFLICTS WITH OTHER UTILITIES. IRRIGATION SYSTEM IS NOT A PART OF THIS PROJECT.

40 LF 6" DI WATER LINE (REQ'D) (FIRE)
40 LF 3" SERVICE TUBING (REQ'D) (DOMESTIC)
3" WATER METER (REQ'D)
6" PIV (FIRE) (REQ'D)
WATER SERVICE TAP (NIC/CBO)
FIRE WATER SERVICE CONNECTION (NIC/CBO)
SEE SHEET No. C1.1 MATCH LINE A
CONNECT PROPOSED GAS SERVICE LINE TO RELOCATED GAS MAIN (REQ'D)
FIRE HYDRANT W/ APPURT (NIC/CBO)
60 LF 3" SERVICE TUBING (DOMESTIC) (REQ'D)
' WATER METER (CAPPED FOR FUTURE) (NIC/CBO)
WATER SERVICE TAP (NIC/CBO)
FIRE WATER SERVICE CONNECTION (NIC/CBO)
6" PIV (FIRE) (CAPPED FOR FUTURE) (REQ'D)
CONNECT PROPOSED GAS SERVICE LINE TO RELOCATED GAS MAIN (REQ'D)
60 LF 6" DI WATER LINE (FIRE) (REQ'D)
16 LF 6' SECURITY FENCE (REQ'D)
INSERT 'I' (SEE DETAIL SHEET C1.5)
4" GAS LINE (NIC/CBO)
12" DI WATER LINE (NIC/CBO)
68 LF 6' SECURITY FENCE (REQ'D)
SEWER LINE (NIC/CBO)
WATER SERVICE TAP, 3" SERVICE TUBING & 3" WATER METER (IRRIGATION) (CAPPED LINE FOR FUTURE) (NIC/CBO)
CONC CURB & GUTTER (NIC/CBO)
INSERT 'J' (SEE DETAIL SHEET C1.5)
CONC WALK (NIC/CBO)
DBL TRAFFIC STRIPE (PLASTIC) (YELLOW) (NIC/CBO)
SINGLE LEAF SLIDE GATE W/ GATE OPERATOR, KEYPAD & APPURT (REQ'D) (SEE DETAIL SHEETS C1.19 & C1.20)
TRAFFIC STRIPING (NIC/CBO)
WATER CONNECTION (NIC/CBO)
MATCH LINE B SEE SHEET No. C1.3
CONNECT PROPOSED GAS LINE TO EXIST GAS LINE (NIC/CBO)
TRAFFIC STRIPING (NIC/CBO)

G1 65 LF GAS SERVICE (REQ'D) (SEE MECHANICAL PLANS FOR SIZE AND LOAD)
G2 48 LF GAS SERVICE (REQ'D) (SEE MECHANICAL PLANS FOR SIZE AND LOAD)
38 LF 6' SECURITY FENCE (REQ'D)
STAIRS (REQ'D) (SEE DETAILS)
CONNECT WATER & GAS SERVICES TO BUILDING (SEE PLUMB PLANS)
BUILDING C (SEE ARCH PLANS) (EXIST)
COURTYARD INSERT (SEE DETAIL SHEETS C1.16 – C1.18)
BOLLARD @ DOWNSPOUT & COLUMN (REQ'D)
BOLLARD @ BLDG CRNR (REQ'D)
LOADING DOCK
60 LF 6' SECURITY FENCE (REQ'D)
WHEEL STOP (THIS SIDE ONLY) (REQ'D) (TYP)
ARLEDGE STREET
LIMITS OF WORK (BASE BID)
UNDER CONSTRUCTION (NIC/CBO)
BUILDING B (BASE BID) (SEE ARCH PLANS)
TRAFFIC ARROW (REQ'D) (TYP) (SEE DETAILS)
WHEEL STOP (THIS SIDE ONLY) (REQ'D) (TYP)
CONC PARKING LOT W/ STRIPING & INTEGRAL CURB (REQ'D) (SEE DETAILS)
℄ CONSTRUCTION
℄ ONE WAY DRIVE
273 LF 6' SECURITY FENCE (REQ'D)
LIMITS OF WORK (BASE BID)
UNDER CONSTRUCTION (NIC/CBO)
CONC WALK (NIC/CBO)
8" DI WATER LINE (NIC/CBO)
FIRE WATER SERVICE CONNECTION (NIC/CBO)
KATIE AVENUE
SEWER LINE (NIC/CBO)
UNDER CONSTRUCTION (NIC/CBO)
LIMITS OF WORK (ADD ALT2)
6" DI WATER LINE (FIRE) (NIC/CBO)
6" PIV (REQ'D) (FIRE) (CAPPED FOR FUTURE)
WATER SERVICE TAP, 3" SERVICE TUBING & 3" WATER METER (IRRIGATION) (CAPPED FOR FUTURE) (NIC/CBO)
WATER SERVICE TAP (NIC/CBO)
1½" SERVICE TUBING (DOMESTIC) (NIC/CBO)
1½" WATER METER (CAPPED FOR FUTURE) (REQ'D)
DBL TRAFFIC STRIPE (PLASTIC)(YELLOW) (NIC/CBO) (TYP)
INSERT 'L' (SEE DETAIL SHEET C1.6)

CONC WALK (REQ'D)
JAMES STREET
MAST ARM TRAFFIC SIGNAL (EXIST)
INSERT 'P' (SEE DETAIL SHEET C1.6)
CROSSWALK (NIC/CBO)
BUILDING A (BASE BID) (SEE ARCH PLANS)
CONC RAMP (REQ'D)
TRAFFIC MARKINGS (EXIST) (TYP)
75 LF RET WALL W/ HANDRAIL (REQ'D) (SEE DETAILS)
CONC WALK (REQ'D)
PROPOSED SEWER LINE (SEE SHT C2.1)
44 LF 6' SECURITY FENCE (REQ'D)
SINGLE LEAF SLIDE GATE W/ GATE OPERATOR, KEYPAD & APPURT (REQ'D) (SEE DETAIL SHEETS 1.17 – 1.20)
STAMPED CONC WALK (REQ'D) (SEE DETAILS)
CONC RAMP (REQ'D)
CONC CURB & GUTTER (REQ'D)
RAISED CROSSWALK (REQ'D) (SEE DETAILS)
CONC PARKING LOT W/ STRIPING & INTEGRAL CURB (REQ'D) (SEE DETAILS)
EDWARDS STREET
CONC CURB & GUTTER (NIC/CBO)
RAISED CROSSWALK (NIC/CBO)
WATER CONNECTION (NIC/CBO)
UNDER CONSTRUCTION (NIC/CBO)
LIMITS OF WORK (ADD ALT1)
FIRE HYDRANT W/ APPURT (NIC/CBO)
TRAFFIC STRIPING (NIC/CBO)

GRAPHIC SCALE
20 0 10 20 40 80
(IN FEET)

SITE & UTILITY PLAN

PREPARED BY:
SDW Engineering Progress
301 Second Ave. | Hattiesburg, MS 39401 | p 601.544.1821 | f 601.544.1820 | sdwi.com
SDW Project No.: 15819 SDW Working No.: SP3

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

BID DOCUMENTS

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Client No:	------
Albert & Associates:	12575

C1.2

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com
Albert & McCleskey Associates Architects

SITE & UTILITY PLAN - NORTH BLOCK

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SIGN LEGEND		
KEY	DESCRIPTION	SIZE
A	PEDESTRIAN TRAFFIC (W11-2)	30"x30"

IRRIGATION SLEEVE NOTE:

IR — IR — DENOTES THE LOCATION THAT AN EMPTY PAIR OF IRRIGATION SLEEVES SHALL BE INSTALLED. (SEE DETAILS) LOCATIONS MAY BE FIELD ADJUSTED TO AVOID CONFLICTS WITH OTHER UTILITIES. IRRIGATION SYSTEM IS NOT A PART OF THIS PROJECT.

FIRE WATER SERVICE CONNECTION (NIC/CBO)
6" DI WATER LINE (FIRE) (NIC/CBO)
6" PIV (FIRE) (CAPPED FOR FUTURE) (NIC/CBO)
WATER SERVICE TAP (NIC/CBO)
1½" SERVICE TUBING (DOMESTIC) (NIC/CBO)
1½" WATER METER (CAPPED FOR FUTURE) (NIC/CBO)
WATER SERVICE TAP, 30 LF 3" SERVICE TUBING & 3" WATER METER (IRRIGATION) (CAPPED FOR FUTURE) (NIC/CBO)
PROPOSED WATER LINE (NIC/CBO)
PROPOSED SEWER LINE (NIC/CBO)
LIMITS OF WORK (BASE BID)
TRAFFIC STRIPING (NIC/CBO)
BUILDING E (SEE ARCH PLANS) (EXIST) (ADD ALT2)
BUILDING I (SEE ARCH PLANS) (ADD ALT2)
28 LF SLIDE GATE W/ GATE OPERATOR, KEYPAD & APPURT (REQ'D) (SEE DETAILS) (ADD ALT2)
SEE SHEET No. C1.2
MATCH LINE B
INSERT 'V' (SEE DETAIL SHEET C1.9)
KATIE AVENUE
INSERT 'R' (SEE DETAIL SHEET C1.7)
RAISED CROSSWALK (NIC/CBO)
CONC WALK (REQ'D)
CONC CURB & GUTTER (NIC/CBO)
CONC WALK (NIC/CBO)
UNDER CONSTRUCTION (NIC/CBO)
LIMITS OF WORK (ADD ALT2)
LIMITS OF WORK (ADD ALT1)
48 LF 6' SECURITY FENCE (REQ'D) (ADD ALT2)
INSERT 'S' (SEE DETAIL SHEET C1.7)
CONC WALK (NIC/CBO)
1½" WATER METER (CAPPED FOR FUTURE) (NIC/CBO)
WATER SERVICE TAP (NIC/CBO)
30 LF 1½" SERVICE TUBING (DOMESTIC) (REQ'D) (ADD ALT2)
14 LF 6' SECURITY FENCE (REQ'D) (ADD ALT2)
25 LF 6" DI WATER LINE (REQ'D) (FIRE)
6" PIV (FIRE) (CAPPED FOR FUTURE) (REQ'D)
FIRE WATER SERVICE CONNECTION (NIC/CBO)
INSERT 'Q' (SEE DETAIL SHEET C1.7)
1½" WATER METER (CAPPED FOR FUTURE) (NIC/CBO)
WATER SERVICE TAP (NIC/CBO)
23 LF 1½" SERVICE TUBING (DOMESTIC) (NIC/CBO)
CONNECT WATER SERVICE TO BUILDING (VERIFY LOCATION) (ADD ALT2)
CONNECT WATER SERVICES TO BUILDING (SEE PLUMB PLANS) (ADD ALT2)
BUILDING F (SEE ARCH PLANS) (ADD ALT2)
CONNECT WATER SERVICES TO BUILDING (SEE PLUMB PLANS)
BUILDING G (ADD ALT2)
ARLEDGE STREET
WHEEL STOP (SIDEWALK SIDES ONLY) (REQ'D) (TYP) (ADD ALT1)
STAMPED CONC WALK (REQ'D) (SEE DETAILS) (ADD ALT1)
35' SS FLAG POLE & BASED (REQ'D) (ADD ALT1)
SEWER LINE (NIC/CBO) (FUTURE)
CONC WALK (REQ'D)
CONC CURB & GUTTER (REQ'D)
INSERT 'O' (SEE DETAIL SHEET C1.6)
UTILITY POLE SHALL BE RELOCATED (REQ'D) (BY OWNER)
WHEEL STOP & SIGN (REQ'D) (ADD ALT2)
STRIPE OUT AREA (WHITE) (ADD ALT2)
PAVED ISLAND (REQ'D) (TYP THIS PARKING LOT) (ADD ALT1)
CONC WALK (REQ'D) (ADD ALT1)
ASPHALT PARKING LOT W/ STRIPING & CONC CURB & GUTTER (REQ'D) (SEE DETAILS) (ADD ALT1)
960 LF 6' SECURITY FENCE (TOTAL LENGTH) (REQ'D) (ADD ALT2)
ASPHALT PARKING LOT W/ STRIPING & CONC CURB & GUTTER (REQ'D) (SEE DETAILS) (ADD ALT2)
EDWARDS STREET
CONC WALK (REQ'D)
WATER SERVICE TAP (NIC) (FUTURE)
1½" SERVICE TUBING (DOMESTIC) (NIC) (FUTURE)
1½" WATER METER (NIC) (FUTURE)
DBL TRAFFIC STRIPE (NIC/CBO) (TYP)
CONC WALK (ADD ALT2)
INSERT 'U' (SEE DETAIL SHEET C1.8)
TRAFFIC ARROW (REQ'D) (TYP) (SEE DETAILS)
HC CURB CUT RAMP (NIC) (FUTURE)
BUILDING H (NIC) (FUTURE)
CONNECT WATER SERVICE TO BUILDING (NIC) (FUTURE)
INSERT 'Z' (THIS SHEET)
NO MARKINGS ON THIS LOT (TYP)
960 LF 6' SECURITY FENCE (TOTAL LENGTH) (REQ'D) (ADD ALT2)
FENCE (EXIST)
DITCH
WATER LINE (EXIST)
SEWER LINE (EXIST)
GAS LINE (EXIST)

ENLARGED SITE DETAIL 'Z'
SIDEWALK CONNECTION
SCALE: 1" = 4'

NORMAL CONC WALK (REQ'D)
SAW-CUT EXIST CONC WALK TO FULL DEPTH PRIOR TO REMOVAL (REQ'D)
CONC WALK (EXIST) (TO REMAIN)
NORMAL CONC CURB & GUTTER (REQ'D)
SAW-CUT EXIST CONC CURB & GUTTER TO FULL DEPTH PRIOR TO REMOVAL (REQ'D)
CONC CURB & GUTTER (EXIST) (TO REMAIN)

GRAPHIC SCALE
20 0 10 20 40 80
(IN FEET)

SITE & UTILITY PLAN

PREPARED BY:
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SDW Project No.: 15819 SDW Working No.: SP4

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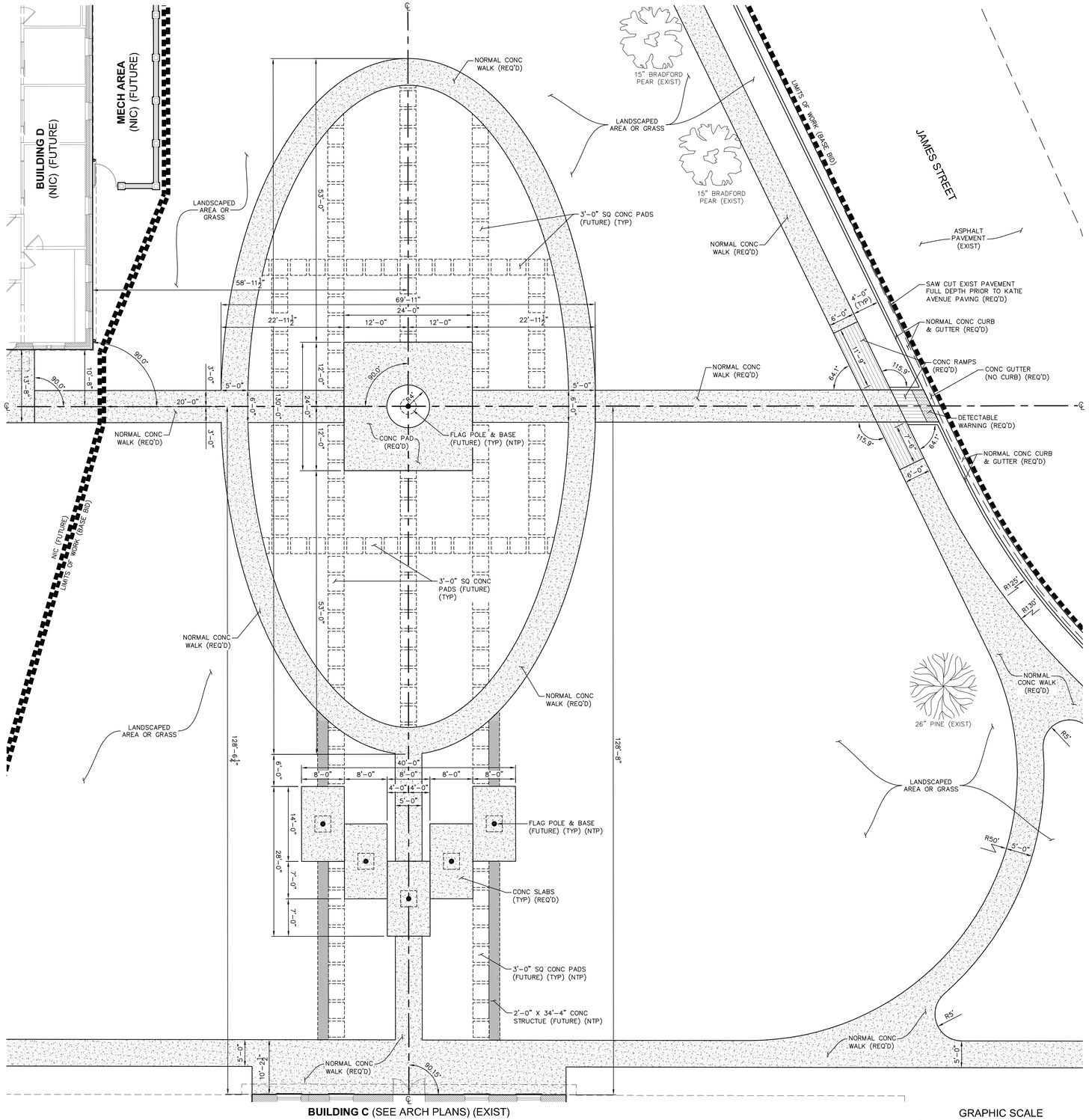
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Albert & Associates:	12575

C1.3

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SITE & UTILITY PLAN - SOUTH BLOCK

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BUILDING C (SEE ARCH PLANS) (EXIST)

ENLARGED SITE DETAIL 'A (BASE BID)

MEMORIAL PARK

SCALE: 1" = 10'

GRAPHIC SCALE

10 0 5 10 20 40

(IN FEET)

MEMORIAL PARK PLAN

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Albert & Associates: 12575

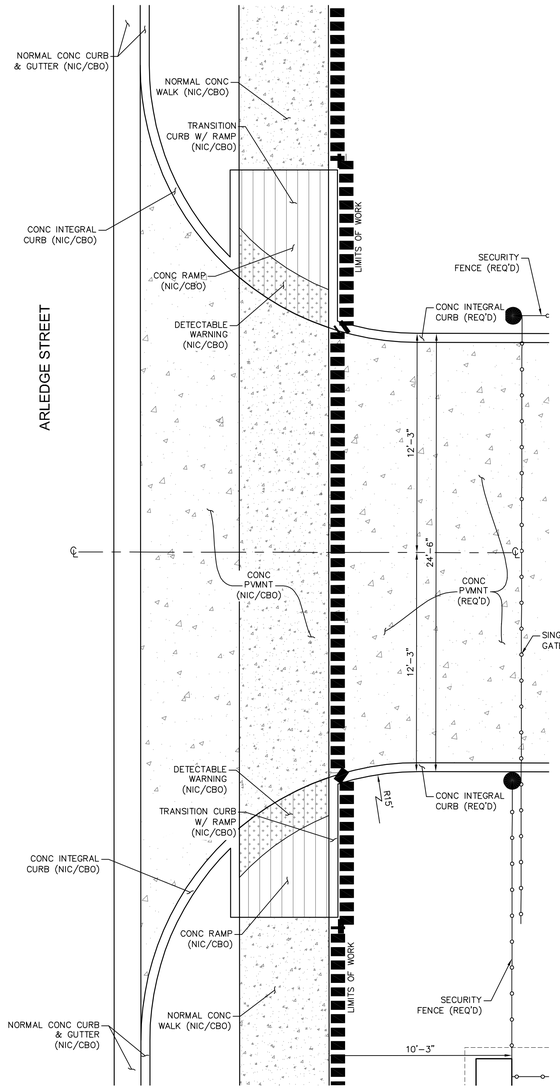
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PREPARED BY:
SDW Engineering Progress
39 Stovall Ave. | Hattiesburg, MS 39402 | p (601)544.1821 | f (601)544.2507 | sdw-usa.com
SDW Project No.: 15819 SDW Working No.: SP5

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SITE PLAN DETAIL
MEMORIAL PARK

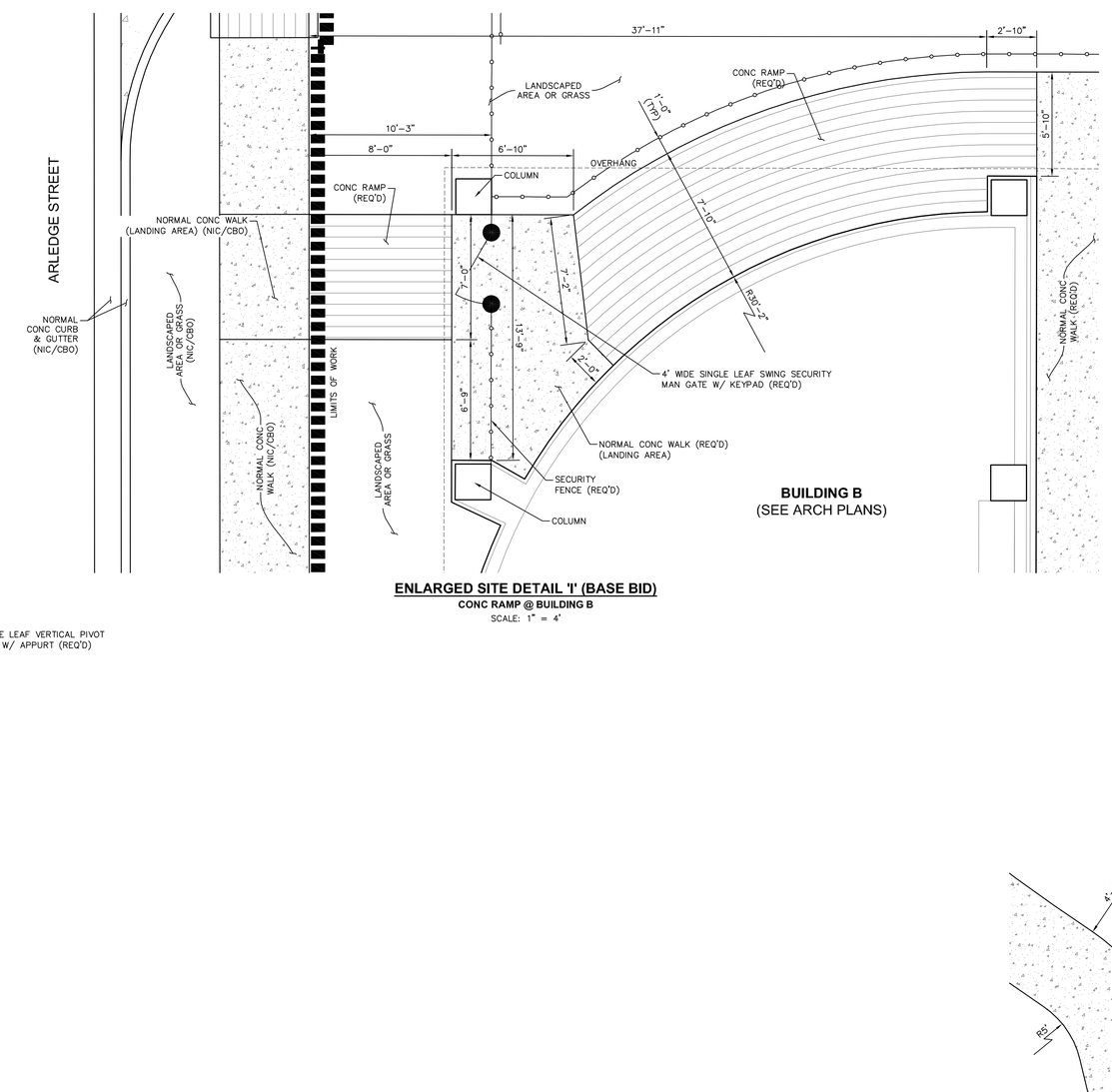
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ENLARGED SITE DETAIL 'H' (BASE BID)

CONC LOADING DOCK DRIVEWAY & CURB RAMPS

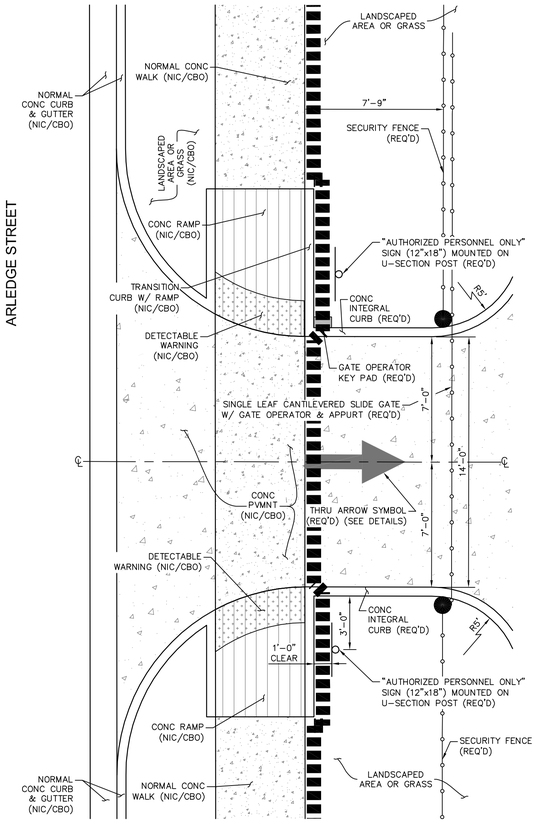
SCALE: 1" = 4'



ENLARGED SITE DETAIL 'I' (BASE BID)

CONC RAMP @ BUILDING B

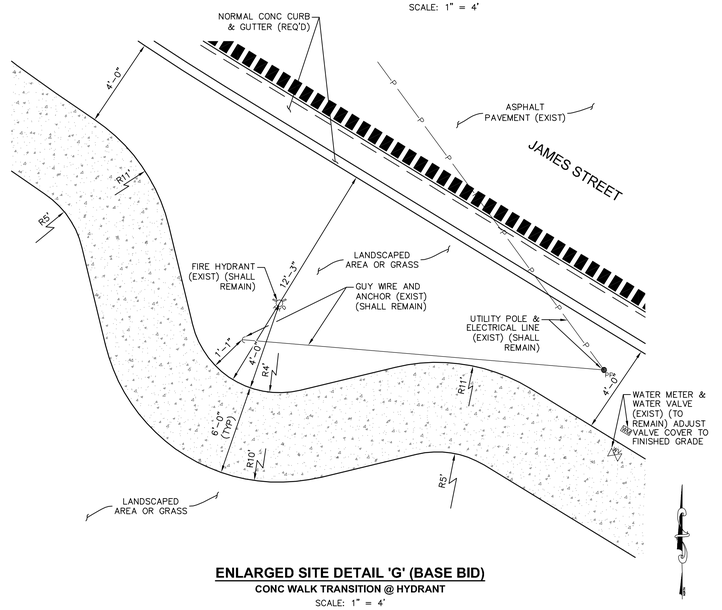
SCALE: 1" = 4'



ENLARGED SITE DETAIL 'J' (BASE BID)

SECURED PARKING ACCESS DRIVE & CURB RAMPS

SCALE: 1" = 4'



ENLARGED SITE DETAIL 'G' (BASE BID)

CONC WALK TRANSITION @ HYDRANT

SCALE: 1" = 4'

SITE DETAILS

PREPARED BY:

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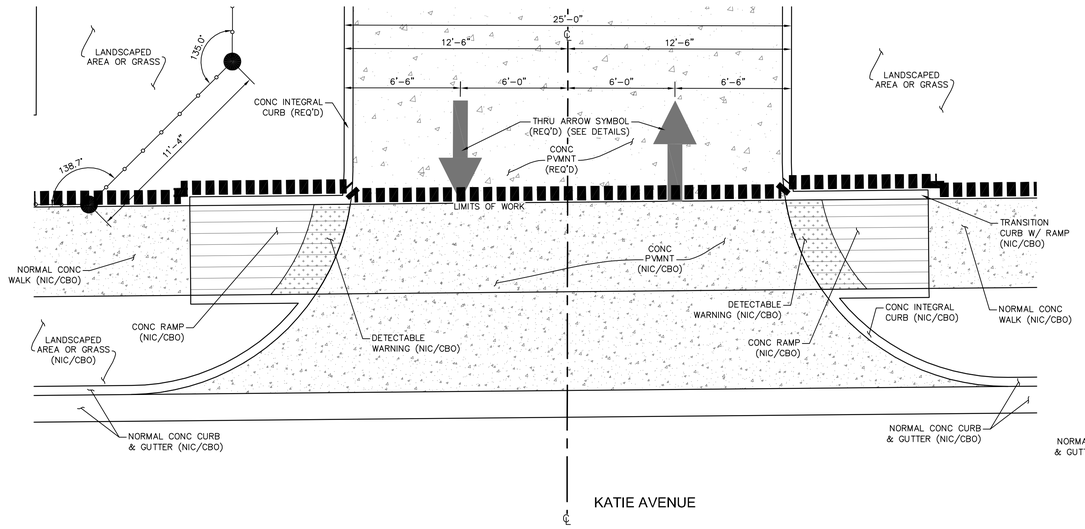
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Albert & Associates:	12575

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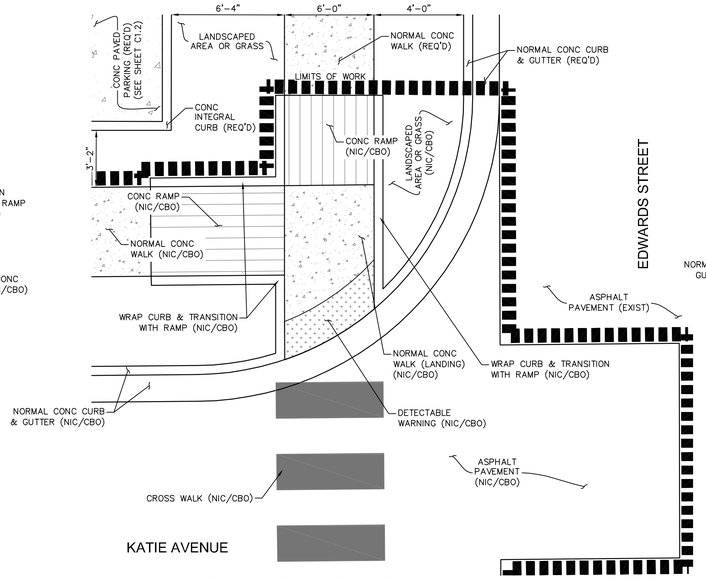
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SITE PLAN DETAILS

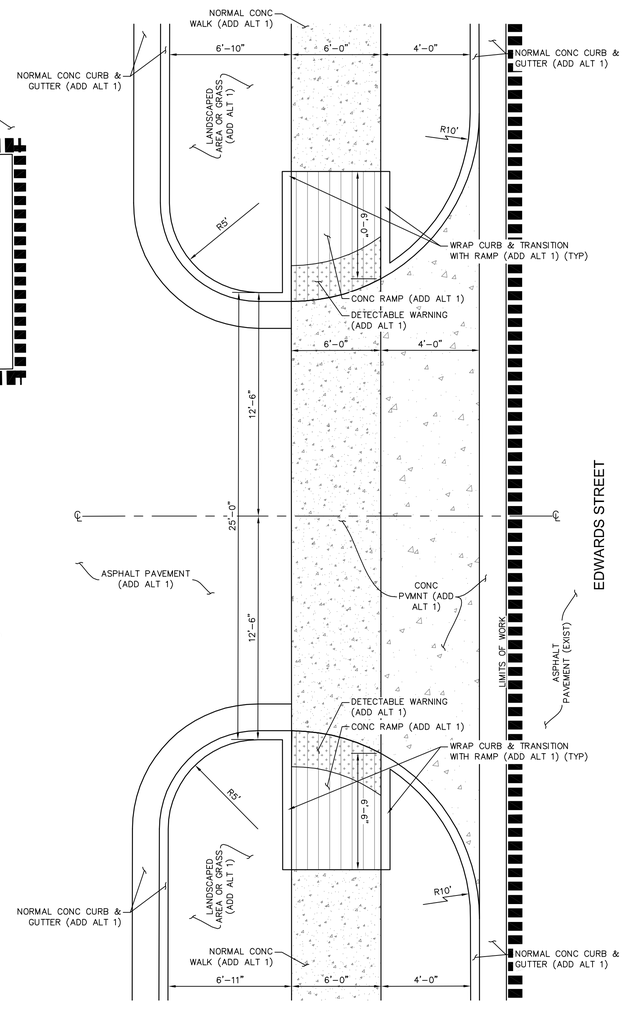
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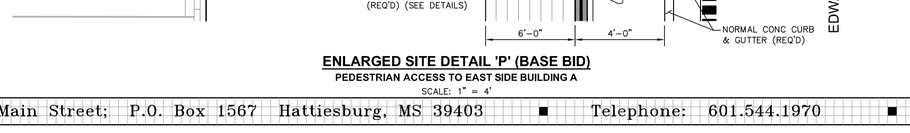
ENLARGED SITE DETAIL 'L' (BASE BID)
NORTH BLOCK PARKING INGRESS/EGRESS DRIVE
SCALE: 1" = 4'



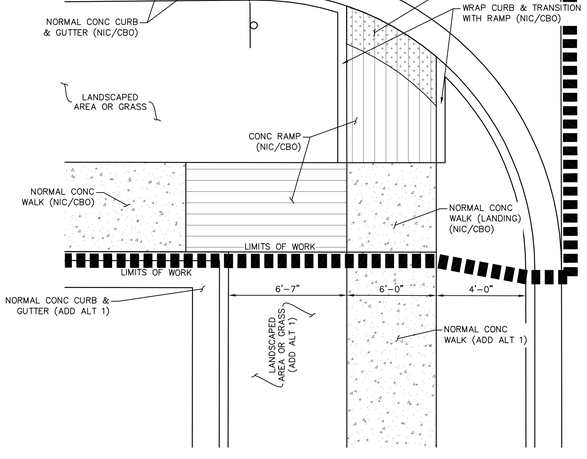
ENLARGED SITE DETAIL 'M' (BASE BID)
NW CURB RAMP @ THE INTERSECTION OF KATIE & EDWARDS
SCALE: 1" = 4'



ENLARGED SITE DETAIL 'O' (ADD ALT 1)
PUBLIC PARKING ACCESS DRIVE (EAST ENTRANCE)
SCALE: 1" = 4'



ENLARGED SITE DETAIL 'P' (BASE BID)
PEDESTRIAN ACCESS TO EAST SIDE BUILDING A
SCALE: 1" = 4'



ENLARGED SITE DETAIL 'N' (ADD ALT 1)
SW CURB RAMP @ THE INTERSECTION OF KATIE & EDWARDS
SCALE: 1" = 4'

SITE DETAILS

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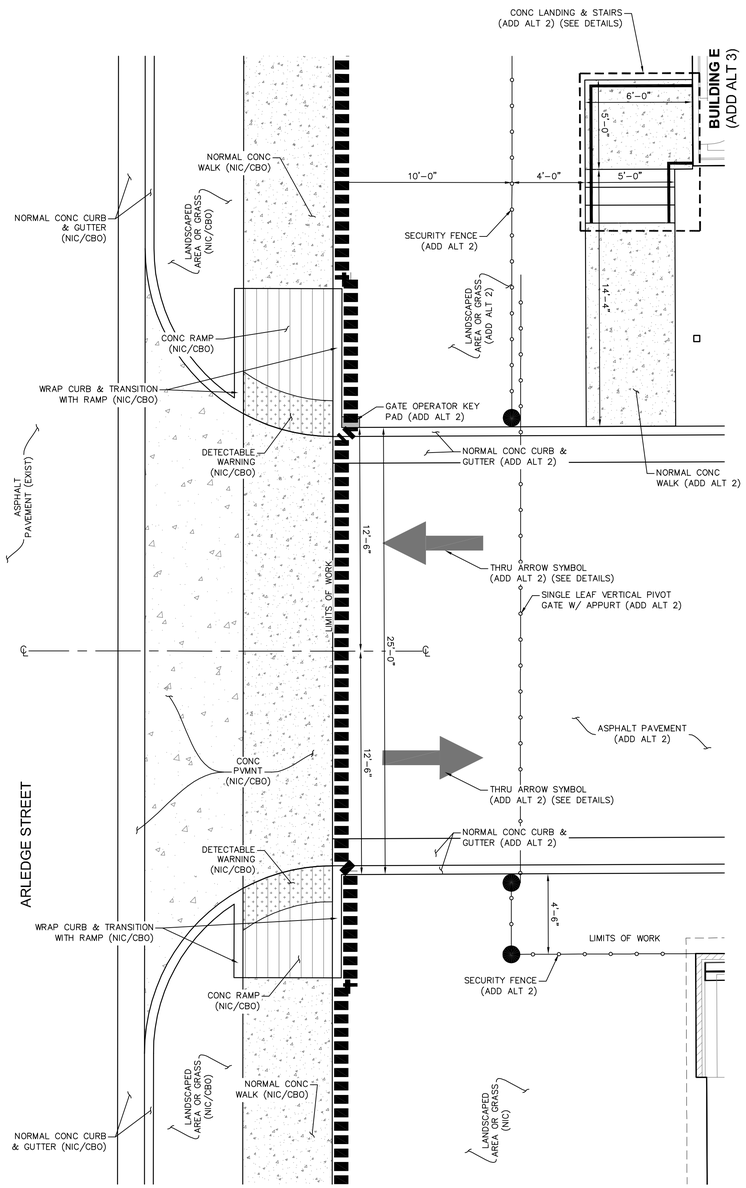
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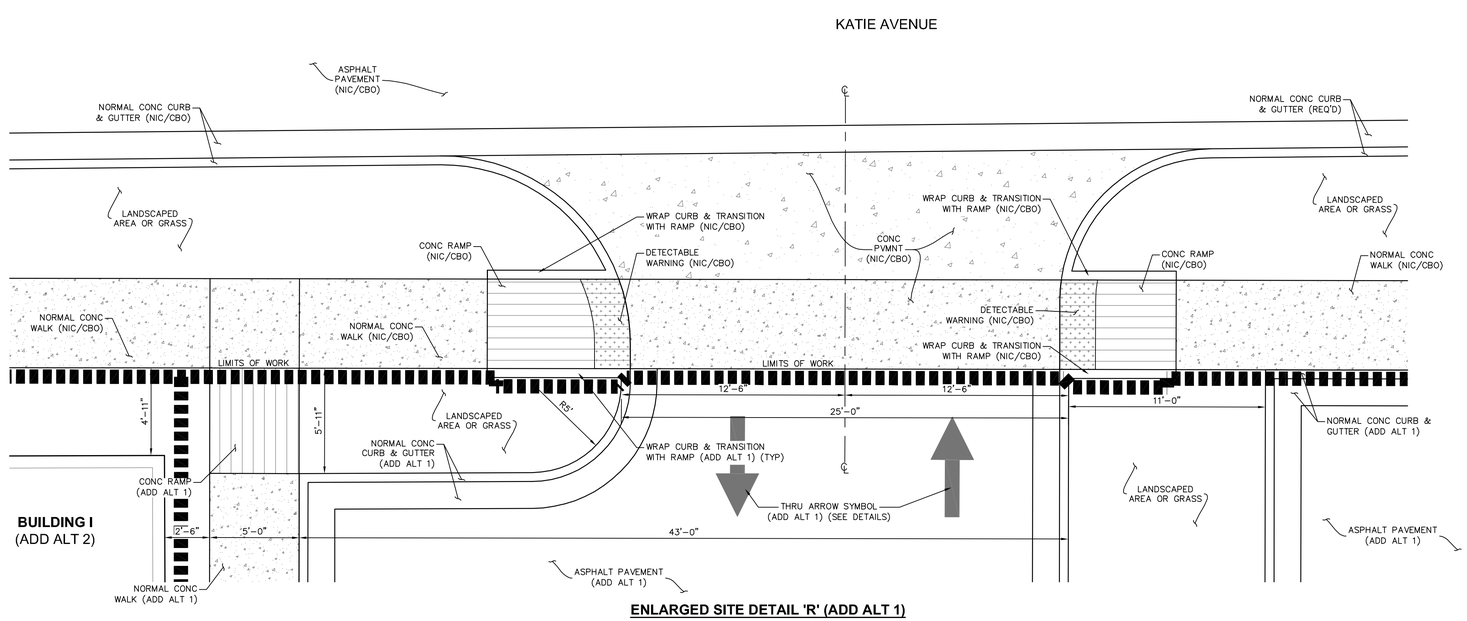
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SITE PLAN DETAILS

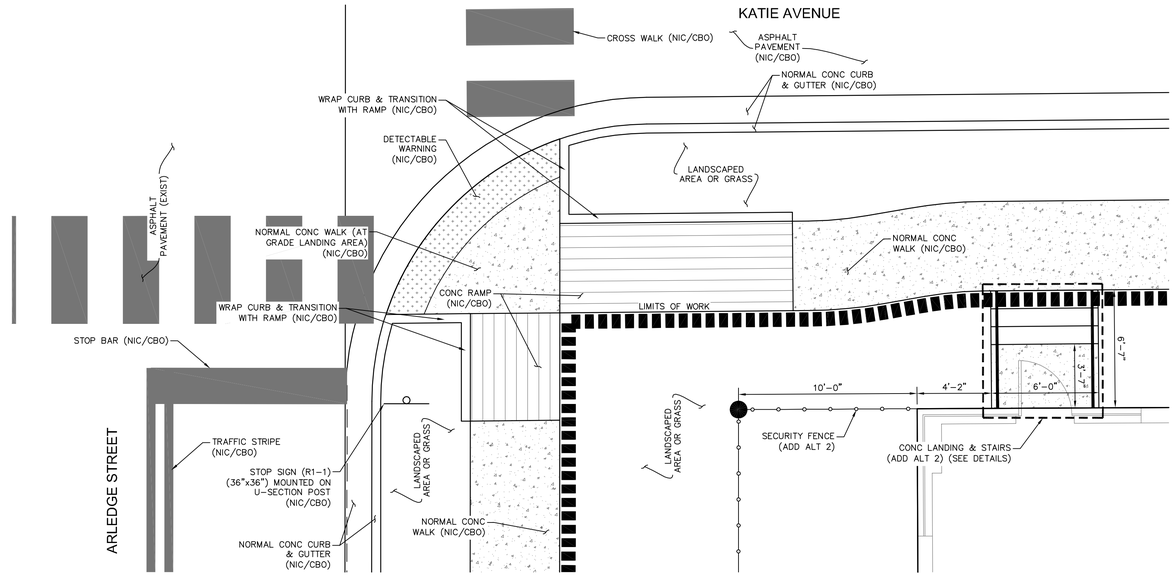
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ENLARGED SITE DETAIL 'Q' (ADD ALT 2)
SOUTH BLOCK AREA ACCESS DRIVE (WEST ENTRANCE)
SCALE: 1" = 4'



ENLARGED SITE DETAIL 'R' (ADD ALT 1)
PUBLIC PARKING ACCESS DRIVE (NORTH ENTRANCE)
SCALE: 1" = 4'



ENLARGED SITE DETAIL 'S' (ADD ALT 2)
SE CURB RAMP @ THE INTERSECTION OF KATIE & ARLEDGE
SCALE: 1" = 4'

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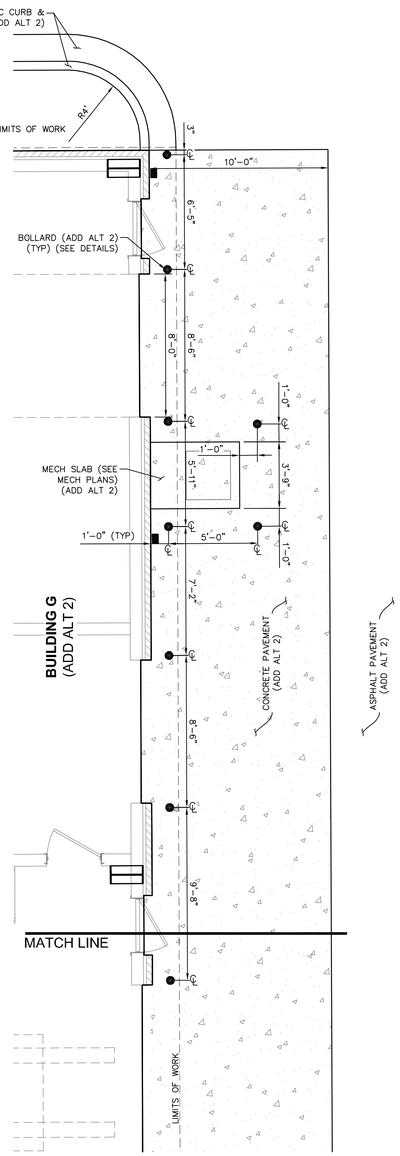
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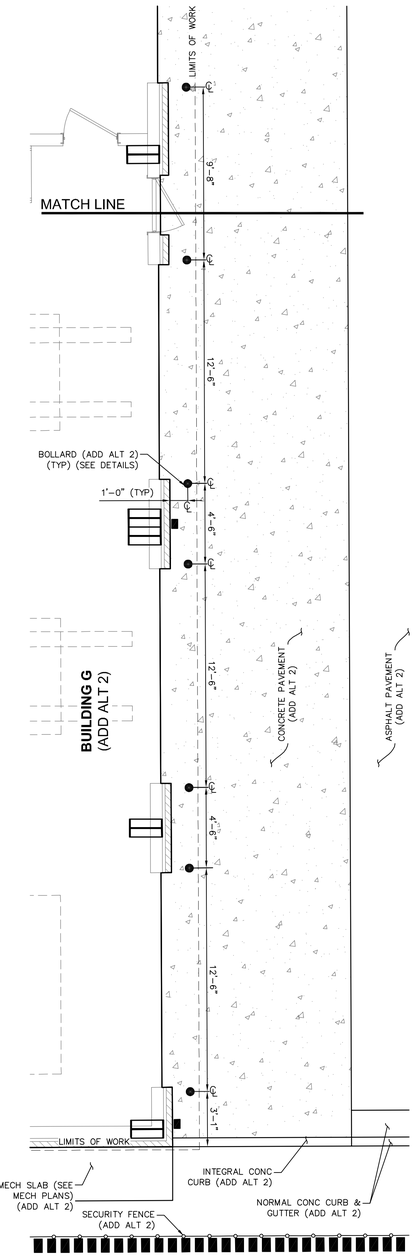
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ENLARGED SITE DETAIL 'U' (ADD ALT 2)

APRON AT BUILDING G

SCALE: 1" = 4'

SITE DETAILS

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Albert & Associates:	12575

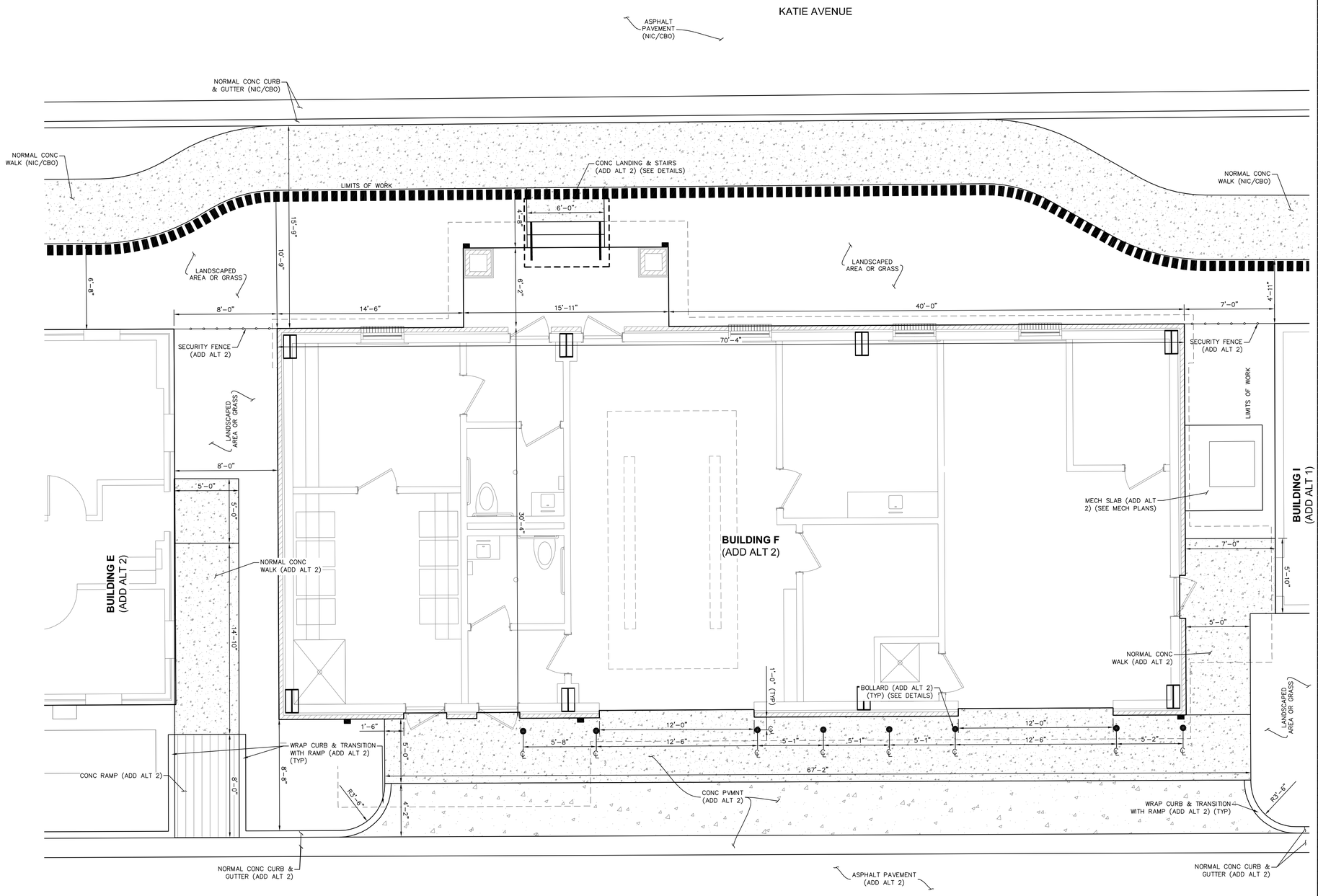
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ENLARGED SITE DETAIL 'V' (ADD ALT 2)

BUILDING F DRIVE APRON & WALK

SCALE: 1" = 4'

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Albert & Associates: 12575	

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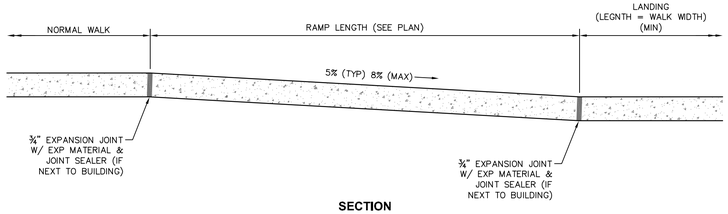
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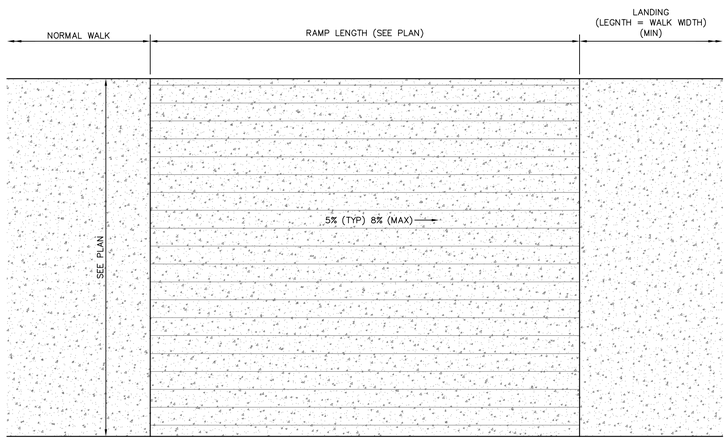
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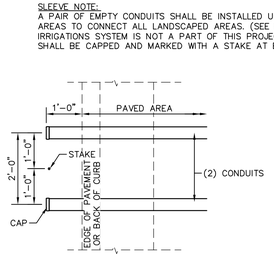


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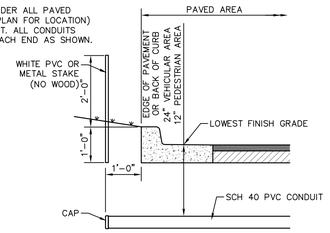
TYPICAL CONCRETE WALK RAMP DETAIL

SCALE: 1" = 1'

SLEEVE NOTE:
A PAIR OF EMPTY CONDUITS SHALL BE INSTALLED UNDER ALL PAVED AREAS TO CONNECT ALL LANDSCAPED AREAS. (SEE PLAN FOR LOCATION) IRRIGATIONS SYSTEM IS NOT A PART OF THIS PROJECT. ALL CONDUITS SHALL BE CAPPED AND MARKED WITH A STAKE AT EACH END AS SHOWN.



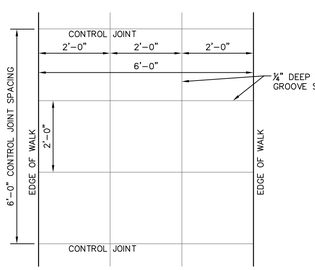
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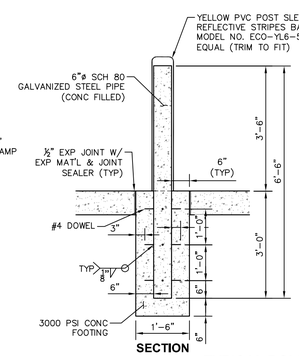
TYPICAL IRRIGATION SLEEVE INSTALLATION DETAIL

SCALE: 1" = 2'

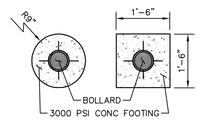


TYPICAL STAMPED CONCRETE WALK DETAIL

SCALE: 1" = 2"



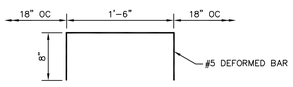
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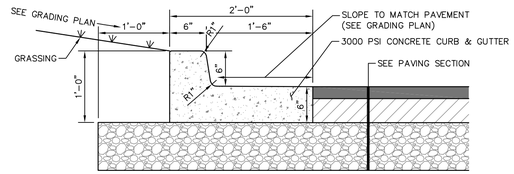
TYPICAL BOLLARD DETAIL

SCALE: 1" = 2'



BAR U

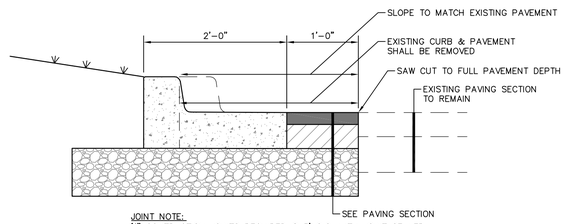
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JOINT NOTE:
½" CONTRACTION JOINTS REQUIRED @ 5' O.C. WITH JOINT SEALER
¾" EXPANSION JOINTS REQUIRED @ 25' O.C. WITH ¾" EXPANSION MATERIAL & JOINT SEALER, UNLESS OTHERWISE DIRECTED BY THE ENGINEER.

TYPICAL CONCRETE CURB & GUTTER SECTION DETAIL

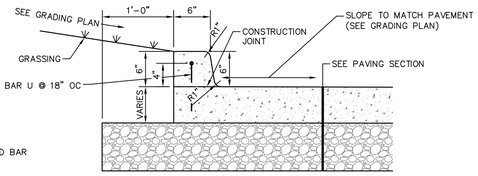
SCALE: 1" = 1'



JOINT NOTE:
½" CONTRACTION JOINTS REQUIRED @ 5' O.C. WITH JOINT SEALER
¾" EXPANSION JOINTS REQUIRED @ 25' O.C. WITH ¾" EXPANSION MATERIAL & JOINT SEALER, UNLESS OTHERWISE DIRECTED BY THE ENGINEER.

TYPICAL CONCRETE CURB & GUTTER SECTION ALONG EXISTING ROADWAY DETAIL

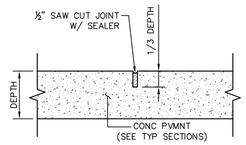
SCALE: 1" = 1'



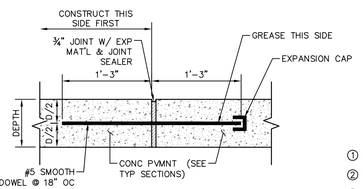
JOINT NOTE:
½" CONTRACTION JOINTS REQUIRED @ 5' O.C. WITH JOINT SEALER
¾" EXPANSION JOINTS REQUIRED @ 25' O.C. WITH ¾" EXPANSION MATERIAL & JOINT SEALER, UNLESS OTHERWISE DIRECTED BY THE ENGINEER.

TYPICAL CONCRETE INTEGRAL CURB SECTION DETAIL

SCALE: 1" = 1'



CONTROL JOINT

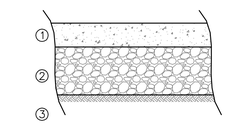


SPACING NOTE:
TYPICALLY: EVERY THIRD JOINT UNLESS NOTED OTHERWISE.
SPECIFICALLY: EDGE OF CHANGE IN PAVEMENT TYPE, DEPTH, SLOPE, OR ADJACENT TO STRUCTURE(S), UNLESS OTHERWISE NOTED.
NO DOWELS SHALL BE PLACED IN JOINTS ADJACENT TO STRUCTURES

EXPANSION JOINT

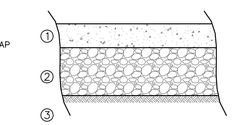
TYPICAL PAVEMENT JOINT DETAILS

NOT TO SCALE



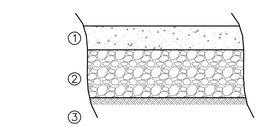
① 5" DEPTH NON-REINFORCED 3500 PSI CONCRETE
② 8" DEPTH SCARIFIED EXISTING SUBGRADE & RE-COMPACTED TO 100%
③ EXISTING SUBGRADE

LIGHT DUTY CONCRETE (LDC1)



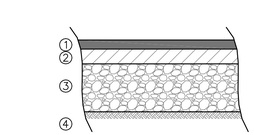
① 5" DEPTH NON-REINFORCED 3500 PSI CONCRETE
② 8" DEPTH GRANULAR MATERIAL (CL 9, GP B) COMPACTED TO 98%
③ EXISTING SUBGRADE COMPACTED TO 95%

LIGHT DUTY CONCRETE (LDC2)



① 7" DEPTH NON-REINFORCED 3500 PSI CONCRETE
② 8" DEPTH GRANULAR MATERIAL (CL 9, GP B) COMPACTED TO 98%
③ EXISTING SUBGRADE COMPACTED TO 95%

HEAVY DUTY CONCRETE (HDC1)



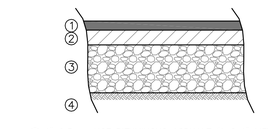
① 1½" 9.5mm HOT BITUMINOUS ASPHALT (1 @ 1½" LIFTS)
② 5½" 19mm HOT BITUMINOUS ASPHALT (2 @ 2¾" LIFTS)
③ 8" DEPTH GRANULAR MATERIAL (CL 9, GP B) COMPACTED TO 98%
④ EXISTING SUBGRADE COMPACTED TO 95%

HEAVY DUTY ASPHALT (HDA1)

COMPACTION NOTE:
ALL COMPACTION NOTED IN THE PAVING SECTIONS HEREON SHALL BE TO STANDARD PROCTOR

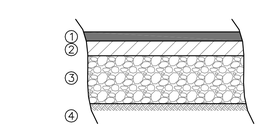
TYPICAL PAVEMENT SECTIONS

NOT TO SCALE



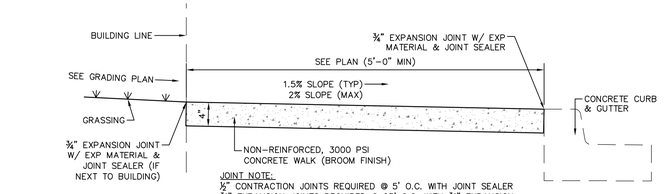
① 1" 9.5mm HOT BITUMINOUS ASPHALT (1 @ 1" LIFTS)
② 3½" 19mm HOT BITUMINOUS ASPHALT (1 @ 3½" LIFTS)
③ 8" DEPTH SCARIFIED EXISTING SUBGRADE & RE-COMPACTED TO 100%
④ EXISTING SUBGRADE

LIGHT DUTY ASPHALT (LDA1)



① 1½" 9.5mm HOT BITUMINOUS ASPHALT (1 @ 1½" LIFTS)
② 3½" 19mm HOT BITUMINOUS ASPHALT (1 @ 3½" LIFTS)
③ 8" DEPTH GRANULAR MATERIAL (CL 9, GP B) COMPACTED TO 98%
④ EXISTING SUBGRADE COMPACTED TO 95%

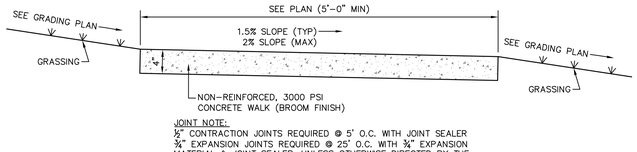
LIGHT DUTY ASPHALT (LDA2)



JOINT NOTE:
½" CONTRACTION JOINTS REQUIRED @ 5' O.C. WITH JOINT SEALER
¾" EXPANSION JOINTS REQUIRED @ 25' O.C. WITH ¾" EXPANSION MATERIAL & JOINT SEALER, UNLESS OTHERWISE DIRECTED BY THE ENGINEER.

TYPICAL CONCRETE WALK AT BUILDING AND/OR CURB SECTION DETAIL

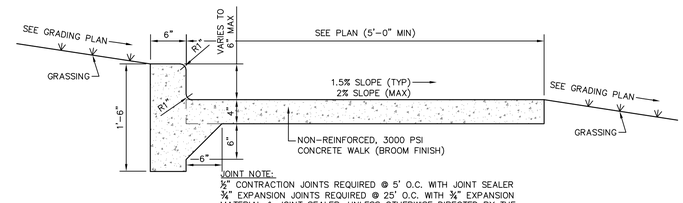
SCALE: 1" = 1'



JOINT NOTE:
½" CONTRACTION JOINTS REQUIRED @ 5' O.C. WITH JOINT SEALER
¾" EXPANSION JOINTS REQUIRED @ 25' O.C. WITH ¾" EXPANSION MATERIAL & JOINT SEALER, UNLESS OTHERWISE DIRECTED BY THE ENGINEER.

TYPICAL CONCRETE WALK SECTION DETAIL

SCALE: 1" = 1'



JOINT NOTE:
½" CONTRACTION JOINTS REQUIRED @ 5' O.C. WITH JOINT SEALER
¾" EXPANSION JOINTS REQUIRED @ 25' O.C. WITH ¾" EXPANSION MATERIAL & JOINT SEALER, UNLESS OTHERWISE DIRECTED BY THE ENGINEER.

TYPICAL CONCRETE WALK WITH ATTACHED CURB SECTION DETAIL (FOR USE AT RAMPS)

SCALE: 1" = 1'

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

BID DOCUMENTS

Drawing Issued:

Date	Rev.	Description
10-31-2015		65% Check Set
12-18-2015		95% Check Set
11-19-2018		Bid Documents

Drawn By:	RES
Checked By:	SEM
Client No:	------
Albert & Associates:	12575

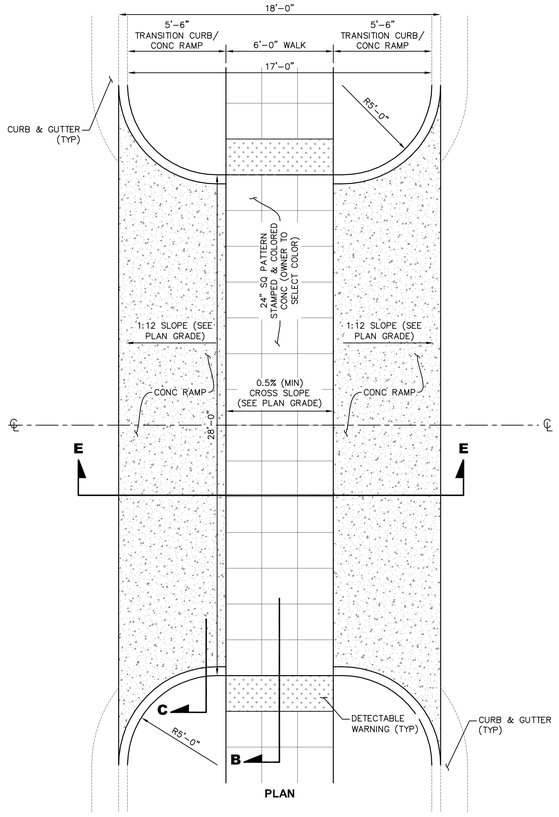
C1.10

PREPARED BY:
SDW Engineering Progress
329 Second Ave. | Hattiesburg, MS. 39401 | p.) 601.544.1821 | f.) 601.544.0501 | sdw.com
SDW Project No.: 15819 SDW Working No.:GSD1

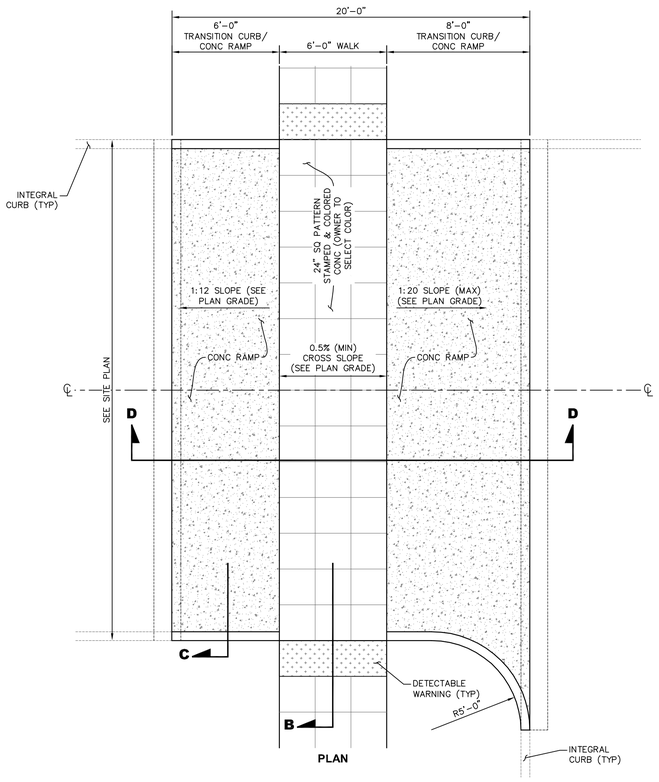
514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com
Albert & McCleskey Associates Architects

GENERAL SITE DETAILS PAVEMENT

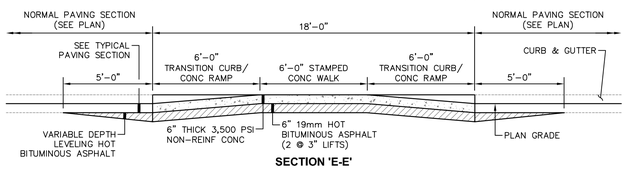
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PLAN



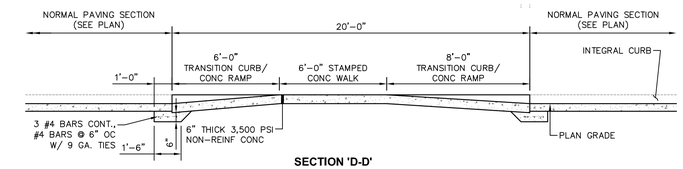
PLAN



SECTION 'E-E'

RAISED CROSSWALK DETAIL FOR SOUTH BLOCK PARKING (ADD ALT. 1)

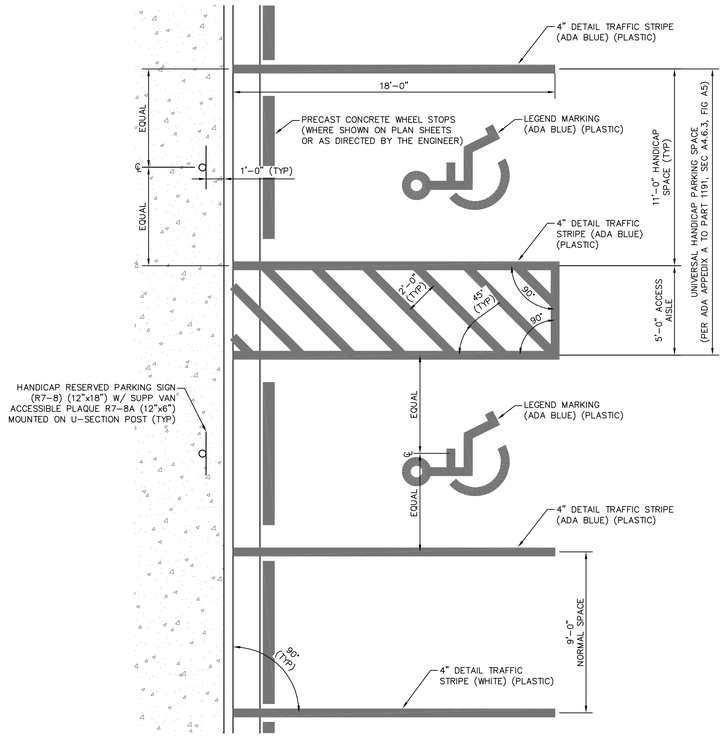
SCALE: 1" = 4'



SECTION 'D-D'

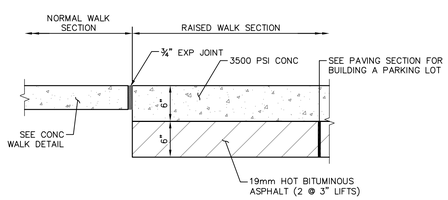
RAISED CROSSWALK DETAIL BUILDING A PARKING

SCALE: 1" = 4'



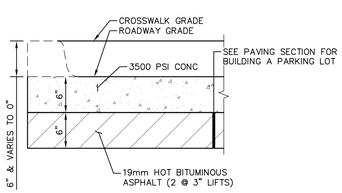
TYPICAL PERPENDICULAR PARKING PAVEMENT MARKING DETAIL

SCALE: 1" = 4'



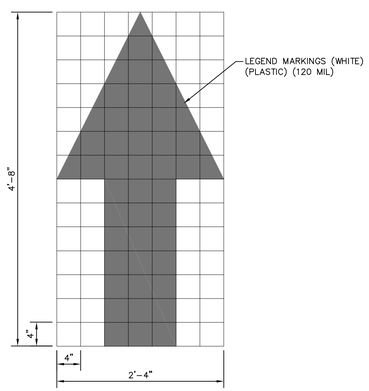
SECTION B-B

SCALE: NONE



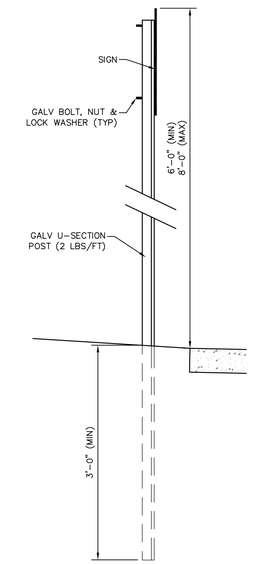
SECTION C-C

SCALE: NONE



TYPICAL TRAFFIC ARROW MARKING DETAIL

SCALE: 1" = 1'



TYPICAL SIGN INSTALLATION SECTION DETAIL

SCALE: 1" = 1'

PREPARED BY:

SDW Engineering Progress
39 Grand Ave. | Hattiesburg, MS 39401 | p (601.544.1821) f (601.544.2501) sdw.com

SDW Project No.: 15819 SDW Working No.: GSD2

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

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Drawing Issued:

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11-19-2018		Bid Documents

Drawn By:	RES
Checked By:	SEM
Client No:	------
Albert & Associates: 12575	

C1.11

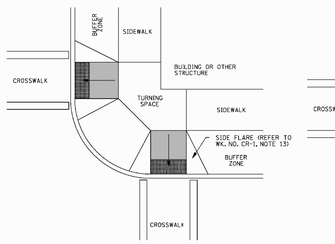
514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com

Albert & McCleskey Associates Architects

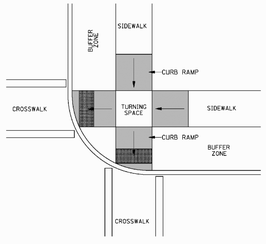
GENERAL SITE DETAILS

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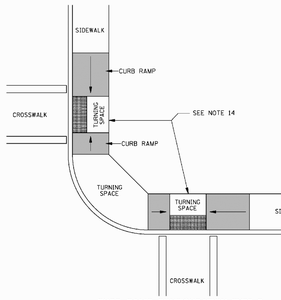
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CURB RAMP CONFIGURATION: TYPE A



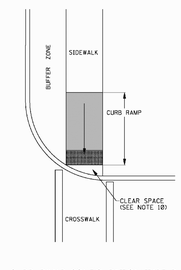
CURB RAMP CONFIGURATION: TYPE B



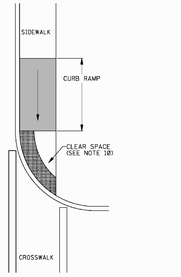
CURB RAMP CONFIGURATION: TYPE C

GENERAL NOTES:

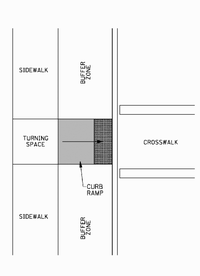
1. FOR DIMENSIONS & GEOMETRIC VALUES REFER TO MK. NO. CR-1.
2. THE CONFIGURATIONS SHOWN GENERALLY REPRESENT THE MOST COMMON SITUATIONS ENCOUNTERED. THEY ARE INTENDED TO PRESENT CURB RAMP DESIGN CONCEPTS. SITE CONDITIONS AT INDIVIDUAL LOCATIONS REQUIRE SPECIFIC DESIGNS. CURB RAMP DESIGNS MUST BE CONSISTENT WITH THE PROVISIONS OF MK. NOS. CR-1, CR-2, CR-3 AND CR-4.
3. COORDINATE TRAFFIC CONTROL DEVICES, UTILITY LOCATIONS, SIGNS, LIGHTING, DRAINAGE INLETS, ETC. WITH THE LOCATIONS OF PEDESTRIAN ACCESS ROUTE AT ALL CURB RAMP LOCATIONS. GUIDANCE FOR CROSSWALK MARKINGS AND TRAFFIC CONTROL DEVICES IS PROVIDED IN THE MUTCD.
4. DETECTABLE WARNINGS SHOWN ON THIS SHEET ARE FOR ILLUSTRATION ONLY. FOR SPECIFIC PLACEMENT ORIENTATIONS AND DIMENSIONS REFER TO MK. NO. CR-4.
5. THE CROSS SLOPE OF CURB RAMPS, BLENDED TRANSITIONS, AND TURNING SPACES SHALL BE 2% MAXIMUM (1.5% PREFERRED). AT PEDESTRIAN STREET CROSSINGS WITHOUT YIELD OR STOP CONTROL AND AT MIDBLOCK PEDESTRIAN STREET CROSSINGS, THE CROSS SLOPE SHALL BE PERMITTED TO EQUAL THE STREET OR HIGHWAY GRADE.
6. DIAGONAL CURB RAMPS ARE UNACCEPTABLE IN NEW CONSTRUCTION, THEY MAY BE USED FOR ALTERATIONS ONLY IF IT IS THE ONLY OPTION THAT WILL WORK.
7. GRATES SHALL NOT BE LOCATED ON CURB RAMPS, BLENDED TRANSITIONS, TURNING SPACES, OR LANDINGS. ACCESS COVERS OF SIMILAR SURFACES SHALL COMPLY WITH APPLICABLE SURFACE REQUIREMENTS.
8. UTILITIES, SIGNS, AND OTHER FIXED OBJECTS SHALL NOT BE PLACED ON A CURB RAMP, BLENDED TRANSITION, OR IN A MANNER THAT INTERFERES WITH THE USE OF THE CURB RAMP.
9. THE SURFACE OF ALL CURB RAMPS SHALL BE STABLE, FIRM, AND SLIP RESISTANT. A COARSE BROOM FINISH RUNNING PERPENDICULAR TO THE SLOPE IS RECOMMENDED ON CONCRETE RAMP SURFACES, EXCLUSIVE OF THE DETECTABLE WARNING FIELDS.
10. THERE SHALL BE A CLEAR SPACE AT THE BOTTOM OF THE ALTERNATE PERPENDICULAR RETURNED CURB RAMP. IT SHALL SLOPE TO DRAIN RUNOFF TO STREET/GUTTER AND HAVE A MAXIMUM SLOPE OF 2% (1.5% PREFERRED).
11. TURNING SPACES MAY OVERLAP WITH ADJACENT TURNING SPACES OR A SINGLE TURNING SPACE MAY SERVE MULTIPLE CURB RAMPS.
12. TURNING SPACES MAY OVERLAP WITH THE CLEAR GROUND SPACE REQUIRED AT PEDESTRIAN SIGNAL PUSH BUTTONS.
13. THE CLEAR WIDTH OF PEDESTRIAN ACCESS ROUTES WITHIN MEDIANS AND PEDESTRIAN REFUGE ISLANDS SHALL BE 5' MINIMUM.
14. BEYOND THE BOTTOM GRADE BREAK, A TURNING SPACE OF 4' MINIMUM BY 4' MINIMUM SHALL BE PROVIDED WITHIN THE WIDTH OF THE PEDESTRIAN STREET CROSSING AND WHOLLY OUTSIDE THE PARALLEL VEHICLE TRAVEL LANE.



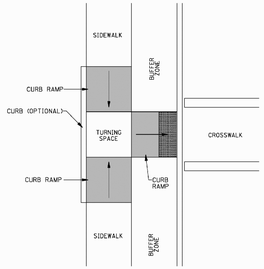
CURB RAMP CONFIGURATION: TYPE D



CURB RAMP CONFIGURATION: TYPE E



CURB RAMP CONFIGURATION: TYPE F



CURB RAMP CONFIGURATION: TYPE G
MID BLOCK CROSSING

THE CURB BEHIND THE TURNING SPACE AND RAMPS IS NOT REQUIRED BUT IS SUGGESTED FOR RETAINING SOIL, AND PROVIDING AN EDGE FOR PEDESTRIANS WITH VISUAL IMPAIRMENTS.

NOTE: SEE MK. NO. CR-4 FOR DETECTABLE WARNING DIMENSIONS AND PLACEMENT ORIENTATION.

BY	DESCRIPTION	DATE

MISSISSIPPI DEPARTMENT OF TRANSPORTATION
ROADWAY DESIGN DIVISION
STANDARD PLAN

CURB RAMPS PLACEMENT DETAILS

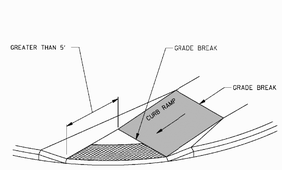
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WORKING NUMBER CR-2

ISSUE DATE: AUGUST 01, 2017

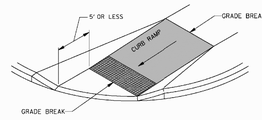
SHEET NUMBER 6422

STATE	PROJECT NO.
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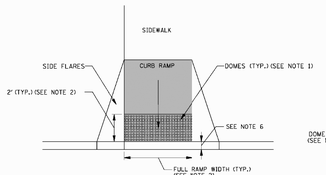
DETECTABLE WARNING PLACEMENT DETAIL 1

NOTE: IF THE DISTANCE FROM THE GRADE BREAK IS GREATER THAN OF EQUAL TO 5', DETECTABLE WARNINGS SHALL BE PLACED ALONG THE RADIUS OF THE CURVE AS SHOWN IN THE ABOVE DETAIL.

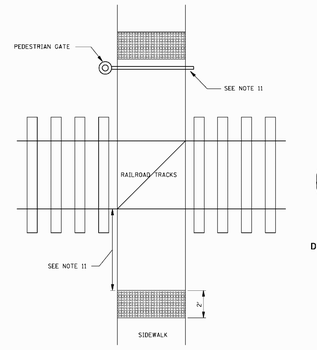


DETECTABLE WARNING PLACEMENT DETAIL 2

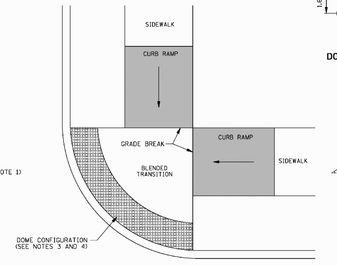
NOTE: IF THE DISTANCE FROM THE GRADE BREAK IS LESS THAN OR EQUAL TO 5', DETECTABLE WARNINGS SHALL BE PLACED ON THE CURB RAMP ALONG THE BOTTOM GRADE BREAK WITH ONE CORNER 5' TO 6' FROM THE FRONT OF THE CURB OR EDGE OF THE ROADWAY.



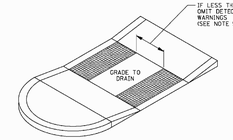
DETECTABLE WARNING AT CURB RAMP



DETECTABLE WARNINGS AT RAILROAD CROSSING



DETECTABLE WARNING AT BLENDED TRANSITION (CONFIGURATION: TYPES K AND J)

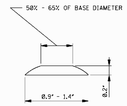


DETECTABLE WARNINGS AT MEDIAN ISLANDS

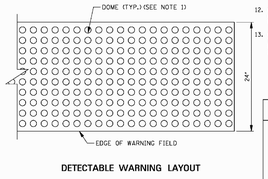
NON-ELEVATED CROSSING



DOME SPACING



DOME SECTION



DETECTABLE WARNING LAYOUT

GENERAL NOTES:

1. THE DETAILS PROVIDED ARE NOT DRAWN TO SCALE. THE QUANTITY OF DOMES DEPICTED ON THE DETECTABLE WARNING UNIT (THE DOMES AND THE ENTIRE 2' LEVEL SURFACE) IS FOR ILLUSTRATION ONLY.
2. ALL DETECTABLE WARNINGS SHOWN ON THIS SHEET SHALL BE PAID FOR - PER SQUARE FEET, UNLESS OTHERWISE NOTED IN THE PLANS.

DETECTABLE WARNING UNIT DIMENSIONS:

3. DETECTABLE WARNING SURFACES SHALL EXTEND 2' MINIMUM IN THE DIRECTION OF PEDESTRIAN TRAVEL. AT CURB RAMPS AND BLENDED TRANSITIONS, DETECTABLE WARNING SURFACES SHALL EXTEND THE FULL WIDTH OF THE RAMP RUN (EXCLUDING ANY FLARED SIDES), BLENDED TRANSITION, OR TURNING SPACES. AT PEDESTRIAN AT-GRADE RAIL CROSSINGS NOT LOCATED WITHIN A STREET OR HIGHWAY, DETECTABLE WARNINGS SHALL EXTEND THE FULL WIDTH OF THE PUBLIC USE AREAS OF THE PLATFORM, AT BOARDING AND ALIGHTING AREAS, DETECTABLE WARNING SURFACES SHALL EXTEND THE FULL LENGTH OF THE PUBLIC USE AREAS OF THE PLATFORM, AT BOARDING AND ALIGHTING AREAS AT SIDEWALK OR STREET LEVEL TRANSIT STOPS FOR RAIL VEHICLES, DETECTABLE WARNING SURFACES SHALL EXTEND THE FULL LENGTH OF THE TRANSIT STOP.

DOME ALIGNMENT:

4. THE ROWS OF DOMES SHALL BE ALIGNED TO BE PERPENDICULAR OR RADIAL TO THE GRADE BREAK AT THE RAMP LANDING OR BETWEEN THE CURB RAMP AND THE STREET.
5. WHERE DOMES ARE ARRAYED RADIALLY THEY MAY DIFFER IN DOME DIAMETER AND CENTER-TO-CENTER SPACING WITHIN THE RANGES SPECIFIED ON THIS SHEET.

COLOR REQUIREMENTS:

6. DETECTABLE WARNING SURFACES SHALL CONTRAST VISUALLY WITH ADJACENT GUTTER, STREET OR HIGHWAY, OR PEDESTRIAN ACCESS ROUTE SURFACE, EITHER LIGHT-ON-DARK OR DARK-ON-LIGHT.

DETECTABLE WARNINGS LOCATIONS:

7. ON PERPENDICULAR CURB RAMPS, WHERE THE ENDS OF THE BOTTOM GRADE BREAK ARE IN FRONT OF THE BACK OF CURB, DETECTABLE WARNING SURFACES SHALL BE PLACED AT THE BACK OF CURB. WHERE THE ENDS OF THE BOTTOM GRADE BREAK ARE BEHIND THE BACK OF CURB AND THE DISTANCE FROM EITHER END OF THE BOTTOM GRADE BREAK TO THE BACK OF CURB IS 5' OR LESS, DETECTABLE WARNING SURFACES SHALL BE PLACED ON THE RAMP RUN WITHIN ONE DOME SPACING OF THE BOTTOM GRADE BREAK. WHERE THE ENDS OF THE BOTTOM GRADE BREAK ARE BEHIND THE BACK OF CURB AND THE DISTANCE FROM EITHER END OF THE BOTTOM GRADE BREAK TO THE BACK OF CURB IS MORE THAN 5', DETECTABLE WARNING SURFACES SHALL BE PLACED ON THE LOWER LANDING AT THE BACK OF CURB.
8. ON PARALLEL CURB RAMPS, DETECTABLE WARNING SURFACES SHALL BE PLACED ON THE TURNING SPACE AT THE FLUSH TRANSITION BETWEEN THE STREET AND SIDEWALK.
9. ON BLENDED TRANSITIONS, DETECTABLE WARNING SURFACES SHALL BE PLACED AT THE BACK OF CURB, WHERE RAISED PEDESTRIAN STREET CROSSINGS, DEPRESSED CORNERS, OR OTHER LEVEL PEDESTRIAN STREET CROSSINGS ARE PROVIDED, DETECTABLE WARNING SURFACES SHALL BE PLACED AT THE FLUSH TRANSITION BETWEEN THE STREET AND THE SIDEWALK.
10. AT CUT-THROUGH PEDESTRIAN REFUGE ISLANDS, DETECTABLE WARNING SURFACES SHALL BE PLACED AT THE EDGES OF THE PEDESTRIAN ISLAND AND SHALL BE SEPARATED BY A 2' MINIMUM LENGTH OF SURFACE WITHOUT DETECTABLE WARNINGS.
11. AT PEDESTRIAN AT-GRADE RAIL CROSSINGS NOT LOCATED WITHIN A STREET OR HIGHWAY, DETECTABLE WARNING SURFACES SHALL BE PLACED ON EACH SIDE OF THE RAIL CROSSING. THE EDGE OF THE DETECTABLE WARNING SURFACE NEAREST THE RAIL CROSSING SHALL BE 6" MINIMUM AND 15' MAXIMUM FROM THE CENTERLINE OF THE NEAREST RAIL. WHERE PEDESTRIAN GATES ARE PROVIDED, DETECTABLE WARNING SURFACES SHALL BE PLACED ON THE SIDE OF THE GATES OPPOSITE THE RAIL.
12. AT BOARDING PLATFORMS FOR BUSES AND RAIL VEHICLES, DETECTABLE WARNING SURFACES SHALL BE PLACED AT THE BOARDING EDGE OF THE PLATFORM.
13. AT BOARDING AND ALIGHTING AREAS AT SIDEWALK OR STREET LEVEL TRANSIT STOPS FOR RAIL VEHICLES, DETECTABLE WARNING SURFACES SHALL BE PLACED AT THE SIDE OF THE BOARDING AND ALIGHTING AREA FACING THE RAIL VEHICLES.

BY	DESCRIPTION	DATE

MISSISSIPPI DEPARTMENT OF TRANSPORTATION
ROADWAY DESIGN DIVISION
STANDARD PLAN

CURB RAMPS DETECTABLE WARNING DETAILS

MDOT

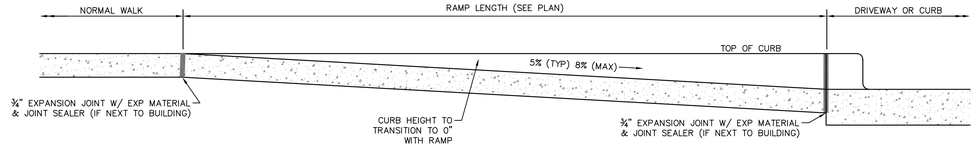
WORKING NUMBER CR-4

ISSUE DATE: AUGUST 01, 2017

SHEET NUMBER 6424

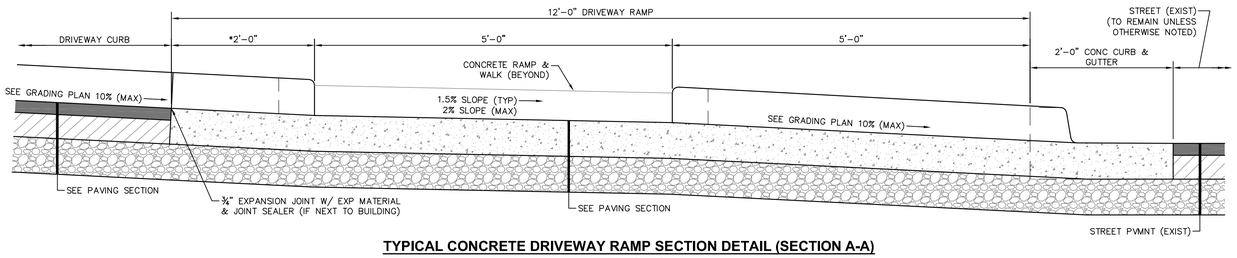
SPECIAL GENERAL NOTE:

ALL REFERENCE TO PAY ITEM NUMBERS SHALL BE USED FOR REFERENCE TO THE SPECIFICATION ONLY. PAY FOR ITEMS SHOWN ON THIS SHALL BE AS NOTED IN THE BID PROPOSAL.



TYPICAL CONCRETE WALK RAMP SECTION WITH CURB DETAIL (SECTION B)

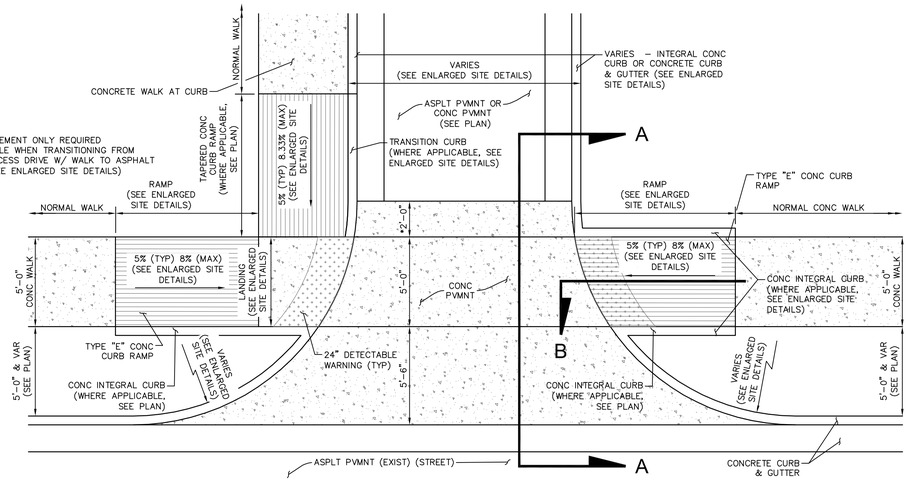
SCALE: 1" = 1'



TYPICAL CONCRETE DRIVEWAY RAMP SECTION DETAIL (SECTION A-A)

SCALE: 1" = 1'

*NOTE:
2'-0" CONC PAVEMENT ONLY REQUIRED WHERE APPLICABLE WHEN TRANSITIONING FROM CONC PAVED ACCESS DRIVE W/ WALK TO ASPHALT PAVED DRIVE (SEE ENLARGED SITE DETAILS)



TYPICAL CONCRETE DRIVEWAY RAMP PLAN DETAIL

SCALE: 1" = 4'

PREPARED BY:
SDW Engineering Progress
SDW Project No.: 15819 SDW Working No.: GSD3

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

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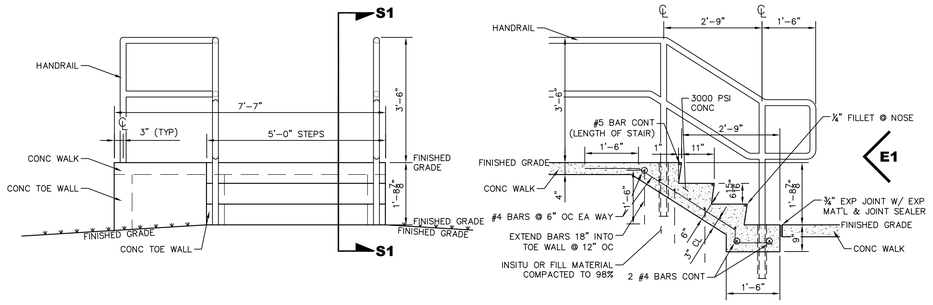
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Checked By: SEM
Client No: ------
Albert & Associates: 12575

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Albert & McCleskey Associates Architects

GENERAL SITE DETAILS
CURB CUT RAMPS

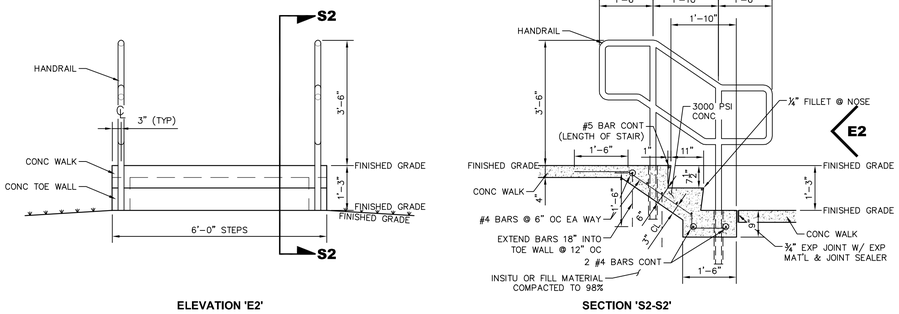
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ELEVATION 'E1' **SECTION 'S1-S1'**

STEPS #1 DETAIL - BUILDING A - EXIT DOOR AT ROOM #A139 (BASE BID)

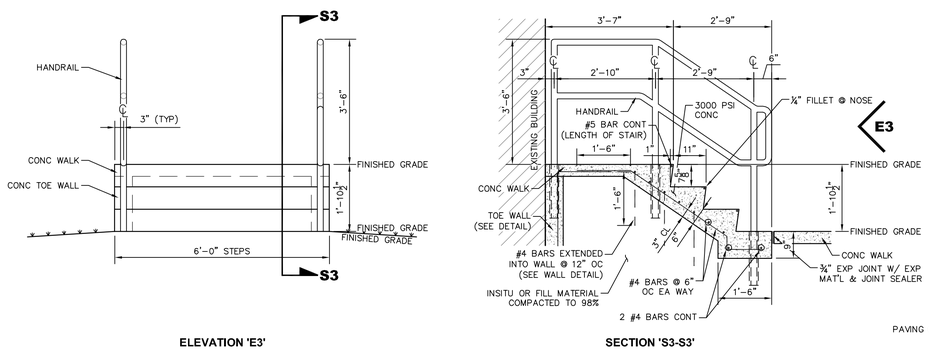
SCALE: 1" = 2'



ELEVATION 'E2' **SECTION 'S2-S2'**

STEPS #2 DETAIL - BUILDING F - EXIT DOOR AT ROOMS #100 & 102 (ADD ALT 2)

SCALE: 1" = 2'



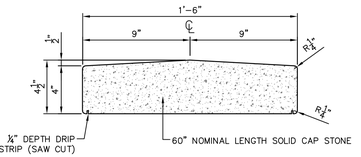
ELEVATION 'E3' **SECTION 'S3-S3'**

STEPS #3 DETAIL - BUILDING E - NORTH EXIT DOOR (ADD ALT 2)

SCALE: 1" = 2'

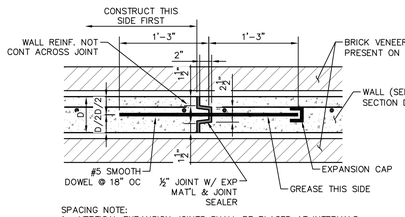
GENERAL CONCRETE STRUCTURE NOTES:

1. LL CONCRETE WORK SHALL BE IN ACCORDANCE WITH THE "AMERICAN CONCRETE INSTITUTE BUILDING CODE" (ACI 318) AND THE "SPECIFICATIONS FOR STRUCTURAL CONCRETE FOR BUILDINGS" (ACI 1301), LATEST EDITIONS.
2. ALL NORMAL WEIGHT CONCRETE (145 P.C.F.) SHALL OBTAIN A MINIMUM 28 DAY COMPRESSIVE STRENGTH OF 3000 PSI.
3. REINFORCING BARS SHALL BE DEFORMED BARS OF NEW BILLET STEEL CONFORMING TO ASTM SPECIFICATIONS A-615, GRADE 60. ALL REINFORCING AND ACCESSORIES SHALL BE DETAILED AND PLACED IN ACCORDANCE WITH ACI STANDARDS 315-80 AND 315R-80.
4. PLACE TWO (2) #5 BARS (EACH WAY) WITH A 24" PROJECTION AROUND ALL OPENINGS IN CONCRETE, UNLESS OTHERWISE SHOWN OR NOTED. REINFORCEMENT SHALL BE CONTINUOUS ACROSS JOINTS AND AROUND CORNERS OR SPLICE BARS SHALL BE PROVIDED IN ACCORDANCE WITH ACI STANDARDS 315-80 AND 315R-80. CORNER BARS SHALL BE PROVIDED AT ALL WALL CORNERS, EQUAL TO HORIZONTAL WALL REINFORCEMENT.
5. ALL REINFORCING SHALL BE BOUND TOGETHER BY 9 GAUGE TIES.
6. ALL IN-SITU MATERIAL SHALL BE PROOF ROLLED PRIOR TO CONSTRUCTION. SOFT OR YIELDING AREAS SHALL BE UNDERCUT TO A DEPTH OF, NOT LESS THAN, 24 INCHES AND EXTENDED BEYOND THE PROPOSED STRUCTURE BY 12 INCHES. FILL MATERIAL SHALL BE ENGINEERED FILL AS DETAILED IN THE GEOTECHNICAL REPORT.
7. NO HORIZONTAL CONSTRUCTION OR EXPANSION JOINTS SHALL BE ALLOWED, OTHER THAN THE CONSTRUCTION JOINT NOTED ON THE DETAILS. VERTICAL CONSTRUCTION OR EXPANSION JOINTS SHALL BE SPACED AS DETAILED, UNLESS OTHERWISE DIRECTED BY THE ENGINEER.



TYPICAL CAP STONE SECTION DETAIL

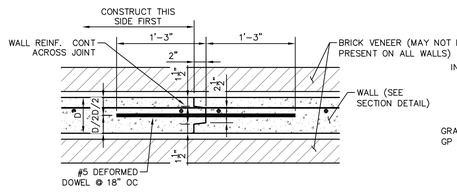
SCALE: 6" = 1'



SPACING NOTE:
1. VERTICAL EXPANSION JOINTS SHALL BE PLACED AT INTERVALS TO BE DETERMINED BY THE CONTRACTOR AND APPROVED BY THE ENGINEER WITH A MINIMUM SPACING OF 20' O.C. AND A MAXIMUM SPACING OF 50' O.C.
2. NO HORIZONTAL EXPANSION JOINTS SHALL BE ALLOWED.

TYPICAL WALL EXPANSION JOINT DETAIL

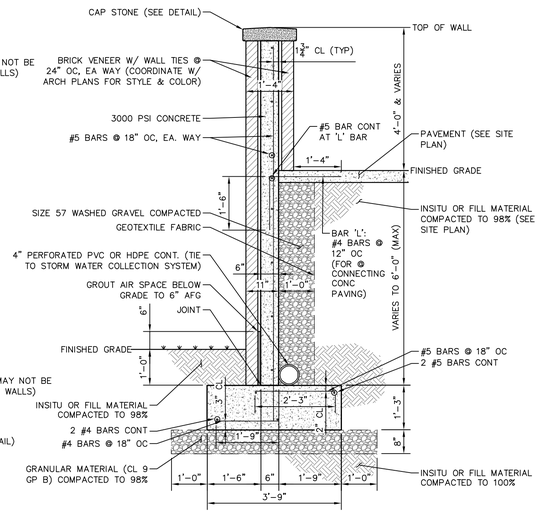
NOT TO SCALE



SPACING NOTE:
1. VERTICAL EXPANSION JOINTS SHALL BE PLACED AT INTERVALS TO BE DETERMINED BY THE CONTRACTOR AND APPROVED BY THE ENGINEER WITH A MINIMUM SPACING OF 20' O.C. AND A MAXIMUM SPACING OF 50' O.C.
2. NO HORIZONTAL EXPANSION JOINTS SHALL BE ALLOWED.

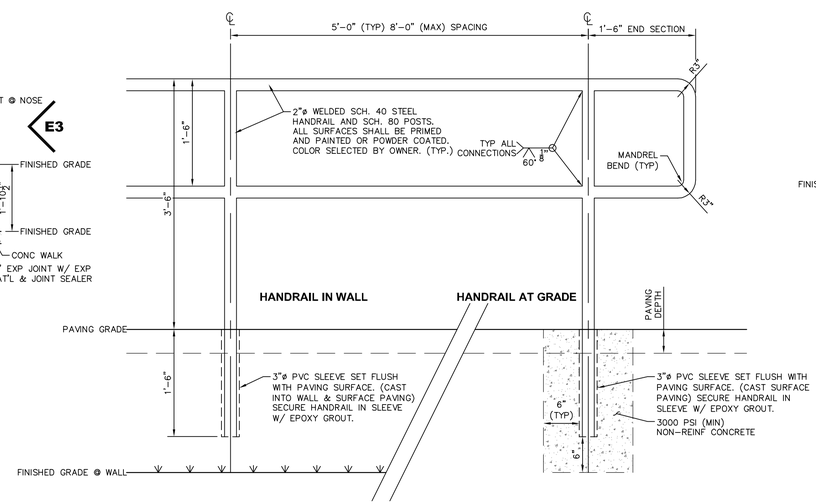
TYPICAL WALL CONSTRUCTION JOINT DETAIL

NOT TO SCALE



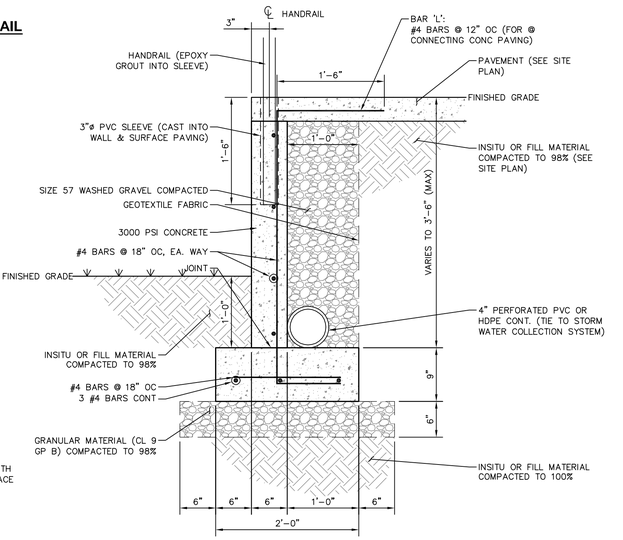
TYPICAL RETAINING WALL SECTION DETAIL

SCALE: 1" = 2'



TYPICAL HANDRAIL ELEVATION DETAIL

SCALE: 1" = 1'



TYPICAL TOE WALL SECTION DETAIL

SCALE: 1" = 1'

PREPARED BY:

SDW Engineering Progress
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SDW Project No.: 15819 SDW Working No.: GSD4

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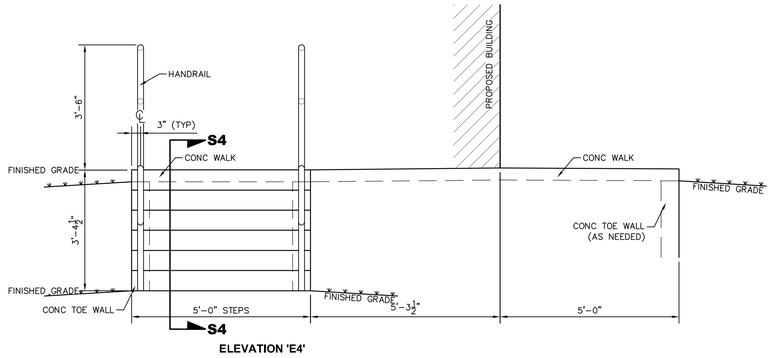
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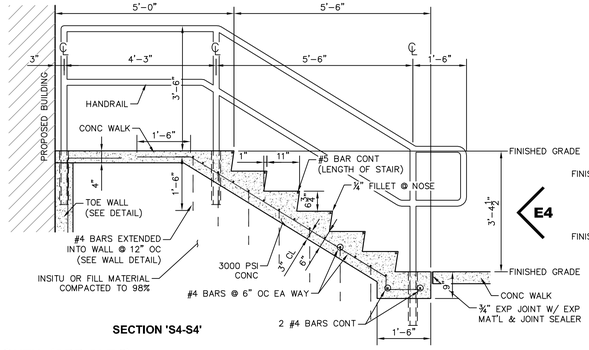
GENERAL SITE DETAILS WALLS & STEPS

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com **Albert & McCleskey Associates Architects**

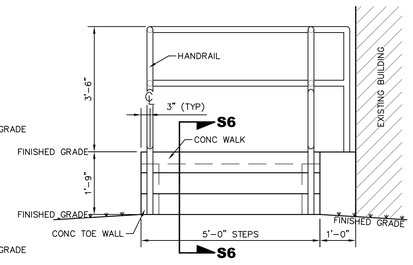
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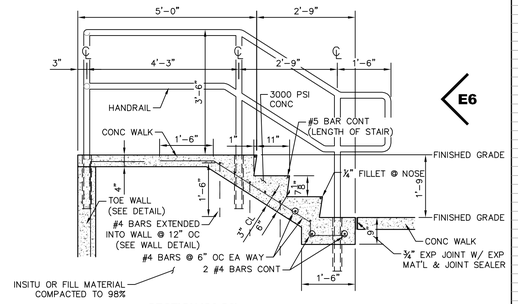
ELEVATION 'E4'



SECTION 'S4-S4'



ELEVATION 'E6'



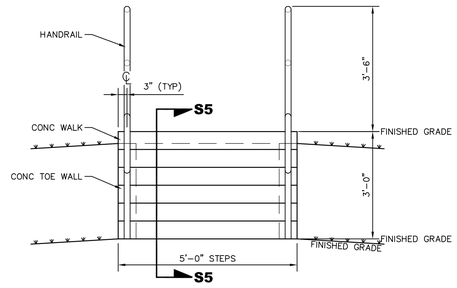
SECTION 'S6-S6'

STEPS #4 DETAIL - BUILDING G - EXIT DOOR AT ROOM #203 - SOUTH (ADD ALT 2)

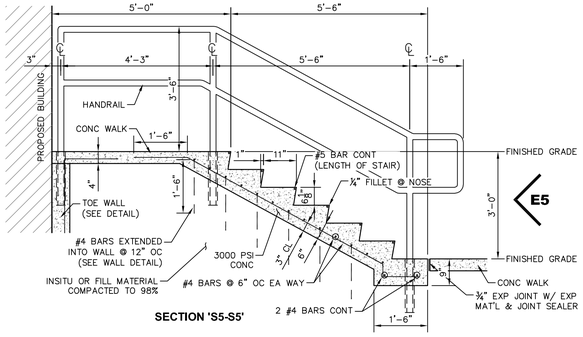
SCALE: 1" = 2'

STEPS #6 DETAIL - BUILDING E - WEST EXIT DOOR (ADD ALT 2)

SCALE: 1" = 2'



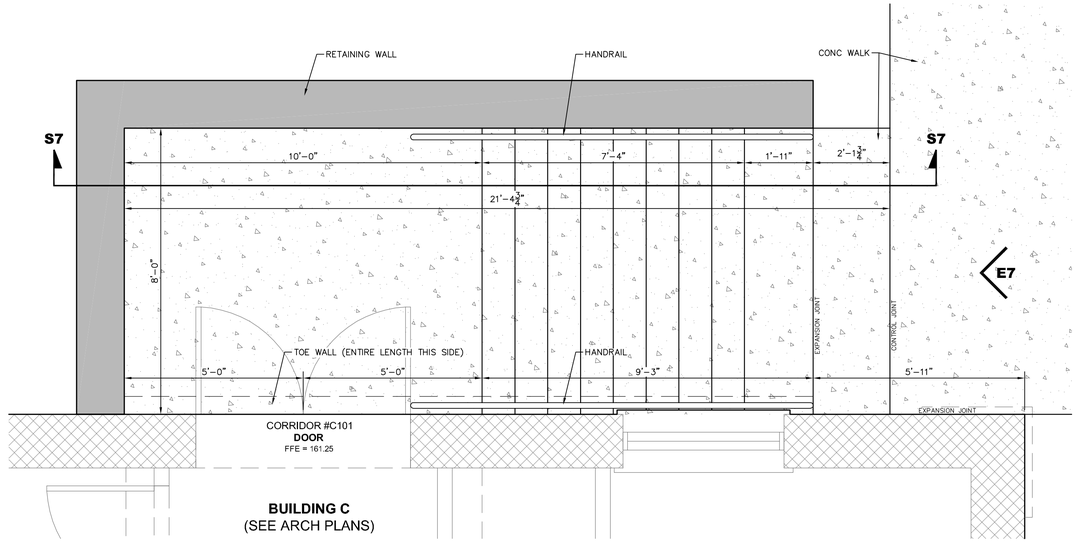
ELEVATION 'E5'



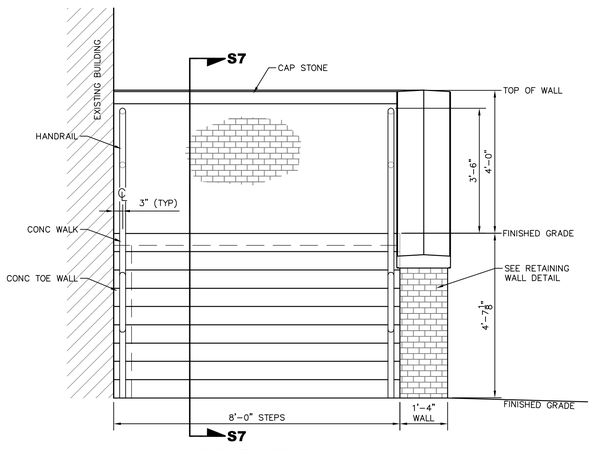
SECTION 'S5-S5'

STEPS #5 DETAIL - BUILDING G - EXIT DOOR AT ROOM #203 - WEST (ADD ALT 2)

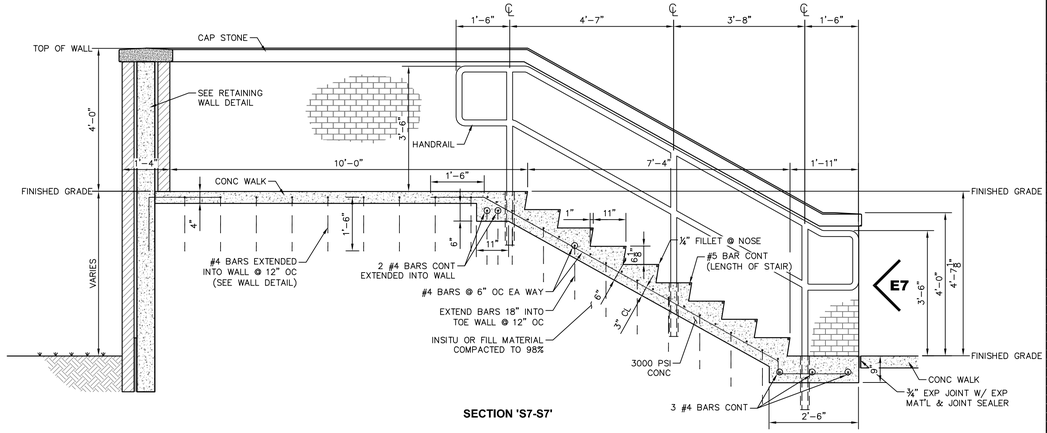
SCALE: 1" = 2'



PLAN



ELEVATION 'E7'



SECTION 'S7-S7'

STEPS #7 DETAIL - BUILDING C - EXIT DOOR AT CORRIDOR #C101 (BASE BID)

SCALE: 1" = 2'

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11-19-2018		Bid Documents

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Checked By:	SEM
Client No:	------
Albert & Associates: 12575	

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PREPARED BY:

SDW Engineering Progress

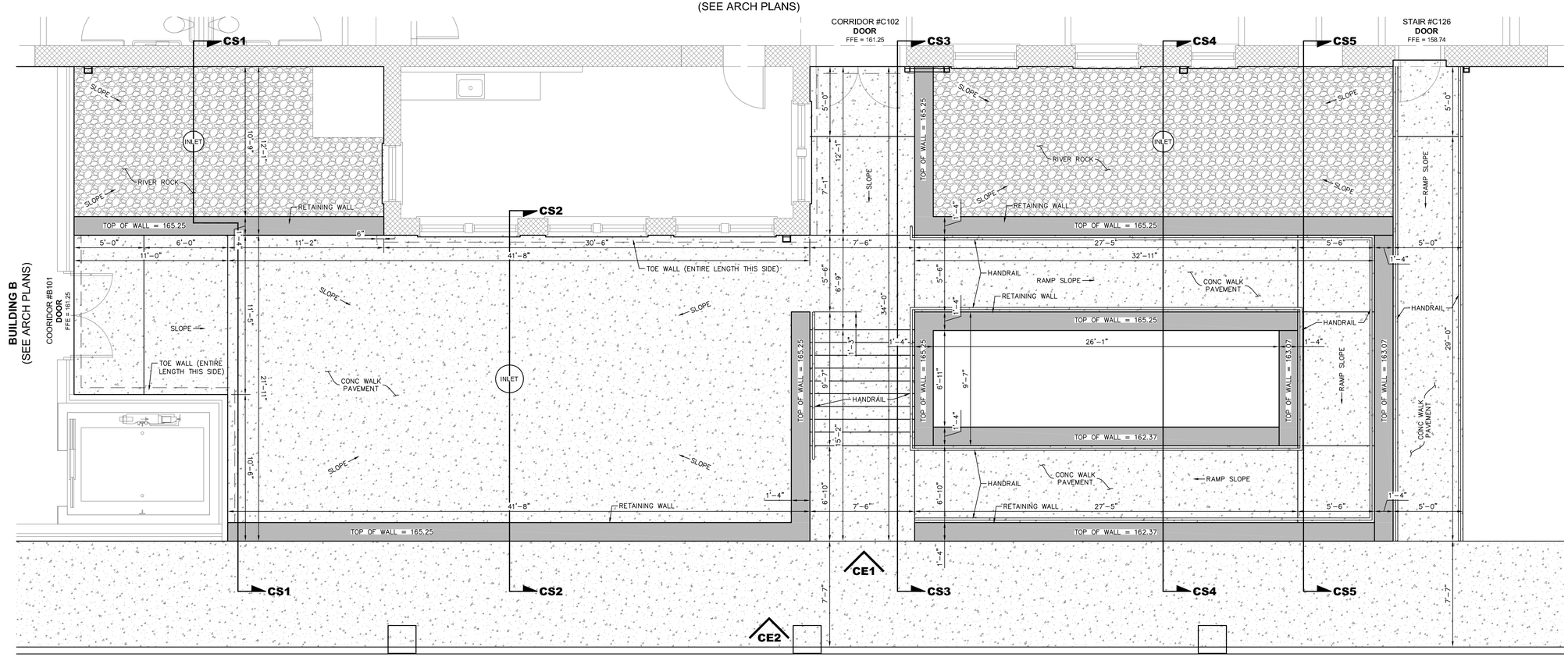
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Albert & McCleskey Associates Architects

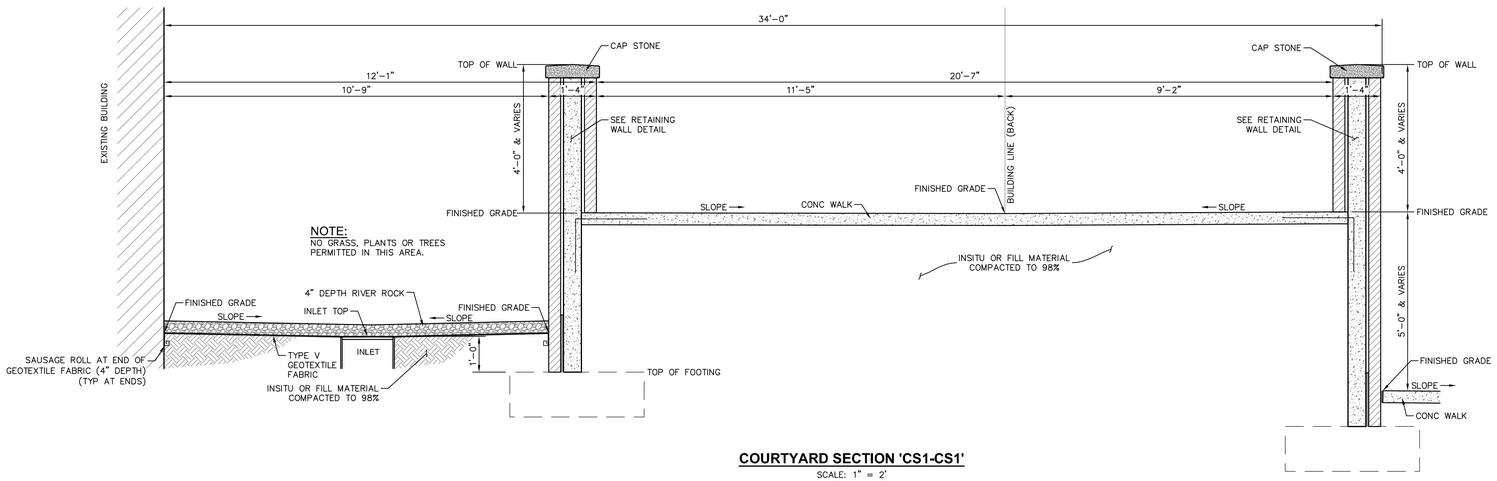
GENERAL SITE DETAILS STEPS

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COURTYARD - ENLARGED PLAN (BASE BID)

SCALE: 1" = 4'



COURTYARD SECTION 'CS1-CS1'

SCALE: 1" = 2'

PREPARED BY:

sdw Engineering Progress
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SDW Project No.: 15819 SDW Working No.: GSD6

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Albert & McCleskey Associates Architects

GENERAL SITE DETAILS
COURTYARD PLAN & SEC

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

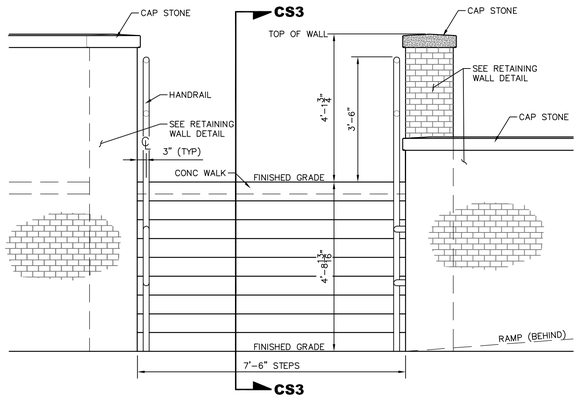
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12-18-2015		95% Check Set
11-19-2018		Bid Documents

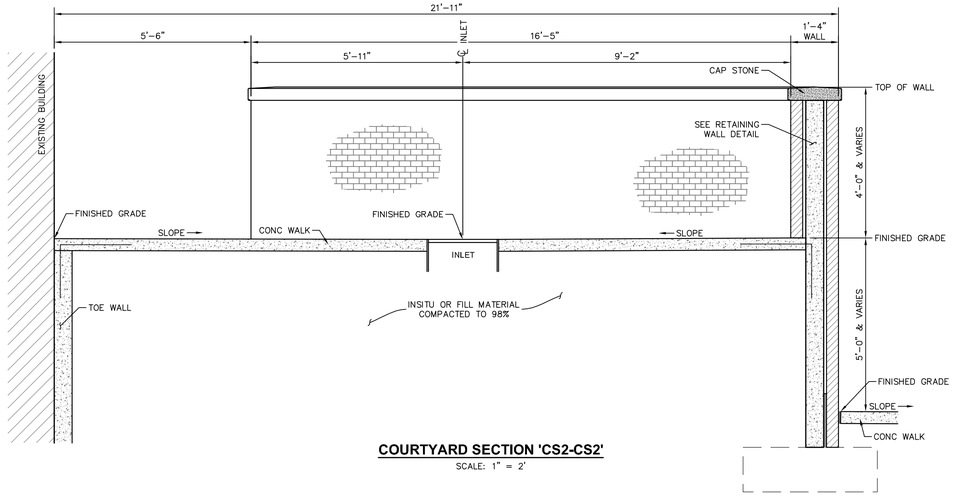
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Checked By:	SEM
Client No:	------
Albert & Associates: 12575	

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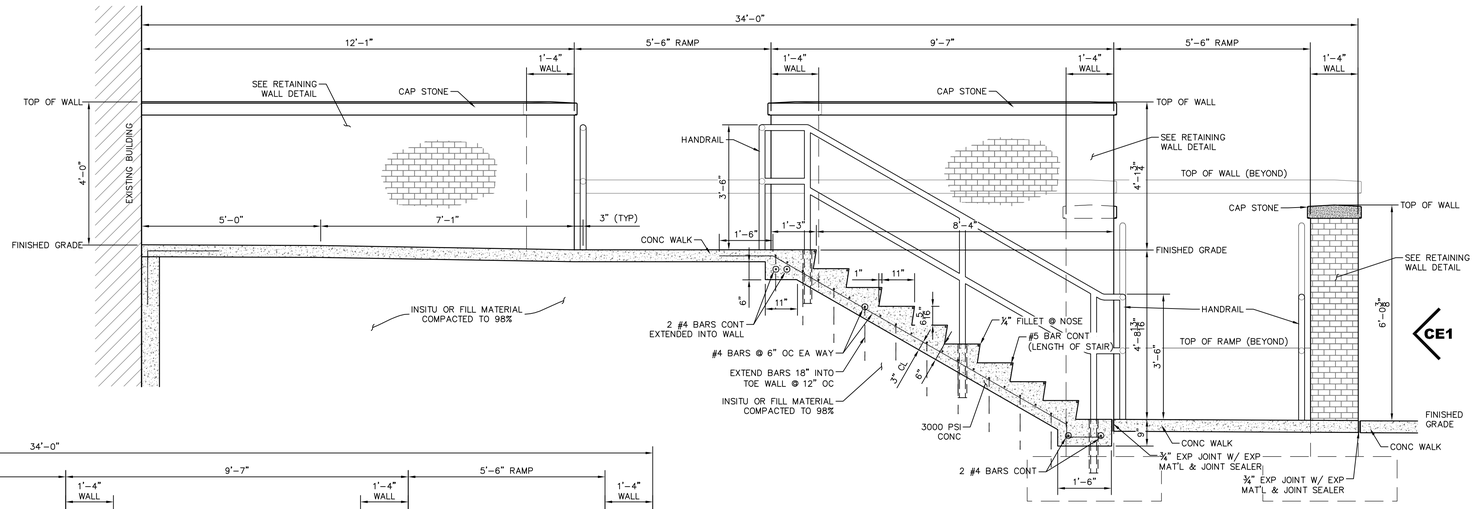
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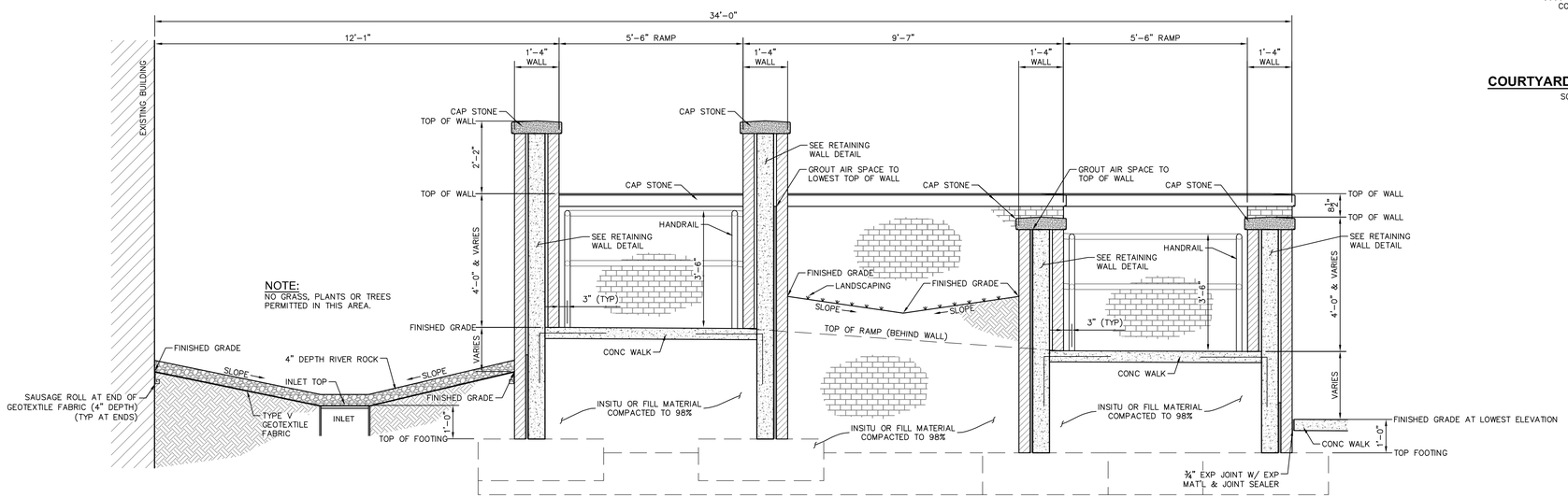
COURTYARD ELEVATION 'CE1'
SCALE: 1" = 2'



COURTYARD SECTION 'CS2-CS2'
SCALE: 1" = 2'



COURTYARD SECTION 'CS3-CS3'
SCALE: 1" = 2'



COURTYARD SECTION 'CS4-CS4'
SCALE: 1" = 2'

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

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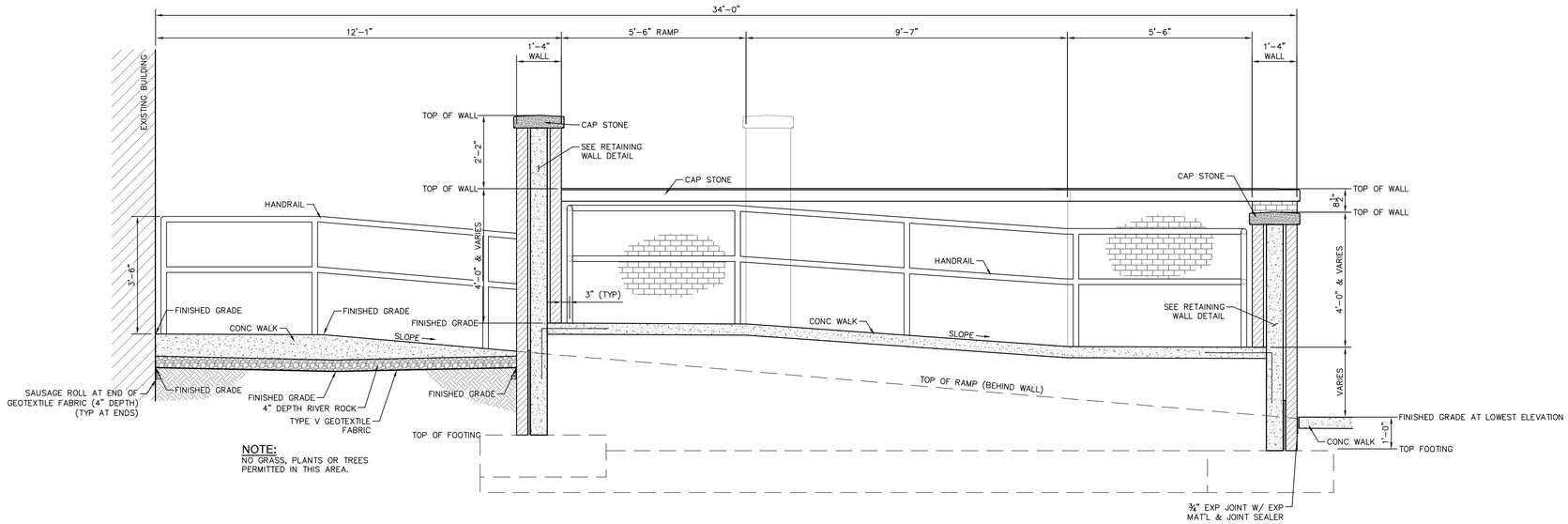
C1.16

PREPARED BY:
SDW Engineering Progress
39 Grand Ave. | Hattiesburg, MS 39401 | p | 601.544.1821 | f 601.544.2501 | sdw.com
SDW Project No.: 15819 SDW Working No.: GSD7

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Albert & McCleskey Associates Architects

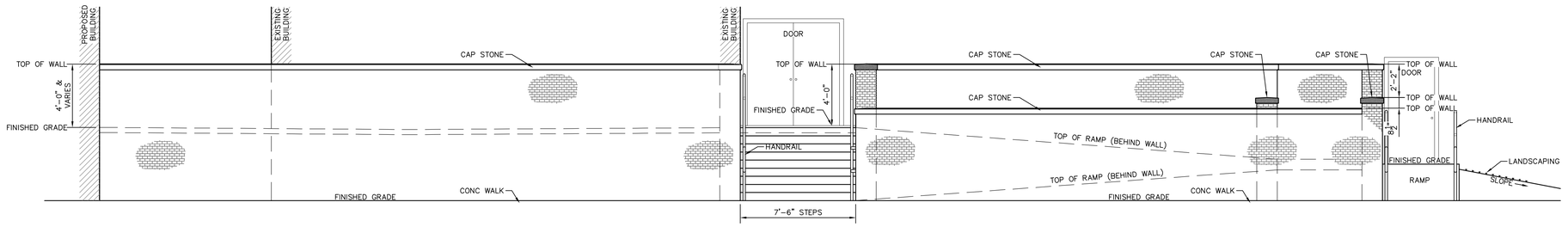
GENERAL SITE DETAILS
COURTYARD SEC & ELEV

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NOTE:
NO GRASS, PLANTS OR TREES PERMITTED IN THIS AREA.

COURTYARD SECTION 'CS5-CS5'
SCALE: 1" = 2'



COURTYARD ELEVATION 'CE2'
SCALE: 1" = 4'

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

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Albert & Associates: 12575	

C1.17

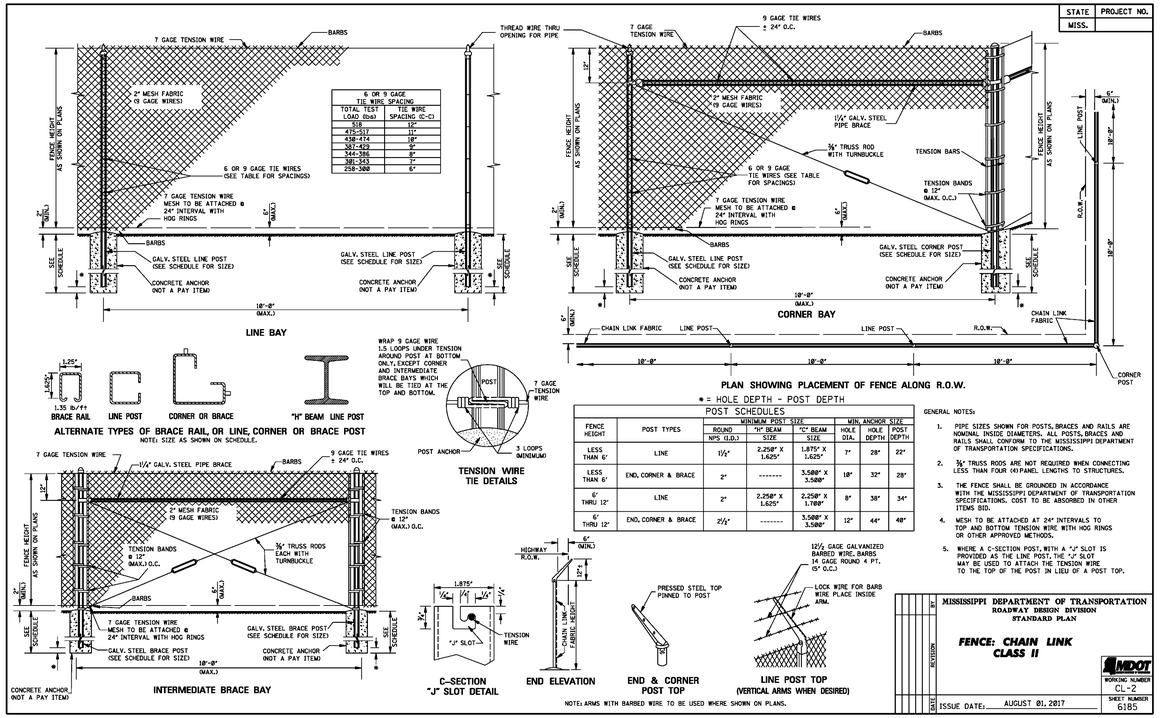
PREPARED BY:
sdw Engineering Progress
305 Second Ave. | Hattiesburg, MS 39401 | p | 601.544.1821 | f | 601.544.2501 | sdwa.com
SDW Project No.: 15819 SDW Working No.:GSDB

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Albert & McCleskey Associates Architects

GENERAL SITE DETAILS
COURTYARD SEC & ELEV

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STATE	PROJECT NO.
MISS.	



6 OR 9 GAGE TIE WIRE SPACING	
TOTAL TEST LOAD (lbs)	TIE WIRE SPACING (C-C)
518	12"
431-517	11"
430-474	10"
387-429	9"
344-386	8"
301-343	7"
258-300	6"

* = HOLE DEPTH - POST DEPTH

POST SCHEDULES

FENCE HEIGHT	POST TYPES	MINIMUM POST SIZE			MIN. ANCHOR SIZE		
		ROUND NPS (I.D.)	"H" BEAM SIZE	"C" BEAM SIZE	HOLE DIA.	HOLE DEPTH	POST DEPTH
LESS THAN 6'	LINE	1½"	2.25#/ X 1.625"	1.875" X 1.625"	7"	28"	22"
LESS THAN 6'	END, CORNER & BRACE	2"	--------	3.50#/ X 3.500"	10"	32"	28"
6' THRU 12'	LINE	2"	2.25#/ X 1.625"	2.25#/ X 1.700"	8"	38"	34"
6' THRU 12'	END, CORNER & BRACE	2½"	--------	3.50#/ X 3.500"	12"	44"	40"

GENERAL NOTES:

1. PIPE SIZES SHOWN FOR POSTS, BRACES AND RAILS ARE NOMINAL INSIDE DIAMETERS. ALL POSTS, BRACES AND RAILS SHALL CONFORM TO THE MISSISSIPPI DEPARTMENT OF TRANSPORTATION SPECIFICATIONS.
2. ⅜" TRUSS RODS ARE NOT REQUIRED WHEN CONNECTING LESS THAN FOUR (4) PANEL LENGTHS TO STRUCTURES.
3. THE FENCE SHALL BE GROUNDED IN ACCORDANCE WITH THE MISSISSIPPI DEPARTMENT OF TRANSPORTATION SPECIFICATIONS. COST TO BE ABSORBED IN OTHER ITEMS BID.
4. MESH TO BE ATTACHED AT 24" INTERVALS TO TOP AND BOTTOM TENSION WIRE WITH HOG RINGS OR OTHER APPROVED METHODS.
5. WHERE A C-SECTION POST, WITH A "J" SLOT IS PROVIDED AS THE LINE POST, THE "J" SLOT MAY BE USED TO ATTACH THE TENSION WIRE TO THE TOP OF THE POST IN LIEU OF A POST TOP.

NOTE: ARMS WITH BARBED WIRE TO BE USED WHERE SHOWN ON PLANS.

BY	REVISION	DATE

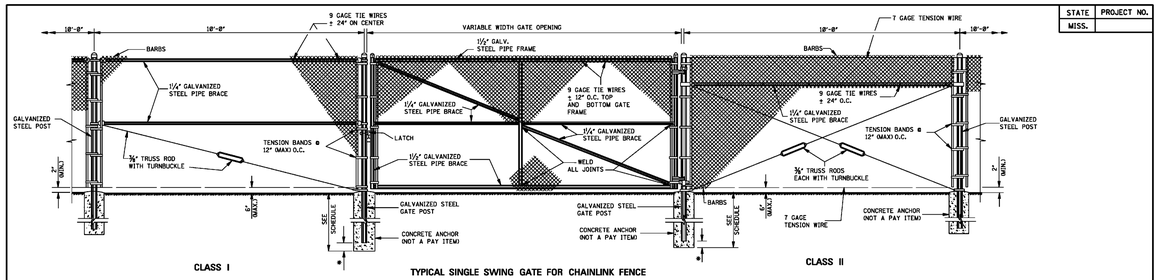
MISSISSIPPI DEPARTMENT OF TRANSPORTATION
ROADWAY DESIGN DIVISION
STANDARD PLAN

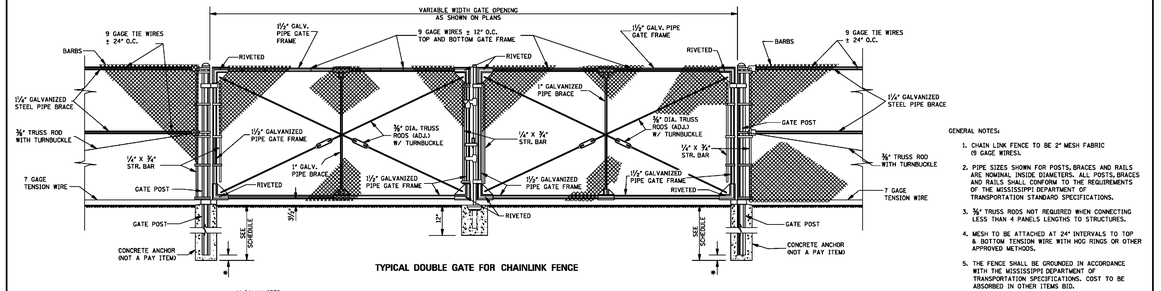
FENCE: CHAIN LINK CLASS II

MDOT
WORKING NUMBER CL-2
SHEET NUMBER 6185

ISSUE DATE: AUGUST 01, 2017

STATE	PROJECT NO.
MISS.	





GENERAL NOTES:

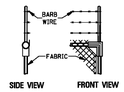
1. CHAIN LINK FENCE TO BE 2" MESH FABRIC (9 GAGE WIRES).
2. PIPE SIZES SHOWN FOR POSTS, BRACES AND RAILS ARE NOMINAL INSIDE DIAMETERS. ALL POSTS, BRACES AND RAILS SHALL CONFORM TO THE REQUIREMENTS OF THE MISSISSIPPI DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS.
3. ⅜" TRUSS RODS NOT REQUIRED WHEN CONNECTING LESS THAN 4 PANELS LENGTHS TO STRUCTURES.
4. MESH TO BE ATTACHED AT 24" INTERVALS TO TOP & BOTTOM TENSION WIRE WITH HOG RINGS OR OTHER APPROVED METHODS.
5. THE FENCE SHALL BE GROUNDED IN ACCORDANCE WITH THE MISSISSIPPI DEPARTMENT OF TRANSPORTATION SPECIFICATIONS. COST TO BE ABSORBED IN OTHER ITEMS BID.

* = HOLE DEPTH - POST DEPTH

POST SCHEDULE

GATE OPENING	POST TYPE & MIN. SIZE			MIN. ANCHOR SIZE		
	ROUND SIZE (NPS)		"C" BEAM SIZE	HOLE DIA.	HOLE DEPTH	POST DEPTH
UP TO 6' SINGLE UP TO 12' DOUBLE	2½"		3.50#/ X 3.50"	12"	48"	54"
OVER 6' TO 13' SINGLE OVER 12' TO 26' DOUBLE	3½"			14"	42"	54"
OVER 13' TO 18' SINGLE OVER 26' TO 36' DOUBLE	6"			16"	46"	48"

TYPE "A": 3' & 4' SQL. 6' & 8' DBL.
TYPE "B": OVER 4' TO 7' SQL. OVER 8' TO 14' DBL.
TYPE "C": OVER 7' TO 11' SQL. OVER 14' TO 22' DBL.
TYPE "D": OVER 11' TO 15' SQL. OVER 22' TO 30' DBL.
TYPICAL FRAMEWORK SHOWING NUMBER OF BAYS IN GATE



BY	REVISION	DATE

MISSISSIPPI DEPARTMENT OF TRANSPORTATION
ROADWAY DESIGN DIVISION
STANDARD PLAN

FENCE: CHAIN LINK GATE

MDOT
WORKING NUMBER CLG-1
SHEET NUMBER 6191

ISSUE DATE: AUGUST 01, 2017

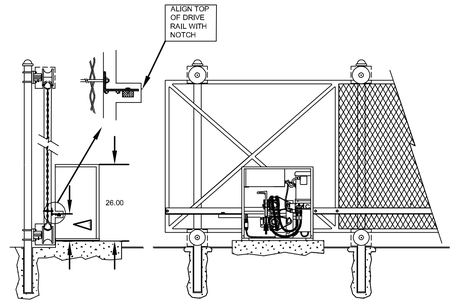
NOTES:

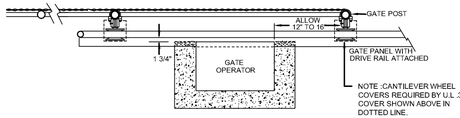
DRIVE RAIL HEIGHT IS MARKED ON THE SIDE OF EACH CHASSIS.

COVERS MUST BE USED FOR PROTECTION ON ALL EXPOSED WHEELS AND/OR HARDWARE. COVERS ARE SHOWN HERE AS DOTTED LINES.

IT MAY BE NECESSARY TO SHIM DRIVE RAIL IF GATE PANEL IS "BOWED". RAIL MUST BE INSTALLED IN A STRAIGHT LINE.

9⅛" APPROXIMATE RAIL HEIGHT FROM PAD. FINAL ADJUSTMENT TO BE MADE PER NOTCH ON CHASSIS.

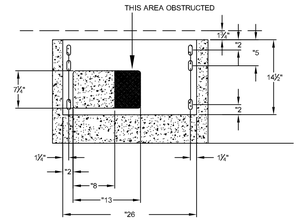




NOTE:

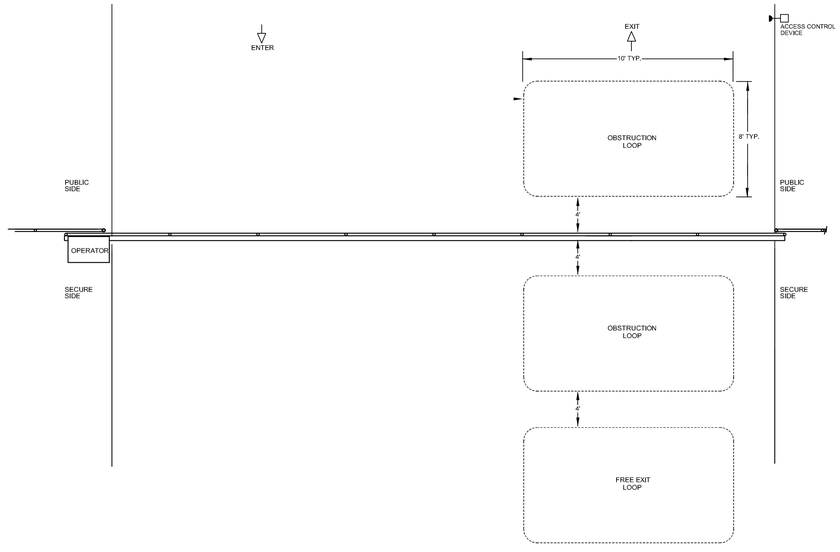
MINIMUM CONC SLAB DIMENSIONS RECOMMENDED ARE: 30"WIDE, 20" FROM FRONT TO BACK AND 16" DEEP.

OPERATOR IS INSTALLED ON A CONC.PAD AND CONNECTED EXISTING CANTILEVER GATE PANEL.



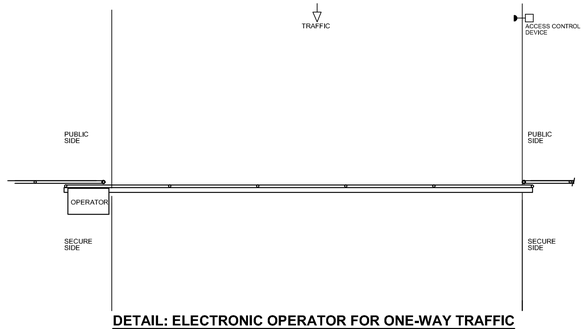
DETAILS: GATE OPERATOR

SCALE: NONE



DETAIL: ELECTRONIC OPERATOR FOR TWO-WAY TRAFFIC

SCALE: NONE



DETAIL: ELECTRONIC OPERATOR FOR ONE-WAY TRAFFIC

SCALE: NONE

ROADWAY

GENERAL FENCE NOTE:

ALL FENCE COMPONENTS, INCLUDING BUT NOT LIMITED TO CHAIN LINK FABRIC, WIRES, POSTS, TIES, AND OTHER MISC PARTS SHALL BE BLACK VINYL COATED.

PREPARED BY:

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20 Grand Ave. | Hattiesburg, MS 39401 | p (601.544.1821) f (601.544.2501) | sdw.com

SDW Project No.: 15819 SDW Working No.: ED1

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

BID DOCUMENTS

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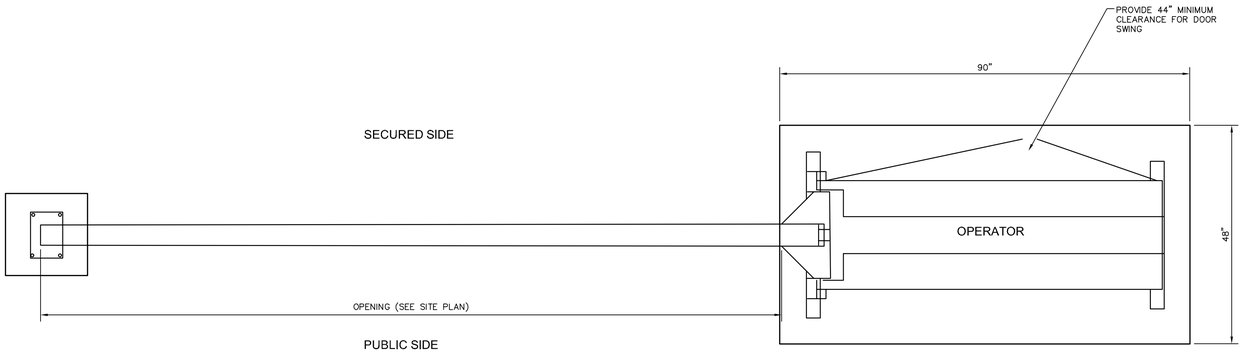
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Albert & Associates: 12575

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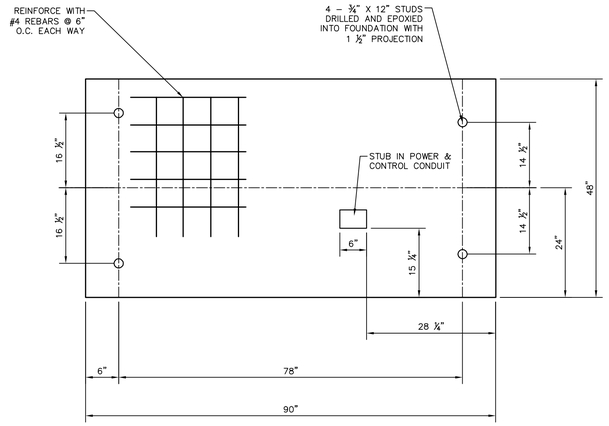
514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com | Albert & McCleskey Associates Architects

GENERAL SITE DETAILS
FENCE & GATE DETAILS

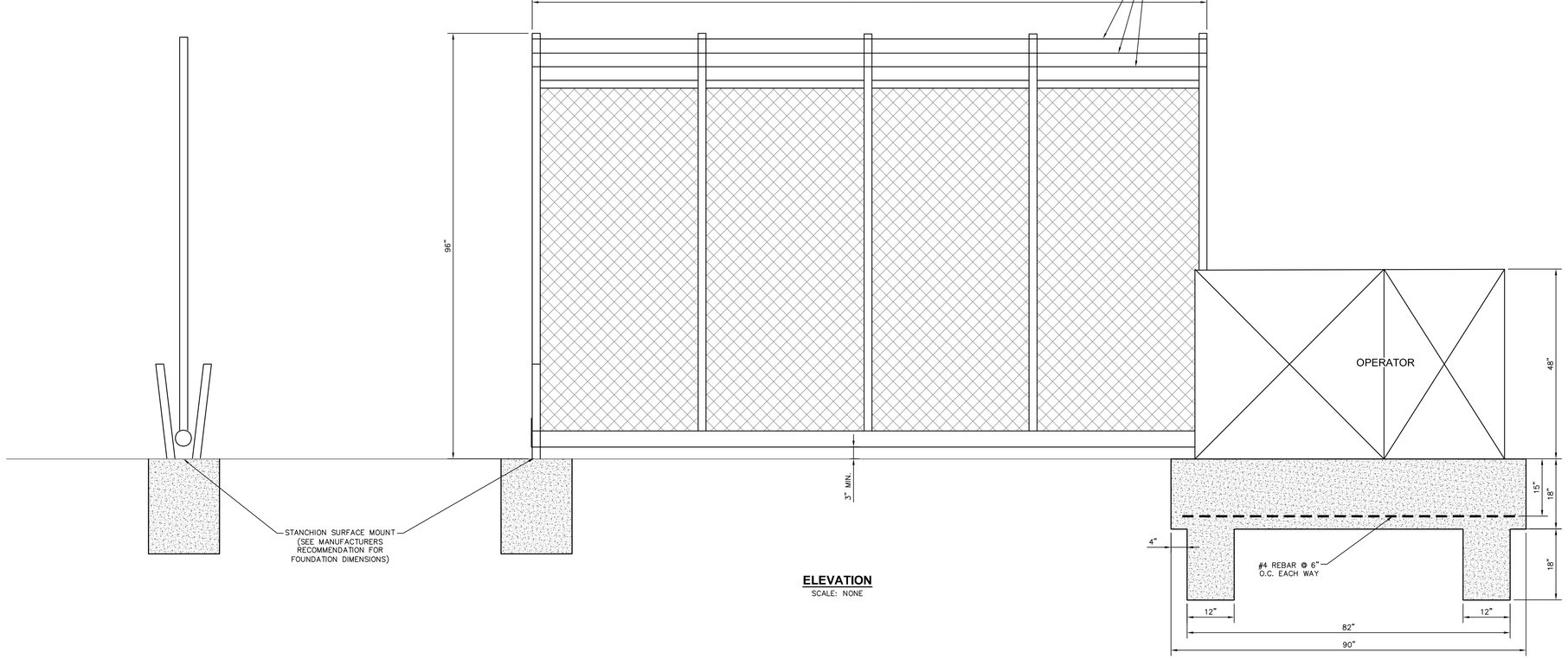
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PLAN
SCALE: NONE



FOUNDATION
SCALE: NONE



ELEVATION
SCALE: NONE

GENERAL FENCE NOTE:

ALL FENCE COMPONENTS, INCLUDING BUT NOT LIMITED TO CHAIN LINK FABRIC, WIRES, POSTS, TIES, AND OTHER MISC PARTS SHALL BE BLACK VINYL COATED.

PREPARED BY:

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329 Second Ave. | Hattiesburg, MS. 39401 | p.) 601.544.1821 | f.) 601.544.1920 | sdwe.com
SDW Project No.: 15819 SDW Working No.:ED2

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

BID DOCUMENTS

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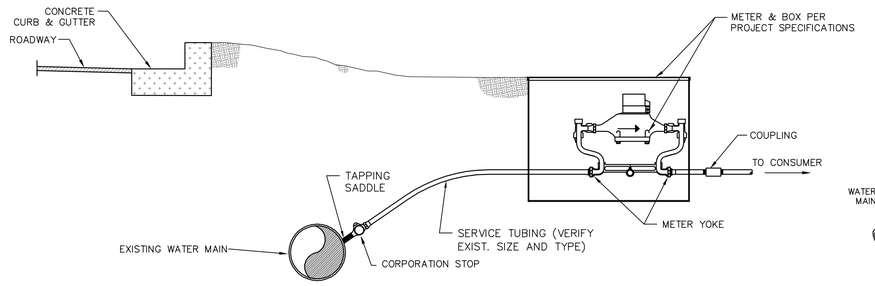
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Albert & Associates: 12575

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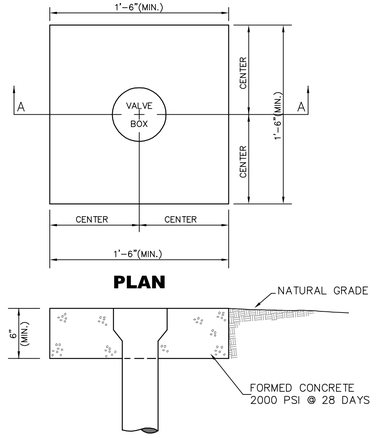
GENERAL SITE DETAILS
VERTICAL PIVOT GATE DETAILS

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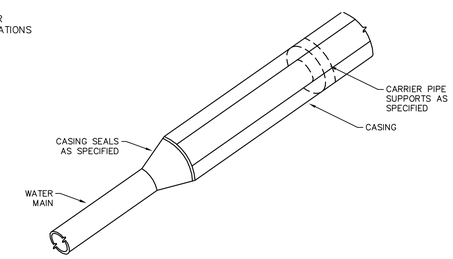
NOTE: THIS DETAIL SHALL BE USED FOR REPAIR OF EXISTING SERVICES DAMAGED DURING CONSTRUCTION.

TYPICAL METER SETTING WITH YOKE

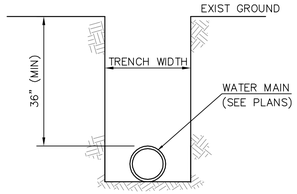


PLAN

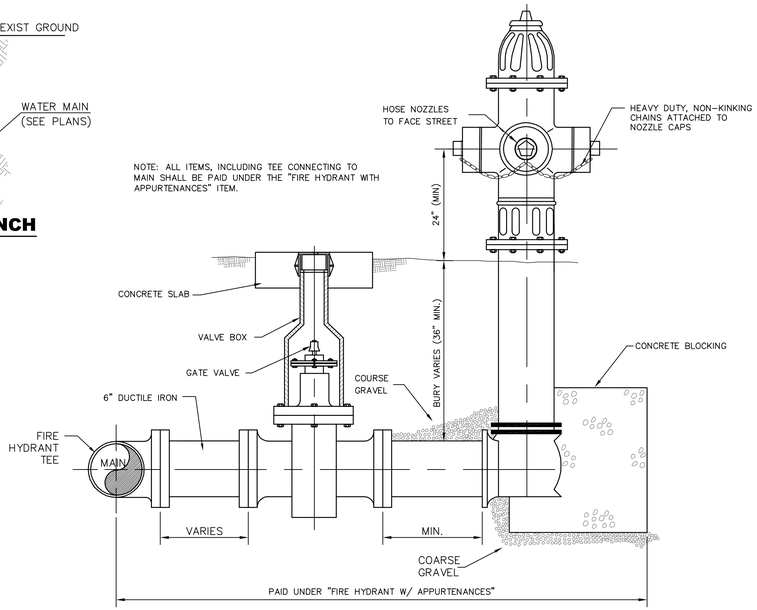
SECTION A-A



CASING END DETAIL

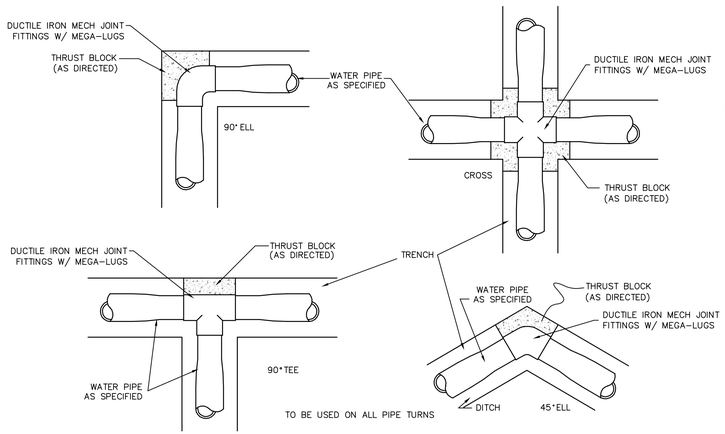


DETAIL OF TRENCH

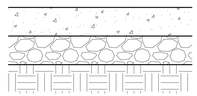


STANDARD 3-WAY FIRE HYDRANT

NOT TO SCALE



THRUST BLOCK DETAILS

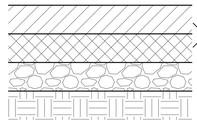


- TEMPORARY: 6" CRUSHED AGGREGATE (SIZE 610) (REMOVE PRIOR TO PAVING)
  PERMANENT: 6" 3000 PSI CONCRETE W/ FIBER REINFORCEMENT
- 6" CRUSHED AGGREGATE (SIZE 610) COMPACTED TO 95%
- EXISTING SUBGRADE AND/OR FILL MATERIAL COMPACTED TO 95%

TYPICAL ROADWAY CONCRETE PAVEMENT REPAIR

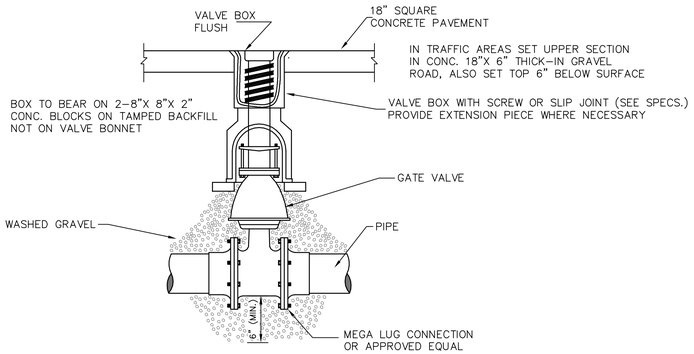
PAVEMENT REPAIR NOTES:

1. TEMPORARY CRUSHED AGGREGATE REMOVED DURING PAVING SHALL BECOME THE PROPERTY OF THE CONTRACTOR.
2. TRENCHES SHALL HAVE A TEMPORARY SURFACE OF CRUSHED AGGREGATE (SIZE 610) TEMPORARY SURFACE INSTALLED FOR A PERIOD OF TIME TO BE DETERMINED BY THE ENGINEER AND REMOVED PRIOR TO PAVING (NO SEPARATE PAY)

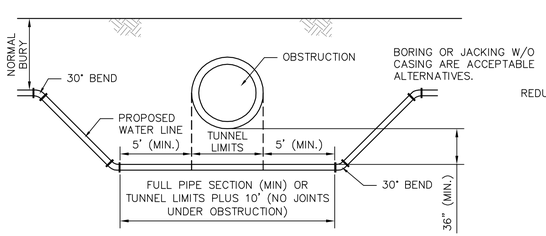


- PERMANENT: 1 1/2" HOT MIX ASPHALT, 9.5 mm, ST OVERLAY
- TEMPORARY: 3 1/2" CRUSHED AGGREGATE (SIZE 610) (REMOVED PRIOR TO PAVING)
- PERMANENT: 2" HOT MIX ASPHALT, 19 mm, ST
- 6" CRUSHED AGGREGATE (SIZE 610) COMPACTED TO 95%
- EXISTING SUBGRADE AND/OR FILL MATERIAL COMPACTED TO 95%

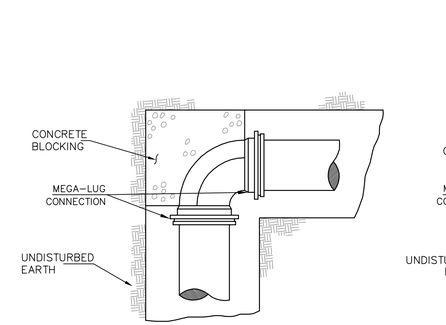
TYPICAL ROADWAY ASPHALT PAVEMENT REPAIR



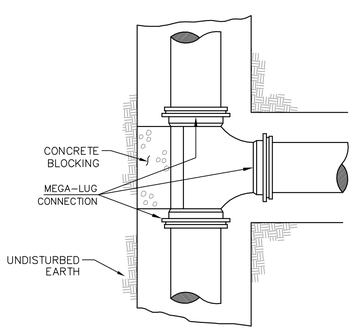
DETAIL OF VALVE & BOX



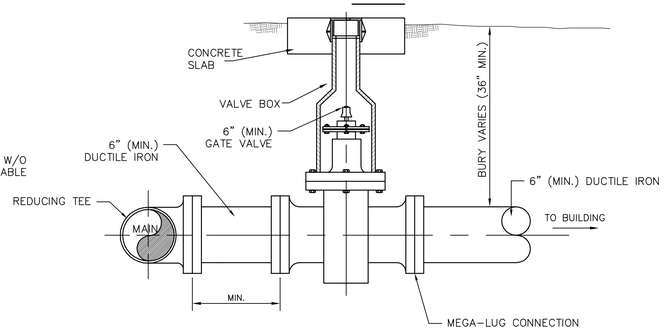
OBSTRUCTION CROSSING DETAIL



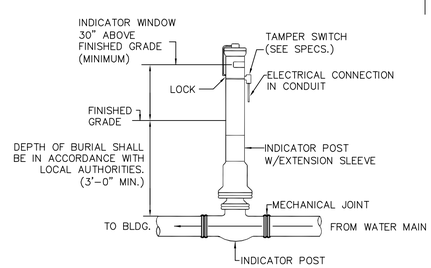
PLAN



PLAN



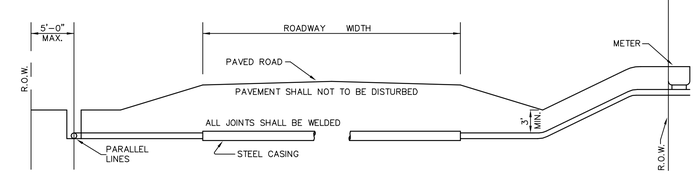
FIRE SUPPRESSION SYSTEM CONNECTION



POST INDICATOR VALVE DETAIL

PIV NOTES:

1. POST INDICATOR VALVES SHALL BE REQUIRED AT ALL EXISTING STRUCTURES WHICH ARE BEING CONNECTED TO THE PROPOSED SYSTEM UNDER THIS PROJECT, IF THE EXISTING PIV IS DAMAGED AND/OR INOPERABLE OR IF NO PIV IS IN PLACE AT THE TIME OF CONNECTION.
2. LOCATIONS FOR PROPOSED PIV'S SHALL BE AS DIRECTED BY THE ENGINEER BUT SHALL BE AT LEAST 40 FEET FROM THE EXISTING STRUCTURE AND CLEARLY VISIBLE.
3. POST INDICATOR VALVES SHALL BE INSTALLED AS PER THE MANUFACTURER'S SPECIFICATIONS AND AS DETAILED HERE.
4. ALL ITEMS, INCLUDING POSSIBLE INSTALLATION ON EXISTING FIRE LINE SHALL BE PAID UNDER THE "POST INDICATOR VALVE" ITEM.



ROAD BORE & WATER LINE PARALLELING

PREPARED BY:

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SDW Project No.: 15819 SDW Working No.:WTR1

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

BID DOCUMENTS

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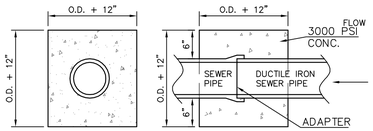
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Checked By:	SEM
Client No:	------
Albert & Associates:	12575

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WATER INSTALLATION DETAILS

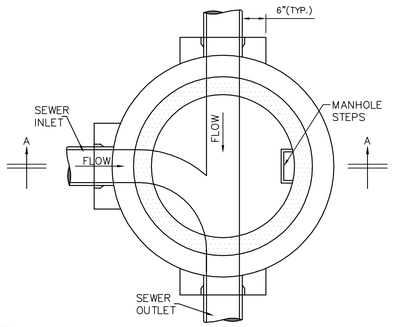
514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com
Albert & McCleskey Associates Architects

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SECTION **PLAN**

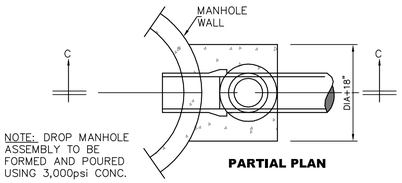
TYPICAL SEWER PIPE CONNECTION TO SAME SIZE DUCTILE IRON SEWER PIPE



SECTIONAL PLAN

STANDARD PRECAST 4'-0" DIAMETER MANHOLE

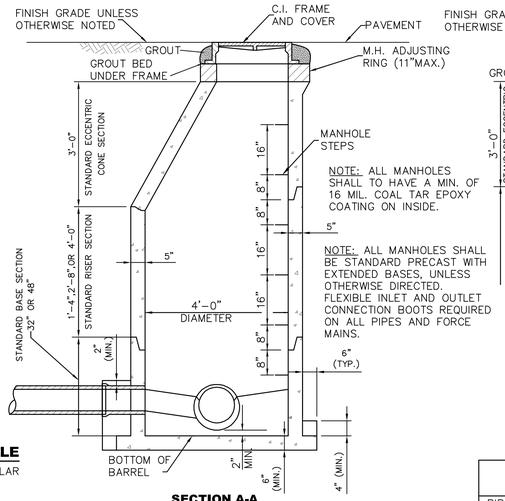
NOTE: 5'-0" & 6'-0" DIAMETER MANHOLE MAY BE SIMILAR DESIGN IF APPROVED BY THE ENGINEER. SHOWN WITH CLAY OR CONCRETE PIPE



NOTE: DROP MANHOLE ASSEMBLY TO BE FORMED AND POURED USING 3,000psi CONC.

PARTIAL PLAN

TYPICAL DROP MANHOLE ASSEMBLY

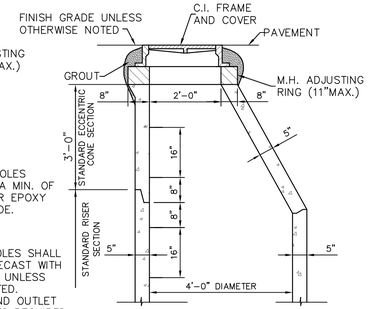


NOTE: ALL MANHOLES SHALL TO HAVE A MIN. OF 16 MIL. COAL TAR EPOXY COATING ON INSIDE.

NOTE: ALL MANHOLES SHALL BE STANDARD PRECAST WITH EXTENDED BASES, UNLESS OTHERWISE DIRECTED. FLEXIBLE INLET AND OUTLET CONNECTION BOOTS REQUIRED ON ALL PIPES AND FORCE MAINS.

SECTION A-A

SHOWN WITH MANHOLE BOTTOM-PRECAST



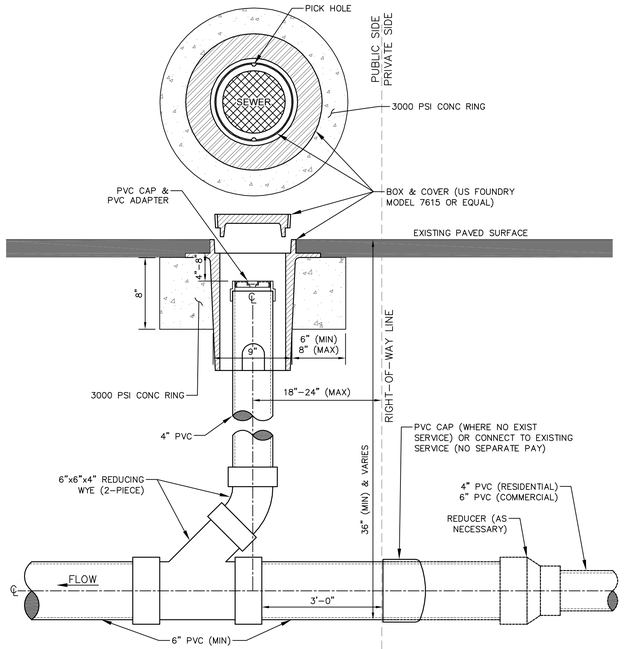
NOTE: DETAILS FOR RISER & BASE SECTIONS ARE SAME AS SHOWN IN SECTION A-A & B-B.

STANDARD ECCENTRIC CONE FOR ALL DIAMETER MANHOLES

TABLE NO. 1
GOVERNING DIMENSIONS FOR MANHOLES

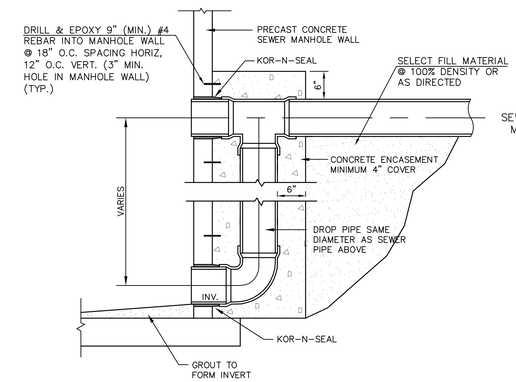
PIPE SIZE	Q ANGLE	MIN. BASE DIAMETER	"R"*
8"THRU 12"	0°TO 90°	4'	1'-6"
15"	0°TO 60°	5'	1'-10"
15"	60°TO 90°	5'	1'-10"
18"	0°TO 90°	5'	2'-3"
18"	60°TO 90°	5'	1'-10"
21"	0°TO 90°	5'	2'-7"
21"	60°TO 90°	5'	2'-4"
24"	0°TO 45°	6'	3'-0"
24"	45°TO 90°	6'	2'-3"
30"	0°TO 60°	6'	3'-9"
30"	60°TO 90°	6'	2'-8"
36"	0°TO 30°	7'	4'-6"
36" AND LARGER	0°TO 90°	CAST IN PLACE MANHOLE BASE OR PRE-BED PIPE M.H. BASE AND ELBOW UNITS.	

* SEE SECTIONAL PLAN, Std. PRECAST MANHOLE

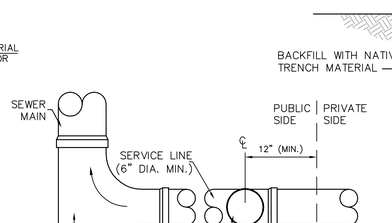


SANITARY SEWER CLEANOUT DETAIL - SECTION VIEW

FOR PAVED AREA
NOT TO SCALE

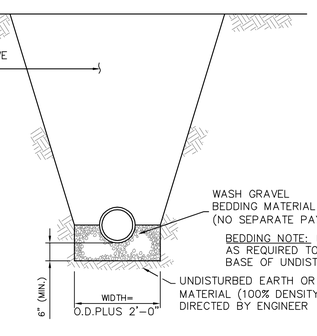


DETAIL "B"
SECTION C-C



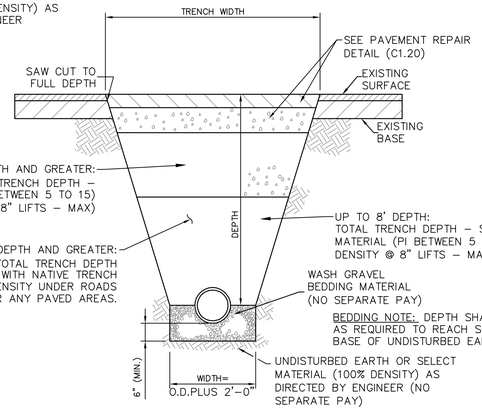
NOTE:
ALL CLEANOUTS SHALL BE CAPPED AT 6" (MIN.) ABOVE EXISTING GRADE EXCEPT IN PAVED AREAS.

TYPICAL STUB OUT PLAN FOR SERVICE LINE



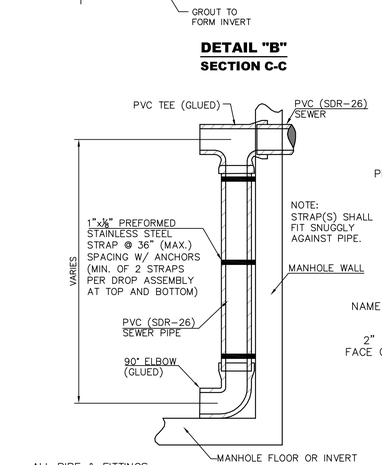
TYPICAL TRENCH DETAIL

NOTE: TRENCH WIDTHS SHALL BE MINIMIZED BY THE CONTRACTOR TO ONLY THE WIDTH NECESSARY FOR CONSTRUCTION AS DETERMINED BY THE ENGINEER.



TYPICAL TRENCH AT ROADWAY DETAIL

NOTE: TRENCH WIDTHS SHALL BE MINIMIZED BY THE CONTRACTOR TO ONLY THE WIDTH NECESSARY FOR CONSTRUCTION AS DETERMINED BY THE ENGINEER.

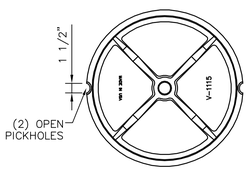


ALL PIPE & FITTINGS SHALL BE SAME MATERIAL AS INLET PIPE.

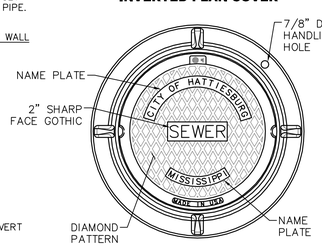
DETAIL "A"
SECTION C-C

TYPICAL DROP MANHOLE ASSEMBLY

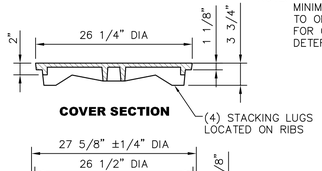
NOTES:
1. USE DETAIL "A" ONLY WHERE SINGLE DROP ASSEMBLY IS REQ'D. FOR MULTIPLE DROPS USE DETAIL "B" SHOWN ELSEWHERE ON THIS SHEET FOR 48" MANHOLE. FOR MULTIPLE DROP ASSEMBLIES IN LARGER MANHOLES, DROPS SHALL BE PLACED AS DIRECTED BY THE ENGINEER.
2. ALL HARDWARE SHALL BE STAINLESS STEEL.
3. ALL APPURTENANCES SHALL BE INCLUDED IN BID PRICE FOR DROP ASSEMBLIES.



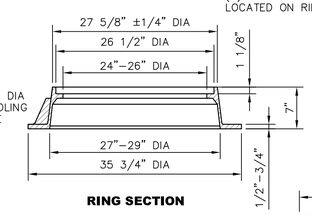
INVERTED PLAN COVER



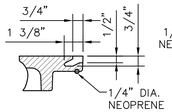
PLAN WITH FRAME



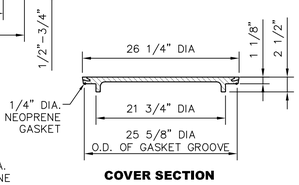
COVER SECTION



RING SECTION



PICKHOLE DETAIL



COVER SECTION

HEAVY DUTY COVER & FRAME V-1115 OR USF 370 WITH OUT HOLES ONLY

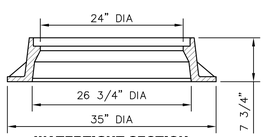
HEAVY DUTY WATERTIGHT COVER & FRAME V-2115-3 AGS WITH OUT HOLES, WITH GASKET & BOLTS ONLY

MANHOLE COVER DETAILS

NOT TO SCALE

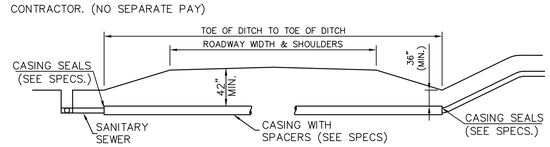


EPIC DETAIL

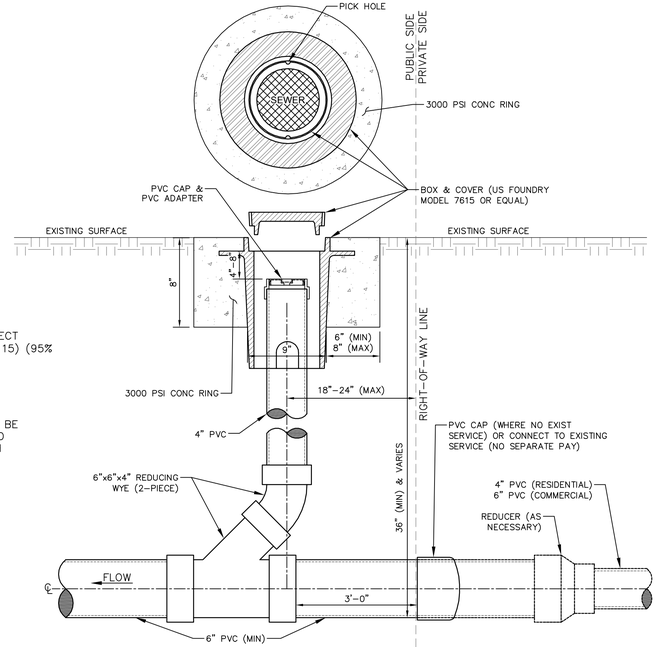


WATERTIGHT SECTION

NOTE: ALL TESTING TO BE THE RESPONSIBILITY OF THE CONTRACTOR. (NO SEPARATE PAY)



ROAD BORE DETAIL



SANITARY SEWER CLEANOUT DETAIL - SECTION VIEW

FOR NON-PAVED AREA
NOT TO SCALE

CLEANOUT NOTE:

CLEANOUTS SHALL BE PLACED AT ALL BENDS IN SERVICE LINES OVER 22.5° AND ALL CHANGES IN GRADE. CLEANOUTS SHALL BE PLACED AT ROW LINES AS DETAILED.

PREPARED BY:
SDW Engineering Progress
320 Second Ave. | Hattiesburg, MS 39401 | p.) 601.544.3821 | f.) 601.544.0929 | sdwa.com
SDW Project No.: 15819 SDW Working No.: SWR1

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HATTIESBURG PUBLIC SAFETY COMPLEX
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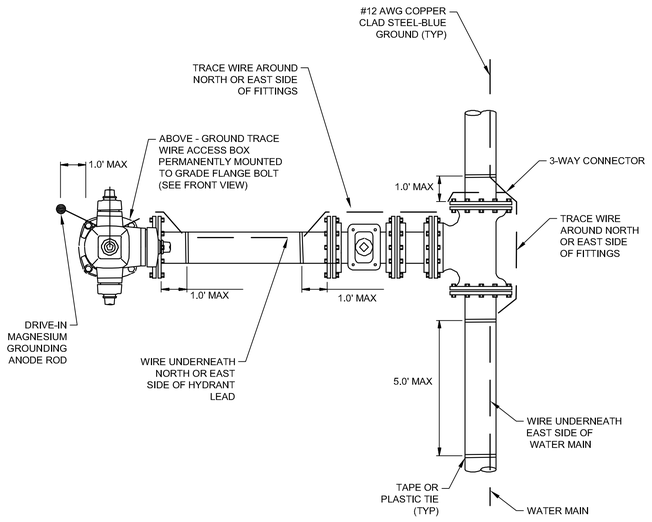
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Albert & Associates:	12575

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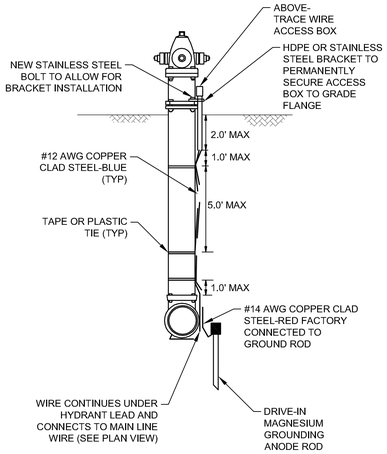
SEWER INSTALLATION DETAILS

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com
Albert & McCleskey Associates Architects

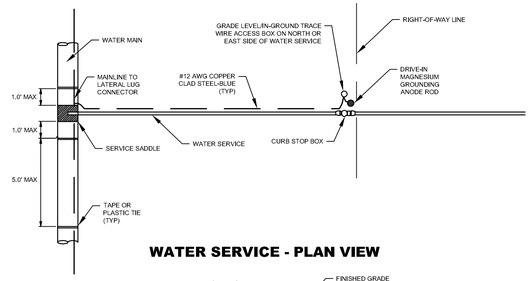
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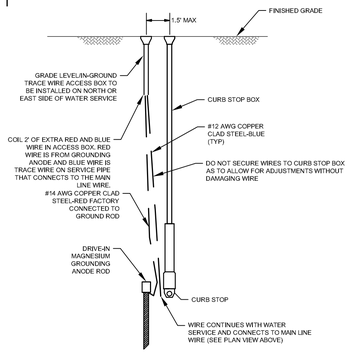
HYDRANT-PLAN VIEW



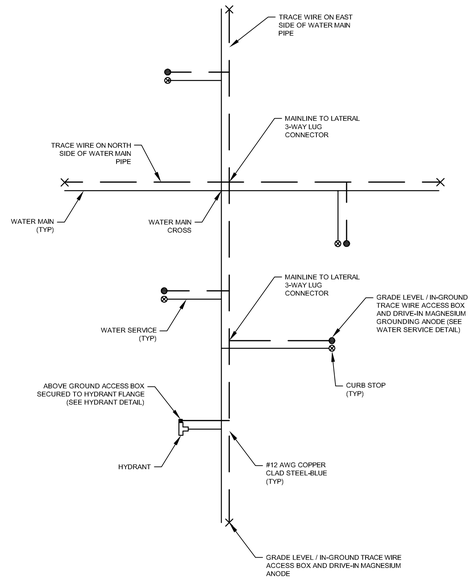
HYDRANT-SECTION VIEW



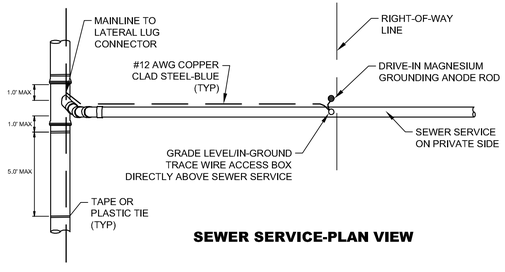
WATER SERVICE - PLAN VIEW



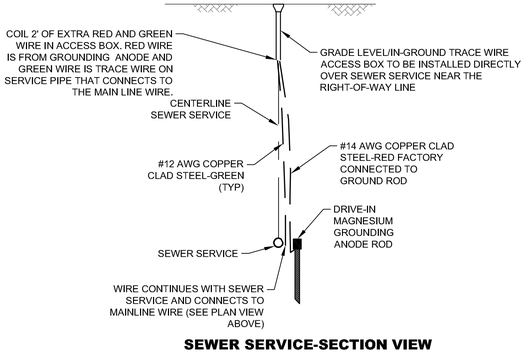
WATER SERVICE - SECTION VIEW



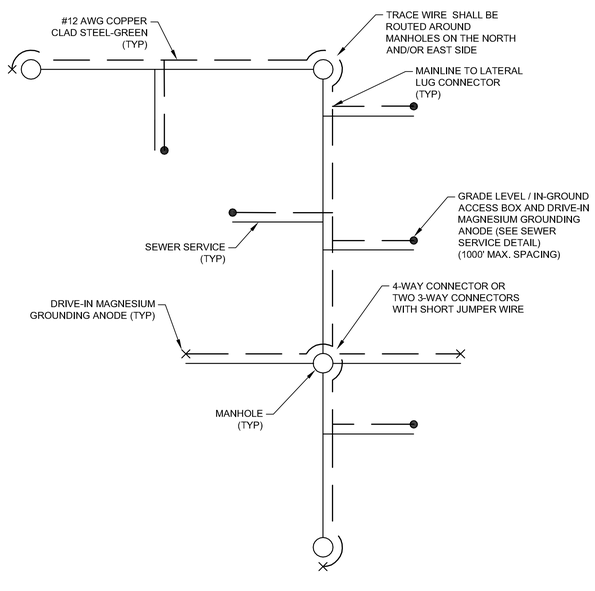
WATER MAIN TRACE WIRE PLAN



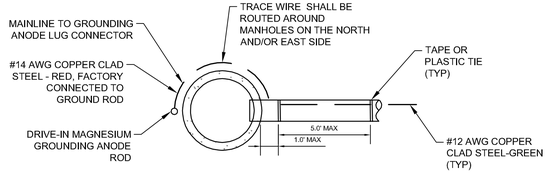
SEWER SERVICE-PLAN VIEW



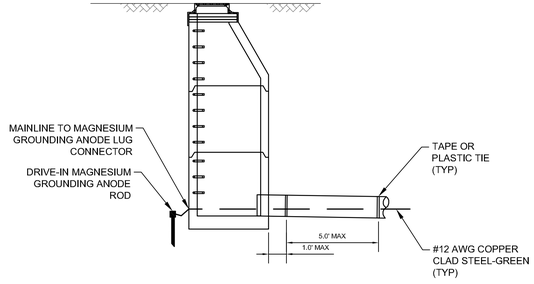
SEWER SERVICE-SECTION VIEW



SEWER MAIN TRACE WIRE PLAN



SEWER MANHOLE - PLAN VIEW



SEWER MANHOLE - SECTION VIEW

NOTE:
WIRE SHOWN AWAY FROM PIPE FOR CLARITY, WIRE SHALL BE INSTALLED ON THE BOTTOM SIDE OF THE PIPE BELOW THE SPRING LINE. THE WIRE SHALL BE FASTENED TO THE PIPE WITH TAPE OR PLASTIC TIES AT 5' INTERVALS.

CITY OF HATTIESBURG MISSISSIPPI

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11-19-2018		Bid Documents

Drawn By:	RES
Checked By:	SEM
Client No:	------
Albert & Associates: 12575	

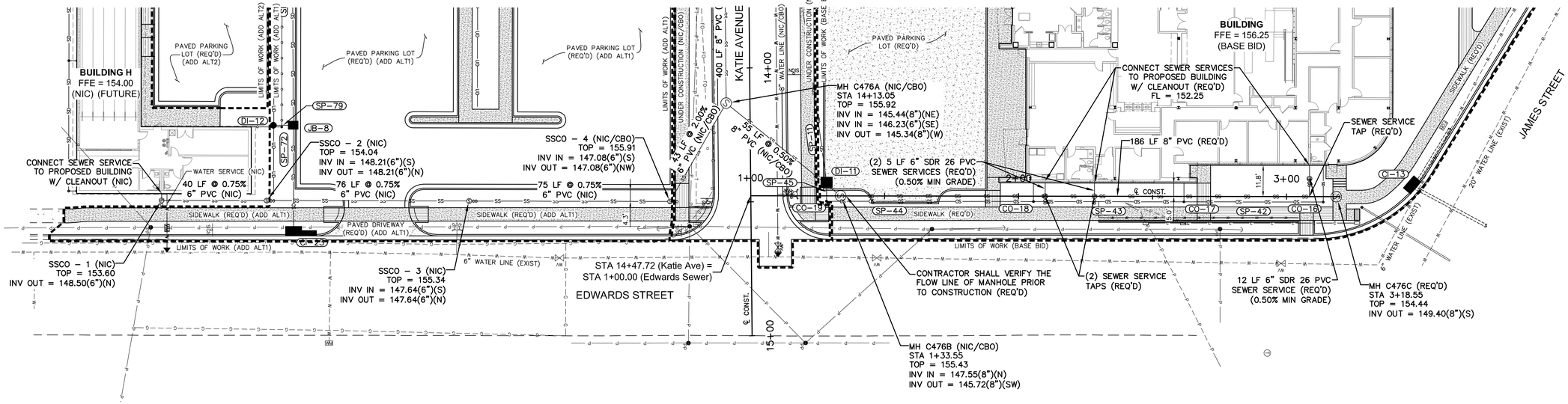
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PREPARED BY:
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SDW Project No.: 15819 SDW Working No.: TWD1

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Albert & McCleskey Associates Architects

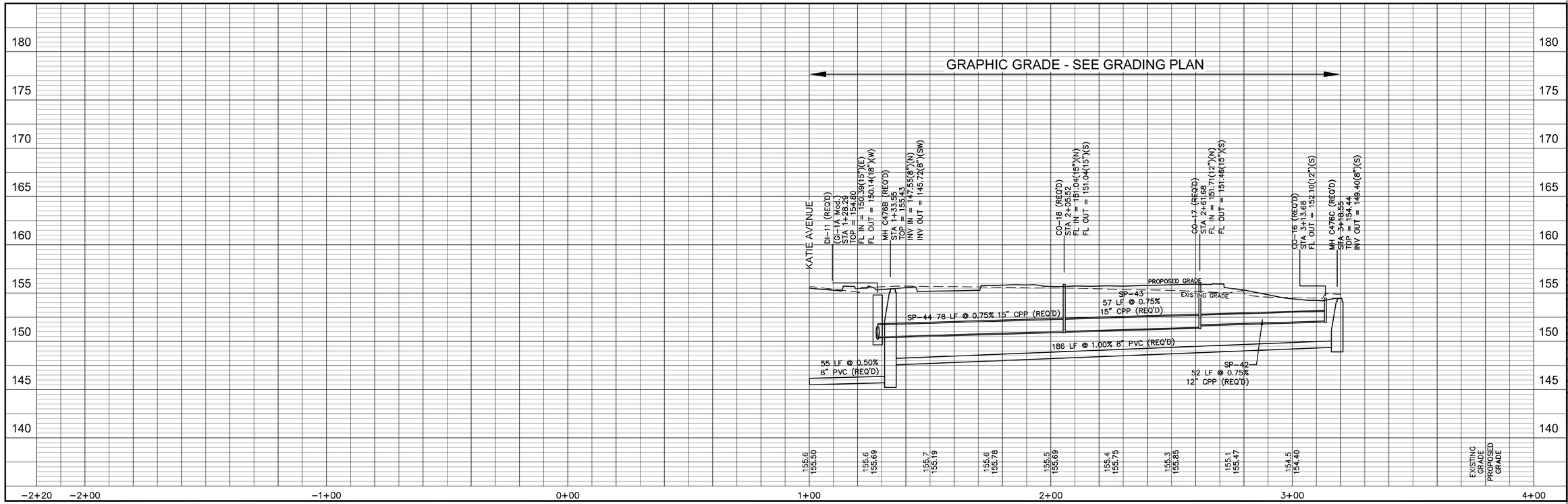
WATER INSTALLATION DETAILS

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NOTE:
COORDINATE THIS SHEET WITH THE SITE, UTILITY & GRADING PLANS.

SCALE:
1" = 20' HORIZONTAL
1" = 5' VERTICAL



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HATTIESBURG MUNICIPAL COURT ■

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12-18-2015		95% Check Set
11-19-2018		Bid Documents

Drawn By:	RES
Checked By:	SEM
Client No:	------
Albert & Associates:	12575

C2.0

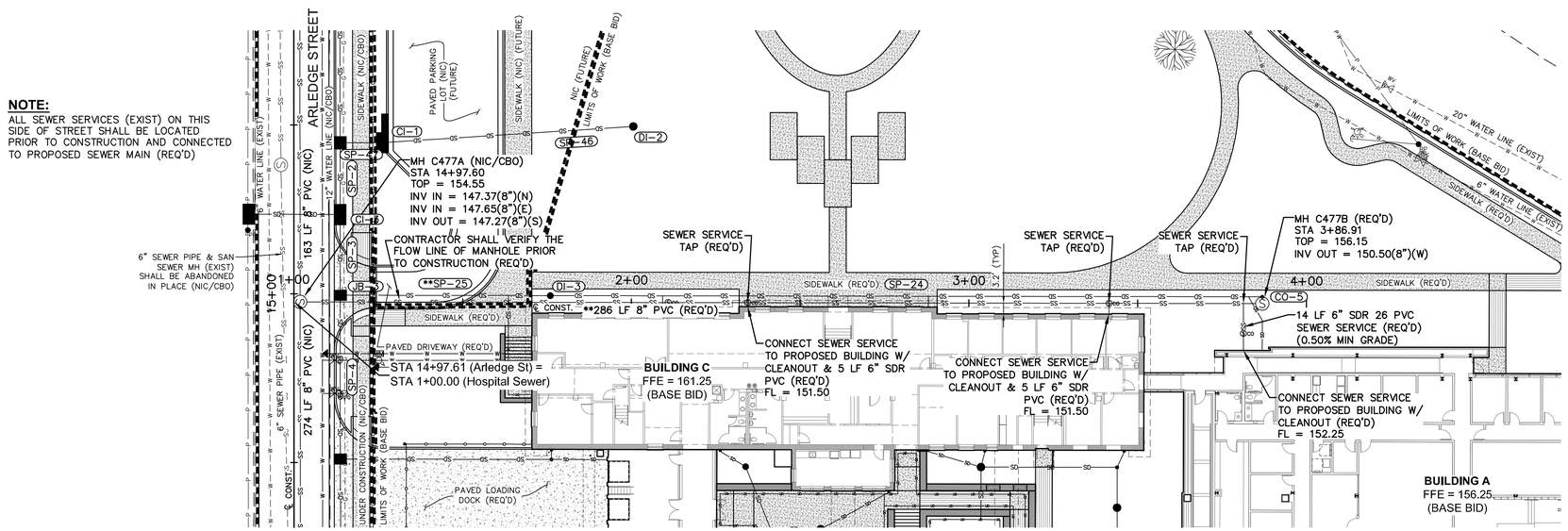
PREPARED BY:
sdw Engineering Progress
39 Grand Ave. | Hattiesburg, MS 39401 | p (601.544.1821) f (601.544.2501) | sdw.com
SDW Project No.: 15819 SDW Working No.: PoP_2

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com
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BUILDING A SEWER PLAN & PROFILE

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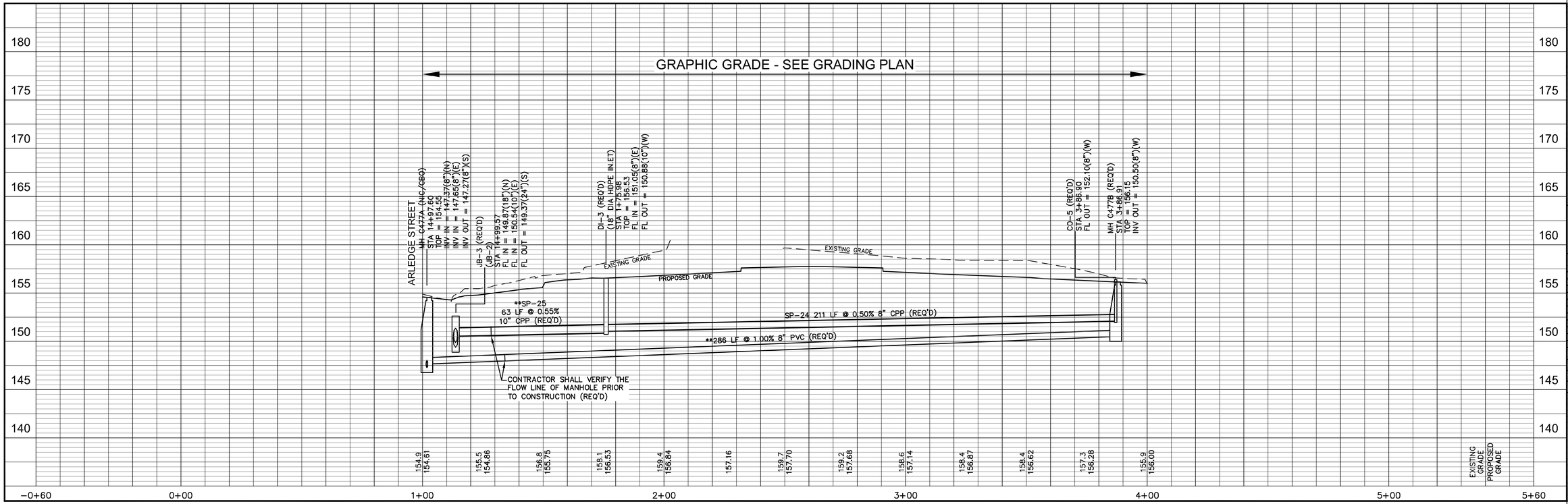
NOTE:
ALL SEWER SERVICES (EXIST) ON THIS SIDE OF STREET SHALL BE LOCATED PRIOR TO CONSTRUCTION AND CONNECTED TO PROPOSED SEWER MAIN (REQ'D)



**NOTE:
CONTRACTOR SHALL VERIFY LENGTH REQ'D PRIOR TO CONSTRUCTION

NOTE:
COORDINATE THIS SHEET WITH THE SITE, UTILITY & GRADING PLANS.

SCALE:
1" = 20' HORIZONTAL
1" = 5' VERTICAL



HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

BID DOCUMENTS

Drawing Issued:		
Date	Rev.	Description
10-31-2015		65% Check Set
12-18-2015		95% Check Set
11-19-2018		Bid Documents

Drawn By: RES
Checked By: SEM
Client No: -----
Albert & Associates: 12575

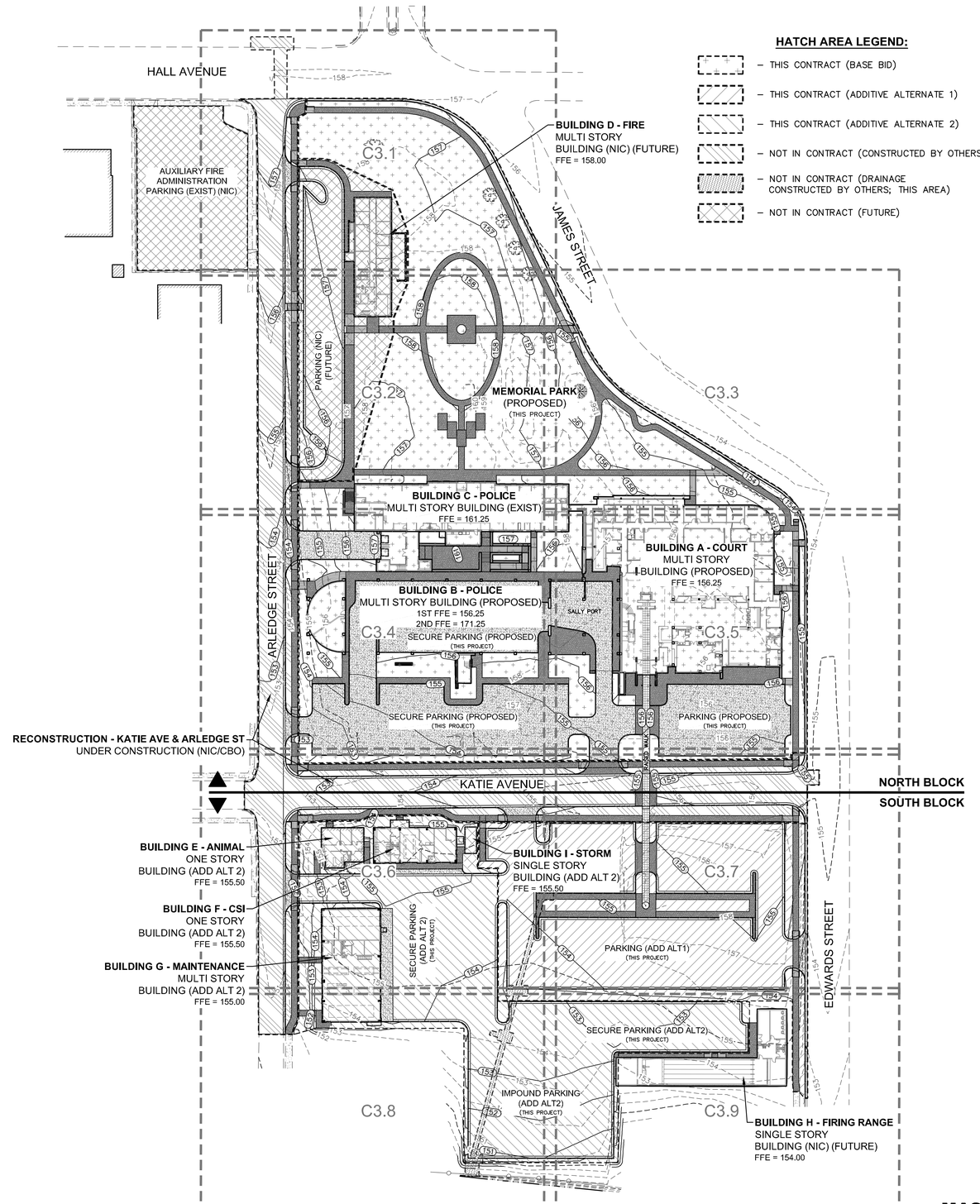
C2.1

PREPARED BY:
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39 Grand Ave. | Hattiesburg, MS 39401 | p (601.544.1821) f (601.544.2501) | sdw.com
SDW Project No.: 15819 SDW Working No.: PoP_5

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BUILDING C SEWER PLAN & PROFILE

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MASTER GRADING PLAN

PREPARED BY:
SDW Engineering Progress
105 Second Ave. | Hattiesburg, MS 39401 | p (601.544.1821) | f (601.544.0501) | sdwe.com
SDW Project No.: 15819 SDW Working No.: GP1

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

BID DOCUMENTS

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12-18-2015		95% Check Set
11-19-2018		Bid Documents

Drawn By:	RES
Checked By:	SEM
Client No:	———
Albert & Associates: 12575	

C3.0

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MASTER GRADING PLAN

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HALL AVENUE

ONLY

ARLEDGE STREET (NIC/CBO)

LIMITS OF WORK (BASE BID)
NIC (FUTURE)

UNDER CONSTRUCTION (NIC/CBO)
NIC (FUTURE)

6" CPP ROOF DRAIN CONNECTION (NIC) (FUTURE)

BUILDING D
(NIC) (FUTURE)
FFE = 158.00

6" CPP ROOF DRAIN CONNECTION (NIC) (FUTURE)

MECH COURTYARD
(NIC) (FUTURE)

6" CPP ROOF DRAIN CONNECTION (NIC) (FUTURE)

LIMITS OF WORK (BASE BID)

GRADE TO DRAIN

JAMES STREET

LIMITS OF WORK (BASE BID)

SHEET KEY

C3.1	
C3.2	C3.3
C3.4	C3.5
C3.6	C3.7
C3.8	C3.9

GRAPHIC SCALE
10 0 5 10 20 40
(IN FEET)

GRADING & DRAINAGE PLAN

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

BID DOCUMENTS

Drawing Issued:

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10-31-2015		65% Check Set
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Drawn By: RES
Checked By: SEM
Client No: ——
Albert & Associates: 12575

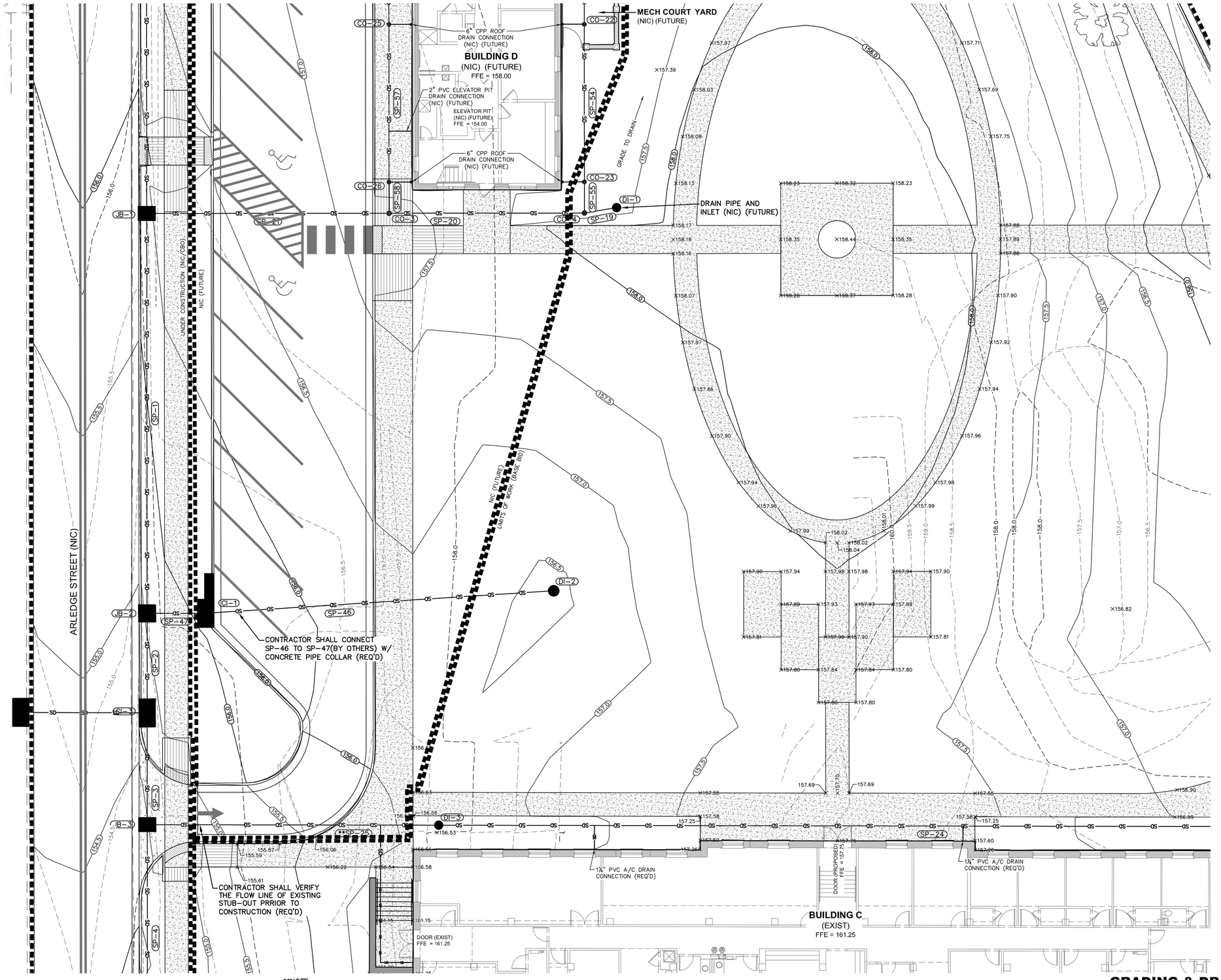
C3.1

PREPARED BY:
SDW Engineering Progress
SDW Project No.: 15819 SDW Working No.: GP2

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GRADING & DRAINAGE PLAN - NORTH BLOCK

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SHEET KEY

C3.1	
C3.2	C3.3
C3.4	C3.5
C3.6	C3.7
C3.8	C3.9

GRAPHIC SCALE
10 0 5 10 20 40
(IN FEET)

GRADING & DRAINAGE PLAN

PREPARED BY:
sdw Engineering Progress
309 Second Ave. | Hattiesburg, MS. 39401 | p.(601)544.3821 | f.(601)544.2501 | sdwa.com
SDW Project No.: 15819 SDW Working No.:GP3

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

BID DOCUMENTS

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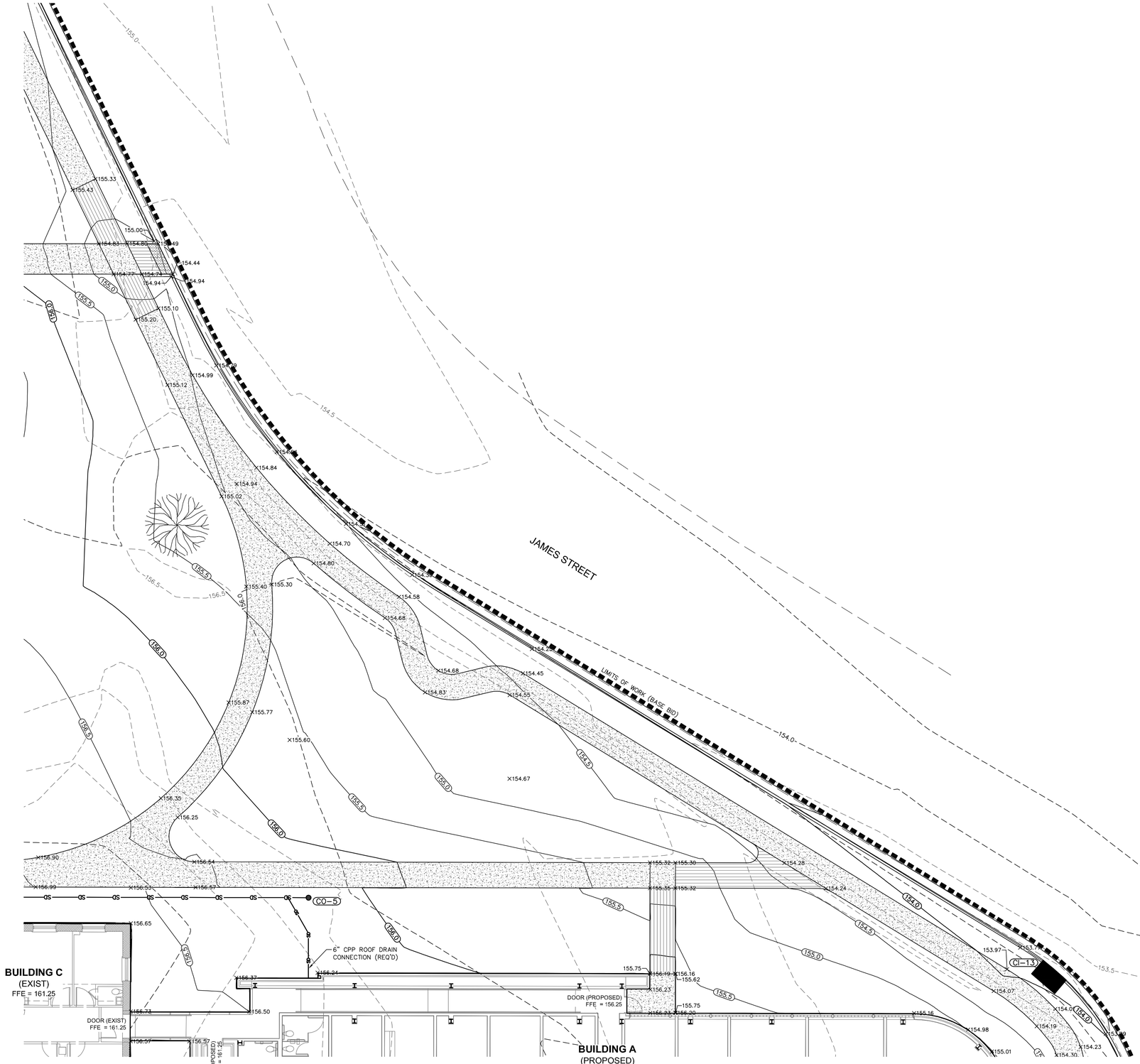
Drawn By: RES
Checked By: SEM
Client No: ——
Albert & Associates: 12575

C3.2

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GRADING & DRAINAGE PLAN - NORTH BLOCK

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SHEET KEY

C3.1	
C3.2	C3.3
C3.4	C3.5
C3.6	C3.7
C3.8	C3.9

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

BID DOCUMENTS

Drawing Issued:

Date	Rev.	Description
10-31-2015		65% Check Set
12-18-2015		95% Check Set
11-19-2018		Bid Documents

Drawn By:	RES
Checked By:	SEM
Client No:	------
Albert & Associates:	12575

GRADING & DRAINAGE PLAN

GRAPHIC SCALE
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(IN FEET)

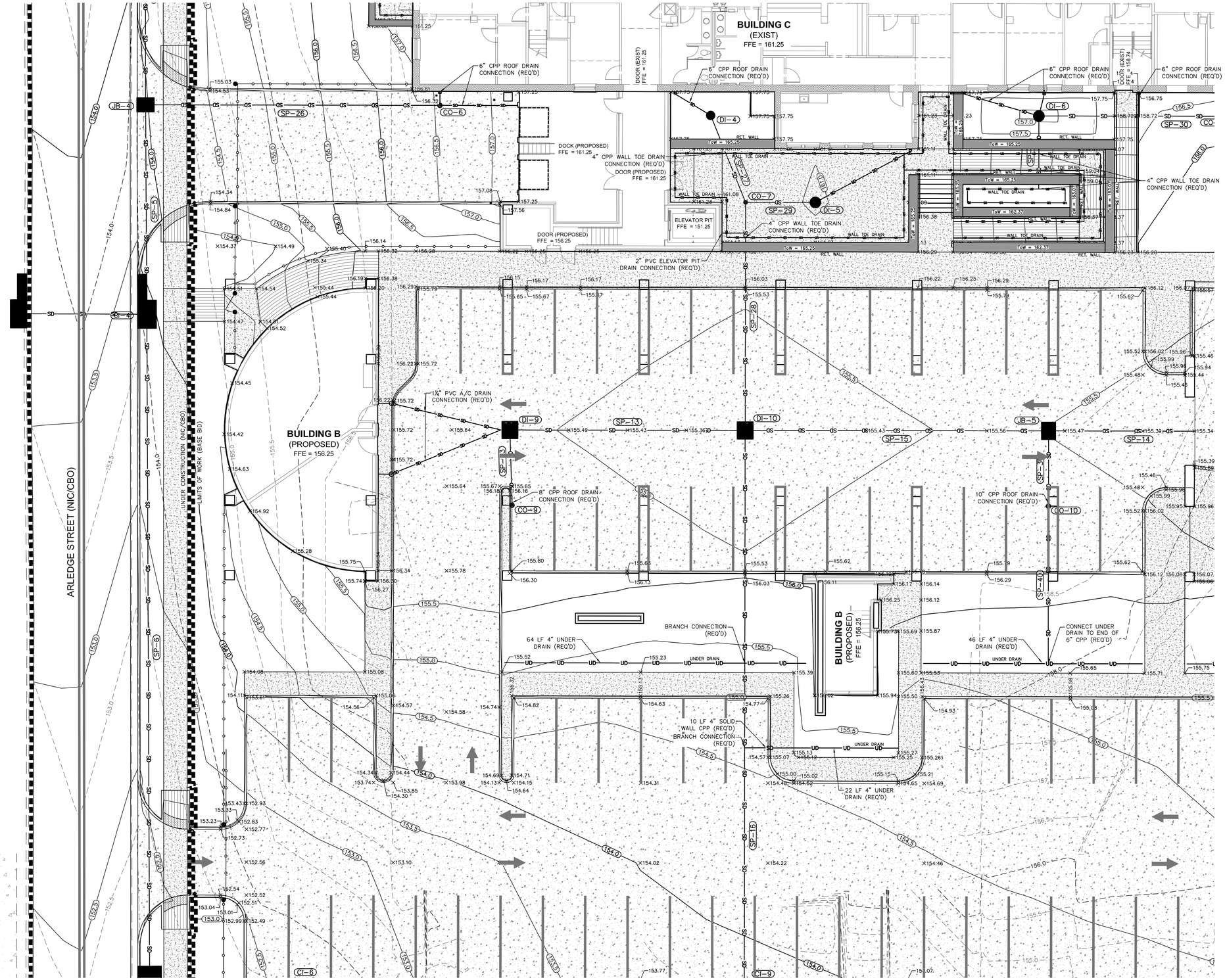
PREPARED BY:
SDW Engineering Progress
309 Second Ave. | Hattiesburg, MS | 39401 | p | 601.544.1821 | f | 601.544.1920 | sdw.com
SDW Project No.: 15819 SDW Working No.: GP4

C3.3

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GRADING & DRAINAGE PLAN - NORTH BLOCK

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SHEET KEY

C3.1	
C3.2	C3.3
C3.4	C3.5
C3.6	C3.7
C3.8	C3.9

GRADING & DRAINAGE PLAN

GRAPHIC SCALE
10 0 5 10 20 40
(IN FEET)

PREPARED BY:
SDW Engineering Progress
105 Second Ave. | Hattiesburg, MS 39401 | p (601.544.3821) | f (601.544.3501) | sdwa.com
SDW Project No.: 15819 SDW Working No.: GP5

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■ PUBLIC SAFETY COMPLEX

BID DOCUMENTS

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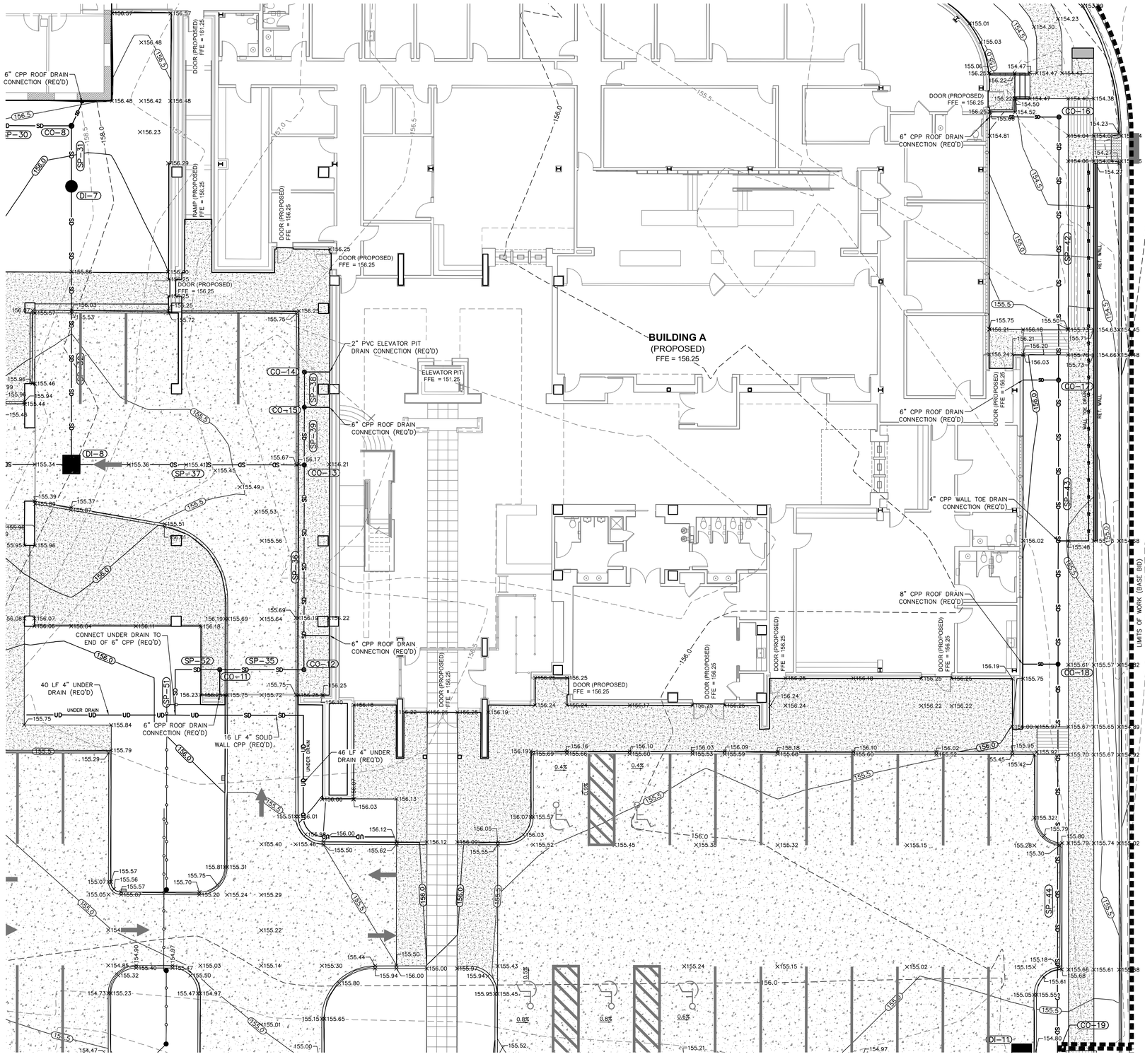
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Checked By: SEM
Client No: ———
Albert & Associates: 12575

C3.4

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GRADING & DRAINAGE PLAN - NORTH BLOCK

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SHEET KEY

C3.1	
C3.2	C3.3
C3.4	C3.5
C3.6	C3.7
C3.8	C3.9

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

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11-19-2018		Bid Documents

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Client No:	------
Albert & Associates: 12575	

GRADING & DRAINAGE PLAN

GRAPHIC SCALE
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(IN FEET)

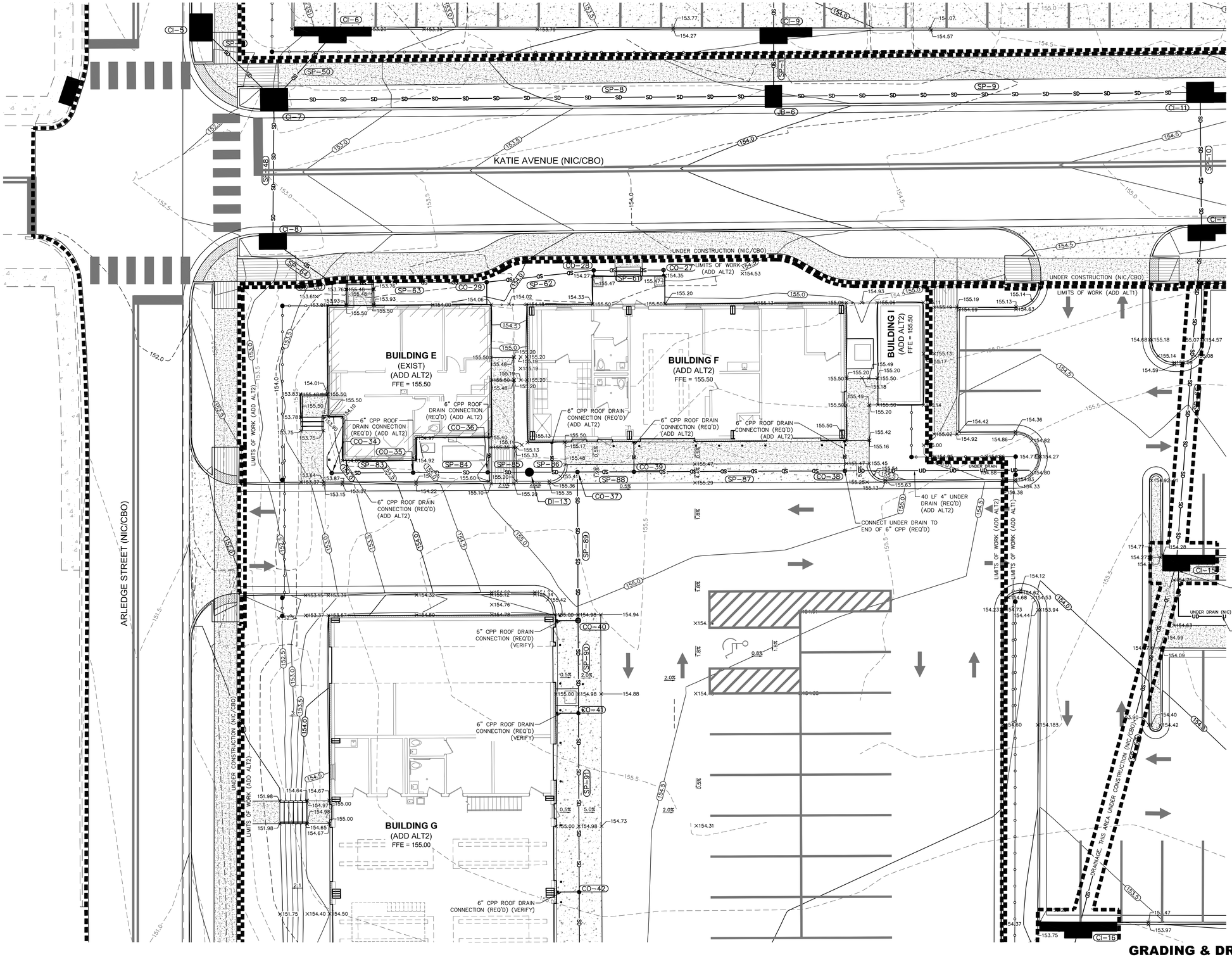
PREPARED BY:
SDW Engineering Progress
309 Second Ave. | Hattiesburg, MS 39401 | p | 601.544.1821 | f | 601.544.2501 | sdw.com
SDW Project No.: 15819 SDW Working No.:GP6

C3.5

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GRADING & DRAINAGE PLAN - NORTH BLOCK

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SHEET KEY

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C3.2	C3.3
C3.4	C3.5
C3.6	C3.7
C3.8	C3.9

GRAPHIC SCALE

10 0 5 10 20 40

(IN FEET)

GRADING & DRAINAGE PLAN

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

BID DOCUMENTS

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Drawn By: RES
Checked By: SEM
Client No: ------
Albert & Associates: 12575

C3.6

PREPARED BY:

SDW Engineering Progress
309 Second Ave. | Hattiesburg, MS 39401 | (p) 601.544.1921 | (f) 601.544.1920 | sdwe.com

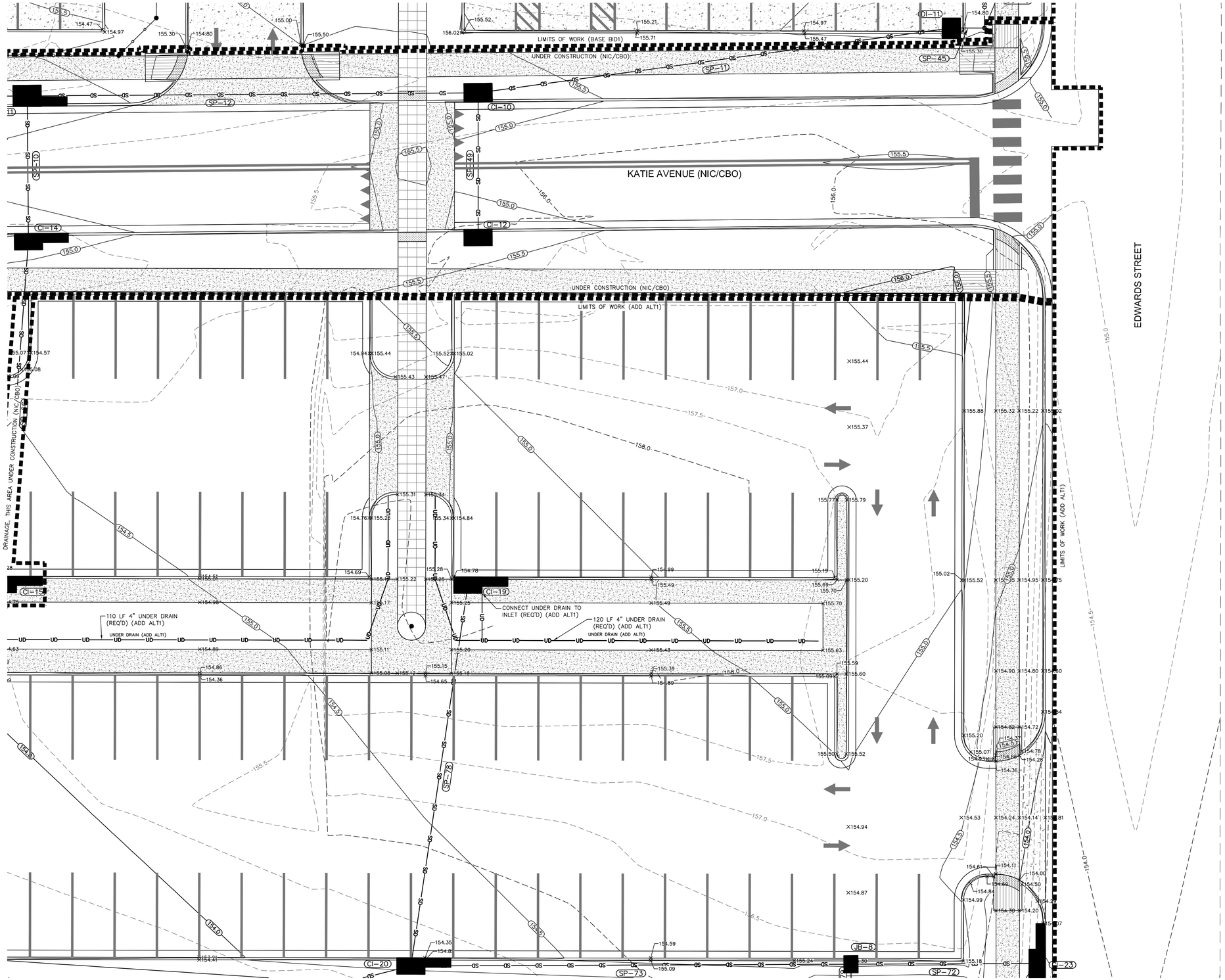
SDW Project No.: 15819 SDW Working No.:GP7

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GRADING & DRAINAGE PLAN - SOUTH BLOCK

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SHEET KEY

C3.1	
C3.2	C3.3
C3.4	C3.5
C3.6	C3.7
C3.8	C3.9

GRAPHIC SCALE

10 0 5 10 20 40

(IN FEET)

GRADING & DRAINAGE PLAN

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SDW Engineering Progress

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SDW Project No.: 15819 SDW Working No.: GPB

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT

CITY OF HATTIESBURG MISSISSIPPI

BID DOCUMENTS

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Checked By: SEM

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Albert & Associates: 12575

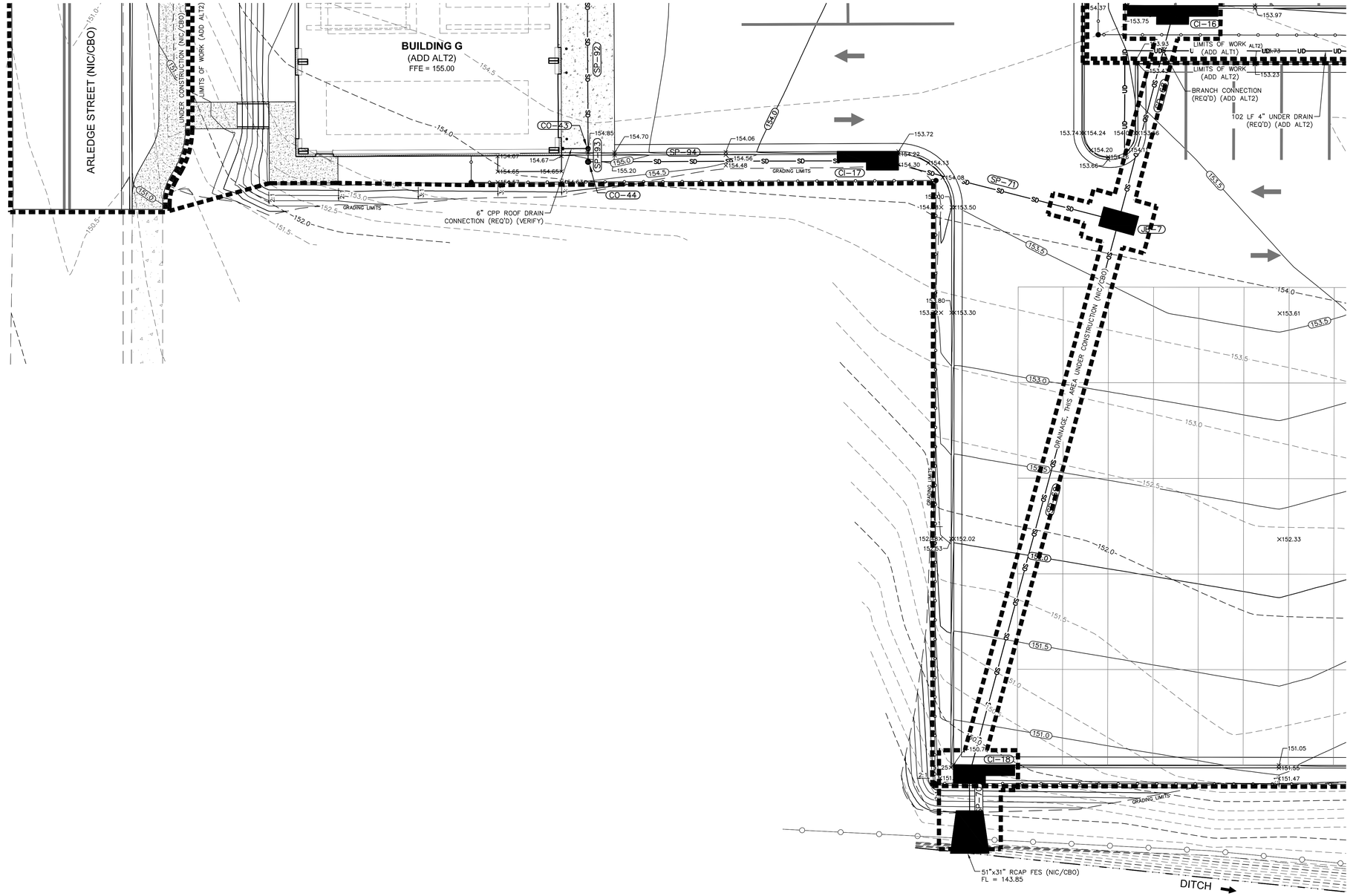
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GRADING & DRAINAGE PLAN - SOUTH BLOCK

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SHEET KEY

C3.1	
C3.2	C3.3
C3.4	C3.5
C3.6	C3.7
C3.8	C3.9

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

BID DOCUMENTS

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12-18-2015		95% Check Set
11-19-2018		Bid Documents

Drawn By:	RES
Checked By:	SEM
Client No:	------
Albert & Associates: 12575	

GRADING & DRAINAGE PLAN

GRAPHIC SCALE
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(IN FEET)

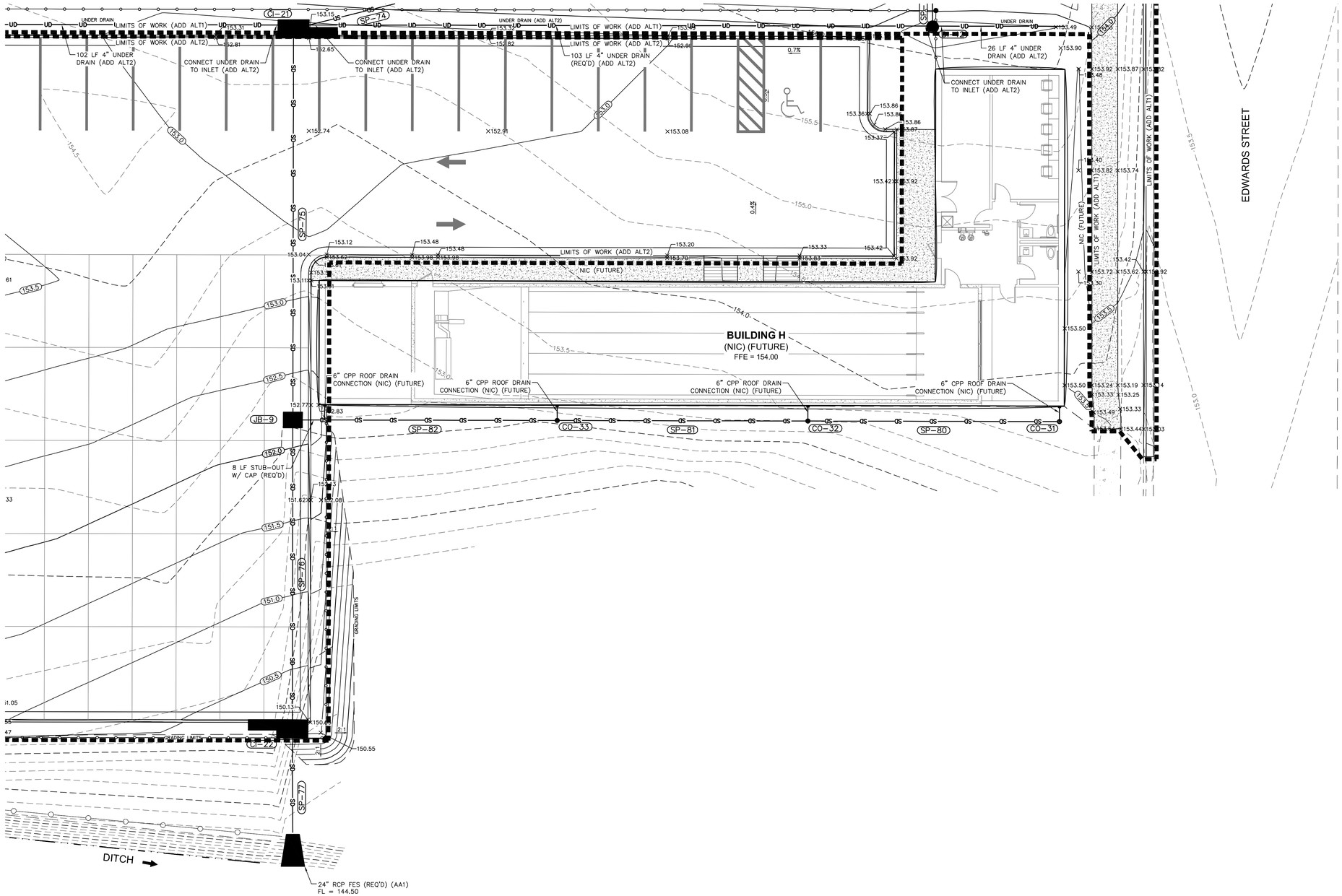
PREPARED BY:
SDW Engineering Progress
329 Second Ave. | Hattiesburg, MS. 39401 | p.) 601.544.1821 | f.) 601.544.0501 | sdwe.com
SDW Project No.: 15819 SDW Working No.:GP9

C3.8

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GRADING & DRAINAGE PLAN - SOUTH BLOCK

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SHEET KEY

C3.1	
C3.2	C3.3
C3.4	C3.5
C3.6	C3.7
C3.8	C3.9

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT

BID DOCUMENTS

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11-19-2018		Bid Documents

Drawn By:	RES
Checked By:	SEM
Client No:	------
Albert & Associates: 12575	

GRADING & DRAINAGE PLAN

GRAPHIC SCALE
10 0 5 10 20 40
(IN FEET)

PREPARED BY:
SDW Engineering Progress
SDW Project No.: 15819 SDW Working No.: GP10

C3.9

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GRADING & DRAINAGE PLAN - SOUTH BLOCK

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Structure Table

Structure Name	Type	Length	Width (W)	Top	Inverts	
CI-1	SS-2	10'-0"	2.50'	156.05	FL IN = 151.88 (8)(SP-46)(E) FL OUT = 151.05 (18)(SP-47)(W)	NIC (FUTURE)
CI-2	SS-2	5'-0"	2.50'	157.15	FL IN = 152.15 (18)(SP-97)(W) FL OUT = 152.15 (18)(SP-18)(S)	NIC/CBO
CI-3	SS-2	5'-0"	2.50'	155.11	FL IN = 150.11 (18)(SP-2)(N) FL IN = 150.11 (18)(SP-96)(W) FL OUT = 150.11 (18)(SP-3)(S)	NIC/CBO
CI-4	SS-2	10'-0"	3.00'	153.83	FL IN = 148.66 (24)(SP-5)(N) FL IN = 148.66 (18)(SP-95)(W) FL OUT = 148.66 (24)(SP-6)(S)	NIC/CBO
CI-5	SS-2	5'-0"	4.00'	152.57	FL IN = 147.57 (24)(SP-6)(N) FL OUT = 147.57 (24)(SP-7)(SE)	NIC/CBO
CI-6	SS-2	15'-0"	2.50'	152.93	FL OUT = 148.43 (15)(SP-50)(SW)	BASE BID
CI-7	SS-2	5'-0"	4.00'	153.11	FL IN = 147.46 (24)(SP-7)(NW) FL IN = 147.96 (18)(SP-48)(S) FL IN = 148.24 (15)(SP-50)(NE) FL OUT = 146.96 (30)(SP-8)(E)	NIC/CBO
CI-8	SS-2	5'-0"	2.50'	153.10	FL IN = 149.02 (8)(SP-64)(SE) FL OUT = 148.19 (18)(SP-48)(N)	NIC/CBO
CI-9	SS-2	10'-0"	2.50'	154.37	FL IN = 147.49 (24)(SP-16)(N) FL OUT = 147.49 (24)(SP-17)(S)	BASE BID
CI-10	SS-2	5'-0"	3.00'	155.34	FL IN = 149.12 (18)(SP-11)(E) FL IN = 150.03 (18)(SP-49)(S) FL OUT = 149.12 (18)(SP-12)(W)	NIC/CBO
CI-11	SS-2	10'-0"	3.50'	154.87	FL IN = 145.93 (30)(SP-9)(W) FL IN = 147.21 (18)(SP-12)(E) FL OUT = 145.93 (44)(SP-10)(S)	NIC/CBO
CI-12	SS-2	5'-0"	2.50'	155.34	FL OUT = 150.34 (18)(SP-49)(N)	NIC/CBO
CI-13	SS-2	5'-0"	2.50'	153.81	FL IN = 151.64 (10)(SP-59)(NW) FL OUT = 151.56 (12)(SP-60)(NE)	BASE BID
CI-14	SS-2	10'-0"	2.50'	156.83	FL IN = 145.79 (44)(SP-65)(N) FL OUT = 145.79 (44)(SP-66)(S)	NIC/CBO
CI-15	SS-2	10'-0"	2.50'	154.78	FL IN = 145.42 (44)(SP-66)(N) FL OUT = 145.09 (51)(SP-67)(S)	NIC/CBO
CI-16	SS-2	15'-0"	2.50'	153.80	FL IN = 144.67 (51)(SP-67)(N) FL OUT = 144.67 (51)(SP-68)(S)	NIC/CBO
CI-17	SS-2	10'-0"	2.50'	154.22	FL IN = 149.21 (12)(SP-94)(W) FL OUT = 148.46 (15)(SP-71)(E)	ADD ALT2
CI-18	SS-2	10'-0"	2.50'	151.25	FL IN = 143.93 (51)(SP-69)(N) FL OUT = 143.93 (51)(SP-70)(S)	NIC/CBO
CI-19	SS-2	10'-0"	2.50'	155.28	FL OUT = 150.78 (15)(SP-78)(S)	ADD ALT1
CI-20	SS-2	10'-0"	2.50'	154.85	FL IN = 147.91 (18)(SP-73)(E) FL IN = 148.16 (15)(SP-78)(N) FL OUT = 147.91 (18)(SP-74)(W)	ADD ALT1
CI-21	SS-2	10'-0"	2.50'	153.15	FL IN = 147.76 (18)(SP-74)(E) FL OUT = 147.76 (18)(SP-75)(S)	ADD ALT1
CI-22	SS-2	10'-0"	2.50'	150.63	FL IN = 146.13 (18)(SP-76)(N) FL OUT = 145.63 (24)(SP-77)(S)	ADD ALT1
CI-23	SS-2	10'-0"	2.50'	154.02	FL OUT = 149.03 (15)(SP-72)(W)	ADD ALT1

Structure Table

Structure Name	Size	Type	Top	Inverts	
DI-1	18"	HDPE	157.24	FL OUT = 153.13 (12)(SP-19)(W)	NIC (FUTURE)
DI-2	24"	HDPE	156.37	FL OUT = 152.37 (8)(SP-46)(W)	BASE BID
DI-3	18"	HDPE	156.53	FL IN = 151.05 (8)(SP-24)(E) FL OUT = 150.88 (10)(SP-25)(W)	BASE BID
DI-4	18"	HDPE	157.65	FL OUT = 152.57 (8)(SP-27)(S)	BASE BID
DI-5	24"	HDPE	160.99	FL OUT = 150.88 (8)(SP-29)(W)	BASE BID
DI-6	24"	HDPE	156.75	FL IN = 151.92 (6)(SP-41)(S) FL OUT = 151.75 (8)(SP-30)(E)	BASE BID
DI-7	24"	HDPE	155.69	FL IN = 151.29 (10)(SP-31)(N) FL OUT = 151.29 (10)(SP-32)(S)	BASE BID
DI-12	24"	HDPE	153.25	FL OUT = 149.25 (8)(SP-79)(N)	ADD ALT1
DI-13	18"	HDPE	155.00	FL IN = 151.30 (6)(SP-85)(W) FL OUT = 151.00 (8)(SP-86)(E)	ADD ALT2

Structure Table

Structure Name	Type	Top	Inverts	
DI-8	SS-3	155.30	FL IN = 150.88 (10)(SP-32)(N) FL IN = 149.34 (15)(SP-37)(E) FL OUT = 149.09 (18)(SP-14)(W)	BASE BID
DI-9	SS-3	155.55	FL IN = 150.97 (10)(SP-33)(S) FL OUT = 150.55 (15)(SP-13)(E)	BASE BID
DI-10	SS-3	155.30	FL IN = 149.05 (15)(SP-13)(W) FL IN = 148.58 (18)(SP-15)(E) FL IN = 150.01 (12)(SP-28)(N) FL OUT = 148.08 (24)(SP-16)(S)	BASE BID
DI-11	GI-1A Mod.	154.80	FL IN = 150.39 (15)(SP-45)(E) FL OUT = 150.14 (18)(SP-11)(W)	BASE BID

Structure Table

Structure Name	Height	Inverts	
JB-1	Min.	FL IN = 151.63 (18)(SP-18)(N) FL IN = 152.13 (12)(SP-21)(E) FL OUT = 151.42 (18)(SP-1)(S)	NIC/CBO
JB-2	Min.	FL IN = 150.56 (18)(SP-1)(N) FL IN = 150.92 (18)(SP-47)(E) FL OUT = 150.35 (18)(SP-2)(S)	NIC/CBO
JB-3	Min.	FL IN = 149.87 (18)(SP-3)(N) FL IN = 150.54 (10)(SP-25)(E) FL OUT = 149.37 (24)(SP-4)(S)	NIC/CBO
JB-4	Min.	FL IN = 149.13 (24)(SP-4)(N) FL IN = 150.46 (8)(SP-26)(E) FL OUT = 148.88 (24)(SP-5)(S)	NIC/CBO
JB-5	Min.	FL IN = 148.90 (18)(SP-14)(E) FL IN = 149.40 (12)(SP-34)(S) FL OUT = 148.90 (18)(SP-15)(W)	BASE BID
JB-6	Min.	FL IN = 146.41 (30)(SP-8)(W) FL IN = 147.22 (24)(SP-17)(N) FL OUT = 146.41 (30)(SP-9)(E)	NIC/CBO
JB-7	Min.	FL IN = 144.47 (51)(SP-68)(N) FL IN = 145.80 (15)(SP-71)(W) FL OUT = 144.47 (51)(SP-69)(S)	NIC/CBO
JB-8	Min.	FL IN = 148.63 (15)(SP-72)(E) FL IN = 149.21 (8)(SP-79)(S) FL OUT = 148.38 (18)(SP-73)(W)	ADD ALT1
JB-9	Min.	FL IN = 147.38 (18)(SP-75)(N) FL IN = 148.21 (8)(SP-82)(E) FL OUT = 146.63 (18)(SP-76)(S)	ADD ALT1

INLET & JUNCTION BOX NOTES:

1. THE FLOW LINE ELEVATIONS SHOWN IN THESE TABLES ARE PIPE ELEVATIONS. THE CONTRACTOR SHALL MAKE WHATEVER ADJUSTMENTS AND CALCULATIONS NECESSARY TO CONSTRUCT THE STRUCTURES TO THE PROPER INVERT ELEVATIONS. ALL INVERTS SHALL BE GROUTED TO INSURE PROPER FLOW AND PREVENT SEDIMENT AND DEBRIS ACCUMULATION.
2. ALL CONCRETE INLETS SHALL HAVE CAST-IN-PLACE TOPS. INLET TOPS & GRATES SHALL BE FORMED AND SET TO MATCH FINISHED GRADES SHOWN ON THE GRADING PLANS. ABSOLUTELY NO PRECAST INLET TOP SECTIONS SHALL BE ALLOWED ON THIS PROJECT.
3. CUT SHEETS FOR ALL DRAINAGE STRUCTURES SHALL BE SUBMITTED FOR APPROVAL PRIOR TO CONSTRUCTION. CUT SHEETS SHALL SHOWN THE TOP GRADES OF THE STRUCTURE AS WELL AS THE SURROUNDING AREA OF THE STRUCTURE.

Structure Table

Structure Name	Inverts	
CO-1	FL OUT = 153.50 (8)(SP-23)(S)	NIC (FUTURE)
CO-2	FL OUT = 154.44 (8)(SP-22)(S)	NIC (FUTURE)
CO-3	FL IN = 152.65 (12)(SP-20)(E) FL IN = 152.98 (8)(SP-58)(N) FL OUT = 152.65 (12)(SP-21)(W)	NIC (FUTURE)
CO-4	FL IN = 153.06 (12)(SP-19)(E) FL IN = 153.40 (8)(SP-55)(N) FL OUT = 153.06 (12)(SP-20)(W)	NIC (FUTURE)
CO-5	FL OUT = 152.10 (8)(SP-24)(W)	BASE BID
CO-6	FL OUT = 151.55 (8)(SP-26)(W)	BASE BID
CO-7	FL IN = 150.58 (8)(SP-27)(N) FL IN = 150.58 (8)(SP-29)(E) FL OUT = 150.25 (12)(SP-28)(S)	BASE BID
CO-8	FL IN = 151.55 (8)(SP-30)(W) FL OUT = 151.38 (10)(SP-31)(S)	BASE BID
CO-9	FL OUT = 151.13 (10)(SP-33)(N)	BASE BID
CO-10	FL IN = 149.98 (6)(SP-40)(S) FL OUT = 149.48 (12)(SP-34)(N)	BASE BID
CO-11	FL IN = 150.61 (6)(SP-52)(W) FL OUT = 150.44 (8)(SP-35)(E)	BASE BID
CO-12	FL IN = 150.36 (8)(SP-35)(W) FL OUT = 150.03 (12)(SP-36)(N)	BASE BID
CO-13	FL IN = 149.82 (12)(SP-36)(S) FL IN = 150.16 (8)(SP-39)(N) FL OUT = 149.57 (15)(SP-37)(W)	BASE BID
CO-14	FL OUT = 150.25 (8)(SP-38)(S)	BASE BID
CO-15	FL IN = 150.22 (8)(SP-38)(N) FL OUT = 150.22 (8)(SP-39)(S)	BASE BID
CO-16	FL OUT = 152.10 (12)(SP-42)(S)	BASE BID
CO-17	FL IN = 151.71 (12)(SP-42)(N) FL OUT = 151.46 (15)(SP-43)(S)	BASE BID
CO-18	FL IN = 151.04 (15)(SP-43)(N) FL OUT = 151.04 (15)(SP-44)(S)	BASE BID
CO-19	FL IN = 150.46 (15)(SP-44)(N) FL OUT = 150.46 (15)(SP-45)(W)	BASE BID
CO-21	FL IN = 153.75 (8)(SP-22)(N) FL OUT = 153.75 (8)(SP-53)(S)	NIC (FUTURE)
CO-22	FL IN = 153.60 (8)(SP-53)(N) FL OUT = 153.60 (8)(SP-54)(S)	NIC (FUTURE)
CO-23	FL IN = 153.43 (8)(SP-54)(N) FL OUT = 153.43 (8)(SP-55)(S)	NIC (FUTURE)
CO-24	FL IN = 153.33 (8)(SP-23)(N) FL OUT = 153.33 (8)(SP-56)(S)	NIC (FUTURE)
CO-25	FL IN = 153.18 (8)(SP-56)(N) FL OUT = 153.18 (8)(SP-57)(S)	NIC (FUTURE)
CO-26	FL IN = 153.01 (8)(SP-57)(N) FL OUT = 153.01 (8)(SP-58)(S)	NIC (FUTURE)
CO-27	FL OUT = 150.00 (8)(SP-61)(W)	ADD ALT2
CO-28	FL IN = 149.92 (8)(SP-61)(E) FL OUT = 149.92 (8)(SP-62)(W)	ADD ALT2
CO-29	FL IN = 149.69 (8)(SP-62)(E) FL OUT = 149.69 (8)(SP-63)(W)	ADD ALT2
CO-30	FL IN = 149.34 (8)(SP-63)(E) FL OUT = 149.34 (8)(SP-64)(NW)	ADD ALT2
CO-31	FL OUT = 149.69 (8)(SP-80)(W)	NIC (FUTURE)
CO-32	FL IN = 149.21 (8)(SP-80)(E) FL OUT = 149.21 (8)(SP-81)(W)	NIC (FUTURE)
CO-33	FL IN = 148.72 (8)(SP-81)(E) FL OUT = 148.72 (8)(SP-82)(W)	NIC (FUTURE)
CO-34	FL OUT = 150.28 (6)(SP-83)(E)	ADD ALT2
CO-35	FL IN = 151.24 (6)(SP-83)(W) FL OUT = 151.55 (6)(SP-84)(E)	ADD ALT2
CO-36	FL IN = 151.39 (6)(SP-84)(W) FL OUT = 151.39 (6)(SP-85)(E)	ADD ALT2
CO-37	FL IN = 150.92 (8)(SP-86)(W) FL IN = 151.09 (6)(SP-88)(E) FL OUT = 150.75 (10)(SP-89)(S)	ADD ALT2
CO-38	FL OUT = 151.53 (6)(SP-87)(W)	ADD ALT2
CO-39	FL IN = 151.18 (6)(SP-87)(E) FL OUT = 151.18 (6)(SP-88)(W)	ADD ALT2
CO-40	FL IN = 150.51 (10)(SP-89)(N) FL OUT = 150.51 (10)(SP-90)(S)	ADD ALT2 (VERIFY)
CO-41	FL IN = 150.35 (10)(SP-90)(N) FL OUT = 150.35 (10)(SP-91)(S)	ADD ALT2 (VERIFY)
CO-42	FL IN = 150.06 (10)(SP-91)(N) FL OUT = 150.06 (10)(SP-92)(S)	ADD ALT2 (VERIFY)
CO-43	FL IN = 149.81 (10)(SP-92)(N) FL OUT = 149.64 (12)(SP-93)(S)	ADD ALT2 (VERIFY)
CO-44	FL IN = 149.62 (12)(SP-93)(N) FL OUT = 149.62 (12)(SP-94)(E)	ADD ALT2 (VERIFY)

CLEAN OUT NOTE:

THE FLOW LINE ELEVATIONS SHOWN IN THIS TABLE ARE PIPE ELEVATIONS. THE ITEM "CLEAN OUT" IN THIS TABLE SHALL INCLUDE, BUT NOT BE LIMITED TO, ALL FITTINGS REQUIRED TO MAKE THE APPROPRIATE CONNECTIONS SUCH AS THE CLEAN OUT, BENDS, TEE, REDUCERS, ETC.

Pipe Table

Pipe Name	Size	Type	Length	Slope	
SP-1	18"	RCP	84 LF	1.00%	NIC/CBO
SP-2	18"	RCP	18 LF	1.14%	NIC/CBO
SP-3	18"	RCP	21 LF	1.00%	NIC/CBO
SP-4	24"	RCP	47 LF	0.50%	NIC/CBO
SP-5	24"	RCP	42 LF	0.50%	NIC/CBO
SP-6	24"	RCP	137 LF	0.77%	NIC/CBO
SP-7	24"	RCP	17 LF	0.50%	NIC/CBO
SP-8	30"	RCP	107 LF	0.50%	NIC/CBO
SP-9	30"	RCP	91 LF	0.50%	NIC/CBO
SP-11	18"	RCP	98 LF	1.00%	BASE BID
SP-12	18"	RCP	91 LF	2.00%	NIC/CBO
SP-13	15"	RCP	48 LF	3.00%	BASE BID
SP-14	18"	RCP	37 LF	0.50%	BASE BID
SP-15	18"	RCP	63 LF	0.50%	BASE BID
SP-16	24"	RCP	117 LF	0.50%	BASE BID
SP-18	18"	RCP	101 LF	0.50%	NIC/CBO
SP-47	18"	RCP	10 LF	1.00%	NIC/CBO
SP-48	18"	RCP	29 LF	0.75%	NIC/CBO
SP-49	18"	RCP	29 LF	1.00%	NIC/CBO
SP-50	15"	RCP	15 LF	1.00%	BASE BID
SP-71	15"	RCP	41 LF	5.79%	BASE BID
SP-72	15"	RCP	38 LF	1.00%	ADD ALT1
SP-73	18"	RCP	91 LF	0.50%	ADD ALT1
SP-74	18"	RCP	26 LF	0.50%	ADD ALT1
SP-75	18"	RCP	74 LF	0.50%	ADD ALT1
SP-76	18"	RCP	58 LF	0.83%	ADD ALT1
SP-77	24"	RCP	18 LF	4.25%	ADD ALT1
SP-78	15"	RCP	80 LF	3.20%	ADD ALT1

Pipe Table

Pipe Name	Size	Type	Length	Slope	
SP-10	44"x27"	RCAP	30 LF	0.50%	NIC/CBO
SP-66	44"x27"	RCAP	74 LF	0.50%	NIC/CBO
SP-67	51"x31"	RCAP	84 LF	0.50%	NIC/CBO
SP-68	51"x31"	RCAP	41 LF	0.50%	NIC/CBO
SP-69	51"x31"	RCAP	108 LF	0.50%	NIC/CBO
SP-70	51"x31"	RCAP	8 LF	0.50%	NIC/CBO

Pipe Table

Pipe Name	Size	Type	Length	Slope	
SP-19	12"	CPP	7 LF	1.00%	NIC (FUTURE)
SP-20	12"	CPP	42 LF	1.00%	NIC (FUTURE)
SP-21	12"	CPP	52 LF	1.00%	NIC (FUTURE)
SP-22	8"	CPP	34 LF	2.05%	NIC (FUTURE)
SP-23	8"	CPP	34 LF	0.50%	NIC (FUTURE)
SP-24	8"	CPP	211 LF	0.50%	BASE BID
SP-25	10"	CPP	63 LF	0.55%	BASE BID
SP-26	8"	CPP	63 LF	1.74%	BASE BID
SP-27	8"	CPP	20 LF	10.00%	BASE BID
SP-28	12"	CPP	49 LF	0.50%	BASE BID
SP-29	8"	CPP	15 LF	2.00%	BASE BID
SP-30	8"	CPP	41 LF	0.50%	BASE BID
SP-31	10"	CPP	12 LF	0.75%	BASE BID
SP-32	10"	CPP	56 LF	0.75%	BASE BID
SP-33	10"	CPP	17 LF	1.00%	BASE BID
SP-34	12"	CPP	17 LF	0.50%	BASE BID
SP-35	8"	CPP	17 LF	0.50%	BASE BID
SP-36	12"	CPP	41 LF	0.50%	BASE BID
SP-37	15"	CPP	46 LF	0.50%	BASE BID
SP-38	8"	CPP	7 LF	0.50%	BASE BID
SP-39	8"	CPP	12 LF	0.50%	BASE BID
SP-40	6"	CPP	34 LF	0.50%	BASE BID
SP-41	6"	CPP	16 LF	0.50%	BASE BID
SP-42	12"	CPP	52 LF	0.75%	BASE BID
SP-43	15"	CPP	57 LF	0.75%	BASE BID
SP-44	15"	CPP	78 LF	0.75%	BASE BID
SP-45	15"	CPP	8 LF	1.00%	BASE BID
SP-46	8"	CPP	75 LF	0.65%	BASE BID
SP-51	6"	CPP	9 LF	0.50%	BASE BID
SP-52	6"	CPP	9 LF	0.50%	BASE BID
SP-53	8"	CPP	31 LF	0.50%	NIC (FUTURE)
SP-54	8"	CPP	34 LF	0.50%	NIC (FUTURE)
SP-55	8"	CPP	7 LF	0.50%	NIC (FUTURE)
SP-56	8"	CPP	31 LF	0.50%	NIC (FUTURE)
SP-57	8"	CPP	34 LF	0.50%	NIC (FUTURE)
SP-58	8"	CPP	7 LF	0.50%	NIC (FUTURE)
SP-61	8"	CPP	16 LF	0.50%	ADD ALT2
SP-62	8"	CPP	24 LF	1.00%	ADD ALT2
SP-63	8"	CPP	35 LF	1.00%	ADD ALT2
SP-64	8"	CPP	16 LF	2.00%	ADD ALT2
SP-79	8"	CPP	8 LF	0.50%	ADD ALT1
SP-80	8"	CPP	49 LF	1.00%	NIC (FUTURE)
SP-81	8"	CPP	49 LF	1.00%	NIC (FUTURE)
SP-82	8"	CPP	52 LF	1.00%	NIC (FUTURE)
SP-83	6"	CPP	18 LF	-5.37%	ADD ALT2
SP-84	6"	CPP	17 LF	1.00%	ADD ALT2
SP-85	6"	CPP	10 LF	1.00%	ADD ALT2
SP-86	8"	CPP	11 LF	0.75%	ADD ALT2
SP-87	6"	CPP	47 LF	0.75%	ADD ALT2
SP-88	6"	CPP	13 LF	0.75%	ADD ALT2
SP-89	10"	CPP	33 LF	0.75%	ADD ALT2 (VERIFY)
SP-90	10"	CPP	21 LF	0.75%	ADD ALT2 (VERIFY)
SP-91	10"	CPP	40 LF	0.75%	ADD ALT2 (VERIFY)
SP-92	10"	CPP	34 LF	0.75%	ADD ALT2 (VERIFY)
SP-93	12"	CPP	3 LF	0.75%	ADD ALT2 (VERIFY)
SP-94	12"	CPP	56 LF	0.75%	ADD ALT2 (VERIFY)

PIPE NOTES:

1. ALL DRAINAGE PIPE SHALL BE INSTALLED AS PER THE DETAILS IN THESE PLANS AND AS PER MANUFACTURERS SPECIFICATIONS.
2. ALL PLASTIC PIPE (PVC, CPP, HDPE, ETC.) SHALL BE PROPERLY BEDDED AND ANCHORED PER MANUFACTURERS SPECIFICATION. NO EXCEPTIONS.
3. NO PIPE, REGARDLESS OF SIZE AND MATERIAL, SHALL BE PLACED ON A GRADE LESS THAN 0.50%

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■ HATTIESBURG POLICE ACADEMY

BID DOCUMENTS

Drawing Issued:		
Date	Rev.	Description
10-31-2015		65% Check Set
12-18-2015		95% Check Set
11-19-2018		Bid Documents

Drawn By: RES
Checked By: SEM
Client No: -----
Albert & Associates: 12575

C3.10

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Albert & McCleskey Associates Architects

SCHEDULES
DRAINAGE

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STATE	PROJECT NO.
MISS.	

CORRUGATED STEEL AND ALUMINUM PIPE (ROUND)

PIPE DIAMETER (in)	MINIMUM COVER FROM TOP OF PIPE TO TOP OF SUBGRADE (in)	MAXIMUM FILL HEIGHT ABOVE TOP OF PIPE (ft) † — SHEET THICKNESS (in) — 0.064 STEEL 0.060 ALUM. 16 GAGE	0.079 STEEL 0.075 ALUM. 14 GAGE	0.109 STEEL 0.105 ALUM. 12 GAGE	0.138 STEEL 0.135 ALUM. 10 GAGE	0.168 STEEL 0.164 ALUM. 8 GAGE
		2½" x ½" CORRUGATED STEEL HELICAL	/	3" x 1" OR 5" x 1" CORRUGATED STEEL HELICAL	/	2½" x ½" CORRUGATED ALUMINUM HELICAL
12"	12"	207'/ - / 1251	259'/ - / 1571	- / - / -	- / - / -	- / - / -
15"	12"	165'/ - / 1089	207'/ - / 1251	- / - / -	- / - / -	- / - / -
18"	12"	138'/ - / 83	172'/ - / 1041	242'/ - / -	- / - / -	- / - / -
24"	12"	103'/ - / 62	129'/ - / 78	181'/ - / 1089	- / - / -	- / - / -
30"	12"	82'/ - / -	103'/ - / 69	145'/ - / 97	- / - / -	- / - / -
36"	12"	68'/ - / -	86'/ - / 62	120'/ - / 87	155'/ - / 1041	- / - / -
42"	12"	58'/ - / -	73'/ - / 51	103'/ - / 73	133'/ - / 88	163'/ - / -
48"	12"	51'/ - / -	64'/ - / -	98'/ - / 62	116'/ - / 78	142'/ - / 85'
54"	12"	- / 46' / -	57'/ 158' / -	88'/ 152' / 94'	103'/ 186'/ 62'	126'/ 129'/ 76'
60"	12"	- / 42' / -	- / 152' / -	72'/ 74'/ 48'	93'/ 95'/ 52'	114'/ 116'/ 64'
66"	12"	- / 38' / -	- / 141' / -	- / 66' / -	84'/ 80'/ -	103'/ 106'/ 52'
72"	12"	- / 35' / -	- / 43' / -	- / 61' / -	77'/ 79' / -	96'/ 97' / 45'
78"	12"	- / 32' / -	- / 40' / -	- / 56' / -	- / 73' / -	84'/ 89' / -
84"	12"	- / 29' / -	- / 37' / -	- / 52' / -	- / 68' / -	72' / 83' / -
90"	12"	- / 27' / -	- / 34' / -	- / 49' / -	- / 63' / -	- / 77' / -
96"	12"	- / - / -	- / 32' / -	- / 46' / -	- / 59' / -	- / 72' / -
102"	24"	- / - / -	- / 30' / -	- / 43' / -	- / 55' / -	- / 68' / -
108"	24"	- / - / -	- / 28' / -	- / 40' / -	- / 52' / -	- / 64' / -
114"	24"	- / - / -	- / - / -	- / 38' / -	- / 48' / -	- / 61' / -
120"	24"	- / - / -	- / - / -	- / 36' / -	- / 45' / -	- / 58' / -

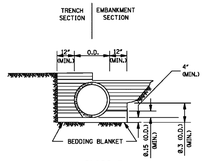
NOTE: THE AVERAGE INSIDE DIAMETER SHALL NOT VARY MORE THAN ONE (1) PERCENT OR ½", WHICHEVER IS GREATER, FROM THE NOMINAL DIAMETER WHEN MEASURED ON THE INSIDE CREST OF THE CORRUGATIONS (AASHTO M 36M/M 36 & AASHTO M 196M/M 196).

CORRUGATED METAL PIPE ARCHES

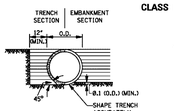
EQUIV. DIAMETER (in)	PIPE DIMENSION (SPAN x RISE) (in)	MINIMUM COVER	STEEL: MINIMUM THICKNESS REQUIRED (in)	STEEL: MAXIMUM FILL HEIGHT ABOVE TOP OF PIPE (ft) † FOR THE FOLLOWING CORNER BEARING PRESSURE (tons/ft²)	ALUMINUM: MINIMUM THICKNESS REQUIRED (in)	ALUMINUM: MAXIMUM FILL HEIGHT ABOVE TOP OF PIPE (ft) † FOR THE FOLLOWING CORNER BEARING PRESSURE (tons/ft²)
				≤ 4 tons/ft²		≤ 4 tons/ft²
				2½" x ½" CORRUGATION HELICAL		2½" x ½" CORRUGATION HELICAL
15"	17" X 13"	12"	0.064"	13'	0.060"	13'
18"	21" X 15"	12"	0.064"	12'	0.060"	12'
24"	28" X 20"	12"	0.064"	12'	0.060"	12'
30"	35" X 24"	12"	0.064"	12'	0.060"	12'
36"	42" X 29"	12"	0.064"	12'	0.060"	12'
42"	49" X 33"	12"	0.079"	12'	0.075"	12'
48"	57" X 38"	12"	0.109"	12'	0.135"	12'
54"	64" X 43"	12"	0.109"	12'	0.135"	12'
60"	71" X 47"	12"	0.138"	12'	0.164"	12'
66"	77" X 52"	12"	0.138"	12'		
72"	83" X 57"	12"	0.168"	12'		
			3" x 1" CORRUGATION HELICAL	5" x 1" CORRUGATION HELICAL		
48"	53" X 41"	12"	0.079" -	12' / -		
54"	59" X 46"	12"	-	20' / -		
60"	66" X 51"	12"	0.079" / -	20' / -		
66"	73" X 55"	18"	0.079" / -	20' / -		
72"	81" X 59"	18" / 18"	0.079" / 0.109"	17' / 17'		
78"	87" X 63"	18" / 18"	0.079" / 0.109"	16' / 16'		
84"	95" X 67"	18" / 18"	0.079" / 0.109"	16' / 16'		
90"	103" X 71"	18" / 18"	0.109" / 0.109"	16' / 16'		
96"	112" X 75"	21" / 21"	0.109" / 0.109"	16' / 16'		
102"	117" X 79"	21" / 21"	0.109" / 0.109"	16' / 16'		
108"	128" X 83"	24" / 24"	0.138" / 0.138"	16' / 16'		
114"	137" X 87"	24" / 24"	0.138" / 0.138"	16' / 16'		
120"	142" X 91"	27" / 27"	0.168" / 0.168"	16' / 16'		

NOTES:
1. THE AVERAGE INSIDE DIAMETER SHALL NOT VARY MORE THAN ONE (1) PERCENT OR ½", WHICHEVER IS GREATER, FROM THE NOMINAL DIAMETER WHEN MEASURED ON THE INSIDE CREST OF THE CORRUGATIONS. (AASHTO M 36M/M 36 & AASHTO M 196M/M 196).
† 2. BEARING PRESSURES FOR GIVEN FILL HEIGHT SHALL HAVE FOUNDATION MATERIALS INVESTIGATED TO DETERMINE BEARING CAPACITY.

TRENCH SECTION | EMBANKMENT SECTION



CLASS B



CLASS C



CLASS C MODIFIED

d = 1" FOR ½" DEEP CORRUGATION
d = 2" FOR 1" DEEP CORRUGATION

MAXIMUM HEIGHT OF FILL OVER REINFORCED CONCRETE PIPE

CLASS OF PIPE	MAXIMUM COVER (ft) — CLASS "C" BEDDING	CLASS "B" BEDDING
III	12'	19'
IV	18'	38'
SPECIAL DESIGN	>28'	>48'

NOTE: CLASS OF PIPE AND BEDDING TO BE CONSISTENT THROUGHOUT THE PIPE LENGTH.

GENERAL NOTES:

1. MINIMUM SPACING BETWEEN MULTIPLE LINES OF PARALLEL PIPE SHALL BE THE DISTANCE REQUIRED FOR INSTALLING THE ADJACENT FLARED END SECTIONS OR AS SHOWN ON THE HEADWALL DRAWINGS FOR CONDUITS REQUIRING HEADWALLS.
2. UNLESS OTHERWISE INDICATED, THE TOP OF THE PIPE SHALL BE BELOW THE TOP OF THE SUBGRADE, AND A MINIMUM OF 12" OF COVER OVER THE TOP OF THE PIPE SHALL BE MAINTAINED BETWEEN THE SHOULDER LINES.
3. WHERE PRE-BED PIPE IS INSTALLED, FLARED END SECTIONS FROM OTHER MANUFACTURERS MAY BE JOINED TO PRE-BED PIPE PROVIDED A CONCRETE COLLAR IS PLACED AT THE CONTRACTOR'S EXPENSE AND A DEFORMATION TO THE PIPE'S FLOWLINE IS NOT EVIDENT ON FINAL PLACEMENT.
4. THE BACKFILL SHALL BE EITHER CLASS "B", CLASS "C", OR CLASS "C" MODIFIED. A MINIMUM COMPACTION LEVEL OF 95% STANDARD PROCTOR DENSITY PER AASHTO T99 SHALL BE ACHIEVED BY USE OF VIBRATORY PLATE, HYDROHAMMER TYPE COMPACTORS SHALL NOT BE USED OVER THE PIPE. ALL COMPACTION EQUIPMENT USED SHALL BE APPROVED BY THE ENGINEER.

BY	REVISION

MISSISSIPPI DEPARTMENT OF TRANSPORTATION
ROADWAY DESIGN DIVISION
STANDARD PLAN

PIPE CULVERT INSTALLATION

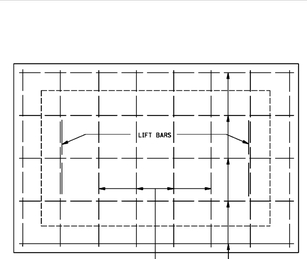
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DATE: ISSUE DATE: AUGUST 01, 2017

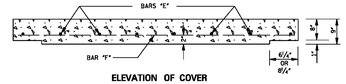
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CONFIRM PLANS BEFORE USE

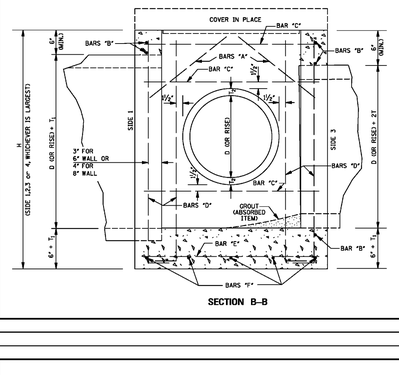
STATE	PROJECT NO.
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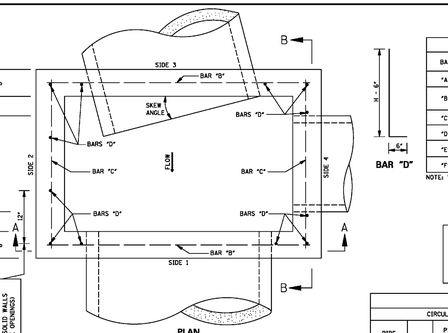
PLAN OF COVER



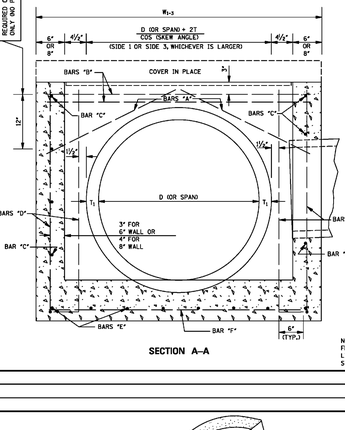
ELEVATION OF COVER



SECTION B–B



PLAN



SECTION A–A

REINFORCING BAR LIST			
BAR	SIZE	NUMBER REQUIRED	LENGTH
"A"	#4	2 PER PIPE OPENING	$196" + \left(\frac{W_{B-4}}{2} + 2"\right)^2$
"B"	#6 FOR 6" WALL	2 + (2 PER OPENING SIDE 3) + (1 PER SIDE 1) + (12" O.C. FOR SOLID WALLS)	$W_{1-3} - 4"$
"C"	#7 FOR 8" WALL	2 + (2 PER OPENING) + (12" O.C. FOR SOLID WALLS)	$W_{2-4} - 4"$
"D"	#4	4 + (2 PER OPENING) + (12" O.C. FOR SOLID WALLS)	H
"E"	#6	$2\left[\left(\frac{W_{1-3}}{12}\right)+1\right]$	$W_{2-4} - 4"$
"F"	#6	$2\left[\left(\frac{W_{2-4}}{12}\right)+1\right]$	$W_{1-3} - 4"$

NOTE: VARIABLES AND DESIGNATIONS ARE AS FOLLOWS:
D (OR SPAN) = PIPE DIAMETER (OR SPAN)
W_{1-3} = WIDTH OF SIDE 1 & SIDE 3
W_{2-4} = WIDTH OF SIDE 2 & SIDE 4
* = W_{1-3} OR W_{2-4} (SIDE OF ENTERING PIPE)
** = ROUND TO NEAREST WHOLE NUMBER

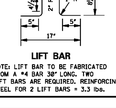
CL. "B" CONC. (yd^3) = (Q1 + Q2) / 46,656) - Σ PIPE OPENING DEDUCTIONS
WHERE: Q1 = (8'-W_{1-3})W_{2-4} + (1'-W_{1-3} - 12.5")W_{2-4} - 12.5"W_{2-4} + ((T_1 + 6" - W_{1-3})W_{2-4})
Q2 = 12"(H - (T_1 + 6"))(8'-W_{1-3} - 12") + W_{2-4})

OR: CL. "B" CONC. (yd^3) = (Q1 + Q2) / 46,656) - Σ PIPE OPENING DEDUCTIONS
WHERE: Q1 = (8'-W_{1-3})W_{2-4} + (1'-W_{1-3} - 16.5")W_{2-4} - 16.5"W_{2-4} + ((T_1 + 6" - W_{1-3})W_{2-4})
Q2 = 12"(H - (T_1 + 6"))(8'-W_{1-3} - 12") + W_{2-4})

COMMON PIPE SIZE					
CIRCULAR PIPE			ARCH PIPE		
PIPE SIZE	T	PIPE OPENING DEDUCTION (yd^3)	PIPE SIZE	T	PIPE OPENING DEDUCTION (yd^3)
		6" WALL / 8" WALL			6" WALL / 8" WALL
18"	2½"	0.053 / 0.071	22" x 13"	2½"	0.053 / 0.071
24"	3"	0.091 / 0.121	29" x 18"	3"	0.087 / 0.116
30"	3½"	0.138 / 0.184	36" x 23"	3½"	0.129 / 0.172
36"	4"	0.196 / 0.261	44" x 27"	4"	0.185 / 0.247
42"	4½"	0.263 / 0.350	51" x 31"	4½"	0.245 / 0.327
48"	5"	0.453 / -	58" x 36"	5"	0.318 / 0.424
54"	5½"	0.569 / -	65" x 40"	5½"	0.394 / 0.525
60"	6"	0.699 / -	73" x 45"	6"	0.489 / 0.652
66"	6½"	0.848 / -			
72"	7"	0.996 / -			

† NOTE: IF ANY PIPE REQUIRING A 8" WALL IS USED, ALL WALLS SHALL BE 8" REGARDLESS OF PIPE SIZE.

GENERAL NOTES:
1. REINFORCING STEEL QUANTITIES TO BE COMPUTED FROM BAR LIST AND SHOWN ELSEWHERE ON THE PLANS.
2. QUANTITIES FOR JUNCTION BOXES SHOWN ON THE PLANS WILL BE THE BASIS FOR PAYMENT UNLESS AUTHORIZED MODIFICATIONS ARE MADE.
3. CONCRETE SHALL BE CLASS "B" AND REINFORCING STEEL SHALL BE DEFORMED BARS, ASTM A 615, GRADE 60 OR AASHTO M 31, GRADE 60.
4. SIDE 1 OF THE JUNCTION BOX WILL ALWAYS BE THE OUTFLOW SIDE.
5. IF PIPES ARE SKEWED MORE THAN 15° OR IF SKEWED PIPES PRODUCE CONFLICTS WITH ANOTHER OPENING, THE PIPE SHALL BE BROKEN BACK TO THE WALL OF THE JUNCTION BOX.



LIFT BAR

NOTE: LIFT BAR TO BE FABRICATED FROM A #4 BAR 38" LONG. TWO LIFT BARS ARE REQUIRED. REINFORCING STEEL FOR 2 LIFT BARS = 3.3 lbs.

BY	REVISION

MISSISSIPPI DEPARTMENT OF TRANSPORTATION
ROADWAY DESIGN DIVISION
STANDARD PLAN

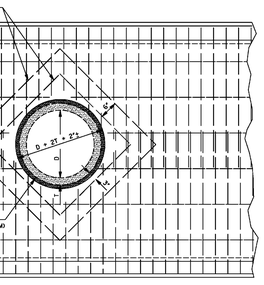
JUNCTION BOX TYPE 2 FOR TRAFFIC LOAD
(MAXIMUM "W"=9'-3")

MDOT WORKING NUMBER JB-2

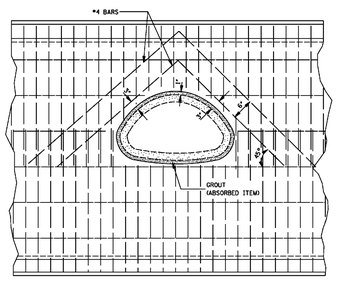
DATE: ISSUE DATE: AUGUST 01, 2017

SHEET NUMBER 6506

STATE	PROJECT NO.
MISS.	



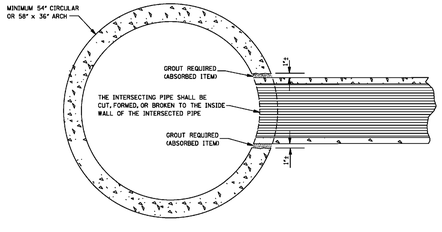
ELEVATION SHOWING CIRCULAR PIPE STUBBED INTO BOX CULVERT BARREL OR WING–WALL



ELEVATION SHOWING ARCH PIPE STUBBED INTO BOX CULVERT BARREL OR WING–WALL

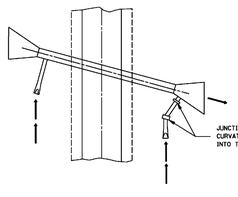
BAR LIST	
PIPE SIZE	#4 BARS — NO. / LGTH.
18"	4 / 2'-6"
	4 / 3'-6"
24"	4 / 3'-1"
	4 / 4'-1"
30"	4 / 3'-8½"
	4 / 4'-8½"
22" X 13"	2 / 3'-10"
	2 / 4'-9"
29" X 18"	1 / 5'-4"
	2 / 4'-6"
	2 / 5'-5"
	1 / 6'-3"

NOTES:
1. A 24" DIAMETER PIPE IS THE MAXIMUM SIZE THAT MAY BE STUBBED INTO A 54" DIAMETER PIPE.
2. A 60" DIAMETER PIPE IS THE MINIMUM SIZE THAT A 30" DIAMETER PIPE MAY BE STUBBED INTO.



ELEVATION SHOWING PIPE CULVERT STUBBED INTO CONCRETE PIPE CULVERT

NOTE: TYPICAL INSTALLATION FOR MEDIAN STUB TO CROSSING DRAIN WITH MINIMUM COVER.



TYPICAL PLAN OF BRANCH CONNECTION TO BOX CULVERT WING–WALL

GENERAL NOTES:
1. PAYMENT FOR WORK AND MATERIALS FOR STUBBING A PIPE CULVERT INTO A BOX CULVERT OR CONCRETE PIPE SHALL BE PAID FOR AS A BRANCH CONNECTION OF THE APPROPRIATE SIZE, TYPE AND DESCRIPTION.
2. THE TABLE ON THIS SHEET INDICATES THE NUMBER AND LENGTHS OF ADDITIONAL REINFORCING STEEL BARS REQUIRED FOR BOX CULVERTS CONSTRUCTED. FOR A DOUBLE ROW OF REINFORCEMENT, DOUBLE THE NUMBER OF BARS SHOWN. THE ADDITIONAL REINFORCING STEEL SHALL BE INCLUDED IN THE COST FOR THIS TYPE OF BRANCH CONNECTION. THE QUANTITIES SHOWN IN THE TABLE ARE FOR THE MOST COMMON SIZES OF PIPE.
3. THE REINFORCEMENT OF THE INTERSECTED BOX OR PIPE SHALL BE CUT AS NECESSARY TO ACCOMMODATE THE STUBBED PIPE.
4. THE CONTRACTOR MAY INSERT THE INTERSECTING PIPE INTO THE FORM AT THE PROPER LOCATION IN LIEU OF FORMING BY BLOCKING OUT.

BY	REVISION

MISSISSIPPI DEPARTMENT OF TRANSPORTATION
ROADWAY DESIGN DIVISION
STANDARD PLAN

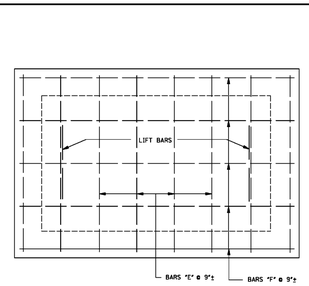
BRANCH CONNECTIONS

MDOT WORKING NUMBER BC-1

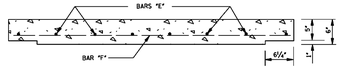
DATE: ISSUE DATE: AUGUST 01, 2017

SHEET NUMBER 6507

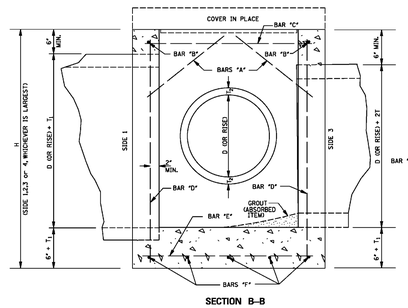
STATE	PROJECT NO.
MISS.	



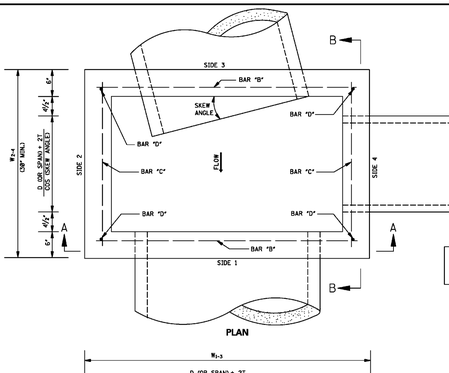
PLAN OF COVER



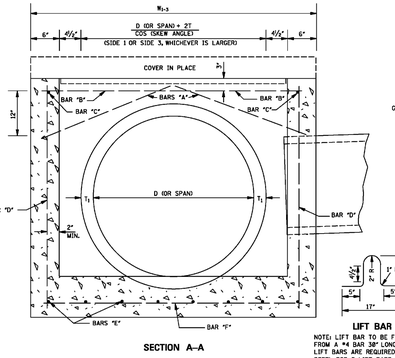
ELEVATION OF COVER



SECTION B–B



PLAN



SECTION A–A

REINFORCING BAR LIST			
BAR	SIZE	NUMBER REQUIRED	LENGTH
A	#4	2 PER PIPE OPENING	$196" + \left(\frac{W_{B-4}}{2} + 2"\right)^2$
B	#4	2	$W_{1-3} - 6"$
C	#4	2	$W_{2-4} - 6"$
D	#4	4	H - 6"
E	#4	$2\left[\left(\frac{W_{1-3}}{12}\right)^{**}+1\right]$	$W_{2-4} - 4"$
F	#4	$2\left[\left(\frac{W_{2-4}}{12}\right)^{**}+1\right]$	$W_{1-3} - 4"$

NOTE: VARIABLES AND DESIGNATIONS ARE AS FOLLOWS:
D (OR SPAN) = PIPE DIAMETER (OR SPAN)
W_{1-3} = WIDTH OF SIDE 1 & SIDE 3
W_{2-4} = WIDTH OF SIDE 2 & SIDE 4
** = W_{1-3} OR W_{2-4} (SIDE OF ENTERING PIPE)
** = ROUND TO NEAREST WHOLE NUMBER

CL. "B" CONC. (yd^3) = (Q1 + Q2) / 46,656) - Σ PIPE OPENING DEDUCTIONS
WHERE: Q1 = (8'-W_{1-3})W_{2-4} + (1'-W_{1-3} - 12.5")W_{2-4} - 12.5"W_{2-4} + ((T_1 + 6" - W_{1-3})W_{2-4})
Q2 = 12"(H - (T_1 + 6"))(8'-W_{1-3} - 12") + W_{2-4})

COMMON PIPE SIZE					
CIRCULAR PIPE			ARCH PIPE		
PIPE SIZE	T	PIPE OPENING DEDUCTION (yd^3)	PIPE SIZE	T	PIPE OPENING DEDUCTION (yd^3)
18"	2½"	0.053	22" x 13"	2½"	0.053
24"	3"	0.091	29" x 18"	3"	0.087
30"	3½"	0.138	36" x 23"	3½"	0.129
36"	4"	0.196	44" x 27"	4"	0.185
42"	4½"	0.263	51" x 31"	4½"	0.245
48"	5"	0.348	58" x 36"	5"	0.318
54"	5½"	0.427	65" x 40"	5½"	0.394
60"	6"	0.524	73" x 45"	6"	0.489
66"	6½"	0.630			
72"	7"	0.747			

GENERAL NOTES:
1. REINFORCING STEEL QUANTITIES TO BE COMPUTED FROM BAR LIST AND SHOWN ELSEWHERE ON THE PLANS.
2. QUANTITIES FOR JUNCTION BOXES SHOWN ON THE PLANS WILL BE THE BASIS FOR PAYMENT UNLESS AUTHORIZED MODIFICATIONS ARE MADE.
3. CONCRETE SHALL BE CLASS "B" AND REINFORCING STEEL SHALL BE DEFORMED BARS.
4. SIDE 1 OF THE JUNCTION BOX WILL ALWAYS BE THE OUTFLOW SIDE.
5. IF PIPES ARE SKEWED MORE THAN 15° OR IF SKEWED PIPES PRODUCE CONFLICTS WITH ANOTHER OPENING, THE PIPE SHALL BE BROKEN BACK TO THE WALL OF THE JUNCTION BOX.

LIFT BAR

NOTE: LIFT BAR TO BE FABRICATED FROM A #4 BAR 38" LONG. TWO LIFT BARS ARE REQUIRED. REINFORCING STEEL FOR 2 LIFT BARS = 3.3 lbs.

BY	REVISION

MISSISSIPPI DEPARTMENT OF TRANSPORTATION
ROADWAY DESIGN DIVISION
STANDARD PLAN

JUNCTION BOX FOR PIPE CULVERTS

MDOT WORKING NUMBER JB-1

DATE: ISSUE DATE: AUGUST 01, 2017

SHEET NUMBER 6504

SPECIAL GENERAL NOTE:

ALL REFERENCE TO PAY ITEM NUMBERS SHALL BE USED FOR REFERENCE TO THE SPECIFICATION ONLY. PAY FOR ITEMS SHOWN ON THIS SHALL BE AS NOTED IN THE BID PROPOSAL.

PREPARED BY:
SDW Engineering Progress
SDW Project No.: 15819 SDW Working No.: GD1

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX
HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT
HATTIESBURG MUNICIPAL COURT ■

BID DOCUMENTS

Drawing Issued:	
Date	Rev. Description
10-31-2015	65% Check Set
12-18-2015	95% Check Set
11-19-2018	Bid Documents

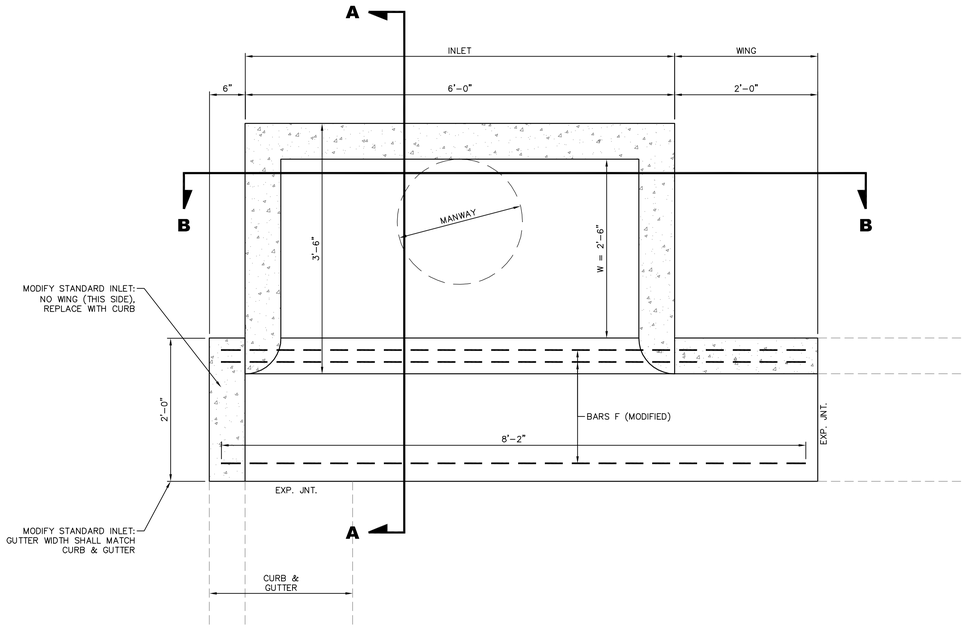
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Checked By: SEM
Client No: ------
Albert & Associates: 12575

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514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com
Albert & McCleskey Associates Architects

DRAINAGE DETAILS CONCRETE STRUCTURES

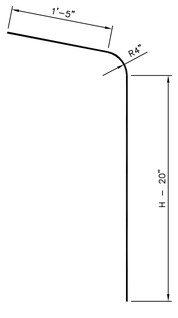
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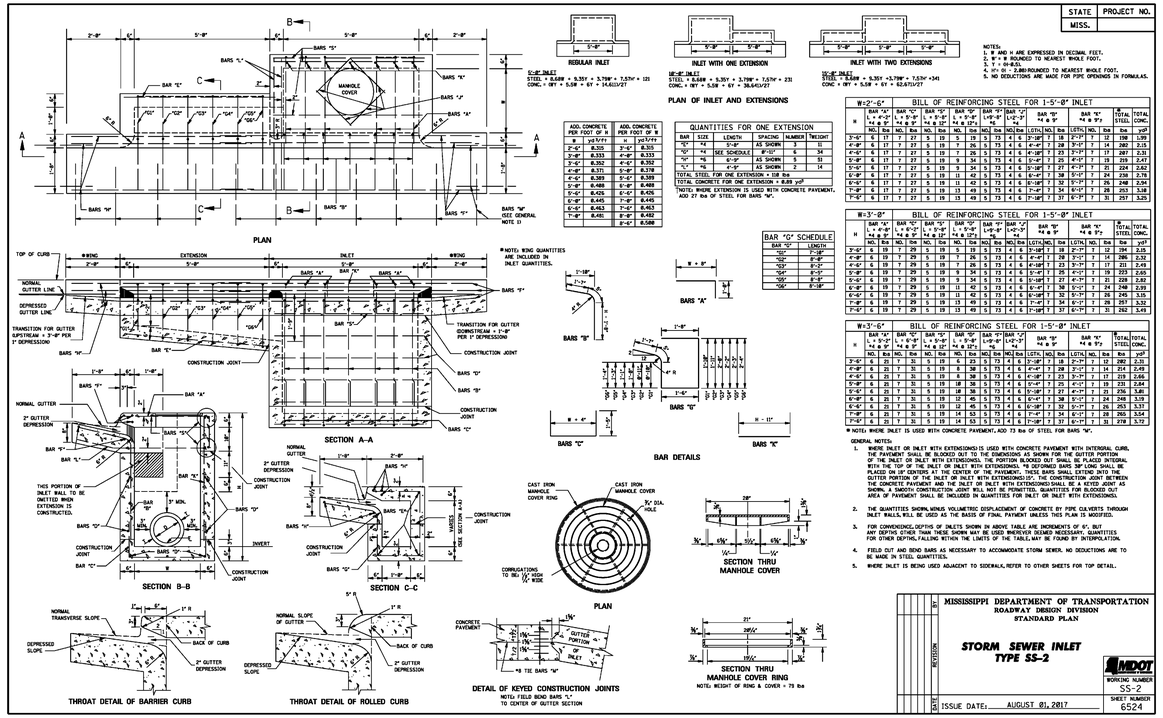
PLAN

MODIFICATION NOTE (This Detail):

1. THIS DETAIL SHALL BE USED IN CONJUNCTION WITH THE STANDARD SS-2 DETAIL "STORM SEWER STRUCTURE SS-2" (ABOVE). THIS DETAIL SHOWS ONLY THE MODIFICATIONS REQUIRED FOR THIS PROJECT. ALL OTHER ASPECTS OF THE ORIGINAL DETAIL SHALL REMAIN UNCHANGED AND IN FULL EFFECT AND VIRTUE.
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR QUANTITY CALCULATION ADJUSTMENTS AS A RESULT OF THIS DETAIL.
3. EXTENSIONS ARE NOT SHOWN ON THIS DETAIL BUT MAY BE REQUIRED. SEE GRADING PLAN – NOTED AS 'SS-2 MOD.'

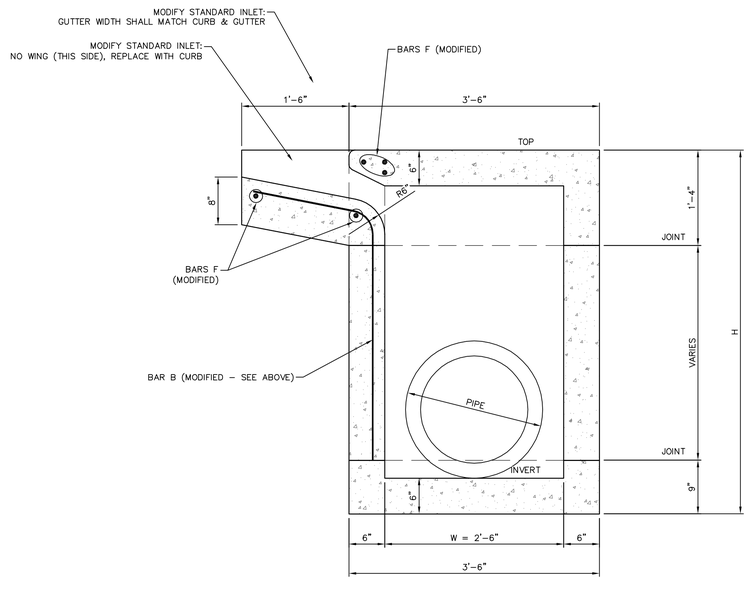


BAR B
MODIFIED

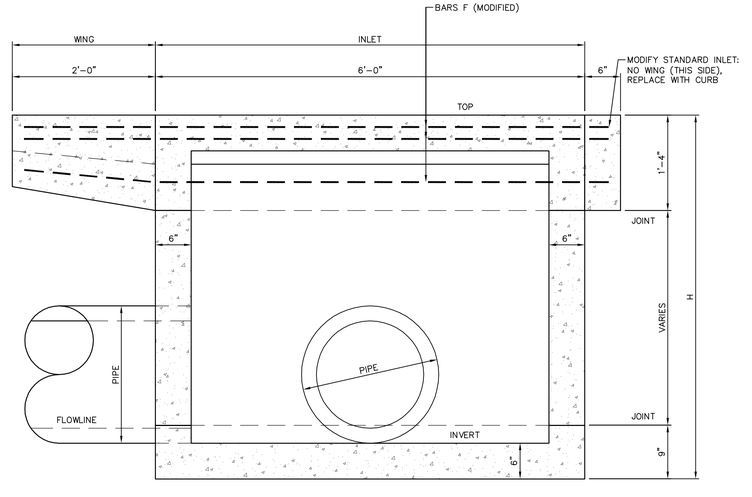


SPECIAL GENERAL NOTE:

ALL REFERENCE TO PAY ITEM NUMBERS SHALL BE USED FOR REFERENCE TO THE SPECIFICATION ONLY. PAY FOR ITEMS SHOWN ON THIS SHALL BE AS NOTED IN THE BID PROPOSAL.



SECTION 'A-A'



SECTION 'B-B'

SPECIAL DESIGN SS-2 MODIFIED DETAIL

SCALE: 1" = 1'

PREPARED BY:

sdw Engineering Progress

109 Second Ave. | Hattiesburg, MS 39401 | p | 601.544.1821 | f | 601.544.2501 | sdwa.com

SDW Project No.: 15819 SDW Working No.: GD2

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

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12-18-2015		95% Check Set
11-19-2018		Bid Documents

Drawn By: RES

Checked By: SEM

Client No: ------

Albert & Associates: 12575

C3.12

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com

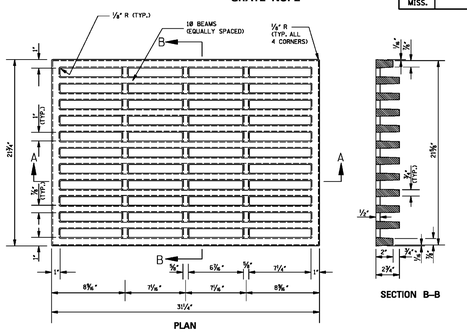
Albert & McCleskey Associates Architects

DRAINAGE DETAILS
MODIFIED SS-2 INLET

G:\PROJECTS\Albert and Associates\15819 - Hattiesburg Public Safety Complex\15819\CAD Files\15819_Grading_dtls_v1.dwg, GD2, 9/21/2018 4:00:40 PM

STATE	PROJECT NO.
MISS.	

GRATE NO. 2



GENERAL NOTES:

1. BASIS OF PAYMENT WILL BE 200 lbs OF GRATING FOR EITHER GRATE.
2. GRATE NO.1
   THE GRATE SHALL BE WELDED STEEL (ASTM A 588).
3. GRATE NO.2
   THE GRATE SHALL BE DUCTILE IRON (ASTM A 536, GRADE 80-55-06).

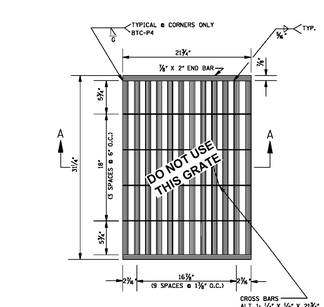
MISSISSIPPI DEPARTMENT OF TRANSPORTATION
ROADWAY DESIGN DIVISION
STANDARD PLAN

DETAILS OF GRATES FOR GUTTER INLETS

MDOT
WORKING NUMBER IG-2
SHEET NUMBER 6517

ISSUE DATE: AUGUST 01, 2017

STATE	PROJECT NO.
MISS.	

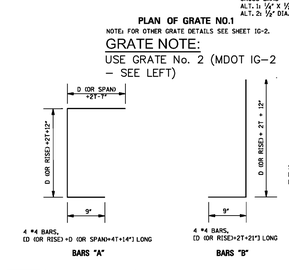


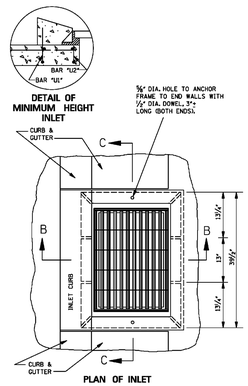
PLAN OF GRATE NO.1

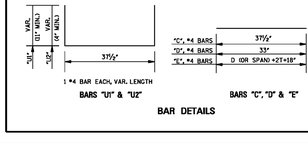
NOTE: FOR OTHER GRATE DETAILS SEE SHEET IG-2.

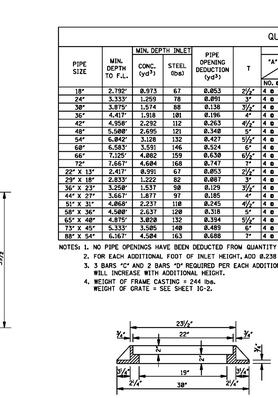
GRATE NOTE:

USE GRATE No. 2 (MDOT IG-2 – SEE LEFT)









QUANTITIES

PIPE SIZE	MIN. DEPTH TO F.L.	MIN. DEPTH INLET CONC. (yd³)	MIN. DEPTH INLET STEEL (lbs)	PIPE OPENING DEDUCTION (yd³)	T	BARS/SIZES "A" #4 NO. @ LGTH.	"B" #4 NO. @ LGTH.	"C" #4 NO. @ LGTH.	"D" #4 NO. @ LGTH.	"E" #4 NO. @ LGTH.	"U1" #4 NO. @ LGTH.	"U2" #4 NO. @ LGTH.
18"	2.795'	0.973	67	0.053	2½"	4 @ 5'-8"	4 @ 3'-8"	18 @ 3'-1½"	2 @ 2'-9"	6 @ 3'-5"	1 @ 4'-11½"	1 @ 3'-9½"
24"	3.333'	1.159	78	0.091	3"	4 @ 5'-8"	4 @ 4'-3"	17 @ 3'-1½"	2 @ 2'-9"	6 @ 4'-0"	1 @ 4'-11½"	1 @ 3'-9½"
30"	3.875'	1.374	88	0.136	3½"	4 @ 5'-8"	4 @ 7'-4"	4 @ 4'-18"	13 @ 3'-1½"	2 @ 2'-9"	6 @ 4'-7"	1 @ 3'-9½"
36"	4.417'	1.918	101	0.196	4"	4 @ 8'-6"	4 @ 5'-5"	16 @ 3'-1½"	2 @ 2'-9"	6 @ 5'-2"	1 @ 4'-11½"	1 @ 3'-9½"
42"	4.958'	2.292	112	0.263	4½"	4 @ 8'-6"	4 @ 6'-8"	18 @ 3'-1½"	2 @ 2'-9"	6 @ 5'-9"	1 @ 4'-11½"	1 @ 3'-9½"
48"	5.500'	2.695	121	0.348	5"	4 @ 8'-10"	4 @ 6'-7"	19 @ 3'-1½"	2 @ 2'-9"	6 @ 6'-4"	1 @ 4'-11½"	1 @ 3'-9½"
54"	6.042'	3.128	132	0.427	5½"	4 @ 9'-0½"	4 @ 7'-2"	21 @ 3'-1½"	2 @ 2'-9"	6 @ 6'-11"	1 @ 4'-11½"	1 @ 3'-9½"
60"	6.583'	3.551	146	0.524	6"	4 @ 9'-1"	4 @ 7'-9"	24 @ 3'-1½"	2 @ 2'-9"	6 @ 7'-6"	1 @ 4'-11½"	1 @ 3'-9½"
66"	7.125'	4.082	159	0.630	6½"	4 @ 9'-3½"	4 @ 8'-4"	27 @ 3'-1½"	2 @ 2'-9"	6 @ 8'-1"	1 @ 4'-11½"	1 @ 3'-9½"
72"	7.667'	4.684	168	0.747	7"	4 @ 9'-5½"	4 @ 8'-11"	28 @ 3'-1½"	2 @ 2'-9"	6 @ 8'-8"	1 @ 4'-11½"	1 @ 3'-9½"
22" X 13"	2.417'	0.991	67	0.053	2½"	4 @ 4'-11½"	4 @ 3'-3½"	18 @ 3'-1½"	2 @ 2'-9"	6 @ 3'-9"	1 @ 4'-11½"	1 @ 3'-9½"
29" X 18"	2.833'	1.222	82	0.087	3"	4 @ 5'-2"	4 @ 3'-9"	12 @ 3'-1½"	2 @ 2'-9"	6 @ 4'-5"	1 @ 4'-11½"	1 @ 3'-9½"
36" X 23"	3.250'	1.537	98	0.129	3½"	4 @ 5'-8"	4 @ 4'-4½"	12 @ 3'-1½"	2 @ 2'-9"	6 @ 5'-1½"	1 @ 4'-11½"	1 @ 3'-9½"
44" X 27"	3.667'	1.877	97	0.185	4"	4 @ 8'-5"	4 @ 4'-8"	14 @ 3'-1½"	2 @ 2'-9"	6 @ 5'-10"	1 @ 4'-11½"	1 @ 3'-9½"
51" X 31"	4.208'	2.237	118	0.245	4½"	4 @ 9'-7"	4 @ 5'-1½"	17 @ 3'-1½"	2 @ 2'-9"	6 @ 6'-6"	1 @ 4'-11½"	1 @ 3'-9½"
58" X 36"	4.500'	2.637	128	0.318	5"	4 @ 10'-0½"	4 @ 5'-7"	18 @ 3'-1½"	2 @ 2'-9"	6 @ 7'-2½"	1 @ 4'-11½"	1 @ 3'-9½"
65" X 40"	4.875'	3.028	132	0.394	5½"	4 @ 10'-3"	4 @ 6'-2"	20 @ 3'-1½"	2 @ 2'-9"	6 @ 7'-10"	1 @ 4'-11½"	1 @ 3'-9½"
73" X 45"	5.333'	3.585	148	0.489	6"	4 @ 10'-8"	4 @ 6'-6"	21 @ 3'-1½"	2 @ 2'-9"	6 @ 8'-1"	1 @ 4'-11½"	1 @ 3'-9½"
88" X 54"	6.167'	4.584	163	0.688	7"	4 @ 11'-6"	4 @ 7'-5"	25 @ 3'-1½"	2 @ 2'-9"	6 @ 10'-8"	1 @ 4'-11½"	1 @ 3'-9½"

NOTES: 1. NO PIPE OPENINGS HAVE BEEN DEDUCTED FROM QUANTITY SHOWN.
2. FOR EACH ADDITIONAL FOOT OF INLET HEIGHT, ADD 0.238 yd³ CLASS "B" CONCRETE AND 13 lbs REINFORCING STEEL.
3. 3 BARS "C" AND 2 BARS "D" REQUIRED PER EACH ADDITIONAL FOOT OF INLET HEIGHT. LENGTH OF BARS "B" WILL INCREASE WITH ADDITIONAL HEIGHT.
4. WEIGHT OF FRAME CASTING = 244 lbs.
   WEIGHT OF GRATE = SEE SHEET IG-2.

GENERAL NOTES:

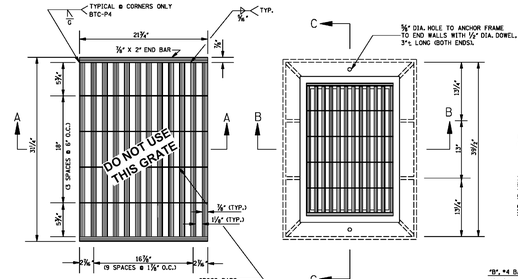
1. QUANTITIES SHOWN WILL BE THE BASIS OF PAYMENT UNLESS AUTHORIZED MODIFICATIONS ARE MADE.
2. CONCRETE SHALL BE CLASS "B" CONCRETE AND REINFORCING STEEL SHALL BE DEFORMED BARS.
3. THE CONTRACTOR HAS THE OPTION TO PROVIDE GRATE NO. 1 OR GRATE NO. 2 AS SHOWN ON SHEET IG-2.
4. FRAME TO BE GRAY IRON CASTING, (AASHTO M 105, CLASS 30).

MISSISSIPPI DEPARTMENT OF TRANSPORTATION
ROADWAY DESIGN DIVISION
STANDARD PLAN

GUTTER INLET FOR TYPE 2 CURB (STORM SEWER ALONG ROADWAY)

MDOT
WORKING NUMBER GI-1A
SHEET NUMBER 6519

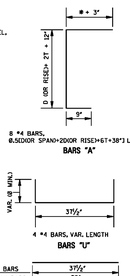
ISSUE DATE: AUGUST 01, 2017



NOTE: FOR OTHER GRATE DETAILS SEE SHEET IG-2.

GRATE NOTE:

USE GRATE No. 2 (MDOT IG-2 – SEE ABOVE)

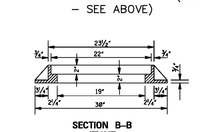


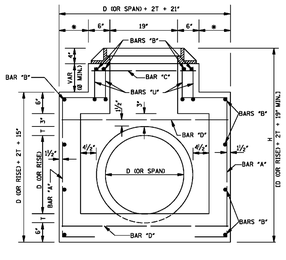
*NOTE: * = (D (OR SPAN) + 2T - 18") / 2

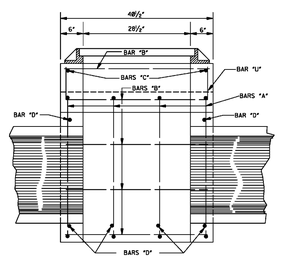
QUANTITIES

PIPE SIZE	MIN. DEPTH TO F.L.	MIN. DEPTH INLET CONC. (yd³)	MIN. DEPTH INLET STEEL (lbs)	PIPE OPENING DEDUCTION (yd³)	T	BARS/SIZES "A" #4 NO. @ LGTH.	"B" #4 NO. @ LGTH.	"C" #4 NO. @ LGTH.	"D" #4 NO. @ LGTH.	"U" #4 NO. @ LGTH.
18"	2.792'	0.869	76	0.053	2½"	8 @ 4'-5½"	12 @ 3'-1½"	2 @ 2'-4"	6 @ 3'-5"	4 @ 3'-9½"
24"	3.334'	1.117	87	0.091	3"	8 @ 5'-4"	14 @ 3'-1½"	2 @ 2'-4"	6 @ 4'-0"	4 @ 3'-9½"
30"	3.875'	1.385	94	0.138	3½"	8 @ 6'-2½"	14 @ 3'-1½"	2 @ 2'-4"	6 @ 4'-7"	4 @ 3'-9½"
36"	4.417'	1.671	105	0.196	4"	8 @ 7'-1"	16 @ 3'-1½"	2 @ 2'-4"	6 @ 5'-2"	4 @ 3'-9½"
42"	4.959'	1.978	116	0.263	4½"	8 @ 7'-11½"	18 @ 3'-1½"	2 @ 2'-4"	6 @ 5'-9"	4 @ 3'-9½"
48"	5.500'	2.305	123	0.348	5"	8 @ 8'-10"	18 @ 3'-1½"	2 @ 2'-4"	6 @ 6'-4"	4 @ 3'-9½"
54"	6.042'	2.650	135	0.427	5½"	8 @ 9'-8½"	20 @ 3'-1½"	2 @ 2'-4"	6 @ 6'-11"	4 @ 3'-9½"
60"	6.583'	3.016	146	0.524	6"	8 @ 10'-7"	22 @ 3'-1½"	2 @ 2'-4"	6 @ 7'-6"	4 @ 3'-9½"
66"	7.125'	3.402	153	0.638	6½"	8 @ 11'-5½"	22 @ 3'-1½"	2 @ 2'-4"	6 @ 8'-1"	4 @ 3'-9½"
72"	7.667'	3.806	164	0.747	7"	8 @ 12'-4"	24 @ 3'-1½"	2 @ 2'-4"	6 @ 8'-8"	4 @ 3'-9½"
22" X 13"	2.417'	0.855	76	0.053	2½"	8 @ 4'-3"	12 @ 3'-1½"	2 @ 2'-4"	6 @ 3'-9"	4 @ 3'-9½"
29" X 18"	2.833'	1.085	83	0.087	3"	8 @ 5'-0⅞"	12 @ 3'-1½"	2 @ 2'-4"	6 @ 4'-4½"	4 @ 3'-9½"
36" X 23"	3.250'	1.358	94	0.129	3½"	8 @ 5'-10"	14 @ 3'-1½"	2 @ 2'-4"	6 @ 5'-1"	4 @ 3'-9½"
44" X 27"	3.635'	1.631	101	0.185	4"	8 @ 6'-7½"	14 @ 3'-1½"	2 @ 2'-4"	6 @ 5'-10"	4 @ 3'-9½"
51" X 31"	4.208'	1.942	113	0.245	4½"	8 @ 7'-5½"	16 @ 3'-1½"	2 @ 2'-4"	6 @ 6'-6"	4 @ 3'-9½"
58" X 36"	4.508'	2.269	120	0.318	5"	8 @ 8'-3"	16 @ 3'-1½"	2 @ 2'-4"	6 @ 7'-2½"	4 @ 3'-9½"
65" X 40"	4.875'	2.575	130	0.394	5½"	8 @ 9'-0"	18 @ 3'-1½"	2 @ 2'-4"	6 @ 7'-10"	4 @ 3'-9½"
73" X 45"	5.333'	2.966	139	0.489	6"	8 @ 9'-10½"	18 @ 3'-1½"	2 @ 2'-4"	6 @ 8'-7"	4 @ 3'-9½"
88" X 54"	6.167'	3.765	156	0.688	7"	8 @ 11'-6"	20 @ 3'-1½"	2 @ 2'-4"	6 @ 10'-8"	4 @ 3'-9½"

NOTES: 1. ONE (1) PIPE OPENING HAS BEEN DEDUCTED FROM THE STRUCTURE.
2. FOR EACH ADDITIONAL FOOT OF INLET HEIGHT, ADD 0.184 yd³ CLASS "B" CONCRETE AND 17 lbs REINFORCING STEEL.
3. 4 BARS "B" AND 2 BARS "C" REQUIRED PER EACH ADDITIONAL FOOT OF INLET HEIGHT.
4. WEIGHT OF FRAME CASTING = 244 lbs.
   WEIGHT OF GRATE = SEE SHEET IG-2.







GENERAL NOTES:

1. QUANTITIES SHOWN WILL BE THE BASIS OF PAYMENT UNLESS AUTHORIZED MODIFICATIONS ARE MADE.
2. CONCRETE SHALL BE CLASS "B" CONCRETE AND REINFORCING STEEL SHALL BE DEFORMED BARS.
3. THE CONTRACTOR HAS THE OPTION TO PROVIDE GRATE NO. 1 OR GRATE NO. 2 AS SHOWN ON SHEET IG-2.
4. FRAME TO BE GRAY IRON CASTING, (AASHTO M 105, CLASS 30).

MISSISSIPPI DEPARTMENT OF TRANSPORTATION
ROADWAY DESIGN DIVISION
STANDARD PLAN

STORM SEWER INLET TYPE SS-3

MDOT
WORKING NUMBER SS-3
SHEET NUMBER 6525

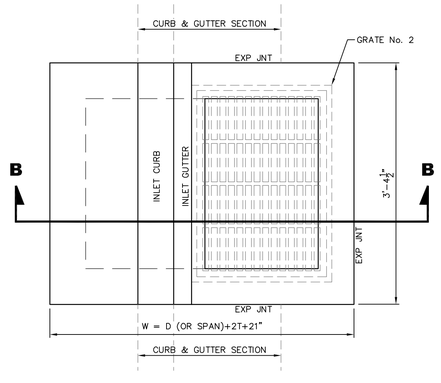
ISSUE DATE: AUGUST 01, 2017

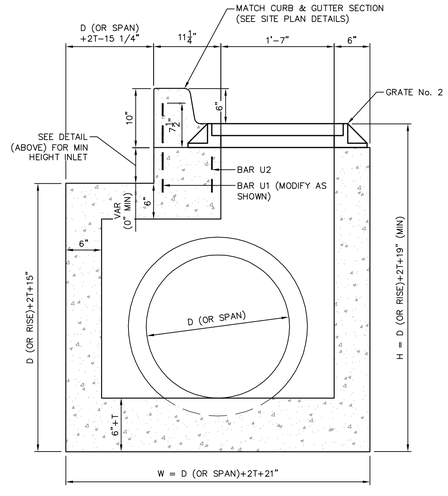
SPECIAL GENERAL NOTE:

ALL REFERENCE TO PAY ITEM NUMBERS SHALL BE USED FOR REFERENCE TO THE SPECIFICATION ONLY. PAY FOR ITEMS SHOWN ON THIS SHALL BE AS NOTED IN THE BID PROPOSAL.

MODIFICATION NOTE (This Detail):

1. THIS DETAIL SHALL BE USED IN CONJUNCTION WITH THE STANDARD GI-1A DETAIL "GUTTER INLET FOR TYPE 2 CURB STORM SEWER ALONG ROADWAY" (ABOVE). THIS DETAIL SHOWS ONLY THE MODIFICATIONS REQUIRED FOR THIS PROJECT. ALL OTHER ASPECTS OF THE ORIGINAL DETAIL SHALL REMAIN UNCHANGED AND IN FULL EFFECT AND VIRTUE.
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR QUANTITY CALCULATION ADJUSTMENTS AS A RESULT OF THIS DETAIL.
3. SEE GRADING PLAN – NOTED AS 'GA-1A MOD.'





SPECIAL DESIGN GI-1A MODIFIED DETAIL

SCALE: 1" = 1'

PREPARED BY:

sdw Engineering Progress
20 Sawmill Ave. | Hattiesburg, MS 39401 | p (601.544.1821) f (601.544.2501) | sdw.com

SDW Project No.: 15819 SDW Working No.: CD3

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

BID DOCUMENTS

Drawing Issued:

Date	Rev.	Description
10-31-2015		65% Check Set
12-18-2015		95% Check Set
11-19-2018		Bid Documents

Drawn By: RES
Checked By: SEM
Client No: ------
Albert & Associates: 12575

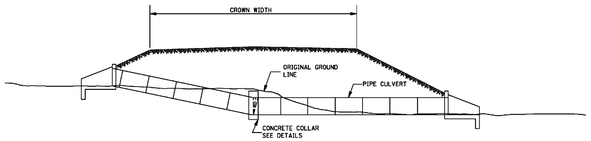
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514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com
Albert & McCleskey Associates Architects

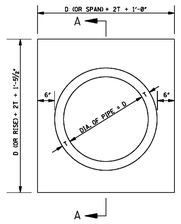
DRAINAGE DETAILS MODIFIED GI-1A INLET

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STATE	PROJECT NO.
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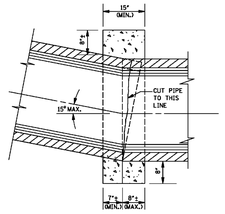


TYPICAL INSTALLATION FOR PIPE CULVERT WITH BROKEN FLOW LINE



ELEVATION OF CONCRETE COLLAR

NOTE: CIRCULAR PIPE IS SHOWN, ARCH PIPE IS SIMILAR.



SECTION A–A

GENERAL NOTES:

1. THE MAXIMUM BEND ANGLE IS 15 DEGREES.
2. THE FOLLOWING QUANTITIES SHALL BE THE BASIS FOR PAYMENT UNLESS AUTHORIZED MODIFICATIONS ARE MADE:

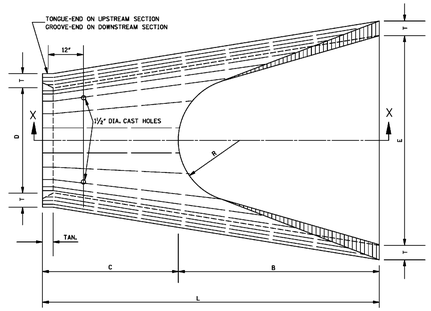
QUANTITIES FOR CONCRETE COLLAR FOR PIPE CULVERTS

CIRCULAR PIPE		ARCH PIPE	
DIA. OF PIPE	CLASS "B" CONCRETE (yd³)	SIZE OF PIPE	CLASS "B" CONCRETE (yd³)
12"	0.240		
15"	0.260	18 x 11	0.280
18"	0.320	22 x 13	0.310
24"	0.410	29 x 18	0.410
30"	0.510	36 x 23	0.490
36"	0.620	44 x 27	0.580
42"	0.730	51 x 31	0.690
48"	0.850	58 x 36	0.820
54"	0.980	65 x 40	0.920
60"	1.110	73 x 45	1.070
66"	1.240	88 x 54	1.366
72"	1.393		

MISSISSIPPI DEPARTMENT OF TRANSPORTATION ROADWAY DESIGN DIVISION STANDARD PLAN		
CONCRETE PIPE COLLAR	WORKING NUMBER PC-1	SHEET NUMBER 6503
ISSUE DATE: AUGUST 01, 2017		

STATE	PROJECT NO.
MISS.	

BELL AND SPIGOT END OPTION



PLAN OF DOWNSTREAM END

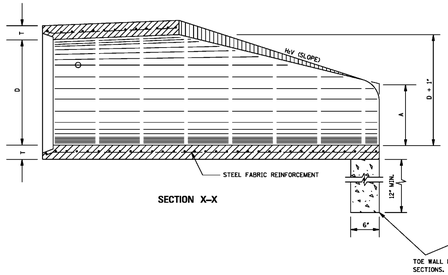
NOTE: BELL-END ON DOWNSTREAM SECTION
SPIGOT-END ON UPSTREAM SECTION.

TABLE OF DIMENSIONS

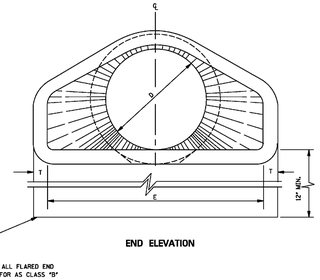
D	T	H:V	A	B	C	E	L
15"	2¼"	3:1	6"	2'-3"	4'-1"	2'-8"	6'-1"
18"	2½"	3:1	9"	2'-3"	3'-10"	3'-8"	6'-1"
24"	3"	3:1	18"	2'-3"	2'-6"	4'-8"	6'-2"
30"	3½"	3:1	1'-8"	4'-6"	1'-8"	5'-8"	6'-2"
36"	4"	3:1	1'-3"	5'-3"	2'-11"	6'-8"	8'-2"
42"	4½"	3:1	1'-9"	5'-3"	2'-11"	6'-6"	8'-2"
48"	5"	3:1	2'-8"	6'-8"	2'-2"	7'-8"	8'-2"
54"	5½"	3:1	2'-4"	6'-6"	1'-10"	7'-6"	8'-4"
* 60"	6"	3:1	2'-10"	6'-6"	1'-10"	8'-8"	8'-4"
* 66"	6½"	3:1	3'-4"	6'-6"	1'-10"	8'-6"	8'-4"
* 72"	7"	3:1	3'-10"	6'-6"	1'-10"	9'-8"	8'-4"

* NOTE: SEE GENERAL NOTE 2.

TOE WALL CONC. QUANTITY (yd³)
0.056
0.063
0.083
0.102
0.123
0.134
0.145
0.156
0.167
0.207



SECTION X–X



END ELEVATION

TOE WALL REQUIRED ON ALL FLARED END SECTIONS. TO BE PAID FOR AS CLASS "B" STRUCTURAL CONCRETE - MINOR STRUCTURES.

GENERAL NOTES:

1. REINFORCEMENT SHALL CONFORM TO THE REQUIREMENTS OF REINFORCED CONCRETE PIPE OF LIKE DIAMETER PER AASHTO M 170, TABLE 2, WALL B.
2. 2 - 1½" DIA. CAST HOLES REQUIRED AS SHOWN TO ACCOMMODATE 2 - 1" DIA. TIE BOLTS, USED IN TYING SECTION TO PIPE CULVERT.
3. LENGTH (L) OF A BELL-END OPTION MAY VARY BY A NOMINAL EXTENSION ON THE BELL END.
4. FLARED END SECTIONS SHOULD BE REGARDED AS OBSTACLES UNDER THE BELOW CONDITIONS AND AS SUCH SHOULD BE LOCATED OUTSIDE OF THE CLEAR ZONE:
   A. CROSS DRAINS WITH SINGLE ROUND PIPES OF DIAMETER GREATER THAN 36" OR EQUIVALENT FOR ARCH PIPES.
   B. CROSS DRAINS WITH MULTIPLE ROUND PIPES OF DIAMETER GREATER THAN 30" OR EQUIVALENT FOR ARCH PIPES.
   C. PARALLEL SIDE DRAINS WITH SINGLE ROUND PIPES OF DIAMETER GREATER THAN 24" OR EQUIVALENT FOR ARCH PIPES.
5. ALL SIZES OF FLARED END SECTIONS FOR CIRCULAR CONCRETE PIPE MAY BE FURNISHED WITH EITHER BELL AND SPIGOT OR TONGUE AND GROOVE ENDS.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION ROADWAY DESIGN DIVISION STANDARD PLAN		
FLARED END SECTION FOR CONCRETE PIPE	WORKING NUMBER FE-1	SHEET NUMBER 6530
ISSUE DATE: AUGUST 01, 2017		

STATE	PROJECT NO.
MISS.	

HOLE OPENING									
ROUND RCP	OPENING		CONCRETE REMOVAL (yd³)	ARCH RCP	OPENING		CONCRETE REMOVAL (yd³)		
SIZE	INCHES HO	INCHES OP	OPENING W/O SPECIAL BASE	SIZE	T	INCHES HO	INCHES OP	OPENING W/SPECIAL BASE	
12	2.00	28	4.8	0.810					
15	2.25	34	4.5	0.810	18X11	2.25	25.5X18.5	1.5	0.805
18	2.50	35	4.8	0.895	22X13	2.50	30X21	1.5	0.895
21	2.75	38	3.5	0.898					
24	3.00	37	4.8	0.875	29X18	3.00	35X27	1.5	0.873
27	3.25	48	6.5	0.898					
30	3.50	48	5.8	0.135	36X23	3.50	46X33	1.5	0.188

*BASED ON 5" WALL THICKNESS FOR 39½" WALL, MULTIPLY BY 0.694

MINIMUM PIPE DEPTH TOP OF COVER TO PIPE INVERT			
ROUND RCP SIZE	ROUND RCP DEPTH (INCHES)	ARCH RCP SIZE	ARCH RCP DEPTH (INCHES)
12	27.8		
15	28.0	18X11	23.5
18	13.0	22X13	25.5
21	30.5		
24	48.0	29X18	36.5
27	44.5		
30	46.8	36X23	36.5

MAXIMUM PIPE SIZE			
INLET OR JUNCTION BOX	ROUND RCP	ARCH RCP	
	IW SIDE	IL SIDE	IW SIDE	IL SIDE
2X2	12	24	NONE	29X18
2X3	18	36	NONE	29X18
3X5	24	58	29X18	36X23

CONCRETE QUANTITIES			
INLET OR JUNCTION BOX	BOTTOM C.Y.	RISER C.Y./FT	COVER C.Y.
2X2	0.873	0.859	0.123
2X3	0.111	0.181	0.205
3X5	0.278	0.275	0.246

NOTE: CONCRETE CUBIC YARDS PER INLET/JUNCTION BOX = BOTTOM + (TOTAL RISER HEIGHT IN FT) X C.Y./FT) + COVER + GRATE OPENING - ANY HOLE OPENINGS

GENERAL DATA										
	WALL THICKNESS	INSIDE DIMENSION		OUTSIDE DIMENSION	BASE HEIGHT	RISER HEIGHT	WEIGHTS			
FEET	INCHES	IW	IL	OW	OL	B	R	BOTTOM	BASE / RISER	COVER
		INCHES				3" INCREMENTS		LB	LB/FT	LB
2 X 2	5	24	24	34	34	24 - 54	18 - 48	398	48	369
2 X 3	5	24	36	34	46	24 - 54	18 - 48	454	735	815
3 X 5	5	36	60	46	70	24 - 54	18 - 48	1125	1114	1877

2' X 2' WALL REINFORCEMENT (SQ. IN. PER LIN. FT.)

DEPTH OF INSTALLATION	BASE		TOP RISER		INTERIOR RISER #1		INTERIOR RISER #2		INTERIOR RISER #3		INTERIOR RISER #4	
	AREA	LB/FT	AREA	LB/FT	AREA	LB/FT	AREA	LB/FT	AREA	LB/FT	AREA	LB/FT
0 - 4	0.23	5.342	0.23	5.342	-	-	-	-	-	-	-	-
4 - 8	0.23	5.342	0.67	5.342	0.13	5.862	-	-	-	-	-	-
8 - 12	0.28	7.786	0.67	5.342	0.13	5.862	-	-	-	-	-	-

2' X 3' WALL REINFORCEMENT (SQ. IN. PER LIN. FT.)

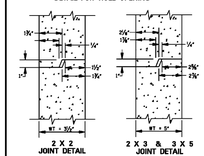
DEPTH OF INSTALLATION	BASE		TOP RISER		INTERIOR RISER #1		INTERIOR RISER #2		INTERIOR RISER #3		INTERIOR RISER #4	
	AREA	LB/FT	AREA	LB/FT	AREA	LB/FT	AREA	LB/FT	AREA	LB/FT	AREA	LB/FT
0 - 4	0.23	5.342	0.23	5.342	-	-	-	-	-	-	-	-
4 - 8	0.28	5.928	0.18	5.948	-	-	-	-	-	-	-	-
8 - 12	0.25	5.545	0.18	5.948	0.28	5.928	-	-	-	-	-	-

3' X 5' WALL REINFORCEMENT (SQ. IN. PER LIN. FT.)

DEPTH OF INSTALLATION		TOP RISER		INTERIOR RISER #1		INTERIOR RISER #2		INTERIOR RISER #3		INTERIOR RISER #4	
FT	AREA	LB/FT	AREA	LB/FT	AREA	LB/FT	AREA	LB/FT	AREA	LB/FT	AREA	LB/FT
0 - 8	0.34	21.839	0.24	17.3264	-	-	-	-	-	-	-	-
8 - 12	0.14	53.578	0.24	17.3264	0.68	43.316	-	-	-	-	-	-
8 - 16	0.68	43.316	0.24	17.3264	0.68	43.316	0.14	53.578	-	-	-	-
8 - 20	1.44	92.455	0.24	17.3264	0.68	43.316	0.14	53.578	1.82	70.853	1.20	82.835
8 - 24	1.44	92.455	0.24	17.3264	0.68	43.316	0.14	53.578	1.82	70.853	1.20	82.835

COVER / BOTTOM REINFORCEMENT				
INLET OR JUNCTION BOX	COVER	LBS. OF STEEL	BOTTOM	LBS. OF STEEL
2 X 2	*4 @ 9" E W	12.247	#W7-W5.0 X W5.0 - 3 X 3	18.559
2 X 3	*4 @ 9" E W	17.860	#W7-W5.0 X W5.0 - 3 X 3	26.682
3 X 5	*4 @ 9" E W	36.145	#W7-W5.0 X W5.0 - 3 X 3	37.389

NOTE: REINFORCEMENT STEEL (LBS) PER INLET/JUNCTION BOX = BOTTOM + TOTAL FOR EACH RISER (TOP PLUS ANY INTERIOR RISERS) (BASE HEIGHT + TOTAL HEIGHT OF RISERS) + COVER; HOLE AND GRATE OPENINGS NOT DEDUCTED

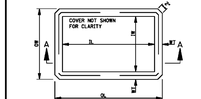


DETAIL FOR HOLE OPENING

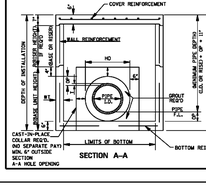
2 X 2 JOINT DETAIL



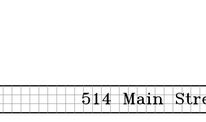
2 X 3 & 3 X 5 JOINT DETAIL



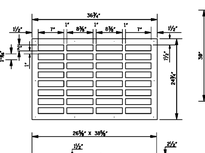
PLAN FOR BASE /RISER INLET /JUNCTION BOX



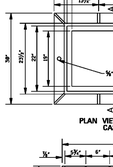
SECTION A–A



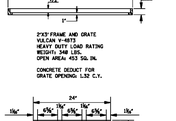
2'X3' FRAME AND GRATE VULCAN V-1873 HEAVY DUTY LOAD RATING WEIGHT: 248 LBS. OPEN AREA: 453 SQ. IN.



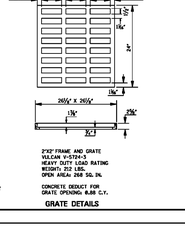
PLAN VIEW — FRAME CAST IRON



SECTION A–A



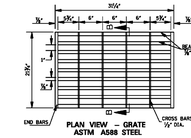
26½" x 36½" GRATE



2'X3' FRAME AND GRATE VULCAN V-5724-3 HEAVY DUTY LOAD RATING WEIGHT: 212 LBS. OPEN AREA: 258 SQ. IN.

CONCRETE DEDUCT FOR GRATE OPENING: 0.88 C.Y.

GRATE DETAILS

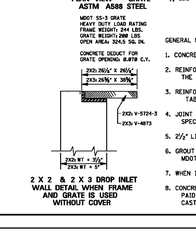


PLAN VIEW — GRATE ASTM A588 STEEL

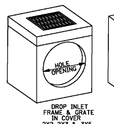
SECTION B–B

MDOT 10-3 GRATE HEAVY DUTY LOAD RATING FRAME WEIGHT: 244 LBS. GRATE WEIGHT: 208 LBS. OPEN AREA: 304.3 SQ. IN.

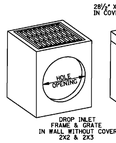
CONCRETE DEDUCT FOR GRATE OPENING: 0.878 C.Y.



2 X 2 & 2 X 3 DROP INLET WALL DETAIL WHEN FRAME AND GRATE IS USED WITHOUT COVER



DROP INLET FRAME & GRATE IN COVER 2X2, 2X3 & 3X5



DROP INLET FRAME & GRATE IN WALL WITHOUT COVER 2X2 & 2X3



TYPE SS-3 INLET 3X5

GENERAL NOTES:

1. CONCRETE SHALL HAVE COMPRESSIVE STRENGTH OF 4000 PSI MINIMUM AT 28 DAYS.
2. REINFORCING FOR BOTTOM AND WALLS SHALL BE WELDED WIRE FABRIC, ASTM A-185, AND OF THE AREA AS SHOWN IN THE TABLE.
3. REINFORCING FOR COVER SHALL BE ASTM A615/A, AND OF THE SIZE AS SHOWN IN THE TABLE AND DRAWINGS.
4. JOINT TO BE SEALED WITH FLEXIBLE PLASTIC GASKET FOR JOINT CONDUIT, AASHTO SPECIFICATION M-198 OR MDOT SPECIFICATION.
5. 2½" LIFTING HOLES TO BE LOCATED ON EACH SIDE OF BOX SECTIONS FOR HANDLING.
6. GROUT FOR JOINING PIPE TO PRECAST UNITS WILL BE A COMMERCIAL MASONRY GROUT MEETING MDOT SPECIFICATIONS.
7. WHEN INTERIOR RISER UNITS ARE REQUIRED, UNITS SHALL BE MARKED TO IDENTIFY EACH UNIT.
8. CONCRETE & REINFORCING STEEL FOR PRECAST INLETS AND JUNCTION BOXES SHALL BE PAID FOR AS THE CALCULATED QUANTITY SHOWN ON THE RECAP SHEET FOR CAST-IN-PLACE INLETS & JUNCTION BOXES.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION ROADWAY DESIGN DIVISION STANDARD PLAN		
PRECAST UNITS (JUNCTION BOX, SS-3 INLET, & DROP INLET) (30" CONC. ROUND PIPE & UNDER) (36"x23" CONC. ARCH PIPE & UNDER)	WORKING NUMBER PCU-1	SHEET NUMBER 6535
ISSUE DATE: AUGUST 01, 2017		

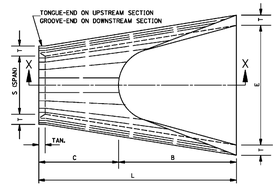
BELL AND SPIGOT END OPTION TYPE I

NOTE: BELL-END ON DOWNSTREAM SECTION
SPIGOT-END ON UPSTREAM SECTION.

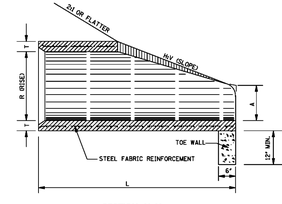
FLARED END SECTION FOR CONCRETE ARCH PIPE

EQUIV. SIZE	R	S	T	H:V	A	B	C	E	L
18"	13½"	22"	2½"	3:1	1"	2'-3"	3'-9"	3'-8"	6'-8"
24"	18"	28½"	3½"	3:1	8"	3'-3"	2'-9"	4'-8"	6'-8"
30"	22½"	36½"	3½"	3:1	10"	4'-8"	2'-8"	5'-8"	6'-8"
36"	26⅞"	43⅝"	4"	3:1	10⅝"	5'-8"	3'-8"	6'-8"	8'-8"
42"	31⅜"	50¼"	4½"	3:1	1'-3⅜"	5'-8"	3'-8"	6'-6"	8'-8"
48"	36"	58½"	5"	3:1	1'-9"	5'-8"	3'-8"	7'-8"	8'-8"
54"	40"	65"	5½"	3:1	2'-1½"	5'-8"	3'-8"	7'-6"	8'-8"
60"	45"	73"	6"	3:1	2'-2"	6'-3"	1'-9"	8'-8"	8'-8"
72"	54"	88"	7"	3:1	2'-11"	6'-6"	1'-10"	10'-8"	8'-4"

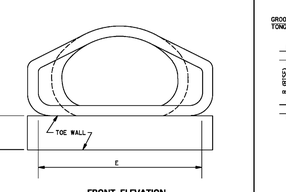
TOE WALL CONC. QUANTITY (yd³)
0.063
0.083
0.102
0.123
0.134
0.145
0.156
0.167
0.207



PLAN OF DOWNSTREAM END



SECTION X–X



FRONT ELEVATION

GENERAL NOTES:

1. FLARED END SECTIONS SHOULD BE REGARDED AS OBSTACLES UNDER THE BELOW CONDITIONS AND AS SUCH SHOULD BE LOCATED OUTSIDE OF THE CLEAR ZONE.
   A. CROSS DRAINS WITH SINGLE ROUND PIPES OF DIAMETER GREATER THAN 36" OR EQUIVALENT FOR ARCH PIPES.
   B. CROSS DRAINS WITH MULTIPLE ROUND PIPES OF DIAMETER GREATER THAN 30" OR EQUIVALENT FOR ARCH PIPES.
   C. PARALLEL SIDE DRAINS WITH SINGLE ROUND PIPES OF DIAMETER GREATER THAN 24" OR EQUIVALENT FOR ARCH PIPES.
2. UNLESS OTHERWISE DESIGNATED, EITHER TYPE I OR TYPE II MAY BE USED, PROVIDED THE SELECTED TYPE IS COMPATIBLE WITH THE CONFIGURATION OF THE PIPE TO WHICH IT SHALL BE ATTACHED.
3. ALL SIZES OF TYPE I AND TYPE II FLARED END SECTIONS FOR CONCRETE ARCH PIPE MAY BE FURNISHED WITH EITHER BELL AND SPIGOT OR TONGUE AND GROOVE ENDS.
4. REINFORCEMENT (SINGLE LINE) FOR FLARED END SECTION SHALL CONFORM TO REQUIREMENTS OF AASHTO M 206 FOR CLASS II ARCH PIPE.
5. TOE WALL REQUIRED ON ALL FLARED END SECTIONS. TO BE PAID FOR AS CLASS "B" STRUCTURAL CONCRETE - MINOR STRUCTURES.
6. FLARED END SECTIONS MUST MEET THE REQUIREMENTS FOR ARCH PIPE OF EITHER AASHTO M 206 OR ASTM C 506.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION ROADWAY DESIGN DIVISION STANDARD PLAN		
FLARED END SECTION FOR CONCRETE ARCH PIPE	WORKING NUMBER FE-1A	SHEET NUMBER 6531
ISSUE DATE: AUGUST 01, 2017		

BELL AND SPIGOT END OPTION TYPE II

STATE	PROJECT NO.
MISS.	

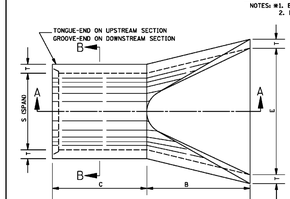
NOTE: BELL-END ON DOWNSTREAM SECTION
SPIGOT-END ON UPSTREAM SECTION.

FLARED END SECTION FOR CONC. ARCH PIPE-SHORT FLARE

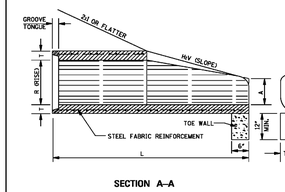
EQUIV. SIZE	R	S	T	H:V	A	B	C	E	L	GROOVE TONGUE
* 18"	13½"	22"	2½"	3:1	1"	2'-3"	3'-9"	3'-8"	6'-8"	2½"
24"	18"	28½"	3½"	3.12:1	9"	3'-3"	2'-9½"	4'-8"	6'-8½"	3"
30"	22½"	36½"	4"	2.94:1	9½"	4'-2"	3'-10½"	5'-8"	8'-0½"	3½"
36"	26⅞"	43⅝"	4½"	3.08:1	11⅝"	5'-8"	3'-8½"	6'-8"	8'-0½"	4"
42"	31⅜"	50¼"	4½"	3.08:1	1'-4⅛"	5'-8"	3'-8½"	6'-6"	8'-0½"	4"
48"	36"	58½"	5"	3.16:1	1'-10"	5'-8"	3'-8½"	7'-8"	8'-0½"	5"
54"	40"	65"	5½"	3.24:1	2'-3"	5'-8"	3'-8½"	7'-6"	8'-0½"	5"
60"	45"	73"	6"	3.33:1	2'-9"	5'-8"	3'-8½"	8'-8"	8'-0½"	5"
68"	51"	82"	6"	3.33:1	2'-9"	5'-8"	3'-8½"	8'-8"	8'-0½"	5"

NOTES: *1. EQUIVALENT 18" FLARED END SECTION SIMILAR TO TYPE I.
2. DIMENSIONS A, B, C, E AND L MAY VARY 1"±.

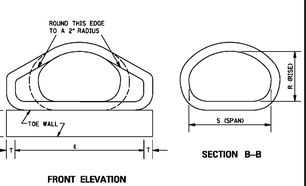
TOE WALL CONC. QUANTITY (yd³)
0.063
0.083
0.102
0.123
0.134
0.145
0.156
0.167



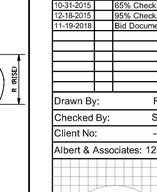
PLAN OF DOWNSTREAM END



SECTION A–A



FRONT ELEVATION



SECTION B–B

MISSISSIPPI DEPARTMENT OF TRANSPORTATION ROADWAY DESIGN DIVISION STANDARD PLAN		
FLARED END SECTION FOR CONCRETE ARCH PIPE	WORKING NUMBER FE-1A	SHEET NUMBER 6531
ISSUE DATE: AUGUST 01, 2017		

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

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SPECIAL GENERAL NOTE:

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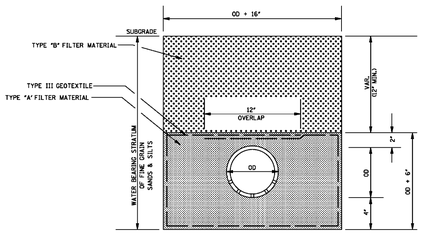
PREPARED BY:
SDW Engineering Progress
20 Grand Ave, Hattiesburg, MS 39401 | p (601.544.1821) f (601.544.2501) sdw.com
SDW Project No.: 15819 SDW Working No.: GD4

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com
Albert & McCleskey Associates Architects

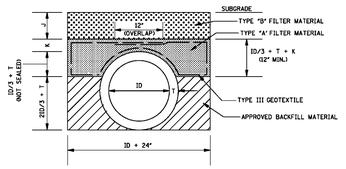
DRAINAGE DETAILS
FLARED END SECTIONS

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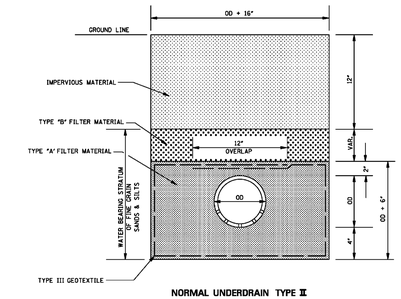
NORMAL UNDERDRAIN TYPE I



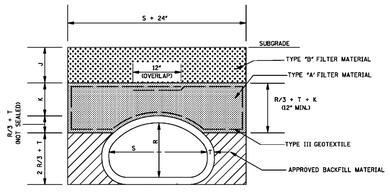
CIRCULAR STORM DRAIN USED AS UNDERDRAIN

PIPE SIZE	T	K	TYPE "A" MATERIAL (yd^3/ft)	TYPE "B" MATERIAL ✱ ($yd^3/ft/ft$)	TYPE III GEOTEXTILE (yd^2/ft)	IMPERVIOUS MATERIAL (yd^3/ft)
6"	--	--	0.0638	0.0694	0.7593	0.0694
18"	2½"	4"	0.099	0.130	1.193	--
24"	3"	2"	0.100	0.148	1.334	--
30"	3½"	2"	0.124	0.167	1.513	--
36"	4"	2"	0.149	0.185	1.691	--
42"	4½"	2"	0.176	0.204	1.869	--
48"	5"	2"	0.204	0.222	2.048	--
54"	5½"	2"	0.233	0.241	2.226	--
60"	6"	2"	0.264	0.259	2.404	--
66"	6½"	2"	0.296	0.278	2.583	--
72"	7"	2"	0.330	0.296	2.761	--
84"	8"	2"	0.401	0.333	3.118	--
96"	9"	2"	0.477	0.370	3.474	--

✱ NOTE: $yd^3/ft/ft$ = CUBIC YARD PER FOOT DEPTH OF MATERIAL PER FOOT LENGTH OF PIPE.



NORMAL UNDERDRAIN TYPE II



ARCH STORM DRAIN USED AS UNDERDRAIN

PIPE SIZE	T	K	TYPE "A" MATERIAL (yd^3/ft)	TYPE "B" MATERIAL ✱ ($yd^3/ft/ft$)	TYPE III GEOTEXTILE (yd^2/ft)
22" X 13"	2½"	5"	0.109	0.142	1.231
29" X 18"	3"	2.92"	0.113	0.162	1.383
36" X 23"	3½"	2"	0.124	0.186	1.537
44" X 27"	4"	2"	0.154	0.209	1.734
51" X 31"	4½"	2"	0.184	0.232	1.913
58" X 36"	5"	2"	0.217	0.255	2.098
65" X 40"	5½"	2"	0.248	0.275	2.158
73" X 45"	6"	2"	0.283	0.299	2.471
88" X 54"	7"	2"	0.374	0.346	2.849

✱ NOTE: $yd^3/ft/ft$ = CUBIC YARD PER FOOT DEPTH OF MATERIAL PER FOOT LENGTH OF PIPE.

GENERAL NOTES:

1. QUANTITIES SHOWN WILL BE THE BASIS FOR PAYMENT UNLESS AUTHORIZED MODIFICATIONS ARE MADE.
2. TYPE I UNDERDRAIN IS GENERALLY USED WHEN UNDERDRAIN IS REQUIRED UNDER THE ROADWAY SUBGRADE.
3. TYPE II UNDERDRAIN IS USED AS REQUIRED OUTSIDE THE ROADWAY.
4. 6" OVERLAP SHALL BE REQUIRED AT THE END OF EACH ROLL OF TYPE III GEOTEXTILE. BOTH THE 6" AND 12" OVERLAP SHALL BE INCLUDED FOR PAYMENT UNDER GEOTEXTILE FOR SUBSURFACE DRAINAGE, TYPE III, PER SQUARE YARD.
5. GJ + K) SHALL BE 12" MINIMUM OR VARIABLE DEPTH UNLESS SPECIFIED ELSEWHERE ON THE PLANS.

BY	MISSISSIPPI DEPARTMENT OF TRANSPORTATION ROADWAY DESIGN DIVISION STANDARD PLAN
REVISION	**DETAILS OF NORMAL UNDERDRAIN AND STORM DRAIN USED AS UNDERDRAIN**
DATE	ISSUE DATE: AUGUST 01, 2017

MDOT — WORKING NUMBER UD-1 — SHEET NUMBER 6533

STATE	PROJECT NO.
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STANDARD INSTALLATION DETAIL

TABLE 1: BEDDING AND BACKFILL REQUIREMENTS

BEDDING AND BACKFILL REQUIREMENTS FOR NON-RIGID PIPE IN CROSS DRAIN AND STORM DRAIN APPLICATIONS

A. BEDDING SHALL BE CLASS B IN ACCORDANCE WITH THE MISSISSIPPI STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, LATEST EDITION.
B. BACKFILL MATERIAL SHALL BE ONE OF THE FOLLOWING:
   1. FLOWABLE FILL IN ACCORDANCE WITH THE MISSISSIPPI STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION LATEST EDITION.
   2. CRUSHED STONE AGGREGATE BACKFILL IN ACCORDANCE WITH THE MISSISSIPPI STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, LATEST EDITION.

IF FLOWABLE FILL IS UTILIZED, CARE SHALL BE TAKEN TO PREVENT "FLOATING" OF THE PIPE.
THE COST OF FURNISHING AND PLACING THE REQUIRED BEDDING AND BACKFILL MATERIAL INDICATED IN A AND B SHALL BE INCLUDED IN THE UNIT COST OF THE NON-RIGID PIPE ALTERNATE, I.E., THERE IS NO SEPARATE PAY ITEM FOR NON-RIGID PIPE BEDDING AND BACKFILL MATERIAL.

BEDDING AND BACKFILL REQUIREMENTS FOR NON-RIGID PIPE IN SIDE DRAIN APPLICATIONS

A. BEDDING SHALL BE CLASS C IN ACCORDANCE WITH THE MISSISSIPPI SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, LATEST EDITION.
B. BACKFILL MATERIAL SHALL BE IN ACCORDANCE WITH THE MISSISSIPPI SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, LATEST EDITION. PIPES THAT SERVE AS A SIDE DRAIN ON DEPARTMENT RIGHT OF WAY, BUT CARRY DRAINAGE UNDER A COUNTY OR LOCAL ROAD SHALL ADHERE TO THE BEDDING AND BACKFILL REQUIREMENTS FOR A CROSS DRAIN CONTAINED ABOVE.

THE COST OF FURNISHING AND PLACING THE REQUIRED BEDDING AND BACKFILL MATERIAL INDICATED IN A AND B SHALL BE INCLUDED IN THE UNIT COST OF THE NON-RIGID ALTERNATE PIPE, I.E., THERE IS NO SEPARATE PAY ITEM FOR NON-RIGID BEDDING AND BACKFILL MATERIAL.

TABLE 2:
HIGH DENSITY CORRIGATED POLYETHYLENE PIPE
HEIGHT OF COVER

NOMINAL DIAMETER IN.	MINIMUM COVER IN.	MAXIMUM COVER - FT. CROSS DRAIN	MAXIMUM COVER - FT. SIDE DRAIN
12	12	38	13
15	12	36	12
18	12	35	11
24	12	38	10
30	12	25	9
36	21	29	10
42	21	27	9
48	21	25	8

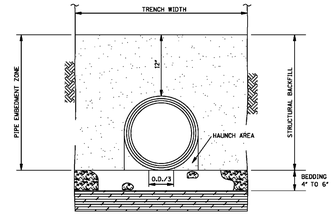
TABLE 3: RECOMMENDED TRENCH WIDTH

DIAMETER IN.	O.D. IN.	TRENCH WIDTH IN.
12	14.45	34
15	17.57	36
18	21.28	44
24	27.88	54
30	35.18	65
36	41.78	75
42	47.78	84
48	53.68	92

THE TRENCH WIDTH MUST BE WIDE ENOUGH TO ACCOMODATE COMPATION EQUIPMENT

TABLE 4: MULTIPLE INSTALLATION OF POLYETHYLENE PIPES

DIAMETER OF PIPE IN.	CLEAR DISTANCE BETWEEN PIPES
12	1'-2½"
18	1'-5"
24	1'-5"
30	1'-8"
36	1'-11"
42	2'-2"
48	2'-5"



TRENCH CROSS SECTION SHOWING TERMINOLOGY

GENERAL NOTES:

1. MATERIALS
   THERMOPLASTIC PIPE
   POLYETHYLENE PIPE SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M 294, LATEST EDITION.
   DESIGNATION OF TYPE: TYPE S: THIS PIPE WILL HAVE A FULL CIRCULAR CROSS SECTION WITH AN OUTER CORRUGATED PIPE WALL AND A SMOOTH INNER LINER.
   BEDDING MATERIAL AND STRUCTURAL BACKFILL
   BEDDING MATERIAL AND STRUCTURAL BACKFILL SHALL MEET THE REQUIREMENTS OF TABLE 1.
2. JOINTS
   JOINTS FOR THERMOPLASTIC PIPE SHALL MEET THE PERFORMANCE REQUIREMENTS OF SOIL TIGHTNESS UNLESS WATERTIGHTNESS IS SPECIFIED.
   SUITABLE JOINTS CAN BE OBTAINED WITH THE FOLLOWING TYPES OF CONNECTIONS:
   A) CORRUGATED BANDS (WITH OR WITHOUT GASKETS)
   B) BELL AND SPIGOT PIPE ENDS (WITH OF WITHOUT GASKETS)
   C) DOUBLE BELL COUPLINGS (WITH OR WITHOUT GASKETS)
3. INSTALLATION
   MINIMUM TRENCH WIDTHS SHALL MEET THE REQUIREMENTS OF TABLE 3.
   THE MIDDLE THIRD OF THE BEDDING MATERIAL UNDER THE PIPE SHOULD BE LOOSELY PLACED, WHILE THE REMAINDER SHALL BE COMPACTED TO A MINIMUM 98% OF MAXIMUM DENSITY PER AASHTO T 99.
   A MINIMUM OF 4 INCHES OF BEDDING SHALL BE PROVIDED PRIOR TO PLACEMENT OF THE PIPE.
   STRUCTURAL BACKFILL SHALL BE PLACED AND COMPACTED IN LAYERS NOT EXCEEDING AN 8" LOOSE LIFT THICKNESS AND BROUGHT UP EVENLY ON BOTH SIDES OF THE PIPE WITH AN ELEVATION NOT LESS THAN 12 INCHES ABOVE THE TOP OF THE PIPE. A MINIMUM COMPACTION LEVEL OF 98% STANDARD DENSITY PER AASHTO T 99 SHALL BE ACHIEVED.
   MINIMUM COVER REQUIREMENTS SHALL MEET THE REQUIREMENTS OF TABLE 2.
   FOR MULTIPLE INSTALLATIONS OF POLYETHYLENE PIPES, A CLEAR DISTANCE BETWEEN THE PIPES SHALL MEET THE REQUIREMENTS OF TABLE 4.
4. CALCULATIONS FOR FILL DEPTHS ARE BASED ON PROPERTIES DEFINED IN AASHTO M294 AND CALCULATIONS IN AASHTO SEC.19.

BY	MISSISSIPPI DEPARTMENT OF TRANSPORTATION ROADWAY DESIGN DIVISION STANDARD PLAN
REVISION	**FLEXIBLE PIPE CULVERT INSTALLATION**
DATE	ISSUE DATE: AUGUST 01, 2017

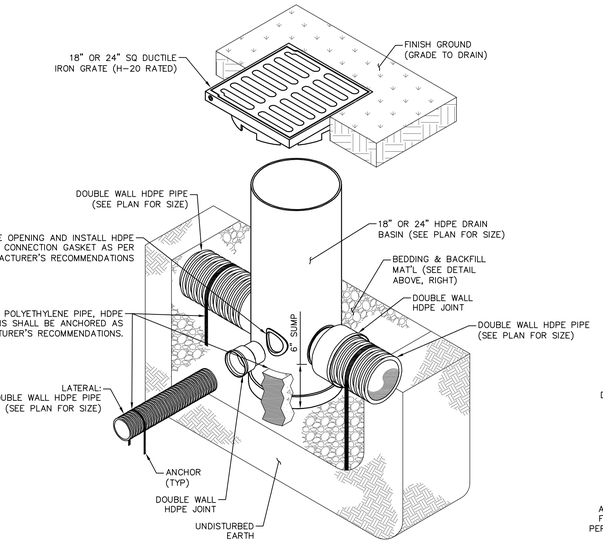
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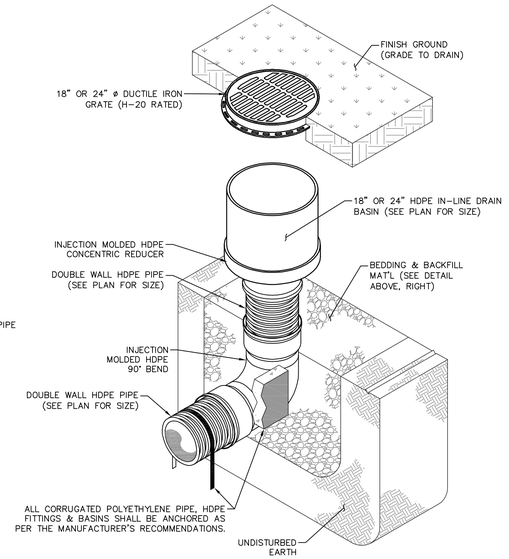
TYPICAL GUTTER DOWNSPOUT/ROOF DRAIN CONNECTION SECTION DETAIL

SCALE: NONE



TYPICAL HDPE BASIN TYPE I DETAIL

SCALE: NONE



TYPICAL HDPE BASIN TYPE II DETAIL

SCALE: NONE

PREPARED BY:
SDW Engineering Progress
SDW Project No.: 15819 SDW Working No.: CD5

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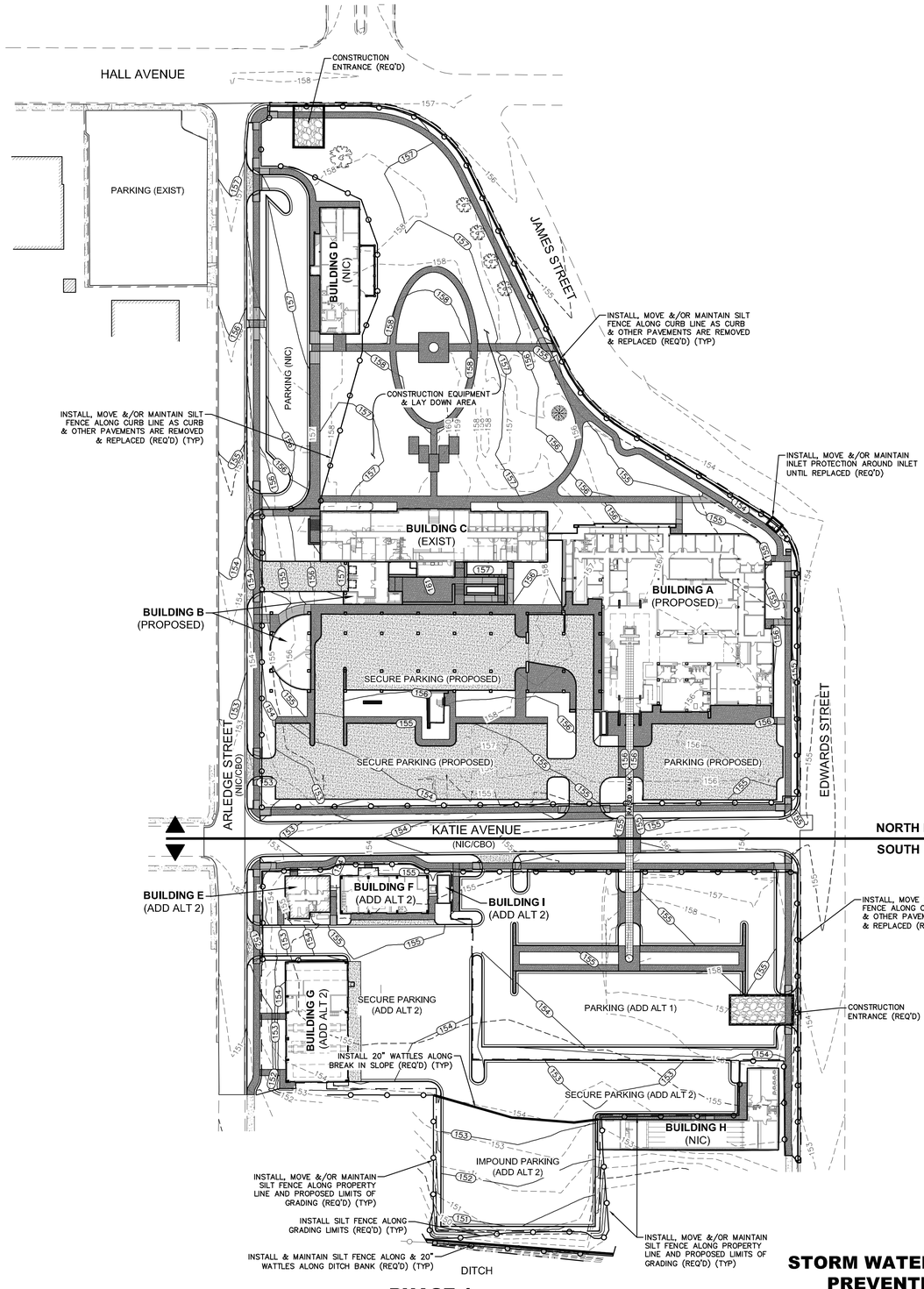
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Albert & Associates: 12575

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PHASE 1
GRADING

GRAPHIC SCALE
50 0 25 50 100 200
(IN FEET)

STORM WATER POLLUTION PREVENTION PLAN

PREPARED BY:
SDW Engineering Progress
301 Second Ave. | Hattiesburg, MS 39401 | p) (601.544.1821) | f) (601.544.0501) | sdw.com
SDW Project No.: 15819 SDW Working No.: ECP1

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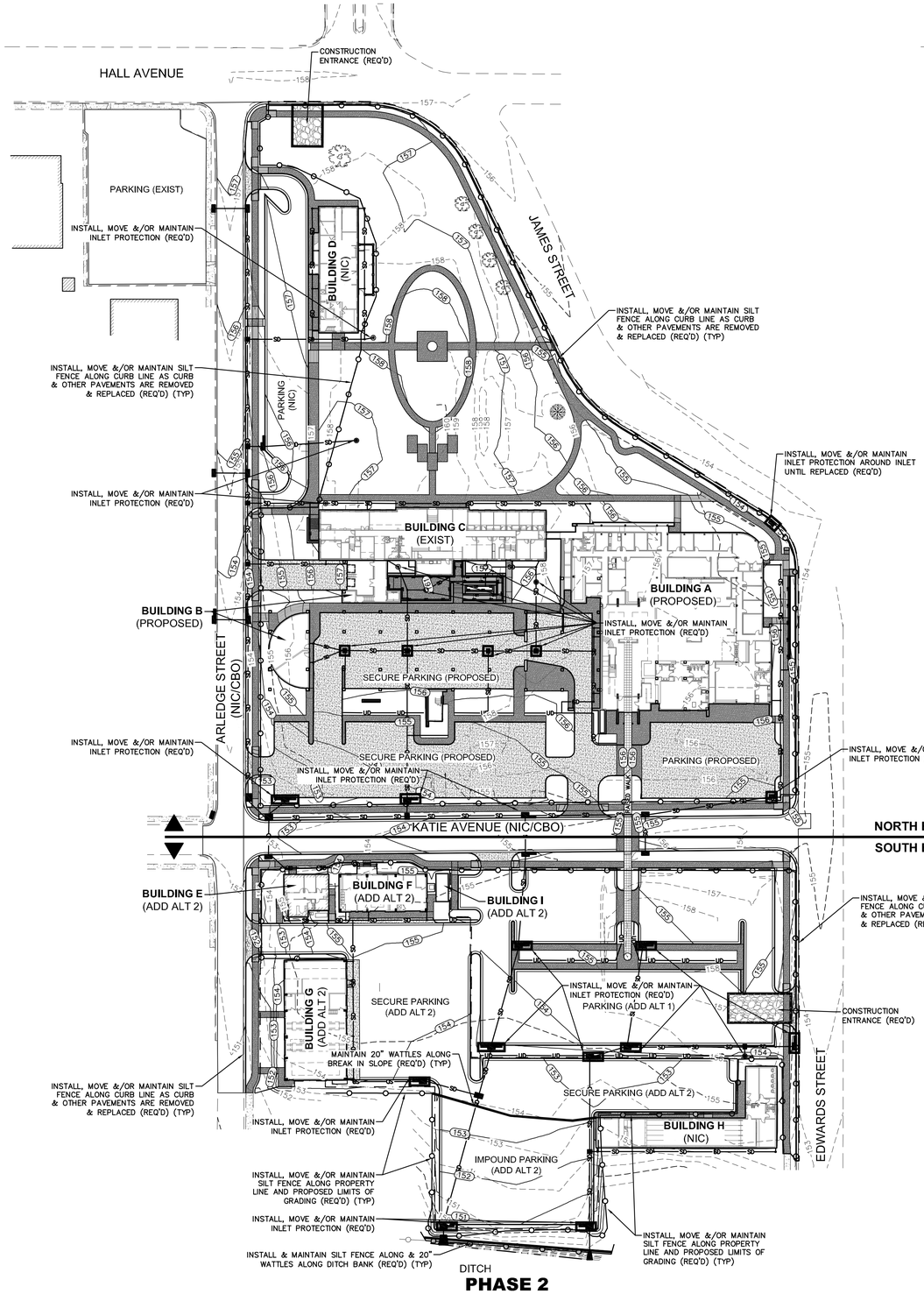
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Albert & Associates:	12575

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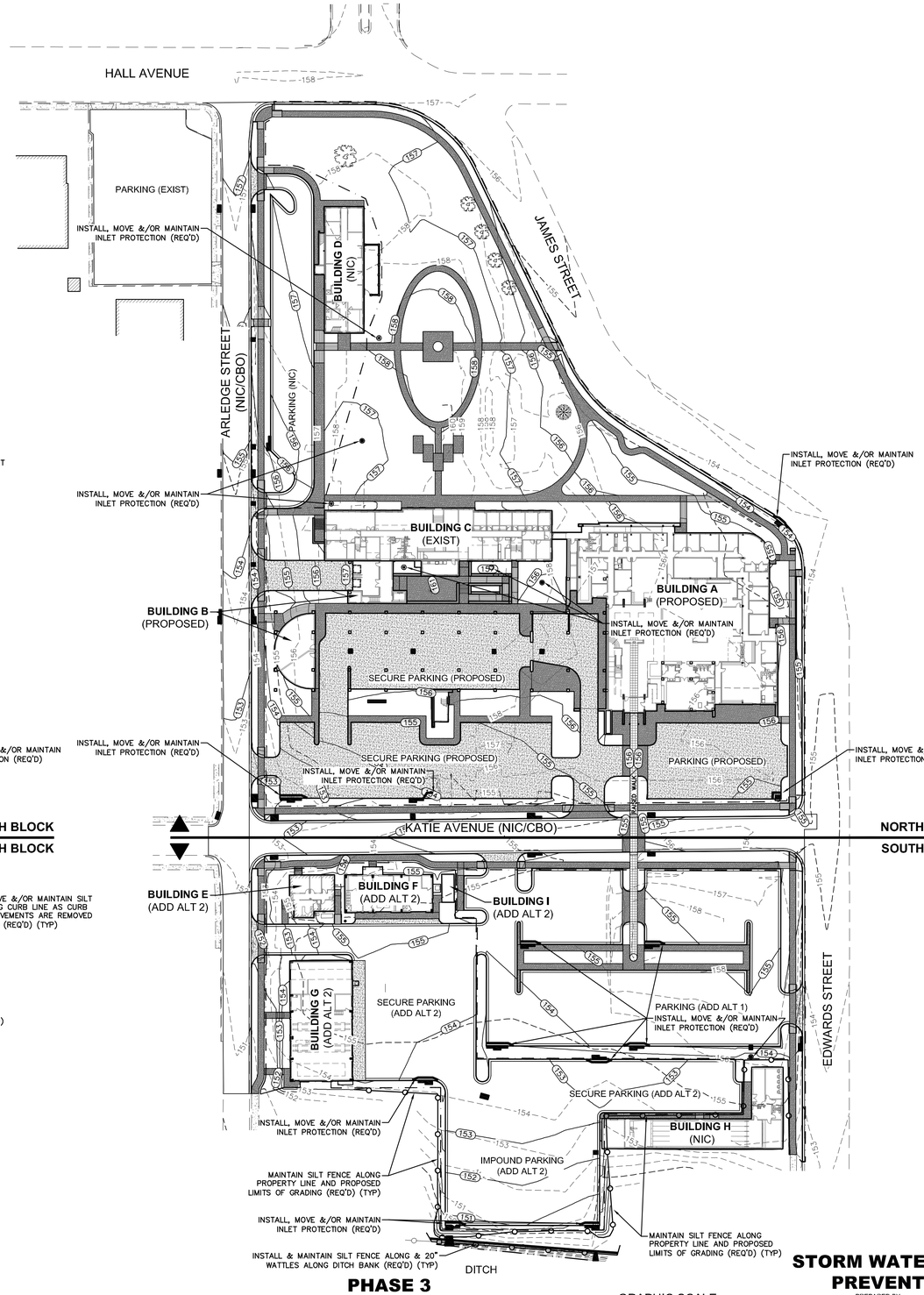
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Albert & McCleskey Associates Architects

SWPPP

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PHASE 2
STORM SEWER INSTALLATION AND COMPLETION OF GRADING



PHASE 3
POST-PAVING END STAGE PROTECTION

GRAPHIC SCALE
50 0 25 50 100 200
(IN FEET)

STORM WATER POLLUTION PREVENTION PLAN

PREPARED BY:
sdw Engineering Progress
309 Second Ave. | Hattiesburg, MS 39401 | p (601.545.3641) | f (601.544.0501) | sdw.com
SDW Project No.: 15819 SDW Working No.: ECP2

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Albert & McCleskey Associates Architects

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TEMPORARY VEGETATION SCHEDULE

	EROSION CONTROL ITEMS		SEASONAL APPLICATIONS - DATES & RATES				REQUIREMENTS
			SPRING & SUMMER		FALL & WINTER		
	PAY ITEM NO.	ITEMS	RATES	DATES	RATES	DATES	
(7)	211–B001	TOPSOIL FOR SLOPE TREATMENT (LVM)	4" THICK	MARCH 1 TO SEPTEMBER 1	4" THICK	SEPTEMBER 1 TO MARCH 1	TOPSOIL REQUIRED ON SLOPES DETERMINED BY THE ENGINEER DURING CONSTRUCTION
	212–B001	STANDARD GROUND PREPARATION	PER SQ. FT.	MARCH 1 TO SEPTEMBER 1	PER SQ. FT.	SEPTEMBER 1 TO MARCH 1	GROUND PREPARATION REQUIRED ON AREAS TO RECEIVE SOLID SODDING OR SEEDING, AS APPLICABLE
	907–213–A001	AGRICULTURAL LIMESTONE	3 TONS / ACRE	MARCH 1 TO SEPTEMBER 1	3 TONS / ACRE	SEPTEMBER 1 TO MARCH 1	LIMESTONE SHALL BE MECHANICALLY SPREAD UNIFORMLY AND INCORPORATED INTO THE SOIL PRIOR TO PLANTING
	213–B001	COMBINATION FERTILIZER (13–13–13)	1000 LBS / ACRE	MARCH 1 TO SEPTEMBER 1	1000 LBS / ACRE	SEPTEMBER 1 TO MARCH 1	FERTILIZER SHALL BE MECHANICALLY SPREAD UNIFORMLY AND INCORPORATED INTO THE SOIL PRIOR TO PLANTING
(1)	213–C001	SUPER PHOSPHATE	0.5 TON / ACRE (EST)	MARCH 1 TO SEPTEMBER 1			SUPER PHOSPHATE (FOR BID ITEM PURPOSES)
(2)	214–A002	SEEDING (BERMUDA GRASS)	20 LBS / ACRE	MARCH 1 TO SEPTEMBER 1	20 LBS / ACRE	SEPTEMBER 1 TO MARCH 1	SEED REQUIRED ON DISTURBED AREAS. UNHULLED SEED MAY BE REQUIRED DURING THE DORMANT SEASON AS DIRECTED
(3)(5)	214–A003	SEEDING (TALL FESCUE)			15 LBS / ACRE	AUGUST 15 TO MARCH 15	SEED REQUIRED IN DISTURBED AREAS
(3)(5)	214–A004	SEEDING (CRIMSON CLOVER)			20 LBS / ACRE	AUGUST 15 TO MARCH 15	SEED REQUIRED ON DISTURBED AREA
(6)	215–A001	VEGETATIVE MATERIAL FOR MULCH	2 TONS / ACRE (EST)	MARCH 1 TO SEPTEMBER 1	2 TONS / ACRE (EST)	SEPTEMBER 1 TO MARCH 1	THE ENGINEER WILL DESIGNATE THE RATES OF APPLICABLE (SEE SUBSECTION 215–03.3)
	216–A001	SOLID SODDING	PER SQ. YD.	MARCH 1 TO SEPTEMBER 1	PER SQ. YD.	SEPTEMBER 1 TO MARCH 1	SOLID SOD REQUIRED ON AREAS SPECIFIED IN THE CONTRACT OR BY THE ENGINEER
	219–A001	WATERING	20 GAL / S.Y. (EST)	MARCH 1 TO SEPTEMBER 1	20 GAL. / S.Y. (EST)	SEPTEMBER 1 TO MARCH 1	TO BE USED AS DIRECTED IN THE PLANTING AND ESTABLISHING OF SOLID SOD
(4)	220–A001	INSECT PEST CONTROL	PER ACRE		PER ACRE		SEE SECTION 220
	TEMPORARY EROSION CONTROL ITEMS						
	212–A001	LIGHT GROUND PREPARATION	PER SQ. YD.		PER SQ. YD.		APPROXIMATELY HALF SQ.YD. STANDARD GROUND PREPARATION
	213–B001	COMBINATION FERTILIZER (13–13–13)	0.25 TONS/ ACRE		0.25 TONS/ ACRE		QUANTITY BASED ON LIGHT GROUND PREPARATION
	214–A013	SEEDING (BROWN TOP MILLET)	20 LBS / ACRE	APRIL 1 TO AUGUST 31			QUANTITY BASED ON LIGHT GROUND PREPARATION
	214–A017	SEEDING (RYE GRASS)			25 LBS / ACRE	SEPTEMBER 1 TO MARCH 31	QUANTITY BASED ON LIGHT GROUND PREPARATION
	214–A015	SEEDING (OATS)			90 LBS / ACRE	SEPTEMBER 1 TO DECEMBER 15	QUANTITY BASED ON LIGHT GROUND PREPARATION
	215–A001	VEGETATIVE MATERIAL FOR MULCH	1 TON / ACRE (EST)		1 TON / ACRE (EST)		QUANTITY BASED ON LIGHT GROUND PREPARATION

(1) ALL AREAS THAT HAVE BEEN VEGETATED, UNDER THIS CONTRACT, FOR AT LEAST (60) SIXTY DAYS, SHALL RECEIVE ADDITIONAL APPLICATION(S) OF FERTILIZER(S) OF THE TYPE(S) AND RATE(S) OF APPLICATIONS AS DETERMINED BY SOIL TEST OR AS DIRECTED DURING THE GROWING SEASONS THE CONTRACT IS IN FORCE. GROUND PREPARATION WILL NOT BE REQUIRED FOR THE ADDITIONAL APPLICATIONS.

(2) PROPOSAL QUANTITIES ESTIMATED ON THE BASIS THAT 100% OF THE ACREAGE WILL BE SEEDED.

(3) PROPOSAL QUANTITIES ESTIMATED ON THE BASIS THAT 50% OF THE ACREAGE WILL BE SEEDED.

(4) QUANTITY ESTIMATED ON THE BASIS THAT 50% OF THE ACREAGE VEGETATED MAY REQUIRED TREATMENT.

(5) THIS ITEM MAY BE OMITTED ON AREAS SELECTED BY THE ENGINEER.

(6) BAHAIA GRASS WILL NOT BE PERMITTED AS A MULCH MATERIAL.

(7) PROPOSAL QUANTITIES ESTIMATED ON THE BASIS THAT 75% OF THE ACREAGE SEEDED MAY REQUIRE TOPSOIL

SPECIAL GENERAL NOTE:

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PREPARED BY:

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301 Second Ave. | Hattiesburg, MS | 39401 | [p] 601.544.1821 | [f] 601.544.0501 | sdw.com

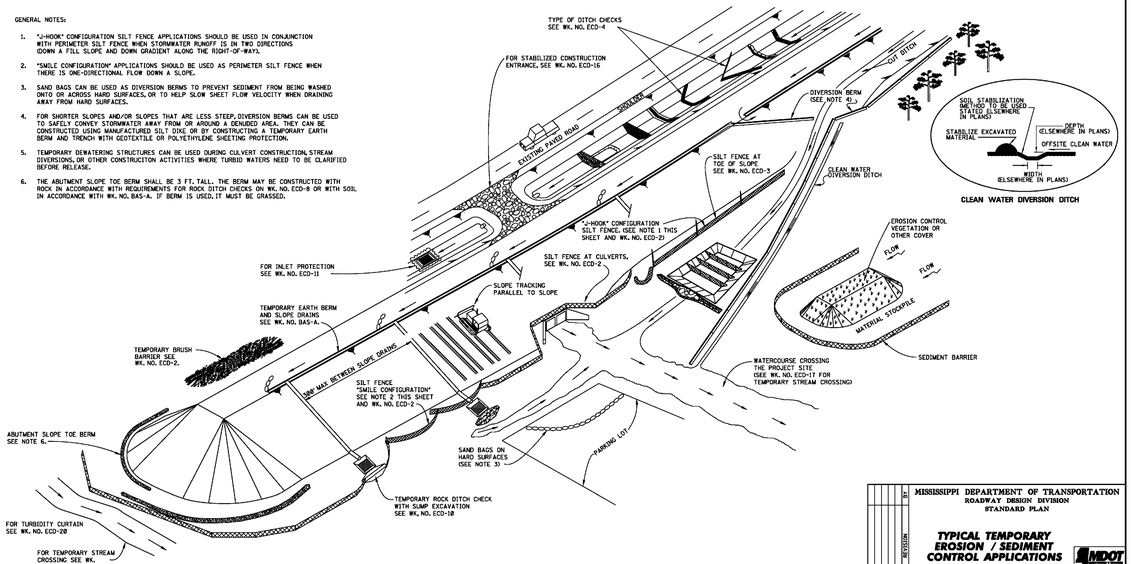
SDW Project No.: 15819 SDW Working No.:VS1

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STATE	PROJECT NO.
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GENERAL NOTES:

1. "J-HOOK" CONFIGURATION SILT FENCE APPLICATIONS SHOULD BE USED IN CONJUNCTION WITH PERIMETER SILT FENCE WHEN STORMWATER RUNOFF IS IN TWO DIRECTIONS (DOWN A FILL SLOPE AND DOWN GRADIENT ALONG THE RIGHT-OF-WAY).
2. "SMILE CONFIGURATION" APPLICATIONS SHOULD BE USED AS PERIMETER SILT FENCE WHEN THERE IS ONE-DIRECTIONAL FLOW DOWN A SLOPE.
3. SAND BAGS CAN BE USED AS DIVERSION BERMS TO PREVENT SEDIMENT FROM BEING WASHED ONTO OR ACROSS HARD SURFACES, OR TO HELP SLOW SHEET FLOW VELOCITY WHEN DRAINING AWAY FROM HARD SURFACES.
4. FOR SHORTER SLOPES AND/OR SLOPES THAT ARE LESS STEEP, DIVERSION BERMS CAN BE USED TO SAFELY CONVEY STORMWATER AWAY FROM OR AROUND A DENUDED AREA. THEY CAN BE CONSTRUCTED USING MANUFACTURED SILT DIKE OR BY CONSTRUCTING A TEMPORARY EARTH BERM AND TRENCH WITH GEOTEXTILE OR POLYETHYLENE SHEETING PROTECTION.
5. TEMPORARY DEWATERING STRUCTURES CAN BE USED DURING CULVERT CONSTRUCTION, STREAM DIVERSIONS, OR OTHER CONSTRUCTION ACTIVITIES WHERE TURBID WATERS NEED TO BE CLARIFIED BEFORE RELEASE.
6. THE ABUTMENT SLOPE TOE BERM SHALL BE 3 FT. TALL. THE BERM MAY BE CONSTRUCTED WITH ROCK IN ACCORDANCE WITH REQUIREMENTS FOR ROCK DITCH CHECKS ON WK. NO. ECD-8 OR WITH SOIL IN ACCORDANCE WITH WK. NO. BAS-A. IF BERM IS USED, IT MUST BE GRASSED.



CLEAN WATER DIVERSION DITCH

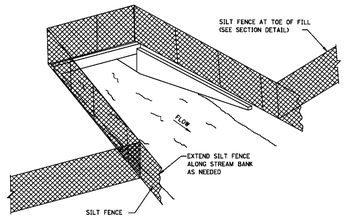
MISSISSIPPI DEPARTMENT OF TRANSPORTATION
ROADWAY DESIGN DIVISION
STANDARD PLAN

TYPICAL TEMPORARY EROSION / SEDIMENT CONTROL APPLICATIONS

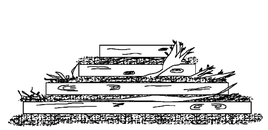
MDOT
WORKING NUMBER ECD-1
SHEET NUMBER 6101

BY | REVISION | DATE

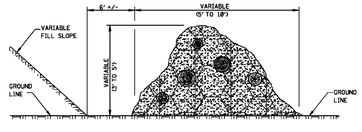
ISSUE DATE: AUGUST 01, 2017



SEDIMENT BARRIER AT CROSS DRAIN



FRONT ELEVATION

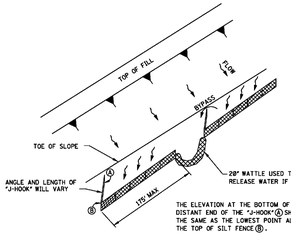


SIDE ELEVATION

TEMPORARY BRUSH BARRIER

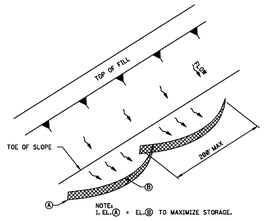
NOTES:
1. BRUSH BARRIER MAY BE USED WHERE NATURAL GROUND IS LEVEL OR SLOPING AWAY FROM PROJECT.
2. PLACE BRUSH, LOG AND TREE LAPS APPROXIMATELY PARALLEL TO TOE OF FILL SLOPE WITH SOME OF THE HEAVIER MATERIALS BEING PLACED ON TO TO PROPERLY SECURE THE BARRIER AS DETAILED AT LOCATIONS SHOWN ON PLANS OR AS DIRECTED OR PERMITTED BY THE ENGINEER.
3. TO ALLOW WATER TO SEEP THROUGH BRUSH BARRIER, INTERMINGLE THE BRUSH, LOG AND TREE LAPS SO AS NOT TO FORM A SOLID DAM.
4. THE BRUSH BARRIER MAY BE CHOKED WITH FILTER FABRIC. THE COST OF FABRIC TO BE INCLUDED IN OTHER ITEMS BID.
5. TEMPORARY BRUSH BARRIER WILL NOT BE MEASURED FOR SEPARATE PAYMENT.

NOTE: ANCHOR AND INSTALL SILT FENCE PER DETAILS SHOWN ON WK. NO. ECD-3



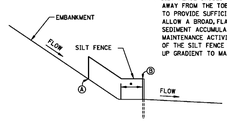
THE ELEVATION AT THE BOTTOM OF THE DISTANT END OF THE "J-HOOK" (A) SHOULD BE THE SAME AS THE LOWEST POINT ALONG THE TOP OF SILT FENCE (B).

"J-HOOK" SILT FENCE APPLICATION



NOTE:
1. EL. (A) = EL. (B) TO MAXIMIZE STORAGE.

"SMILE-CONFIGURATION" SILT FENCE APPLICATION



SILT FENCE SECTION AT TOE OF FILL

- SILT FENCE SHOULD BE LOCATED AWAY FROM THE TOE OF THE SLOPE TO PROVIDE SUFFICIENT SPACE TO ALLOW A BROAD, FLAT AREA FOR SEDIMENT ACCUMULATION AND MAINTENANCE ACTIVITIES. THE ENDS OF THE SILT FENCE SHOULD BE TURNED UP GRADIENT TO MAXIMIZE STORAGE.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION
ROADWAY DESIGN DIVISION
STANDARD PLAN

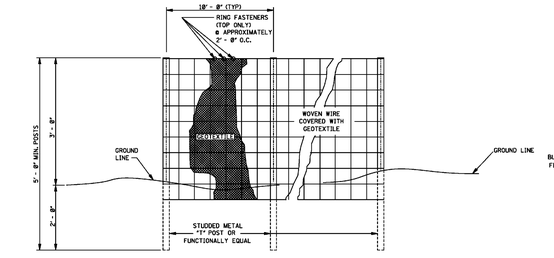
DETAILS OF SEDIMENT BARRIER APPLICATIONS

MDOT
WORKING NUMBER ECD-2
SHEET NUMBER 6102

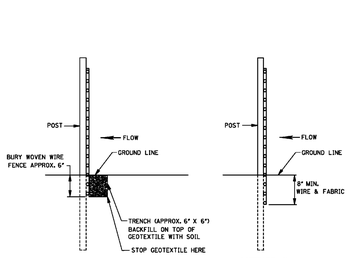
BY | REVISION | DATE

ISSUE DATE: AUGUST 01, 2017

STATE	PROJECT NO.
MISS.	



ELEVATION VIEW



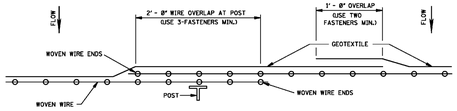
METHOD I

METHOD II
MECHANICAL INSTALLATION

SIDE VIEW

GENERAL NOTES:

1. SILT FENCES SHOULD BE USED IN AREAS WHERE FLOW IS NOT SEVERE.
2. SILT FENCES ARE TEMPORARY SEDIMENT CONTROL ITEMS THAT SHOULD BE ERECTED OPPOSITE ERODIBLE AREAS SUCH AS NEWLY GRADED FILL SLOPES AND ADJACENT TO STEAMS AND CHANNELS.
3. SILT FENCE SHOULD BE PLACED WELL INSIDE RIGHT-OF-WAY AND ALONG EDGE OF CLEARING LIMITS. THIS WILL ALLOW ROOM FOR BACK-UP FENCE IF FIRST FENCE BECOMES FULL.
4. WHENEVER POSSIBLE SILT FENCE SHOULD BE CONSTRUCTED ACROSS A LEVEL AREA IN THE SHAPE OF A SMILE. THIS AIDS IN PONDING OF RUNOFF AN FACILITATES SEDIMENTATION.
5. THE CONTRACTOR MAY ELECT TO USE EITHER METHOD I OR METHOD II. COST TO BE LINEAR FEET OF SILT FENCE.
6. METHOD II INSTALLATION SHALL BE ACCOMPLISHED USING AN IMPLEMENT THAT IS MANUFACTURED FOR THE APPLICATION AND PROVIDES A CONFIGURATION MEETING THE REQUIREMENTS OF DETAIL.
7. WIRE SHALL BE A MINIMUM OF 32" IN WIDTH AND SHALL HAVE A MINIMUM OF 6 LINE WIRES WITH 12" STAY SPACING.
8. GEOTEXTILE FABRIC MEETING THE TYPE II MATERIAL REQUIREMENTS AND INSTALLED ACCORDING TO SPECIFICATION MAY BE USED WITHOUT WIRE FENCE.



PLAN VIEW

REQUIRED LAPPING

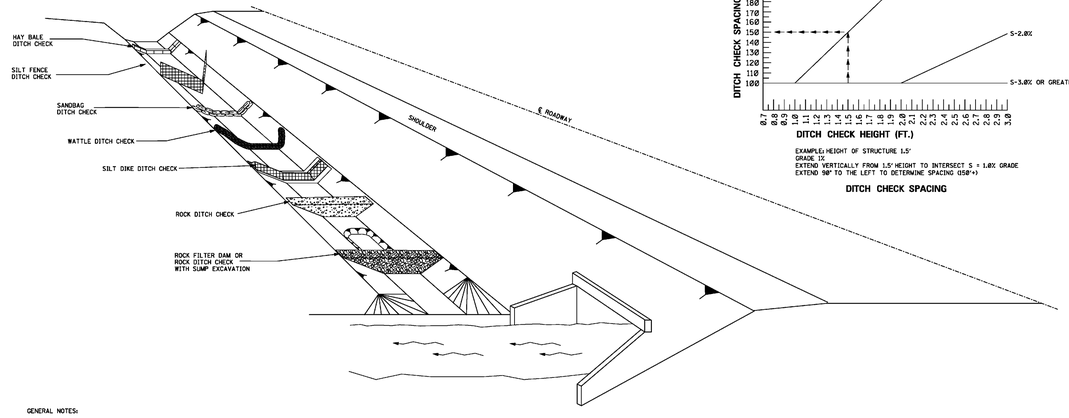
MISSISSIPPI DEPARTMENT OF TRANSPORTATION
ROADWAY DESIGN DIVISION
STANDARD PLAN

DETAILS OF SILT FENCE INSTALLATION

MDOT
WORKING NUMBER ECD-3
SHEET NUMBER 6103

BY | REVISION | DATE

ISSUE DATE: AUGUST 01, 2017



DITCH CHECK HEIGHT (FT.)

EXAMPLE: HEIGHT OF STRUCTURE 1.5'
GRADE IS
EXTEND VERTICALLY FROM 1.5' HEIGHT TO INTERSECT S = 1.0% GRADE
EXTEND 90° TO THE LEFT TO DETERMINE SPACING (150')

DITCH CHECK SPACING

GENERAL NOTES:

1. THE DITCH CHECK PERSPECTIVE ILLUSTRATES A TOOL BOX OF TEMPORARY PRACTICES THAT MAY BE USED. DITCH CHECKS ARE INSTALLED TO CONTROL RUNOFF VELOCITY AND THUS REDUCE EROSION AND PROVIDE FOR TRAPPING OF SEDIMENTS.
2. SELECTION OF THE APPROPRIATE DITCH CHECK SHOULD BE A FUNCTION OF CONSTRUCTION PHASE, DRAINAGE AREA, DITCH GRADIENT, SOIL TYPE, ECONOMY AND SAFETY.
3. DITCH CHECKS CAN BE REMOVED FOR MAINTENANCE AND/OR REPLACEMENT BUT MUST REMAIN IN PLACE UNTIL UPSLOPE AREAS HAVE BEEN PERMANENTLY STABILIZED. MAINTENANCE INCLUDES REMOVAL OF SEDIMENT BEGINNING WHEN SEDIMENT ACCUMULATION REACHES ½ THE CAPACITY OR HEIGHT OF THE STRUCTURE AND NEVER ALLOWING FOR SEDIMENT TO ACCUMULATE MORE THAN ½ THE VOLUME OR HEIGHT OF THE DITCH CHECK STRUCTURE.
4. HAY BALES SHOULD BE USED TO INTERCEPT LOW VOLUME FLOWS IN LOW TO MODERATE GRADIENT DITCHES.
5. SILT FENCE DITCH CHECKS SHOULD BE USED WHERE IT HAS BEEN DETERMINED THAT HAY BALE CHECKS ARE INADEQUATE. SILT FENCE DITCH CHECKS SHOULD BE USED TO INTERCEPT LOW VOLUME FLOWS IN LOW TO MODERATE GRADIENT DITCHES.
6. SANDBAG DITCH CHECKS SHOULD BE USED FOR VELOCITY REDUCTION AND MINIMAL SEDIMENT TRAPPING IN CONCRETE PAVED DITCHES OR IN DITCHES THAT HAVE ROCK BOTTOMS.
7. WATTLE DITCH CHECKS CAN BE USED FOR VELOCITY REDUCTION AND CONTROL OF SEDIMENT TRANSPORT UNDER LOW TO MEDIUM FLOW CONDITIONS.
8. SILT DIKES CAN BE USED IN DITCHES WITH CONCENTRATED FLOWS WITHIN THE CLEAR ZONE WHERE RIPRAP CAN NOT BE USED. AS CONSTRUCTION PROGRESSES.
9. ROCK DITCH CHECKS WITH SUMP EXCAVATION CAN BE PLACED IN DITCHES TO ASSURE ON-SITE SEDIMENT TRAPPING REQUIREMENTS ARE MET. DITCH CHECK WITH SUMP EXCAVATION IS USED WHEN DITCHES RECEIVE DRAINAGE FROM CUT OR FILL SLOPES OR OTHER CRITICAL AREAS WHERE SOIL EROSION IS EXPECTED. DRAINAGE AREA FOR A TEMPORARY SEDIMENT TRAP SHOULD BE LIMITED TO 3 ACRES. THEY CAN BE USED IN SERIES TO INCREASE ON-SITE SEDIMENT TRAPPING EFFICIENCY.
10. DITCH CHECKS, IN NO CASE, SHALL BE PLACED IN LIVE STREAMS.
11. CONFIGURATION AND SPACING MAY BE ADJUSTED IF APPROVED BY THE ENGINEER TO ACCOMMODATE TRAVELWAY SAFETY, WATER FLOW, OR SOIL AND INSTALLATION CHALLENGES.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION
ROADWAY DESIGN DIVISION
STANDARD PLAN

DITCH CHECK STRUCTURES, TYPICAL APPLICATIONS AND DETAILS

MDOT
WORKING NUMBER ECD-4
SHEET NUMBER 6104

BY | REVISION | DATE

ISSUE DATE: AUGUST 01, 2017

SPECIAL GENERAL NOTE:

ALL REFERENCE TO PAY ITEM NUMBERS SHALL BE USED FOR REFERENCE TO THE SPECIFICATION ONLY. PAY FOR ITEMS SHOWN ON THIS SHALL BE AS NOTED IN THE BID PROPOSAL.

PREPARED BY:
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SDW Project No.: 15819 SDW Working No.: ECD1

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX
HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

BID DOCUMENTS

Drawing Issued:

Date	Rev.	Description
10-31-2015		65% Check Set
12-18-2015		95% Check Set
11-19-2018		Bid Documents

Drawn By: RES
Checked By: SEM
Client No: ------
Albert & Associates: 12575

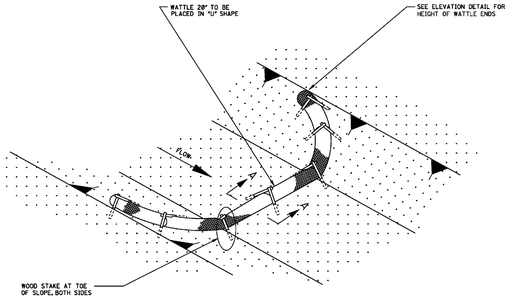
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EROSION CONTROL DETAILS

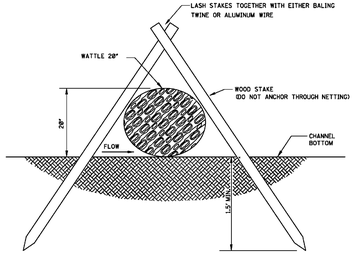
514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com | Albert & McCleskey Associates Architects

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STATE	PROJECT NO.
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DETAIL (DITCH CHECK)

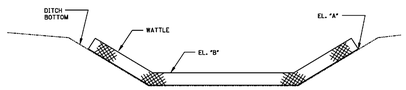


SECTION A–A

NOTES:

1. WATTLE DITCH CHECKS CAN BE USED FOR VELOCITY REDUCTION AND CONTROL OF SEDIMENT TRANSPORT UNDER LOW TO MEDIUM FLOW CONDITIONS.
2. THE PLACEMENT INTERVAL BETWEEN WATTLE DITCH CHECK SHALL BE 100' UNLESS SHOWN OTHERWISE ON THE PLANS OR EROSION CONTROL PLAN APPROVED BY THE ENGINEER. SEE SPACING GUIDANCE ON WK. NO. ECD-4.
3. ANCHORING WOOD STAKES SHALL BE SIZED, SPACED, DRIVEN, AND BE OF A MATERIAL THAT EFFECTIVELY SECURES THE CHECK. STAKE SPACING SHALL BE A MAXIMUM OF THREE FEET. ALL NON-DEGRADABLE MATERIALS SHALL BE REMOVED WHEN NO LONGER NEEDED.
4. TRENCHING OF WATTLES MAY BE NECESSARY IF PIPING BECOMES EVIDENT.
5. WATTLES SHOULD NOT BE USED IN HARD BOTTOM CHANNELS.
6. IN THE EVENT WATTLES CANNOT BE SECURED IN PLACE USING WOOD STAKES, SAND BAGS MAY BE USED IN LIEU OF WOOD STAKES IN ORDER TO SECURE THE WATTLES IN PLACE. IF SANDS BAGS ARE USED IN THIS APPLICATION THEY WILL NOT BE A SEPARATE PAY ITEM.

NOTE: END POINTS "A" SHALL BE HIGHER THAN FLOWLINE POINT "B".



ELEVATION DETAIL

BY	REVISION	DATE

MISSISSIPPI DEPARTMENT OF TRANSPORTATION
ROADWAY DESIGN DIVISION
STANDARD PLAN

DETAILS OF EROSION CONTROL WATTLE DITCH CHECK

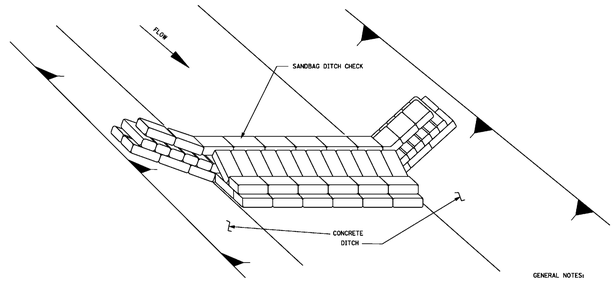
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WORKING NUMBER ECD-6

ISSUE DATE: AUGUST 01, 2017

SHEET NUMBER 6106

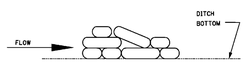
STATE	PROJECT NO.
MISS.	



DETAIL (DITCH CHECK)

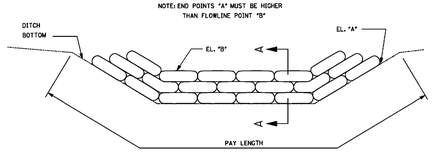
GENERAL NOTES:

1. SANDBAG DITCH CHECKS ARE USED FOR VELOCITY REDUCTION AND MINIMAL SEDIMENT TRAPPING IN CONCRETE PAVED DITCHES OR IN DITCHES WITH ROCKY BOTTOMS.
2. MINIMUM RECOMMENDED PLACEMENT INTERVAL BETWEEN SANDBAG DITCH CHECK IS 100' UNLESS SHOWN OTHERWISE ON THE PLANS OR APPROVED BY THE ENGINEER. SEE SPACING GUIDANCE ON WK. NO. ECD-4.
3. PREVENTING SEDIMENT FROM ENTERING A PAVED DITCH IS PREFERABLE TO CAPTURING SEDIMENT WITHIN PAVED DITCH.
4. ROCKBAGS MAY BE USED IN LIEU OF SANDBAGS, ONLY WHEN PAY ITEM FOR ROCKBAGS IS INCLUDED IN THE CONTRACT.



SECTION A–A
(IN DITCH BOTTOM)

NOTE: END POINTS "A" MUST BE HIGHER THAN FLOWLINE POINT "B"



ELEVATION DETAIL

BY	REVISION	DATE

MISSISSIPPI DEPARTMENT OF TRANSPORTATION
ROADWAY DESIGN DIVISION
STANDARD PLAN

DETAILS OF EROSION CONTROL SANDBAG DITCH CHECK

MDOT

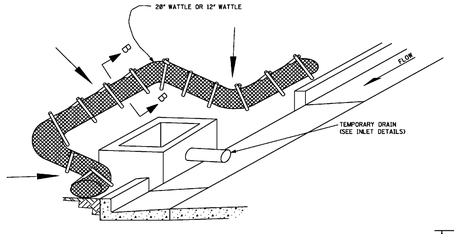
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ISSUE DATE: AUGUST 01, 2017

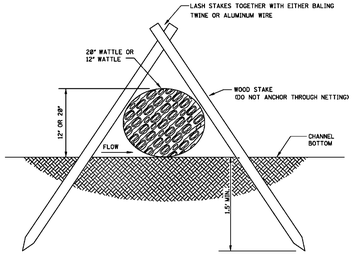
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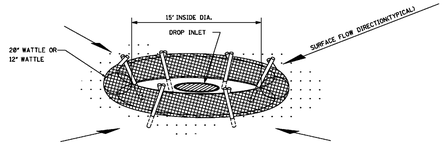
NOTE: SILT FENCE OR SANDBAGS MAY ALSO BE USED FOR THIS APPLICATION. HAY BALES NOT ACCEPTABLE DURING THIS STAGE.



CURB INLET PROTECTION (STAGE 2)
SINGLE OR DOUBLE WING INLET



SECTION B–B



DROP INLET PROTECTION

NOTES:

1. ANCHORING STAKES SHALL BE SIZED, SPACED, AND BE OF A MATERIAL THAT EFFECTIVELY SECURES THE WATTLE. STAKE SPACING SHALL BE A MAXIMUM OF THREE FEET.
2. OVERLAP ENDS OF WATTLES PER MANUFACTURER'S RECOMMENDATIONS (1' MIN., 3' MAX.)
3. TRENCHING OF WATTLES MAY BE NECESSARY IF PIPING BECOMES EVIDENT.
4. IN THE EVENT WATTLES CANNOT BE SECURED IN PLACE USING WOOD STAKES, SANDBAGS MAY BE USED IN LIEU OF WOOD STAKES IN ORDER TO SECURE WATTLES IN PLACE. COST OF SANDBAGS USED IN THIS APPLICATION SHALL BE INCLUDED IN OTHER ITEMS BID.

BY	REVISION	DATE

MISSISSIPPI DEPARTMENT OF TRANSPORTATION
ROADWAY DESIGN DIVISION
STANDARD PLAN

INLET PROTECTION DETAILS OF WATTLES

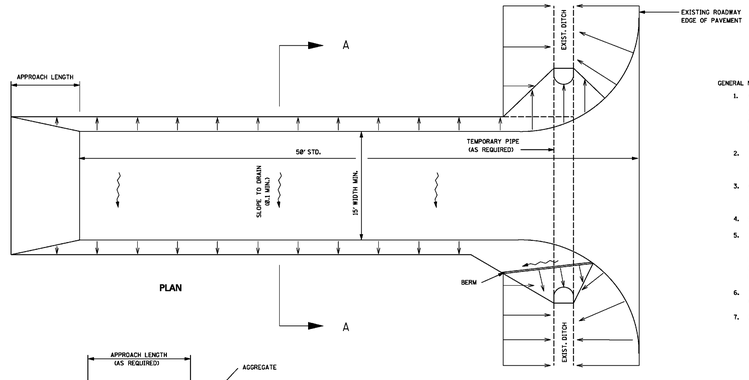
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WORKING NUMBER ECD-13

ISSUE DATE: AUGUST 01, 2017

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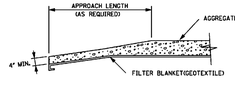
STATE	PROJECT NO.
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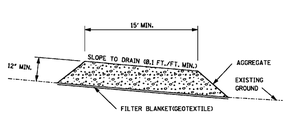
PLAN

GENERAL NOTES:

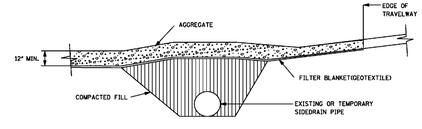
1. A STABILIZED CONSTRUCTION ENTRANCE SHALL BE CONSTRUCTED AT POINTS OF EGRESS FROM UNSTABILIZED AREAS OF THE PROJECT TO PUBLIC ROADS WHERE OFFSITE TRACKING OF MUD COULD OCCUR. TRAFFIC FROM UNSTABILIZED AREAS OF THE PROJECT SHALL BE DIRECTED THRU THE STABILIZED ENTRANCE. BARRIERS, FLAGGING, OR OTHER POSITIVE MEANS SHALL BE USED AS REQUIRED TO LIMIT AND DIRECT VEHICULAR EGRESS ACROSS THE STABILIZED ENTRANCE.
2. THE CONTRACTOR MAY PROPOSE AN ALTERNATIVE TECHNIQUE TO MINIMIZE OFFSITE TRACKING OF SEDIMENT. THE ALTERNATIVE MUST BE REVIEWED AND APPROVED BY THE ENGINEER PRIOR TO ITS USE.
3. ALL MATERIALS SPILLED, DROPPED, OR TRACKED ONTO PUBLIC ROADS (INCLUDING THE STABILIZED CONSTUCTION ENTRANCE AGGREGATE AND CONSTRUCTION MUD) SHOULD BE REMOVED DAILY, OR MORE FREQUENTLY IF SO DIRECTED BY THE ENGINEER.
4. SIZE III STABILIZER AGGREGATE OR LARGER SHALL BE USED.
5. THE STABILIZED CONSTRUCTION ENTRANCE SHALL BE MAINTAINED IN A CONDITION THAT WILL ALLOW IT TO PERFORM ITS FUNCTION TO PREVENT OFFSITE TRACKING. THE STABILIZED CONSTRUCTION ENTRANCE SHOULD BE RINSED WHEN NECESSARY TO MOVE ACCUMULATED MUD DOWNWARD THRU THE STONE. ADDITIONAL STABILIZATION OF THE VEHICULAR ROUTE LEADING TO THE STABILIZED ENTRANCE MAY BE REQUIRED TO LIMIT THE MUD TRACKED.
6. THE NOMINAL SIZE OF A STANDARD STABILIZED CONSTRUCTION ENTRANCE IS 15'X 50' UNLESS OTHERWISE SHOWN IN THE EROSION CONTROL PLAN.
7. COSTS OF ALL ITEMS ON THIS SHEET SHALL BE INCLUDED IN OTHER ITEMS BID.



TRANSITION DETAIL



SECTION A–A



RURAL CONNECTION DETAIL

BY	REVISION	DATE

MISSISSIPPI DEPARTMENT OF TRANSPORTATION
ROADWAY DESIGN DIVISION
STANDARD PLAN

STABILIZED CONSTRUCTION ENTRANCE

MDOT

WORKING NUMBER ECD-16

ISSUE DATE: AUGUST 01, 2017

SHEET NUMBER 6116

SPECIAL GENERAL NOTE:

ALL REFERENCE TO PAY ITEM NUMBERS SHALL BE USED FOR REFERENCE TO THE SPECIFICATION ONLY. PAY FOR ITEMS SHOWN ON THIS SHALL BE AS NOTED IN THE BID PROPOSAL.

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SDW Project No.: 15819 SDW Working No.: ECD2

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT

BID DOCUMENTS

Drawing Issued:

Date	Rev.	Description
10-31-2015		65% Check Set
12-18-2015		95% Check Set
11-19-2018		Bid Documents

Drawn By: RES
Checked By: SEM
Client No: ----
Albert & Associates: 12575

C4.4

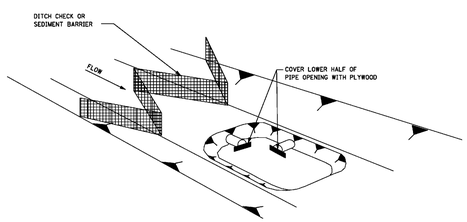
514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com

Albert & McCleskey Associates Architects

EROSION CONTROL DETAILS

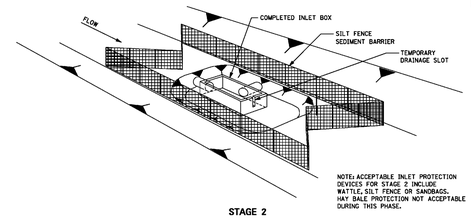
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STATE	PROJECT NO.
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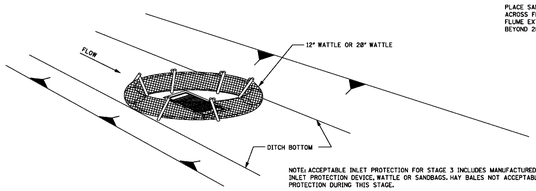
STAGE 1

INLET/JUNCTION BOX LOCATION EXCAVATED



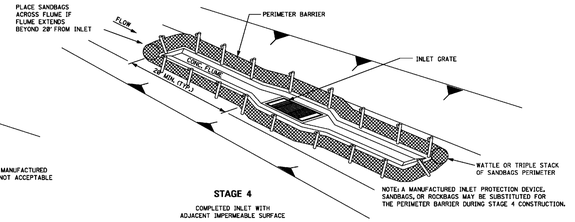
STAGE 2

INLET/JUNCTION BOX
CONSTRUCTED BUT NOT BACKFILLED



STAGE 3

INLET CONSTRUCTED AND BACKFILLED



STAGE 4

COMPLETED INLET WITH
ADJACENT IMPERMEABLE SURFACE

DITCH INLET CONSTRUCTION STAGES

NOTES:

1. DRAINAGE STRUCTURE BACKFILL SHOULD BE PLACED IN STAGE 1 IMMEDIATELY AFTER PIPE INSTALLATION. INLET CONSTRUCTION SHOULD COMMENCE AS SOON AS POSSIBLE AND BE CONTINUOUS THROUGH COMPLETION.
2. CONFIGURATIONS MAY BE ADJUSTED WITH APPROVAL OF THE ENGINEER FOR TRAVELWAY SAFETY, WATER FLOW, OR SOIL AND INSTALLATION CHALLENGES.
3. DURING STAGE 1 AND STAGE 2, SILT FENCE MAY BE REQUIRED UPSLOPE OF THE INLET EXCAVATION AS DIRECTED BY THE ENGINEER.
4. IF SILT FENCE IS INSTALLED AROUND THE INLET INSTALLATION IT SHOULD BE IN A CONFIGURATION THAT WILL ALLOW INLET CONSTRUCTION.
5. FOR INLET PROTECTION TO BE USED IN STAGES 1 AND 2 OF CONSTRUCTION, SEE WK. NO. ECD-12.

BY	REVISION	DATE

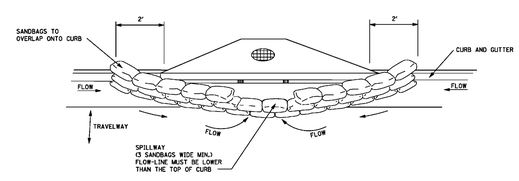
MISSISSIPPI DEPARTMENT OF TRANSPORTATION
ROADWAY DESIGN DIVISION
STANDARD PLAN

TYPICAL APPLICATIONS AND DETAILS FOR INLET CONSTRUCTION

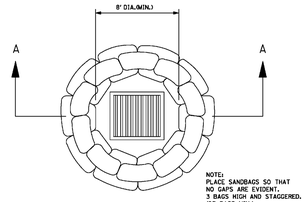
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WORKING NUMBER ECD-11
SHEET NUMBER 6111

ISSUE DATE: AUGUST 01, 2017

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MISS.	

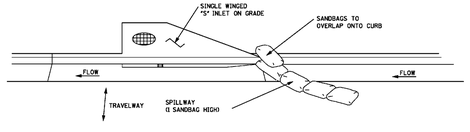


TYPICAL (SANDBAG) PROTECTION FOR INLET IN SAG

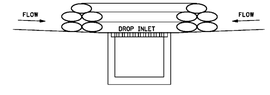


DROP INLET

PLAN VIEW



TYPICAL (SANDBAG) PROTECTION FOR INLET ON GRADE



SECTION A–A

SANDBAG BARRIER



CURB AND GUTTER SEDIMENT CONTAINMENT SYSTEM

CURB INLET PROTECTION NOTES:

1. THIS CURB INLET PROTECTION METHOD CAN BE USED DURING ANY STAGE OF BASE AND PAVEMENT CONSTRUCTION.
2. BAG HEIGHT AND NUMBER OF BAGS SHOULD BE BASED ON CURB HEIGHT AND USE OF TRAVELWAY.
3. SEDIMENT SHOULD BE CONTROLLED PRIOR TO ENTERING GUTTER. GUTTER CHECKS AND INLET PROTECTION ARE FOR SECONDARY CONTROL.
4. REMOVE ACCUMULATED SEDIMENT AFTER EVERY RAINFALL. SWEEP SEDIMENT FROM HARD SURFACES AND DISPOSE OF APPROPRIATELY AWAY FROM INLETS AND/OR WATER BODIES.
5. IF DENUDED AREAS EXIST BEHIND THE INLET, A SEDIMENT BARRIER SHOULD BE INSTALLED AROUND ITS PERIMETER TO CONTOL SEDIMENT.

BY	REVISION	DATE

MISSISSIPPI DEPARTMENT OF TRANSPORTATION
ROADWAY DESIGN DIVISION
STANDARD PLAN

INLET PROTECTION DETAILS OF SANDBAGS

MDOT
WORKING NUMBER ECD-15
SHEET NUMBER 6115

ISSUE DATE: AUGUST 01, 2017

SPECIAL GENERAL NOTE:

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SDW Project No.: 15819 SDW Working No.: ECD3

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EROSION CONTROL DETAILS

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HISTORIC HOSPITAL BUILDING

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG MISSISSIPPI

ARCHITECTURAL SYMBOLS

WINDOW TAG

DOOR TAG

ARCHITECTURAL NOTES

FABRICATED RAILING DESIGNATION

MODIFICATION DESIGNATION

ROOM NAME AND NUMBER

ADDENDA MODIFICATIONS

NOTATION LINES

COLUMN LINES

WALL/PARTITION TYPES

VERTICAL ELEVATION

CENTER LINE

BUILDING SECTION

INTERIOR ELEVATION

INTERIOR ELEVATION

WALL SECTION

EXTERIOR ELEVATION

MISCELLANEOUS SECTION

AREA TO BE ENLARGED ON DRAWINGS

ABBREVIATIONS

A/C	AIR CONDITIONING
ADD'M	ADDENDUM
ADJ	ADJUSTABLE
AFF	ABOVE FIRST FLOOR
BD	BOARD
BLKG	BLOCKING
CJ	CONTROL JOINT
CLG.	CEILING
CMU	CONCRETE MASONRY UNIT
CONC	CONCRETE
CONT	CONTROL OR CONTINUOUS
CPT	CARPET
CTR	CENTER
DIM	DIMENSION
DN	DOWN
DS	DOWN SPOUT
DWGS	DRAWINGS
EA	EACH
EDF	ELECTRIC DRINKING FOUNTAIN
ELEC	ELECTRICAL
EQ	EQUAL
EXP	EXPOSED
FD	FLOOR DRAIN
FE	FIRE EXTINGUISHER
FFE	FINISHED FLOOR ELEVATION
GB	GRAB BAR
GYP	GYPSUM
HM	HOLLOW METAL
HORIZ	HORIZONTAL
HGHT	HEIGHT
INSUL	INSULATION
JAN	JANITOR
JT	JOINT
LAM	PLASTIC LAMINATE
L.A.T.	LAY-IN ACOUSTIC TILE
MAX	MAXIMUM
MECH	MECHANICAL
MIN	MINIMUM
MISC	MISCELLANEOUS
MO	MASONRY OPENING
MRGB	MOISTURE RESISTANT GYP. BOARD
MTD	MOUNTED OR MOUNTING
MTL	METAL
N	NORTH
NIC	NOT IN CONTRACT
NTS	NOT TO SCALE
OC	ON CENTER
O.H.	OPPOSITE HAND
OPNG	OPENING
PL	PLATE OR PLATED
PLYWD	PLYWOOD
PNTD	PAINTED
POR	PORCELAIN TILE
PT	PAINT
PTD	PAPER TOWEL DISPENSER/DISPOSAL
PVR	PORCELAIN PAVER
QT	QUARRY TILE
RB	RUBBER BASE
RD	ROOF DRAIN
RE	REFERENCE
REQ'D	REQUIRED
RM	ROOM
SCH	SCHEDULE
SHT	SHEET
SIM	SIMILAR
S/M	SHEET METAL
SMACNA	S/M AND A/C CONTRACTORS NATIONAL ASSOCIATION, INC.
SND	SANITARY NAPKIN DISPOSAL
SPECS	SPECIFICATIONS
SS	STAINLESS STEEL
STRUCT.	STRUCTURAL
STN	STAINED WOOD
TPD	TOILET PAPER DISPENSER
TYP	TYPICAL
VCT	VINYL COMPOSITION TILE
VERT	VERTICAL
VWC	VINYL WALL COVERING
WB	WOOD BASE
WD	WOOD

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JACKSON, MS 39206
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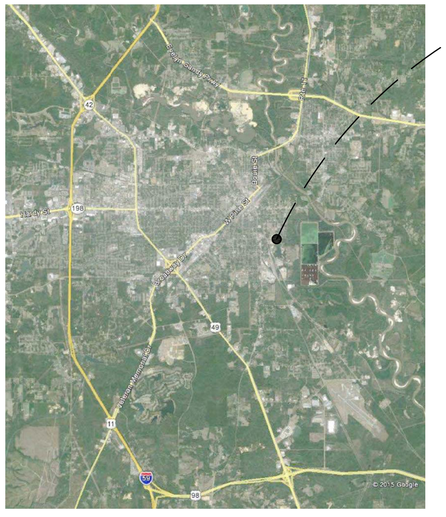
ELECTRICAL
THE POWER SOURCE
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MADISON, MS 39110
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601.605.4875 FAX

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SEC1.0	SECURITY PLAN - FIRST AND SECOND FLOOR
SEC1.1	SECURITY PLAN - THIRD FLOOR AND ROOF

PROJECT LOCATION

PROJECT SITE: 701 JAMES ST., HATTIESBURG, MS 39401




Main St
Hardy St
Forrest St
Pine St
Mobile St
Jackson St
Arlington Ave
Hemlock St
Laurel St
Bay Ave
Myrtle St
Magnolia St
Hillcrest Ave
Ruby Ave
Mamie St
Sunset Dr
Rowan Ave
Hall Ave
Hillcrest Dr
Ridgeway St
Ridgeway Ave
Hall Ave

GENERAL NOTES

00 - PROCUREMENT AND CONTRACTING

0.1 REVIEW BY ALL PARTIES: CONTRACTOR SHALL ENSURE THAT ALL SUBCONTRACTORS AND SUPPLIERS REVIEW AND ABIDE BY THE TERMS OF THESE GENERAL NOTES FOR CONTRACT COMPLIANCE.

0.2 RELATIONSHIP TO CONSTRUCTION DOCUMENTS: GENERAL NOTES ARE MEANT TO COMPLIMENT AND/OR EMPHASIZE INFORMATION PRESENTED IN THE CONTRACT DOCUMENTS. THE CONTRACTOR SHALL NOTIFY THE ARCHITECT WHERE A CONFLICT ARISES BETWEEN THE FOLLOWING GENERAL NOTES AND REMAINING CONTRACT DOCUMENTS DURING BIDDING AND FOR THE DURATION OF THE PROJECT. IF A CONFLICT ARISES DURING BIDDING THAT CANNOT BE LEGALLY CLARIFIED BY THE ARCHITECT, THE CONTRACTOR SHALL BASE THE BID ON THE MOST EXPENSIVE COMBINATION OF QUALITY AND QUANTITY OF WORK INDICATED.

0.3 KEYED NOTES: WHERE PROVIDED, NUMBERED NOTES ARE KEYED ON THE DRAWINGS TO DEMONSTRATE AN EXAMPLE OF A PARTICULAR CONDITION AT THE TIME OF DRAWING PREPARATION AND ARE NOT INCLUSIVE OF ALL INSTANCES OF THAT CONDITION, AND THUS MAY ALSO APPLY AS GENERAL NOTES FOR SITUATIONS OF THE SAME CONDITION.

01 - GENERAL REQUIREMENTS

1.1. FIELD CONDITIONS DURING BIDDING: CONTRACTOR SHALL PAY VERY CLOSE ATTENTION TO FIELD CONDITIONS DURING BIDDING TO ENSURE THAT ALL CONDITIONS ARE ACCOUNTED FOR AT THAT TIME. KNOWN OMISSIONS AND ERRORS BY THE A CONTRACTOR OR A SUBCONTRACTOR SHALL BE BROUGHT TO THE ARCHITECT'S ATTENTION FOR CLARIFICATION PRIOR TO BIDDING.

1.2. PUBLIC SAFETY: THE CONTRACTOR SHALL COORDINATE WITH THE JURISDICTION HAVING AUTHORITY TO ENSURE PUBLIC SAFETY AROUND THE CONSTRUCTION LIMITS AT ALL TIMES.

1.3. CONTRACTOR/SUBCONTRACTOR COORDINATION: ALL SUBCONTRACTORS (INCLUDING BUT NOT LIMITED TO HVAC, PLUMBING, FIRE SPRINKLER, AND ELECTRICAL) SHALL BE BOUND TO THE DESIGN AS INDICATED ON ARCHITECTURAL DRAWINGS, ENGINEERING DRAWINGS, SUPPLEMENTAL INSTRUCTIONS AND SHOP DRAWINGS. WHERE A CONFLICT ARISES BETWEEN THE THOSE DOCUMENTS, THE SUBCONTRACTOR SHALL COORDINATE WITH THE GENERAL CONTRACTOR PRIOR TO EXECUTION OF WORK TO DETERMINE A SOLUTION AND THE GENERAL CONTRACTOR SHALL INVOLVE THE ARCHITECT AS NECESSARY.

1.4. COORDINATION W/ OWNER'S CONTRACTORS: CONTRACTOR IS RESPONSIBLE FOR COORDINATING OWNER SUPPLIED CONTRACTORS (SECURITY EQUIPMENT, TELEPHONE EQUIP., FURNITURE, ETC.) SO THAT CONFLICTS DO NOT OCCUR BETWEEN TRADES AND SCHEDULING.

1.5. ADA: ALL PHYSICAL PROPERTIES OF THE BUILDING WITHIN THE CONTRACT LIMITS MUST COMPLY WITH THE 2010 ADA STANDARDS FOR ACCESSIBLE DESIGN.

1.6. MOCK-UPS FOR APPROVAL: THE CONTRACTOR SHALL PROVIDE MOCK-UPS AS DIRECTED IN THE DRAWINGS AND SPECIFICATIONS FOR REVIEW BY THE OWNER, ARCHITECT, AND APPLICABLE ENGINEERS AND CONSULTANTS, IN A SINGLE PRESENTATION. WHEN POSSIBLE, MEASURES TO CORRECT UNAPPROVED SAMPLES SHALL BE COMPLETED IMMEDIATELY TO AVOID AN ADDITIONAL ON-SITE INSPECTION BY THE GROUP. THE CONTRACTOR SHALL INCUR ANY ADDITIONAL COSTS ARISING OUT OF THE NECESSITY OF RESCHEDULING AN ADDITIONAL REVIEW BY SAID GROUP AS A RESULT OF THE CONTRACTOR'S FAILURE TO PROVIDE THE REQUESTED SAMPLES AS DIRECTED. AMPLE NOTICE (NO LESS THAN 5 CALENDAR DAYS) SHALL BE GIVEN TO THE ARCHITECT THAT THE SAMPLES ARE READY TO BE REVIEWED. IN SOME CASE, APPROVED MOCK-UPS CAN REMAIN PART OF THE WORK. SEE SPECIFICATIONS FOR ADDITIONAL SAMPLE AND MOCK-UP REQUIREMENTS.

1.7. DIMENSIONS: CONTRACTOR TO VERIFY ALL DIMENSIONS.

1.8. ANGLES: ALL ANGLES ARE 45 AND 90 DEGREES, UNLESS NOTED OTHERWISE.

1.9. CONSTRUCTION LIMITS: THE CONTRACTORS MUST KEEP THEIR EMPLOYEES WITHIN THE DEFINED, CONTROLLED CONSTRUCTION LIMITS AT ALL TIMES OR AS DIRECTED BY THE GENERAL CONTRACTOR. THE GENERAL CONTRACTOR WILL BE RESPONSIBLE TO KEEP THE OWNER AND ARCHITECT INFORMED OF ANY OCCASIONS WHEN WORKERS NEED TO BE OUTSIDE THE CONSTRUCTION LIMITS. A SIX-FOOT HIGH CHAIN LINK CONSTRUCTION FENCE IS REQUIRED AROUND THE PERIMETER OF THE CONSTRUCTION LIMITS. TWELVE-FOOT WIDE, IN-SWINGING, LOCKABLE GATES ARE REQUIRED AT CONSTRUCTION LIMIT ACCESS POINTS.

1.10. BUILDING LAYOUT: CONTRACTOR SHALL STAKEOUT ENTIRE BUILDING LAYOUT AND ALL IMPROVEMENTS FOR APPROVAL BY THE ARCHITECT AND OWNER BEFORE BEGINNING WORK. ALL DISCREPANCIES TO BE DISCUSSED AND ADJUSTED AT THAT MEETING.

1.11. FINISH FLOOR ELEVATIONS: ARCHITECT AND CIVIL ENGINEER MUST APPROVE FINISH FLOOR ELEVATION/BUILDING LOCATION PRIOR TO SETTING FORM WORK.

02 - EXISTING CONDITIONS

2.1. VERIFY EXISTING CONDITIONS: THE CONTRACTOR SHALL VERIFY EXISTING BUILDING AND SITE CONDITIONS AS THEY RELATE TO THE CONSTRUCTION DOCUMENTS AND REPORT ANY AND ALL DISCREPANCIES TO THE ARCHITECT IN WRITING AND IN A TIMELY MANNER.

2.2. SITE DEMOLITION: CONTRACTOR SHALL BE RESPONSIBLE FOR THE REMOVAL OR MODIFICATION OF ANY AND ALL EXISTING CONDITIONS REQUIRED TO ACCOMPLISH WORK.

2.3. EXISTING TREE PROTECTION: ALL EXISTING TREES NOTED TO REMAIN ARE TO BE PROTECTED. CONTRACTOR SHALL PROVIDE CHAIN LINK FENCE AT A 15' RADIUS AROUND THE TREE TRUNK AND PAINT ON THE GROUND, WITH GREEN SURVEYING PAINT, AN OUTLINE OF THE TREE CANOPY ABOVE, SHOULD IT EXCEED 15'. AREAS INSIDE OF THE FENCING AND WITHIN THE GREEN PAINT ARE NOT TO BE USED FOR PERMANENT STORAGE OF MATERIAL OR EQUIPMENT OR VEHICLE PARKING. SHOULD DAMAGE OCCUR TO TREES SCHEDULED TO BE PROTECTED DUE TO INADEQUATE TREE PROTECTION, THE CONTRACTOR SHALL CONSULT WITH A PROFESSIONAL ARBORIST TO REMEDY THE SITUATION AND/OR REPLACE THE TREE WITH A NEW SPECIMEN EQUAL IN SPECIES AND SIZE. IN THE EVENT OF REPLACEMENT, THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE FULL ESTABLISHMENT OF THE TREE.

2.4. TREE AND STUMP REMOVAL: REMOVE ALL TREES AND STUMPS WITHIN 10' OF BUILDING UNLESS MARKED FOR PROTECTION. REVIEW ALL TRESS MARKED FOR REMOVAL WITH ARCHITECT PRIOR TO CUTTING (SEE SITE PLAN).

03 - CONCRETE

3.1. EXPOSED CONCRETE: ALL EXPOSED CONCRETE SURFACES SHALL RECEIVE A RUBBED FINISH TO CREATE A SMOOTH, UNIFORM APPEARANCE AND SHALL HAVE A MIN. 1/2" RADIUS ON ALL EXPOSED CORNER CONDITIONS.

3.2. CONCRETE BLOCK-OUTS: CONTRACTOR TO VERIFY ALL REQUIRED BLOCK-OUTS IN CONCRETE CONSTRUCTION DURING THE SHOP DRAWINGS PHASE AND/OR BEFORE CONCRETE POURS ARE ORDERED. CONTRACTOR SHALL PROVIDE BLOCK-OUTS IN ALL CONCRETE CONSTRUCTION FOR ALL ITEMS SHOWN ON ARCHITECTURAL, STRUCTURAL, AND MEP DRAWINGS AS BEING "RECESSED" OR FOR ITEMS SHOWN PENETRATING CONCRETE.

3.3. CONCRETE WORK: VIBRATE ALL CONCRETE IN BEAMS, PARTICULARLY AT THE RECESSES AROUND PERIMETER, TO ELIMINATE HONEYCOMBS.

04 - MASONRY

4.1. MASONRY EXPANSION JOINTS: WHERE NOT SHOWN OF DRAWINGS, MASONRY EXPANSION JOINTS ARE TO BE LOCATED 50'-0" APART MAXIMUM AND NO MORE THAN 25'-0" FROM BUILDING CORNERS. PLACE REQUIRED EXPANSION JOINTS AT INSIDE CORNERS WHERE POSSIBLE. HORIZONTAL EXPANSION JOINTS ARE REQUIRED AT ALL FLOORS WHERE STRUCTURAL RELIEF ANGLES ARE USED. MASONRY EXPANSION JOINTS ARE TO BE LOCATED TO LIMIT MASONRY AREA TO A MAXIMUM OF 500 SQ. FT. UNLESS OTHERWISE DIRECTED. THE CONTRACTOR SHALL COORDINATE ALL OF THE EXPANSION JOINT LOCATIONS WITH THE ARCHITECT AND STRUCTURAL ENGINEER BEFORE STARTING MASONRY WORK.

4.2. WEEPS: ALL MASONRY WEEPS ARE TO BE FULL OPEN HEAD JOINTS WITH PLASTIC INSERTS AT A MAXIMUM OF 24 INCHES ON CENTER. COORDINATE MASONRY CONSTRUCTION WITH "MORTAR NET" APPLICATION IN CAVITY WALLS AT ALL WALL FLASHING LOCATIONS.

4.3. MASONRY REINFORCING: ALL MASONRY WALL TIES SHALL BE SPACED A MAXIMUM OF 16" OC VERTICAL AND 16" OC HORIZONTAL. WALL TIE LOCATIONS THAT FALL NEXT TO CONCRETE COLUMNS REQUIRE THE USE OF DOVETAIL EMBED ANCHORS AND WALL TIES THAT FALL NEXT TO STEEL BEAMS REQUIRE THE USE OF SCREW APPLIED WALL ANCHORS. SEE STRUCTURAL DRAWINGS FOR ADDITIONAL REINFORCING REQUIREMENTS AND SPECIFICATIONS.

4.4. MASONRY LINTELS: PROVIDE LINTELS AT ALL MASONRY OPENINGS AS SHOWN IN STRUCTURAL DRAWINGS.

4.5. BOND COURSES: PROVIDE CONTINUOUS BOND COURSES AS SHOWN IN STRUCTURAL DRAWINGS.

4.6. DEFECTIVE MASONRY: BROKEN, CHIPPED, OR CRACKED CONCRETE MASONRY UNITS SHALL NOT BE USED IN THIS PROJECT.

05 - METALS

5.1. STEEL FINISH: ALL EXPOSED STEEL IS TO BE HOT DIPPED GALVANIZED OR SS.

5.2. EXTERIOR FASTENERS: USE HOT DIP GALVANIZED OR SS FASTENERS AT ALL EXTERIOR CONDITIONS. CONTRACTOR SHALL CONFIRM THAT ALL FASTENERS SUIT LOAD AND CONDITIONS.

5.3. MISCELLANEOUS STEEL: CONTRACTOR SHALL PROVIDE FOR ALL MISCELLANEOUS STEEL IN CONTRACT. NOT ALL STRUCTURAL AND MISCELLANEOUS STEEL IS SHOWN IN ARCHITECTURAL DRAWINGS AND NOT ALL MISCELLANEOUS STEEL IS SHOWN IN STRUCTURAL DRAWINGS. SOME BUILDING COMPONENTS AND SYSTEMS INCLUDING BUT NOT LIMITED TO PLUMBING FIXTURES, MECHANICAL UNITS, LIGHT FIXTURES, GUARDRAILS, WINDOWS, SIGNAGE, TOILET PARTITIONS, SPECIAL WALL CONDITIONS, EAVE, RAKE, WINDOW & DOOR FRAMING, ETC. MAY REQUIRE MISCELLANEOUS STEEL NOT SHOWN IN THE DRAWINGS.

5.4. STEEL DETAILING: CONTRACTOR TO VERIFY LOCATIONS AND SIZES OF ALL ROOF PENETRATIONS WITH MECHANICAL, STRUCTURAL, AND ARCHITECTURAL DRAWINGS AND VERIFY THAT STRUCTURAL STEEL MEETS THE UL ASSEMBLY SPECIFIED BEFORE DETAILING STEEL.

5.5. GUARDRAIL LOAD DESIGN: ALL GUARDRAILS ARE TO BE DESIGNED TO WITHSTAND THE REQUIREMENTS STATED IN THE MOST RECENT AND APPLICABLE BUILDING CODE. SEE LIFE SAFETY REVIEW IN DRAWINGS.

5.6. HANDRAILS: UNLESS NOTED OTHERWISE, ALL HANDRAILS ARE TO BE 1-1/4" OD (WOOD AND STEEL).

5.7. METAL STUDS: ALL METAL STUDS ARE 16" O.C. UNLESS NOTED OTHERWISE, SIZES AND GAUGES ARE SHOWN ON DRAWINGS OR IN SPECIFICATIONS.

06 - WOOD & PLASTICS

6.1. WOOD STUDS: WOOD WALL STUDS SHALL BE 16" OC UNLESS NOTED OTHERWISE.

6.2. WOOD BLOCKING: PROVIDE BLOCKING AND SOLID GROUNDS FOR ALL EQUIPMENT, ACCESSORIES SUCH AS: FIXTURES, TOILET PARTITIONS, WALL MOUNTED DOOR STOPS, HARDWARE, SHELVING, CABINETS, APPLIANCES, PLUMBING FIXTURES, ETC.

6.3. BLOCK-OUTS IN STUD WALLS: COORDINATE WITH ARCHITECTURAL, MECHANICAL, ELECTRICAL, AND STRUCTURAL FOR REQUIRED ROUGH-IN DIMENSIONS. PROVIDE STUD SPACING, BLOCKS, ETC. TO SUIT VARIOUS EQUIPMENT, REGISTERS, GRILLES, ETC. TO BE BUILT-IN. FORM HEADERS TO ADEQUATELY SUIT SPANS WHERE REQUIRED.

6.4. TREATED WOOD: ALL WOOD IN CONTACT WITH EARTH, MASONRY, CONCRETE OR STEEL SHALL BE PRESSURE PRESERVATIVE TREATED (PT), SEE SPECS AND DRAWINGS.

07 - THERMAL PROTECTION

7.1. MOLD AND MILDEW PLAN: THE CONTRACTOR WILL PROVIDE A COMPLETE PHOTOGRAPHIC RECORD OF THE ENTIRE INSTALLATION PROCESS AND COMPLETED INSTALLATION OF ALL BELOW AND ABOVE GRADE WATERPROOFING SYSTEM INSTALLATION, INCLUDING BUT NOT LIMITED TO, UNDER SLAB, SUB GRADE WALLS, ABOVE GRADE WALLS, WINDOWS, DOORS, PARAPETS, ROOF, ETC. BEFORE COVERING UP WITH FINISH MATERIAL. ALL PHOTOGRAPHS SHALL BE DATE-STAMPED WITH LOCATIONS NOTED ON THE AS-BUILT SET OF DRAWINGS. PHOTOGRAPHIC COVERAGE SHALL AT LEAST INCLUDE 50% OF EACH INSTALLED WATERPROOFING SYSTEM.

7.2. WATER TESTING AND RECORDS: THE CONTRACTOR SHALL PROVIDE WATER TESTING OF THE ENTIRE BUILDING ENVELOPE WATER PROTECTION SYSTEM WHICH INCLUDES BUT IS NOT LIMITED TO UNDER SLAB, SUB GRADE WALLS, ABOVE GRADE WALLS AND WINDOWS, FLASHING, AND ROOF CONSTRUCTION, IN A TIMELY MANNER AND AS DIRECTED BY THE ARCHITECT AND CXA (WHEN APPLICABLE). ANY DEFICIENCIES DISCOVERED WILL BE CORRECTED (INCLUDING REPLACING ANY DAMAGED MATERIALS) AND RETESTED PRIOR TO BEGINNING MASONRY INSTALLATION.

7.3. INSULATION AND VAPOR BARRIERS: THE CONTRACTOR IS RESPONSIBLE FOR MAINTAINING THE CONTINUITY OF THE BUILDING INSULATION AND VAPOR BARRIERS WHEN SEPARATING CONDITIONED, UNCONDITIONED, AND SEMI-CONDITIONED SPACES. UNLESS NOTED OTHERWISE CONTRACTOR SHALL PROVIDE:

- ON EXTERIOR CMU: 2" R10 RIGID INSULATION ON EXTERIOR SIDE
- ON EXTERIOR METAL OR WOOD STUDS: 6" R19 BLANKET INSULATION WITHIN STUD SPACING
- IN ATTIC: 9-1/2" R30 BLANKET INSULATION THROUGHOUT ATTIC (AT CEILING AND ROOF DECK)

7.1. ROOF PENETRATIONS: WHERE PLUMBING, MECHANICAL, ELECTRICAL DEVICES AND EQUIPMENT PENETRATE ROOF, PROVIDE FLASHING CAPS, ROOFING MASTIC AND MEMBRANES AS REQUIRED TO MAKE PENETRATIONS THOROUGHLY WATERTIGHT. USE MATERIALS COMPATIBLE WITH ROOF MATERIAL. PROTECT VENTS FROM ULTRAVIOLET LIGHT AS RECOMMENDED BY MANUFACTURER. ALL PENETRATIONS IN ROOF CONSTRUCTION TO BE PERFORMED BY A QUALIFIED ROOFING CONTRACTOR AND AS PART OF THE ROOF WARRANTY. NO PENETRATIONS ARE TO BE PERFORMED BY PLUMBERS OR OTHER NON-ROOFING SUBCONTRACTORS.

7.2. SHEET METAL WORK: ALL SHEET METAL WORK INCLUDING METAL GAUGE THICKNESS, WALL FLASHING, GUTTERS, DOWN SPOUTS, EXPANSION JOINTS, FASCIA METAL, ETC. SHALL COMPLY WITH THE STANDARDS AND RECOMMENDED PRACTICES OF THE SHEET METAL AND AIR-CONDITIONING CONTRACTORS NATIONAL ASSOCIATION. (SMACNA)

7.3. GUTTER EXPANSION JOINTS: GUTTER EXPANSION JOINTS ARE REQUIRED AT A MAXIMUM OF 50'-0."

7.4. METAL FLASHING FINISH: ALL METAL ROOF AND WALL FLASHING, EDGE STRIPS, EXTERIOR TRIM, DOWN SPOUTS, GUTTERS SHALL BE FACTORY FINISHED AND COMPATIBLE WITH SPECIFIED ROOFING SYSTEM (WHERE APPLICABLE). CONTRACTOR SHALL PROVIDE ARCHITECT WITH MANUFACTURER'S COLOR SAMPLES FOR APPROVAL.

7.5. WALL OPENING FLASHING: PROVIDE FLASHINGS ON ALL SIDES OF ALL WINDOW, DOOR AND LOUVER PENETRATIONS INCLUDING HEAD FLASHINGS AND WEEPS, JAMB FLASHINGS TO ALLOW MOISTURE TO FALL VERTICALLY TO SILL FLASHING, AND SILL FLASHINGS WITH END DAMS AND WEEPS.

7.6. CAVITY WALL FLASHING: THRU-WALL MEMBRANE FLASHING IS REQUIRED IN ALL MASONRY CAVITY WALL CONDITIONS WHERE THE WATER MUST BE DIRECTED OUT OF THE CAVITY WALL SPACE. IT IS CRITICAL THAT THE CONTRACTOR VERIFY THAT THE THRU-WALL FLASHING IS COORDINATED WITH THE OTHER TRADES SO THAT THE INTEGRITY OF THE TOTAL FLASHING SYSTEM WORKS AS DESIGNED AND THAT ALL FLASHING PIECES ARE IN THE RIGHT LOCATION TO DIRECT WATER OUT OF THE BUILDING.

7.7. UL APPROVED STANDARDS: THE CONTRACTOR AND SUBCONTRACTOR ARE TO PROVIDE THE ARCHITECT WITH A WRITTEN GUARANTEE THAT THE SPECIFIED AMOUNTS OF FIREPROOFING AND FIRESTOPPING ARE INSTALLED PROPERLY TO MEET APPLICABLE CODES AND UL APPROVED CONSTRUCTION STANDARDS.

7.8. JOINT SEALANTS: PROVIDE CAULKING AND/OR SEALANT AT ALL CRACKS AND INTERSECTIONS OF MATERIALS WHERE WEATHER-TIGHTNESS OR INSECT CONTROL IS NEEDED OR WHERE APPEARANCE IS IMPORTANT. INTENT IS A NEAT, WEATHER TIGHT, FINISHED PROJECT AT ALL LOCATIONS.

7.9. SEALANT COLORS: ALL EXTERIOR SEALANT COLOR IS TO MATCH THE MORTAR COLOR OF MASONRY CONSTRUCTION. INCLUDE A SAMPLE WITH MASONRY MOCK-UP FOR APPROVAL. ALL INTERIOR CAULK COLORS ARE TO MATCH ADJACENT PAINT OR MATERIAL COLORS OR BE PAINTABLE.

7.10. EXPANSION JOINTS: PROVIDE FOR EXPANSION JOINTS AND COVERS WHERE NEEDED IN ALL MATERIALS.

08 - DOORS & WINDOWS

8.1. THRESHOLDS: CONTRACTOR TO SET DOOR THRESHOLDS IN A FULL BED OF SEALANT.

8.2. DOOR LOCATION DIMENSIONS: ALL DOORS SHALL BE LOCATED 6" FROM THE FACE OF THE WALL IN METAL STUD/GYPSUM BOARD WALLS, 8" FROM THE FACE OF THE WALL IN CMU CONSTRUCTION, OR CENTERED ON THE WALL, UNLESS NOTED OTHERWISE ON THE DRAWINGS.

8.3. EXTERIOR LOUVERS: THE EXTERIOR LOUVERS WILL BE FACTORY PRE-FINISHED TO EXACTLY MATCH THE COLOR OF THE ADJACENT SURFACES. CONTRACTOR SHALL VERIFY THAT ALL LOUVERS PREVENT WATER FROM ENTERING THE BUILDING. A SAMPLE LOUVER COLOR WILL BE APPROVED BEFORE MANUFACTURING.

09 - FINISHES

9.1. PARTITION TYPES: WHERE CHANGES IN PARTITION TYPES COME TOGETHER ALONG A CONTINUOUS WALL, ADJUST THE STUDS TO ALLOW THE OUTERMOST FACES OF FINISH TO BE FLUSH. PARTITION TYPE TRANSITIONS SHALL BE IMPERCEPTIBLE.

9.2. CEMENTITIOUS BACKER BOARD: CEMENTITIOUS BACKER BOARD IS REQUIRED BEHIND ALL CERAMIC WALL TILE LOCATIONS.

9.3. FLOOR TRANSITIONS: AT ALL FLOORING PRODUCT TRANSITIONS, PROVIDE NECESSARY ADA COMPLIANT TRANSITION MATERIALS.

9.4. FLOOR PREP: ALL FLOORS TO BE PROPERLY PREPPED AND FLOATED AS REQUIRED AND BASED ON EXISTING OR NEW SLAB CONIDTIONS.

9.5. FLOOR PATTERNS: CONTRACTOR TO LAYOUT ALL PATTERN FLOOR AREAS AND DRY INSTALL A PORTION OF DESIGN FOR ARCHITECT'S APPROVAL BEFORE INSTALLING FLOOR.

9.6. TILE WORK: ALL FLOOR AND WALL TILE INSTALLATIONS SHALL COMPLY WITH THE STANDARDS AND RECOMMENDED PRACTICES OF THE TCA HANDBOOK FOR CERAMIC TILE INSTALLATION BY THE TILE COUNCIL OF NORTH AMERICA, INC.

9.7. STAIR FINISHES: CONTRACTOR TO VERIFY STAIR FINISH ON FINISH FLOOR PLANS, STAIR PLANS AND DETAILS, AND FINISH SCHEDULE OF ROOM THAT STAIR IS LOCATED BEFORE POURING CONCRETE TREAD. IF NO FINISH IS SHOWN OR CALLED FOR ON STAIR, THEN CONTRACTOR TO PROVIDE FINISH FOR TREADS AND LANDINGS THE SAME AS FINISH SPECIFIED IN ROOM STAIR IS LOCATED ON THE FINISH SCHEDULE. ALL EXPOSED PORTIONS OF STEEL PAN STAIRS SHALL BE PAINTED WHERE NO OTHER FINISH IS SHOWN.

9.8. CEILING GRIDS: ALL SUSPENDED CEILING GRIDS SHALL BE APPROVED BY THE ARCHITECT FOR EXACT LAYOUT BEFORE INSTALLATION. IF THE GRID IS INSTALLED WITHOUT APPROVAL, THEN THE GRID SHALL BE REMOVED AND REINSTALLED BY THE CONTRACTOR AT NO ADDITIONAL COST TO THE OWNER.

9.9. PAINT: ALL SURFACES IN THE PROJECT THAT ARE NOT PRE-FINISHED PAINTABLE IN NATURE ARE TO BE PAINTED. NOTHING SHALL BE LEFT UNPAINTED. SEE SPECIFICATIONS FOR TYPES OF PAINT TO BE USED. CONTRACTOR SHALL PUT UP AN 8'X8' SAMPLE AREA OF ALL PAINT COLORS FOR APPROVAL BEFORE ORDERING PAINT.

9.10. GRILLES: ALL GRILLES THAT ARE EXPOSED ARE TO BE THE MATCHING COLOR OF ADJACENT SURFACES UNLESS OTHERWISE NOTED. EXACT PLACEMENT OF GRILLE LOCATIONS IN THE WALLS ARE TO BE APPROVED BY THE ARCHITECT BEFORE INSTALLATION. IF GRILLES ARE INSTALLED WITHOUT APPROVAL, THEY WILL BE RELOCATED AND THE WALL PATCHED BY THE CONTRACTOR AT NO ADDITIONAL COST TO THE OWNER.

9.11. FURR-DOWN PAINT: UNLESS NOTED OR SPECIFIED OTHERWISE, ALL WALL SURFACES AT FURR DOWNS SHALL RECEIVE PAINTED FINISH TO MATCH ADJACENT WALL COLORS. VERIFY ALL FURR DOWNS WITH ARCHITECT BEFORE PROCEEDING.

9.12. CMU FINISH: ALL CMU BLOCK TO RECEIVE DRYLOK COATING AS SPECIFIED.

9.13. ACOUSTICAL BATT: INSULATE ALL INTERIOR WALLS WITH A MINIMUM OF 3-1/2" UN-FACED FIBERGLASS ACOUSTICAL BATT INSULATION FOR ACOUSTIC CONTROL.

10 - SPECIALTIES

10.1. RECESSED EQUIPMENT: VERIFY THAT ALL RECESSED EQUIPMENT SPECIFIED INCLUDING BUT NOT LIMITED TO FIRE EXTINGUISHER CABINETS, PAPER TOWEL DISPENSERS, ETC., WILL BE CONCEALED IN WALLS. ADJUST WALL THICKNESS AS REQUIRED FOR RECESSED EQUIPMENT.

10.2. BLOCKING FOR EQUIPMENT: PROVIDE BLOCKING AND SOLID GROUNDS FOR ALL EQUIPMENT AND ACCESSORIES INCLUDING BUT NOT LIMITED TO PLUMBING AND LIGHTING FIXTURES, TOILET PARTITIONS, BATHROOM ACCESSORIES, WALL-MOUNTED DOOR STOPS, HARDWARE, SHELVING, CABINETS, APPLIANCES, ETC. ALL WOOD BLOCKING IN METAL STUD PARTITIONS SHALL BE FIRE RETARDANT TREATED.

10.3. EQUIPMENT INSTALLATION: VERIFY ALL EQUIPMENT INSTALLATION CLEARANCES WITH MANUFACTURER, INCLUDING BUT NOT LIMITED TO APPLIANCES AND EQUIPMENT NOT-IN-CONTRACT BUT SHOWN IN DRAWINGS.

13 - SPECIAL CONSTRUCTION

13.1. METAL BUILDING REQUIREMENTS: NOT APPLICABLE TO THIS PROJECT.

GENERAL MEP

MEP.1 EQUIPMENT INSTALLATION: CONTRACTOR SHALL VERIFY ALL EQUIPMENT INSTALLATION CLEARANCES AND POWER REQUIREMENTS WITH MANUFACTURER AND COORDINATE ALL SUBCONTRACTORS TO KEEP THE SYSTEMS AS CLOSE TO THE UNDERSIDE OF FLOOR DECK AS POSSIBLE.

MEP.2 FURR-DOWNS / FURR-OUTS: UNLESS OTHERWISE NOTED, THE CONTRACTOR SHALL NOT FURR-OUT OR FURR-DOWN FOR ANY REASON. THE CONTRACTOR SHALL NOTIFY THE ARCHITECT IMMEDIATELY IF IS SUSPECTED THAT A PIPE, DUCT, CONDUIT, OR ANY OTHER MECHANICAL, ELECTRICAL OR PLUMBING DEVICE WILL NOT REMAIN CONCEALED UNDER A FLUSH CONDITION. RE; REFLECTED CEILING PLANS FOR THE LAYOUT OF APPROVED FURR-DOWNS.

MEP.3 DEVICE CONTROLLER LOCATIONS: THE COLORS AND PLACEMENT OF ALL VISIBLE DEVICE CONTROLLERS FOR MECHANICAL, ELECTRICAL, A/V, COMMUNICATIONS, AND OTHER RELATED EQUIPMENT SHALL BE COORDINATED AND APPROVED BY THE ARCHITECT PRIOR TO INSTALLATION TO ENSURE A COHESIVE AND ORGANIZED RESULT. ALL DEVICE CONTROLLERS SHALL MATCH IN MOUNTING HEIGHT ABOVE FINISHED FLOOR AND IN COLOR.

MEP.4 EXPOSED MECHANICAL/ELECTRICAL FIXTURE MOUNTING HEIGHTS: REFER TO ARCHITECTURAL REFLECTED CEILING PLANS AND INTERIOR ELEVATIONS FOR MOUNTING LOCATIONS AND HEIGHTS OF ALL LIGHT FIXTURES AND CEILING FANS AND MECHANICAL DUCTS, DIFFUSERS, ETC. IF MOUNTING HEIGHTS ARE NOT SHOWN, OR DIFFER FROM THE ENGINEERING DRAWINGS, CONSULT THE ARCHITECT.

MEP.5 SPRINKLER SYSTEM SHOP DRAWINGS: THE CONTRACTOR MUST SUBMIT A SPRINKLER SYSTEM LAYOUT WITH THE SPRINKLER SYSTEM SUBMITTAL FOR REVIEW BY THE ARCHITECT. THIS LAYOUT DRAWING MUST BE TO A MIN. OF 1/8=1' SCALE. THE DRAWING MUST INCLUDE CEILING MATERIALS, LIGHT FIXTURES, HVAC DIFFUSERS AND RETURNS, SMOKE DETECTORS, ETC.

MEP.6 SPRINKLER SYSTEM: THE BUILDING FIRE PROTECTION SPRINKLER SYSTEM IS TO BE INSTALLED ABOVE CEILINGS UNLESS NOTED OTHERWISE ON RCP'S. SPRINKLER HEADS SHALL BE CENTERED IN CEILING TILES OR GYPSUM BOARD CEILINGS. WHERE HEADS ARE NOT CENTERED OR OUT OF ALIGNMENT, THEY SHALL BE REINSTALLED AND ALL SURROUNDING FINISHES REPAIRED WHERE FORMER HOLE WAS LOCATED. FIRE SPRINKLER SUBCONTRACTOR SHALL BE PREPARED TO MODIFICATIONS TO THREADED PIPE IN THE FIELD AS REQUIRED TO ENSURE PROPER LOCATION OF HEADS. (WHERE CEILINGS ARE NOT IN CONTRACT (IE, SHELLED SPACES), THE FUTURE CEILING HEIGHTS ARE SHOWN ON THE RCP'S. NOTE THAT IN SUCH CASE, CONTRACTOR MUST TAKE INTO ACCOUNT OTHER SYSTEMS TO BE INSTALLED IN FUTURE SPACE AND COORDINATE PLACEMENT OF FIRE SPRINKLER ACCORDINGLY).

MEP.7 FLOOR DRAINS: WHERE FLOOR DRAINS ARE PRESENT, FLOORS SHALL SLOPE AT A MINIMUM OF 1/8" PER FOOT TO THE DRAIN AND DRAINS SHALL BE LOCATED AT THE LOWEST POINT OF THE AREA WHICH THE DRAIN SERVES.

MEP.8 LIGHT FIXTURES: STEM LENGTH OF ALL PENDANT LIGHT FIXTURES SHALL BE APPROVED BY THE ARCHITECT. CONTRACTOR SHALL INSTALL A SAMPLE FIXTURE FOR APPROVAL, MAKING ADJUSTMENTS TO THE LENGTH AS REQUIRED.

31 - EARTHWORK

31.1. SITE TRENCHING: FOR ALL TRENCHING WORK, CONTRACTOR SHALL REPLACE ALL DISTRIBUTED GROUND WITH NEW FILL AND SOD; REPLACE ALL CUT, BROKEN, REMOVED, DISTURBED ASPHALT PAVING, CONCRETE CURBS AND CONCRETE SIDEWALKS WITH NEW IN-KIND MATERIALS TO MATCH ORIGINAL DESIGN. USE APPROVED BACKFILL UNDER ALL ITEMS AS SPECIFIED. CUT ALL SIDEWALKS AT EXISTING CONTROL JOINTS ONLY. IF EXISTING UTILITIES, ARE ENCOUNTERED, PATCH ANY DISTURBED LINES.

31.2. TEMPORARY SHORING: PROVIDE SHORING AS NEEDED FOR EXCAVATION FOOTINGS, MECHANICAL & ELECTRICAL WORK AS DIRECTED BY THE CIVIL, STRUCTURAL DRAWINGS, AND REQUIRED BY CODE AND OSHA REQUIREMENTS.

31.3. SILT AND SOIL EROSION CONTROL: THE CONTRACTOR MUST CONTROL EROSION FROM SITE DURING CONSTRUCTION OF THE PROJECT AS REQUIRED IN THE SPECIFICATIONS.

32 - EXTERIOR IMPROVEMENTS

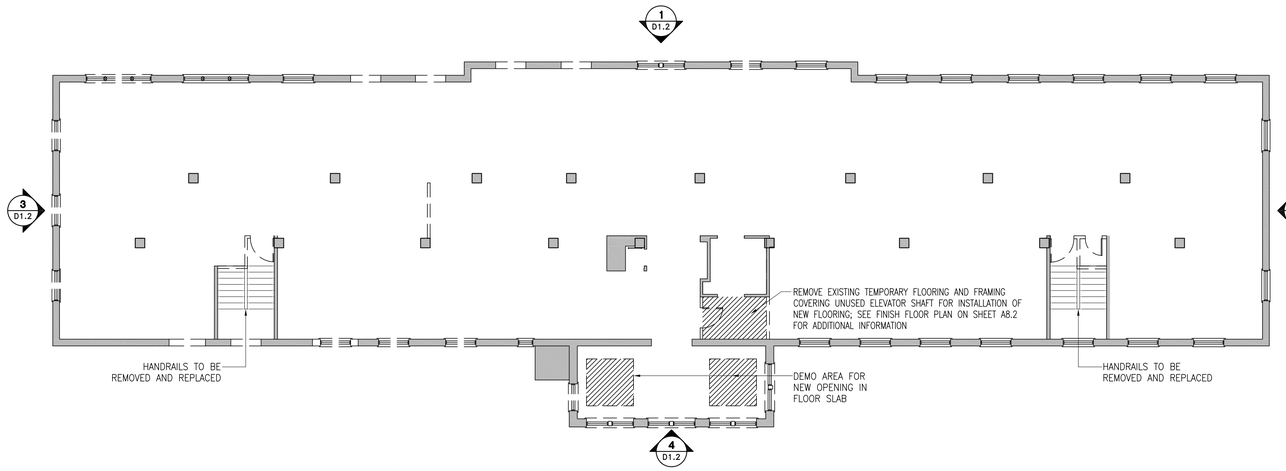
32.1. CONCRETE PAVEMENT SLOPES: SLOPE ALL CONCRETE PARKING LOT PAVEMENT A MIN. OF 1% IN DIRECTION OF WATER RUN-OFF AND SLOPE ALL CONCRETE PORCHES, SLABS, & SIDEWALKS AWAY FROM BUILDING 1/4" PER FOOT TO INSURE POSITIVE DRAINAGE. CONTRACTOR IS RESPONSIBLE FOR MAINTAINING POSITIVE RUN-OFF AWAY FROM THE BUILDING AND THE ELIMINATION OF STANDING WATER ON THE PARKING LOT AND SITE. ANY CONCRETE, PAVED, OR FINISHED PAVER SURFACES THAT POND WATER SHALL BE REMOVED AND TOTALLY REWORKED TO PROVIDE A NON-PONDING FINISHED RESULT.

32.2. FINISH GRADING: SEE CIVIL DRAWINGS FOR ALL FINISH GRADES AROUND THE BUILDING. FINISH GRADES SHALL NEVER BE ABOVE THE FINISH FLOOR ELEVATION (FFE) AND SHALL SLOPE AWAY FROM BUILDING ON ALL SIDES. THE FINISH GRADE SHALL BE A MINIMUM OF 1/2" BELOW THE FFE AT ALL DOORS. ALL DOOR THRESHOLDS SHALL MEET THE ADA.

32.3. TERMITE PROTECTION: PROVIDE TERMITE TREATMENT, WITH CERTIFICATE TO OWNER; SEE SPECS. PROVIDE A FIVE-YEAR WARRANTY.

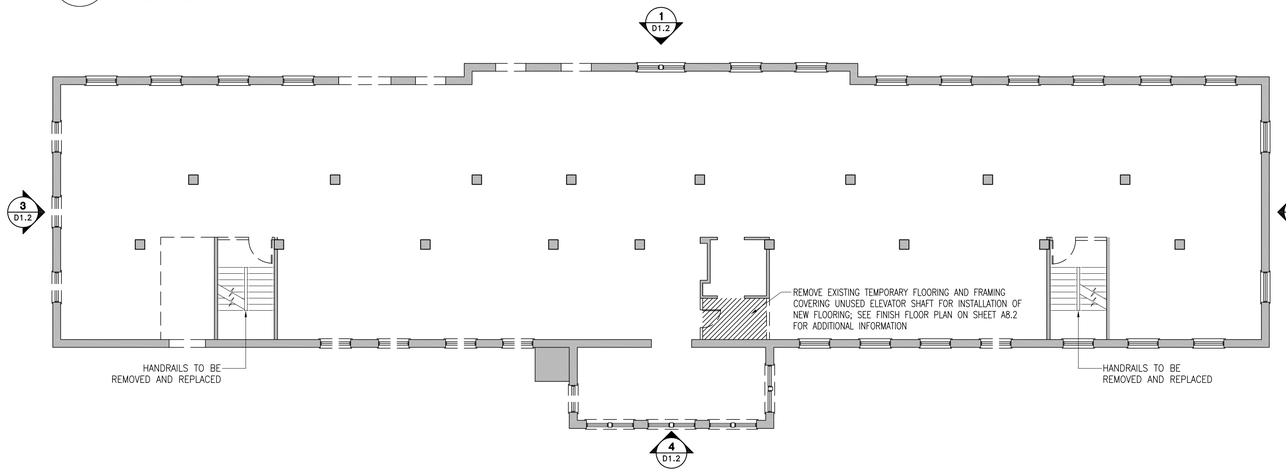
32.4. SLEEVES FOR FUTURE: THE GENERAL CONTRACTOR SHALL PROVIDE A MINIMUM OF (2) EMPTY 4" PVC SLEEVES UNDER ALL PAVING AREAS SO ALL AREAS ARE ACCESSIBLE IN THE FUTURE. THESE SLEEVES CAN BE USED FOR IRRIGATION AND ELEC. CONNECTIONS.

32.5. SODDING DISTURBED SOIL: ALL DISTURBED GROUNDS LOCATED INSIDE THE PROJECT CONSTRUCTION LIMITS NO



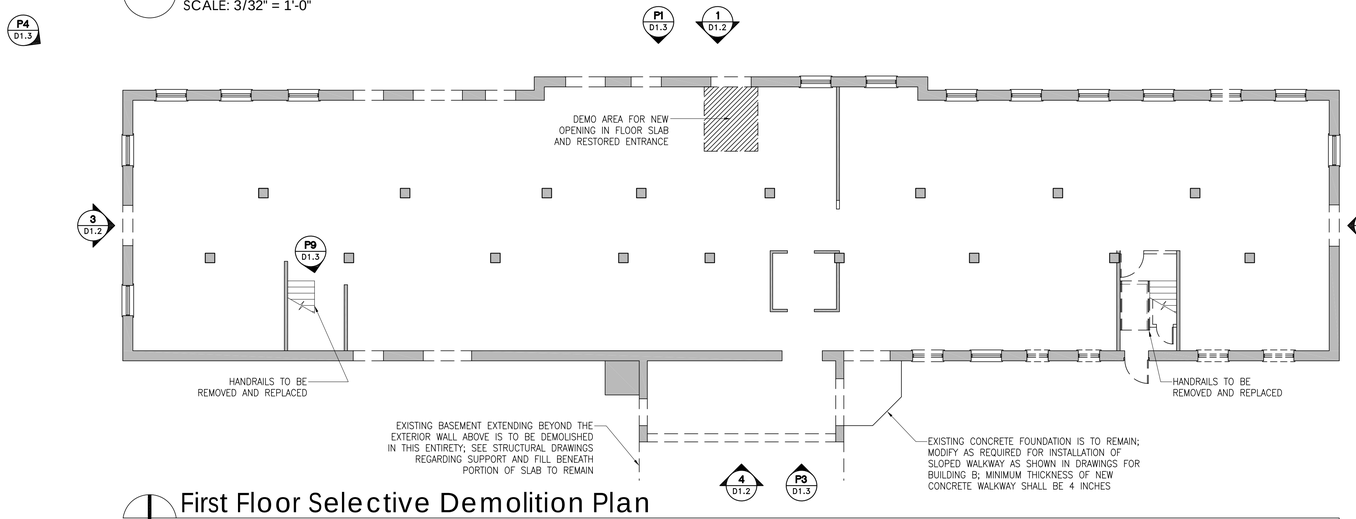
Third Floor Selective Demolition Plan

SCALE: 3/32" = 1'-0"



Second Floor Selective Demolition Plan

SCALE: 3/32" = 1'-0"



First Floor Selective Demolition Plan

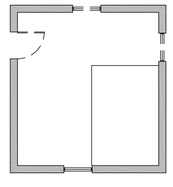
SCALE: 3/32" = 1'-0"

General Demolition Notes

1. THE CONTRACTOR IS RESPONSIBLE TO REMOVE ALL THAT IS REQUIRED IN ORDER TO ACCOMPLISH THE NEW WORK.
2. THE CONTRACTOR IS RESPONSIBLE FOR THE ENTIRE BUILDING AND THE SURROUNDING SITE INSURE THAT GAS, ELECTRIC, AND WATER SYSTEMS ARE SAFELY MONITORED AND PROTECTED DURING DEMOLITION.
3. THE PUBLIC WALKS AND STREETS TO REMAIN SHALL BE PROTECTED AND THE PROPER MEASURES TAKEN AND COORDINATED WITH THE CITY TO PROTECT PUBLIC SAFETY. THIS SHALL INCLUDE SAFE AND CLEAR LIMITS OF CONSTRUCTION.
4. THE CONTRACTOR IS RESPONSIBLE FOR KEEPING THE DEMOLITION WORK AREA SAFE BY SHORING AND BRACING THE BUILDING AS REQUIRED DURING DEMOLITION AND DEBRIS REMOVAL. THE ARCHITECT SHALL BE CONTACTED WHENEVER UNCLEAR CONDITIONS EXIST.
5. THE BUILDING MUST BE KEPT SECURE AND DRY DURING DEMOLITION. WHEN DEMO CONTRACT IS COMPLETE, INSTALL PROTECTIVE MEASURES TO ENSURE THE SECURITY AND CONTINUED WEATHERPROOFING OF THE BUILDING.
6. PROTECT EXISTING FINISHES TO REMAIN INCLUDING BUT NOT LIMITED TO FACE BRICK, TERRA COTTA AND PLASTER FROM DAMAGE DURING DEMOLITION.
7. IF DURING THE COURSE OF DEMOLITION A CONFLICT ARISES AS TO WHAT IS TO BE REMOVED CONTACT THE ARCHITECT FOR ON SITE CLARIFICATION BEFORE PROCEEDING.
8. THE CONTRACTOR IS RESPONSIBLE FOR ALL SALVAGED MATERIALS THAT ARE TO BE REUSED AND SHALL NEATLY STORE THEM IN A DRY WEATHER PROOF AREA ON SITE. ALL ITEMS TO BE STORED AS APPROVED BY ARCHITECT. CLEAN ALL SALVAGE ITEMS THOROUGHLY BEFORE STORING.
9. EXISTING PLASTER WALLS THAT ARE TO REMAIN SHALL BE PROTECTED AS REQUIRED.
10. IF ANY ITEM THAT IS TO REMAIN OR BE REUSED IN THE PROJECT IS DAMAGED, ALL EXPENSES INCURRED IN REPRODUCING ANY DAMAGED ITEM WILL BE THE RESPONSIBILITY OF THE CONTRACTOR. ALL REPLACEMENT REPRODUCTIONS SHALL BE APPROVED BY THE ARCHITECT FOR ACCURACY.
11. MECHANICAL & PLUMBING: THE FINAL PROJECT WILL UTILIZE COMPLETELY NEW MECHANICAL AND PLUMBING SYSTEMS. THE CONTRACTOR IS TO REMOVE ANY REMAINING EXTERIOR AND INTERIOR MECHANICAL AND PLUMBING EQUIPMENT INCLUDING BUT NOT LIMITED TO: GAS AND WATER PIPES, DUCTWORK, FIRE SPRINKLER EQUIPMENT AND OTHER MISC. EQUIPMENT UNLESS NOTED OTHERWISE.
12. ELECTRICAL: THE FINAL PROJECT WILL UTILIZE A COMPLETELY NEW ELECTRICAL SYSTEM. THE CONTRACTOR IS TO REMOVE ANY REMAINING EXTERIOR AND INTERIOR ELECTRICAL EQUIPMENT INCLUDING BUT NOT LIMITED TO: CONDUIT, WIRING, LIGHT FIXTURES IN AND AROUND BUILDING, AND BOTH INTERIOR AND EXTERIOR CONDUIT ETC. UNLESS SPECIFIED BY THE ELECTRICAL ENGINEER.

Legend

- EXISTING WALL TO REMAIN
- EXISTING WALL, DOOR, WINDOW, PLUMBING FIXTURE TO BE REMOVED
- PHOTO REFERENCE



Penthouse Demo Plan

SCALE: 3/32" = 1'-0"

CITY OF HATTIESBURG MISSISSIPPI 1884

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Historic Hospital (C)

Drawing Issued:

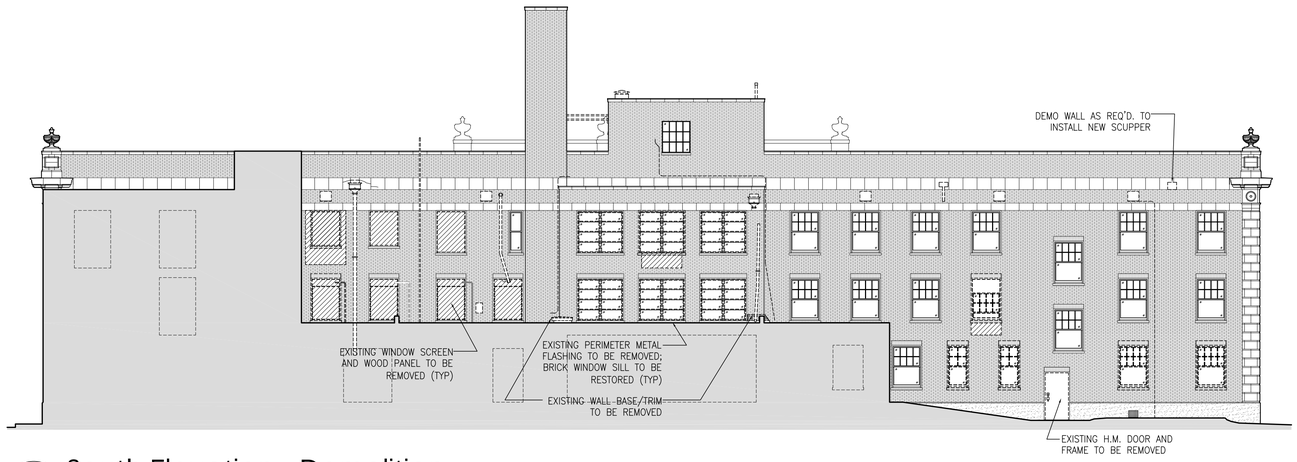
Date	Rev.	Description
08-31-2015		DD Check Set
10-20-2015		75% Progress Set
11-02-2015		90% Pricing Set
11-19-2018		100% Bid Docs

Drawn By:	SN,RB,AS
Checked By:	CR,LA,CF
Client No:	------
Albert & Associates:	12571

REGISTERED ARCHITECT Larry M. Albert Hattiesburg, MS STATE OF MISSISSIPPI

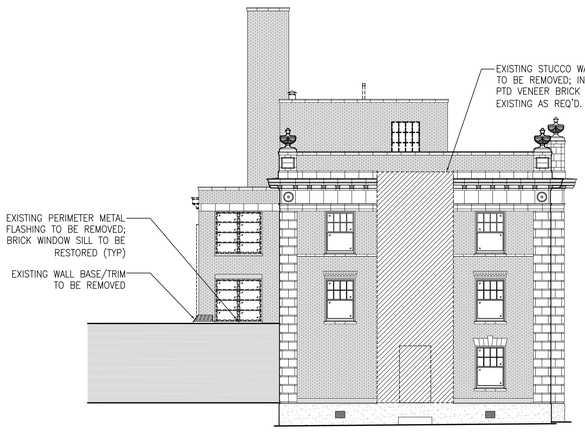
D1.1

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com **Albert & McCleskey Associates Architects**



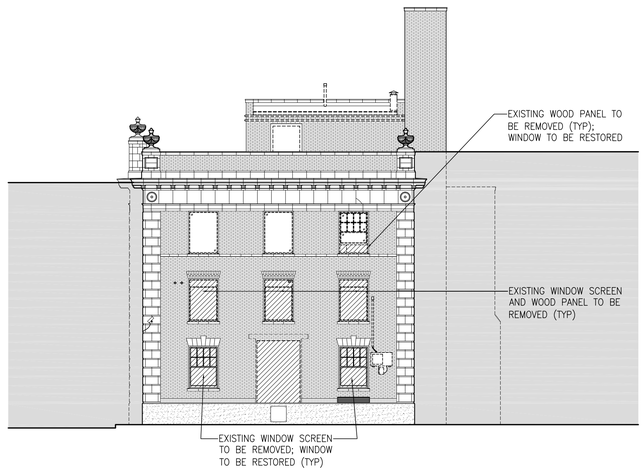
4 South Elevation - Demolition

SCALE: 3/32" = 1'-0"



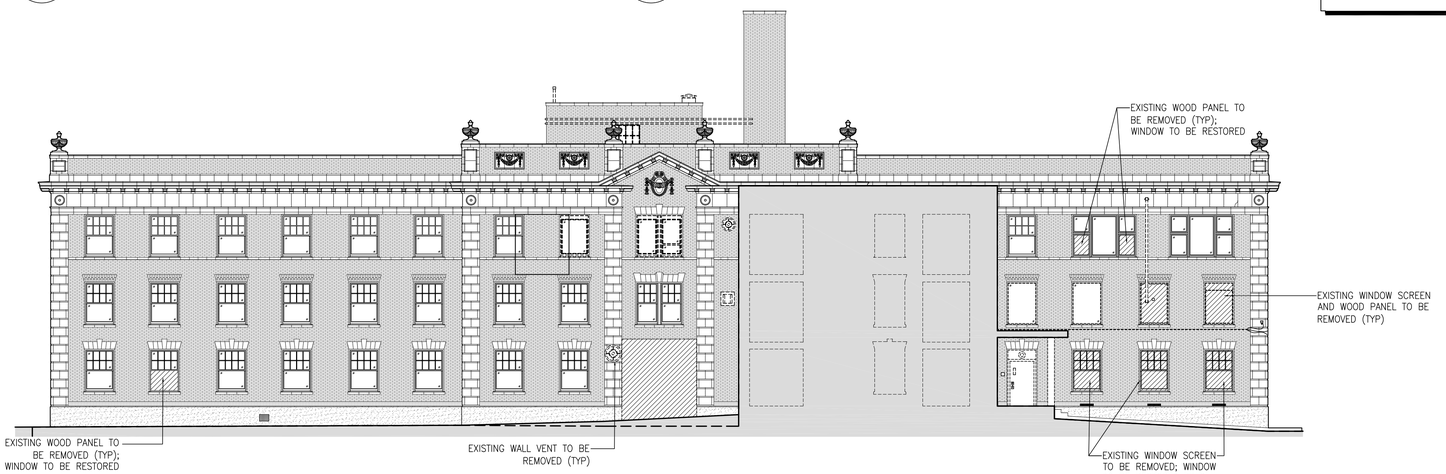
2 East Elevation - Demolition

SCALE: 3/32" = 1'-0"



3 West Elevation - Demolition

SCALE: 3/32" = 1'-0"



1 North Elevation - Demolition

SCALE: 3/32" = 1'-0"

General Demolition Notes

1. THE CONTRACTOR IS RESPONSIBLE TO REMOVE ALL THAT IS REQUIRED IN ORDER TO ACCOMPLISH THE NEW WORK.
2. THE CONTRACTOR IS RESPONSIBLE FOR THE ENTIRE BUILDING AND THE SURROUNDING SITE INSURE THAT GAS, ELECTRIC, AND WATER SYSTEMS ARE SAFELY MONITORED AND PROTECTED DURING DEMOLITION.
3. THE PUBLIC WALKS AND STREETS TO REMAIN SHALL BE PROTECTED AND THE PROPER MEASURES TAKEN AND COORDINATED WITH THE CITY TO PROTECT PUBLIC SAFETY. THIS SHALL INCLUDE SAFE AND CLEAR LIMITS OF CONSTRUCTION.
4. THE CONTRACTOR IS RESPONSIBLE FOR KEEPING THE DEMOLITION WORK AREA SAFE BY SHORING AND BRACING THE BUILDING AS REQUIRED DURING DEMOLITION AND DEBRIS REMOVAL. THE ARCHITECT SHALL BE CONTACTED WHENEVER UNCLEAR CONDITIONS EXIST.
5. THE BUILDING MUST BE KEPT SECURE AND DRY DURING DEMOLITION. WHEN DEMO CONTRACT IS COMPLETE, INSTALL PROTECTIVE MEASURES TO ENSURE THE SECURITY AND CONTINUED WEATHERPROOFING OF THE BUILDING.
6. PROTECT EXISTING FINISHES TO REMAIN INCLUDING BUT NOT LIMITED TO FACE BRICK, TERRA COTTA AND PLASTER FROM DAMAGE DURING DEMOLITION.
7. IF DURING THE COURSE OF DEMOLITION A CONFLICT ARISES AS TO WHAT IS TO BE REMOVED CONTACT THE ARCHITECT FOR ON SITE CLARIFICATION BEFORE PROCEEDING.
8. THE CONTRACTOR IS RESPONSIBLE FOR ALL SALVAGED MATERIALS THAT ARE TO BE REUSED AND SHALL NEATLY STORE THEM IN A DRY WEATHER PROOF AREA ON SITE. ALL ITEMS TO BE STORED AS APPROVED BY ARCHITECT. CLEAN ALL SALVAGE ITEMS THOROUGHLY BEFORE STORING.
9. EXISTING PLASTER WALLS THAT ARE TO REMAIN SHALL BE PROTECTED AS REQUIRED.
10. IF ANY ITEM THAT IS TO REMAIN OR BE REUSED IN THE PROJECT IS DAMAGED, ALL EXPENSES INCURRED IN REPRODUCING ANY DAMAGED ITEM WILL BE THE RESPONSIBILITY OF THE CONTRACTOR. ALL REPLACEMENT REPRODUCTIONS SHALL BE APPROVED BY THE ARCHITECT FOR ACCURACY.
11. MECHANICAL & PLUMBING: THE FINAL PROJECT WILL UTILIZE COMPLETELY NEW MECHANICAL AND PLUMBING SYSTEMS. THE CONTRACTOR IS TO REMOVE ANY REMAINING EXTERIOR AND INTERIOR MECHANICAL AND PLUMBING EQUIPMENT INCLUDING BUT NOT LIMITED TO: GAS AND WATER PIPES, DUCTWORK, FIRE SPRINKLER EQUIPMENT AND OTHER MISC. EQUIPMENT UNLESS NOTED OTHERWISE.
12. ELECTRICAL: THE FINAL PROJECT WILL UTILIZE A COMPLETELY NEW ELECTRICAL SYSTEM. THE CONTRACTOR IS TO REMOVE ANY REMAINING EXTERIOR AND INTERIOR ELECTRICAL EQUIPMENT INCLUDING BUT NOT LIMITED TO: CONDUIT, WIRING, LIGHT FIXTURES IN AND AROUND BUILDING, AND BOTH INTERIOR AND EXTERIOR CONDUIT ETC. UNLESS SPECIFIED BY THE ELECTRICAL ENGINEER.

Demolition Elevation Legend

- THE SHADED AREAS REPRESENT PORTIONS OF THE FACADE WHERE THE RECENTLY DEMOLISHED BUILDINGS MADE CONTACT WITH THE HISTORIC HOSPITAL BUILDING.
- EXISTING EXTERIOR WALL DEMOLITION (UNLESS NOTED OTHERWISE)
- EXISTING DOOR, WINDOW, PIPING, MECHANICAL, DOWNSPOUT, ETC. TO BE REMOVED AND DISPOSED OF (UNLESS NOTED OTHERWISE)

CITY OF HATTIESBURG MISSISSIPPI 1884

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Historic Hospital (C)

Drawing Issued:

Date	Rev.	Description
08-31-2015		DD Check Set
10-20-2015		75% Progress Set
11-02-2015		90% Pricing Set
11-19-2018		100% Bid Docs

Drawn By: SN,RB,AS
Checked By: CR,LA,CF
Client No: ------
Albert & Associates: 1257

REGISTERED ARCHITECT Larry M. Albert Hattiesburg, MS STATE OF MISSISSIPPI

D1.2

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SELECTIVE DEMO ELEVATIONS



P1/D1.3: PHOTOGRAPH OF EXISTING NORTH ELEVATION AS OF 2018.09.20.



P2/D1.3: PHOTOGRAPH OF EXISTING EAST ELEVATION AS OF 2018.09.20.



P3/D1.3: PHOTOGRAPH OF EXISTING SOUTH ELEVATION AS OF 2018.09.20.



P4/D1.3: PHOTOGRAPH OF EXISTING WEST ELEVATION AS OF 2018.09.20.

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Historic Hospital (C)

Drawing Issued:

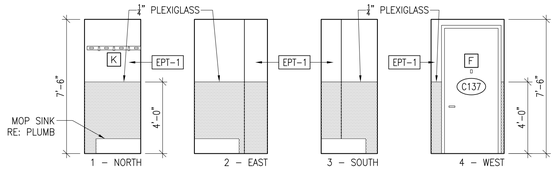
Date	Rev.	Description
08-31-2015		DD Check Set
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11-19-2018		100% Bid Docs

Drawn By:	SN,RB,AS
Checked By:	CR,LA,CF
Client No:	------
Albert & Associates:	1257

REGISTERED ARCHITECT Larry A. Albert Hattiesburg, MS STATE OF MISSISSIPPI

D1.3

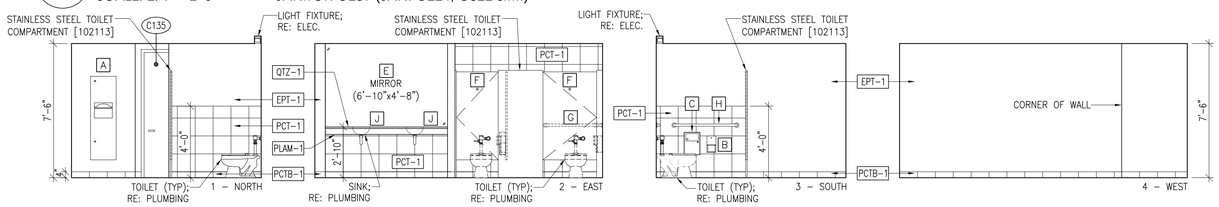
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4 Interior Elevations

SCALE: 1/4" = 1'-0"

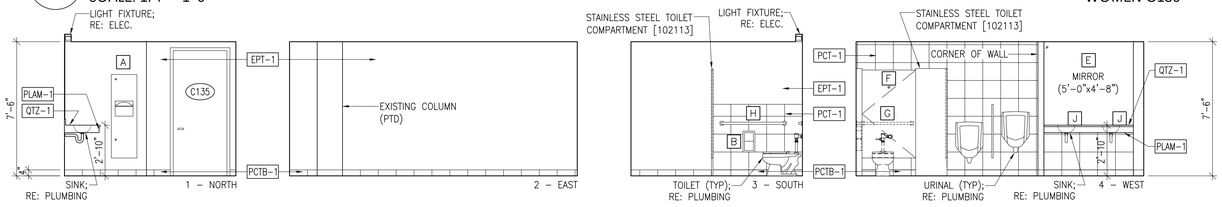
JANITOR C137 (JAN. C224, C321 SIM.)



3 Interior Elevations

SCALE: 1/4" = 1'-0"

WOMEN C136



2 Interior Elevations

SCALE: 1/4" = 1'-0"

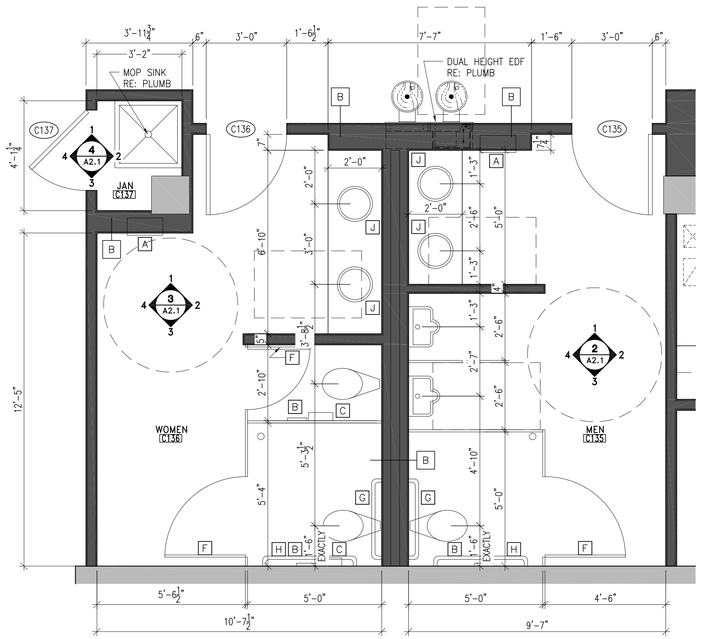
MEN C135

Restroom Accessory Key

- A — RECESSED PAPER TOWEL DISPENSER AND WASTE RECEPTACLE (B–39003) BY BOBRICK OR EQUAL
- B — SURFACE–MOUNTED–MULTI ROLL TOILET TISSUE DISPENSER (B–4288) BY BOBRICK OR EQUAL
- C — SANITARY NAPKIN DISPOSAL (B–254) BY BOBRICK OR EQUAL
- D — SURFACE–MOUNTED SOAP DISPENSER (B–2111) BY BOBRICK OR EQUAL
- E — MIRROR (WALL MOUNT, BEVELED EDGES) – SEE INTERIOR ELEVS. FOR SIZES.
- F — VANDAL–RESISTANT CLOTHES HOOK (B–983) BY BOBRICK OR EQUAL
- G — 36" GRAB BAR (B–5806) BY BOBRICK OR EQUAL
- H — 42" GRAB BAR (B–5806) BY BOBRICK OR EQUAL
- J — DECK MOUNTED AUTOMATIC SOAP DISPENSER
- K — MOP & BROOM HOLDER
- L — FLOOR MOUNTED GRAB–BAR; CONSTRUCT OF ALUMINUM TO FINISH AND TEXTURE OF MANUFACTURED BOBRICK GRAB BARS

Notes

1. PROVIDE CUTSHEETS PRIOR TO ORDERING ACCESSORIES.
2. VERIFY ADA COMPLIANT MOUNTING HEIGHTS AND INSTALL ALL BATHROOM ACCESSORIES IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.
3. PROVIDE ALL NECESSARY BLOCKING AND PARTS FOR COMPLETE INSTALLATION.
4. ALL ACCESSORIES SHALL BE BRAND NEW AND OUT OF THE BOX, AND PROVIDED WITH THE MANUFACTURER'S MANUALS.
5. COORDINATE ACCESSORIES INSTALLATION WITH PLUMBING FIXTURES (RE: PLUMBING).



1 Enlarged Plan

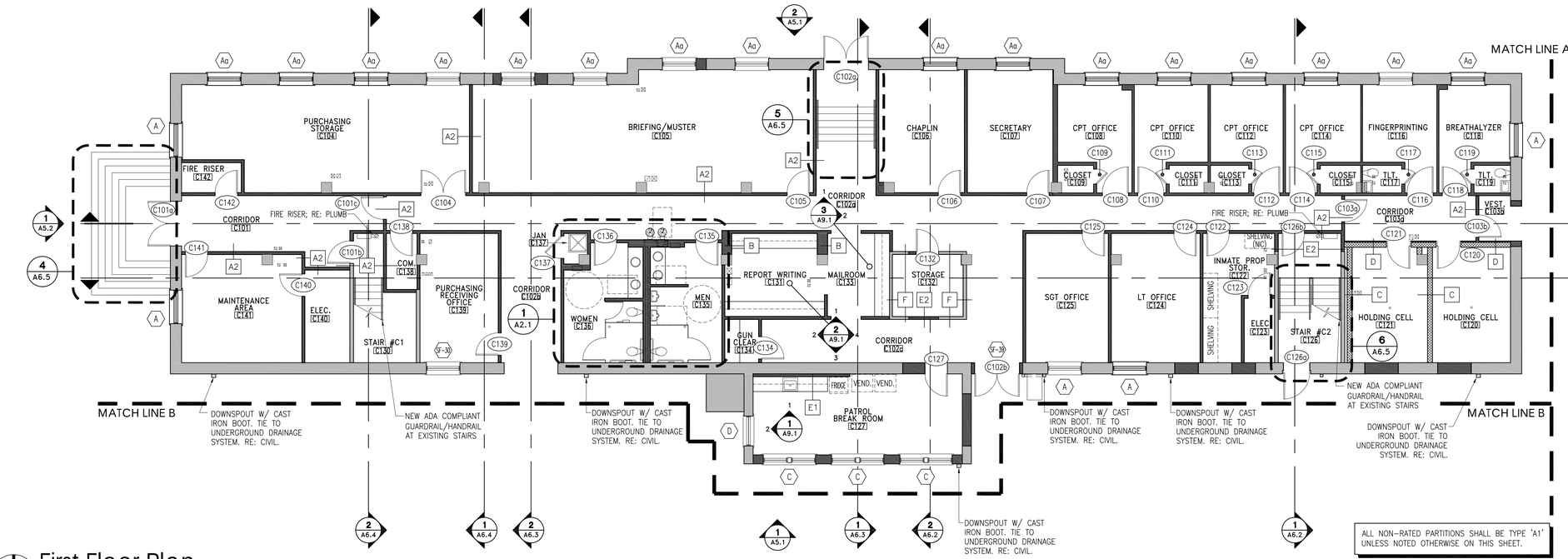
SCALE: 3/8" = 1'-0"

MEN C135 / WOMEN C136 / JAN 137

Existing & New Windows Note

THE NORTH FACADE OF THE HISTORIC HOSPITAL IS TO FEATURE THE ORIGINAL WOODEN WINDOWS THROUGHOUT. OPENINGS WHERE THE ORIGINAL WINDOWS HAVE BEEN REMOVED, OR ELEMENTS OF WINDOWS ARE DAMAGED BEYOND REPAIR, SHALL BE FILLED OR REPAIRED WITH SALVAGED WINDOWS FROM THE OTHER FACADES OF THE BUILDING. ALL HISTORIC WINDOWS ON THIS FACADE ARE TO BE RESTORED TO A "LIKE NEW" CONDITION. ALL LOOSE AND FLAKING PAINT IS TO BE REMOVED, AND THE WINDOWS ARE TO BE REPAINTED TO MATCH THE ORIGINAL COLOR.

ALL OTHER WINDOWS THROUGHOUT THE HISTORIC BUILDING SHALL BE NEW ENERGY EFFICIENT, METAL CLAD, WOOD WINDOWS WITH LOW–E, INSULATED GLAZING. THE NEW WINDOWS SHALL EXACTLY MATCH THE HISTORIC WINDOWS IN DIMENSION, PROFILE, DETAIL, AND COLOR. NEW WINDOWS SHALL BE JELD–WEN OR EQUAL.



First Floor Plan

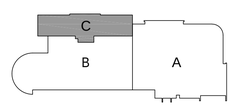
SCALE: 1/8" = 1'-0"

General Plan Notes

1. SEE DIMENSION PLAN SHEET(S) FOR PLAN DIMENSIONS.
2. ALL DIMENSIONS ARE TO THE FACE OF FINISH OR FACE OF BRICK UNLESS NOTED OTHERWISE.
3. IN MASONRY WALL CONSTRUCTION DIMENSIONS ARE TO ROUGH OPENINGS.
4. IN STUD WALL CONSTRUCTION DIMENSIONS ARE TO CENTERLINE OF OPENINGS.
5. ALL DOORS ARE 6" FROM FACE OF STUD UNLESS DIMENSIONED OTHERWISE.
6. ALL ANGLES ARE 90° OR 45° UNLESS DIMENSIONED OTHERWISE.
7. SEE SHEETS T1.1 FOR GENERAL NOTES.
8. SEE SHEET A4.1–4.3 FOR RCP's.
9. SEE SHEET A5.1–A5.2 FOR BUILDING ELEVATIONS AND WINDOW SCHEDULES.
10. SEE SHEET A7.1–A7.2 FOR DOOR & FRAME SCHEDULES.
11. SEE SHEET A8.1–A8.2 FOR FINISH SCHEDULE AND FINISH FLOOR PLANS.
12. SEE SHEET A2.3 FOR PARTITION TYPES REFERENCED ON FLOOR PLANS.
13. G.C. TO CONFIRM ALL AREAS ARE FINISHED AND ALL VOIDS OR RAISED AREAS ARE IN A FINISHED CONDITION.

Legend

- A — PARTITION TYPE REFERENCE
- NEW WALL (SEE PARTITION TYPES ON SHEET A2.3)
- EXISTING WALL TO REMAIN



HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Historic Hospital (C)

Drawing Issued:

Date	Rev.	Description
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Drawn By: SN,RB,AS
Checked By: CR,LA,CF
Client No: ------
Albert & Associates: 1257

Larry A. Albert, Hattiesburg, MS — REGISTERED ARCHITECT — STATE OF MISSISSIPPI

A2.1

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Albert & McCleskey Associates Architects

Restroom Accessory Key

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- B — SURFACE-MOUNTED-MULTI ROLL TOILET TISSUE DISPENSER (B-4288) BY BOBRICK OR EQUAL
- C — SANITARY NAPKIN DISPOSAL (B-254) BY BOBRICK OR EQUAL
- D — SURFACE-MOUNTED SOAP DISPENSER (B-2111) BY BOBRICK OR EQUAL
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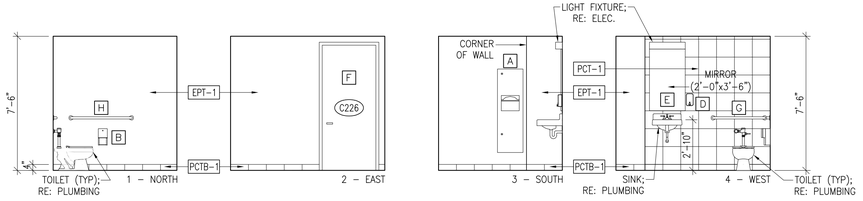
Notes

1. PROVIDE CUTSHEETS PRIOR TO ORDERING ACCESSORIES.
2. VERIFY ADA COMPLIANT MOUNTING HEIGHTS AND INSTALL ALL BATHROOM ACCESSORIES IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.
3. PROVIDE ALL NECESSARY BLOCKING AND PARTS FOR COMPLETE INSTALLATION.
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5. COORDINATE ACCESSORIES INSTALLATION WITH PLUMBING FIXTURES (RE: PLUMBING).

Existing & New Windows Note

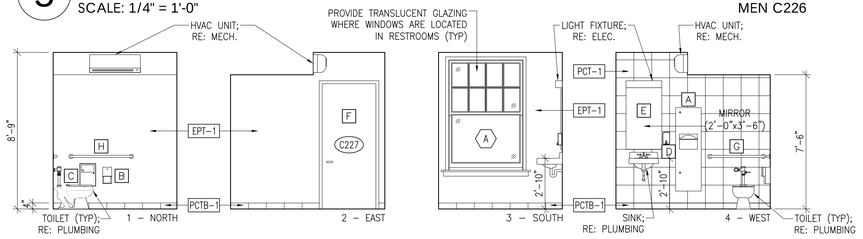
THE NORTH FACADE OF THE HISTORIC HOSPITAL IS TO FEATURE THE ORIGINAL WOODEN WINDOWS THROUGHOUT. OPENINGS WHERE THE ORIGINAL WINDOWS HAVE BEEN REMOVED, OR ELEMENTS OF WINDOWS ARE DAMAGED BEYOND REPAIR, SHALL BE FILLED OR REPAIRED WITH SALVAGED WINDOWS FROM THE OTHER FACADES OF THE BUILDING. ALL HISTORIC WINDOWS ON THIS FACADE ARE TO BE RESTORED TO A "LIKE NEW" CONDITION. ALL LOOSE AND FLAKING PAINT IS TO BE REMOVED, AND THE WINDOWS ARE TO BE REPAINTED TO MATCH THE ORIGINAL COLOR.

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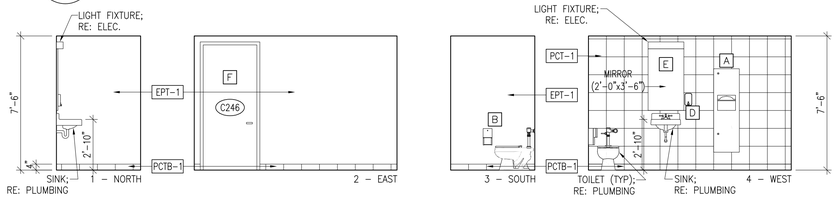
5 Interior Elevations

SCALE: 1/4" = 1'-0" — MEN C226



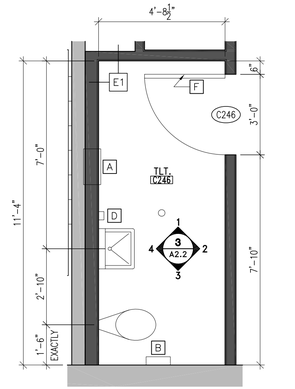
4 Interior Elevations

SCALE: 1/4" = 1'-0" — WOMEN C227



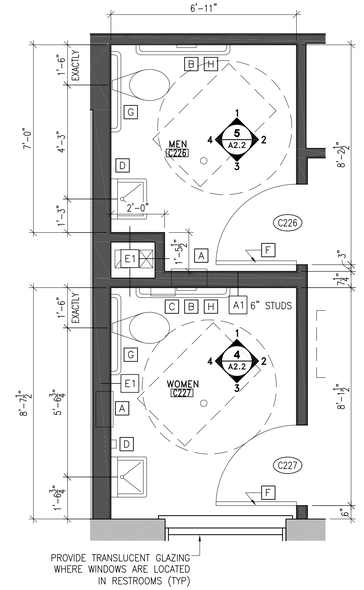
3 Interior Elevations

SCALE: 1/4" = 1'-0" — TOILET C246



2 Enlarged Plan

SCALE: 3/8" = 1'-0" TOILET C246

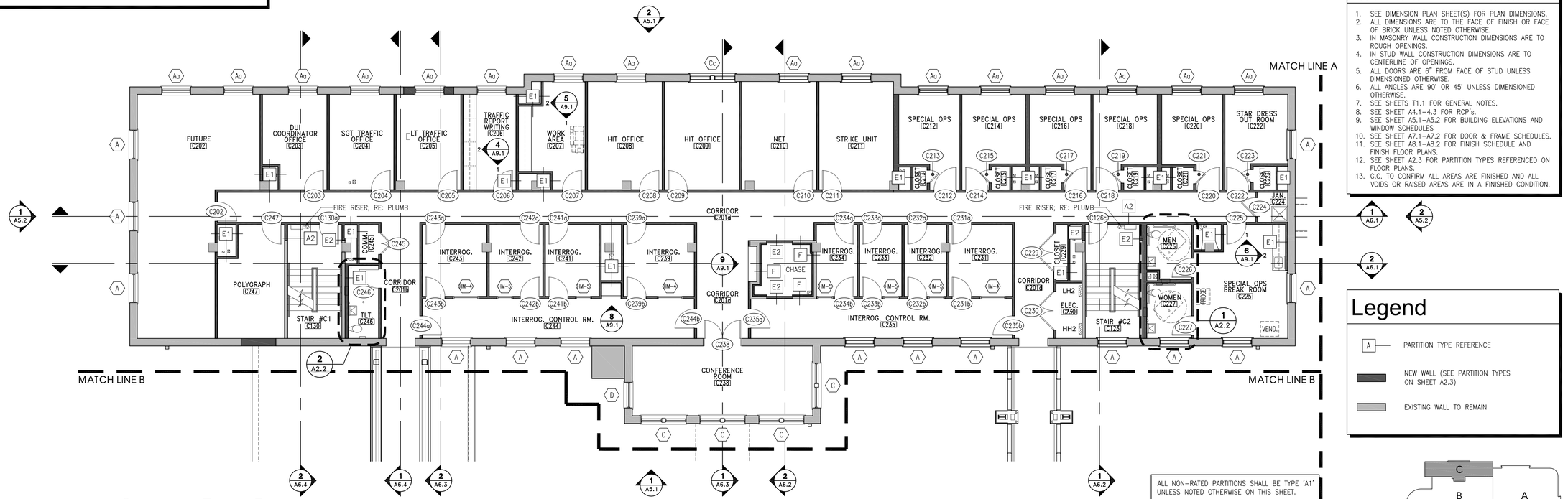


1 Enlarged Plan

SCALE: 3/8" = 1'-0" TOILETS C226, C227

General Plan Notes

1. SEE DIMENSION PLAN SHEET(S) FOR PLAN DIMENSIONS.
2. ALL DIMENSIONS ARE TO THE FACE OF FINISH OR FACE OF BRICK UNLESS NOTED OTHERWISE.
3. IN MASONRY WALL CONSTRUCTION DIMENSIONS ARE TO ROUGH OPENINGS.
4. IN STUD WALL CONSTRUCTION DIMENSIONS ARE TO CENTERLINE OF OPENINGS.
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9. SEE SHEET A5.1–A5.2 FOR BUILDING ELEVATIONS AND WINDOW SCHEDULES.
10. SEE SHEET A7.1–A7.2 FOR DOOR & FRAME SCHEDULES.
11. SEE SHEET A8.1–A8.2 FOR FINISH SCHEDULE AND FINISH FLOOR PLANS.
12. SEE SHEET A2.3 FOR PARTITION TYPES REFERENCED ON FLOOR PLANS.
13. G.C. TO CONFIRM ALL AREAS ARE FINISHED AND ALL VOIDS OR RAISED AREAS ARE IN A FINISHED CONDITION.



Second Floor Plan

SCALE: 1/8" = 1'-0"

Legend

- A — PARTITION TYPE REFERENCE
- NEW WALL (SEE PARTITION TYPES ON SHEET A2.3)
- EXISTING WALL TO REMAIN

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Historic Hospital (C)

Drawing Issued:

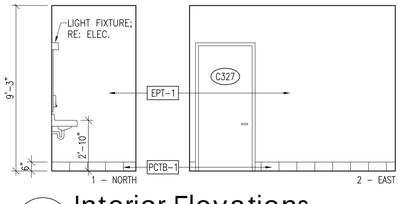
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10-20-2015		75% Progress Set
11-02-2015		90% Pricing Set
11-19-2018		100% Bid Docs

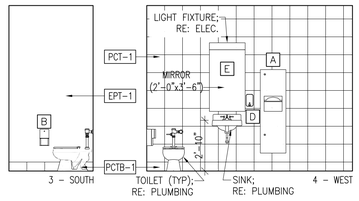
Drawn By:	SN,RB,AS
Checked By:	CR,LA,CF
Client No:	------
Albert & Associates:	1257

REGISTERED ARCHITECT — Larry A. McCleskey — Hattiesburg, MS — STATE OF MISSISSIPPI

A2.2

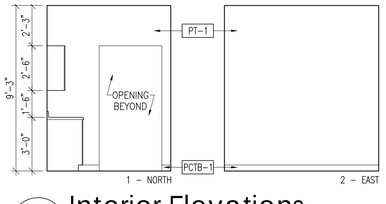
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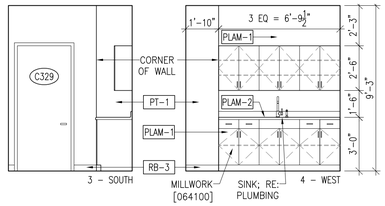




6 Interior Elevations

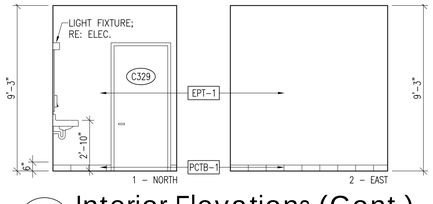
SCALE: 1/4" = 1'-0" — TOILET C327





5 Interior Elevations

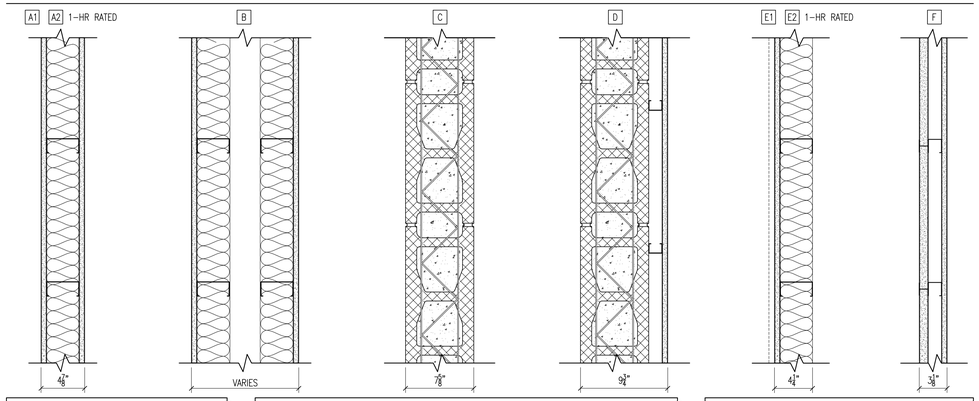
SCALE: 1/4" = 1'-0" — ALCOVE C324



4 Interior Elevations (Cont.)

SCALE: 1/4" = 1'-0" — TOILET C329

Partition Assemblies



Legend

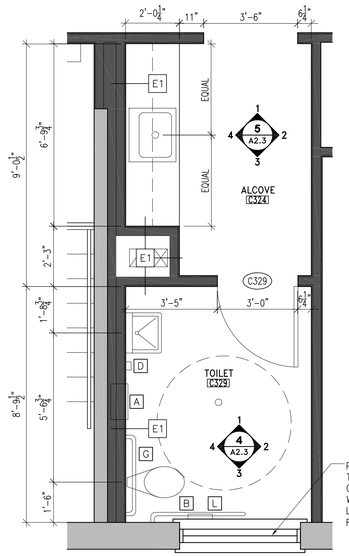
- A — PARTITION TYPE REFERENCE
- NEW WALL (SEE PARTITION TYPES ON SHEET A2.3)
- EXISTING WALL TO REMAIN

Partition Schedule

TYPE	THICKNESS	RATNG.	STUDS	CMU	SPACE	INSULATION	GYP. BOARD	UL LISTING
A1	4–⅞"	0 HR.	⅝" MTL.	–	16" O.C.	3½" ACOUSTIC	⅝" EA. SIDE	---
A2	4–⅞"	1 HR.	⅝" MTL.	–	16" O.C.	3½" ACOUSTIC	⅝" EA. SIDE	U419
B	VARIES	0 HR.	⅝" MTL.	–	16" O.C.	3½" ACOUSTIC	⅝" EA. SIDE	---
C	7–⅝"	0 HR.	–	8" CMU	–	–	–	---
D	9–¼"	0 HR.	1½" MTL.	8" CMU	16" O.C.	–	⅝" @ CORRIDOR	---
E1	4–⅛"	0 HR.	⅝" MTL.	–	16" O.C.	3½" ACOUSTIC	⅝" FINISH SIDE	---
E2	4–⅞"	1 HR.	⅝" MTL.	–	16" O.C.	3½" ACOUSTIC	2 @ ⅝"	U419
F	3–⅜"	1 HR.	2½" MTL.	–	16" O.C.	–	1" / 1@⅝"	U415

General Partition Notes

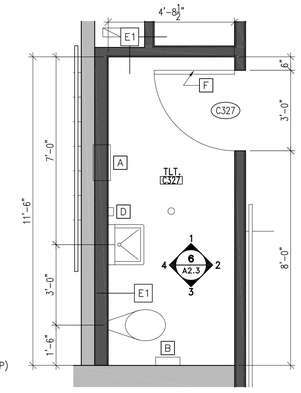
1. GYPSUM BOARD SHEATHING SHALL BE INSTALLED TO DECK ABOVE UNLESS NOTED OTHERWISE.
2. MIN. 3–1/2" ACOUSTICAL BATT INSULATION SHALL BE INSTALLED IN ALL PARTITIONS UNLESS NOTED OTHERWISE.
3. IN CHASE WALL CONSTRUCTION, ADJUST CLEAR SPACE BETWEEN STUDS AS REQUIRED TO ACCOMMODATE EQUIPMENT TO BE INSTALLED IN PARTITION.
4. MATERIALS LISTED IN PARTITION SCHEDULE ARE GENERAL. REFER TO SPECIFICATIONS FOR COMPLETE DESCRIPTIONS.
5. THE PARTITION ASSEMBLIES HEREIN ARE FOR THE HISTORIC HOSPITAL BUILDING ONLY. SEE LIFE SAFETY PLANS INCLUDED WITH THE POLICE/COURT DOCUMENTS FOR HISTORIC HOSPITAL BUILDING LIFE SAFETY PLANS AND LOCATIONS OF RATED WALLS.



3 Enlarged Plan

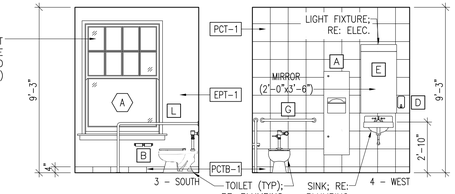
SCALE: 3/8" = 1'-0" — TOILET C329

SEE RESTROOM ACCESSORY KEY SHEET A2.2 FOR ACCESSORIES



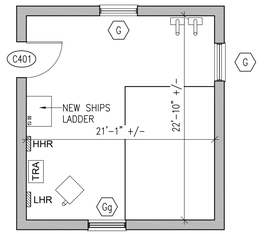
2 Enlarged Plan

SCALE: 3/8" = 1'-0" — TOILET C327



4 Interior Elevations

SCALE: 1/4" = 1'-0" — TOILET C329

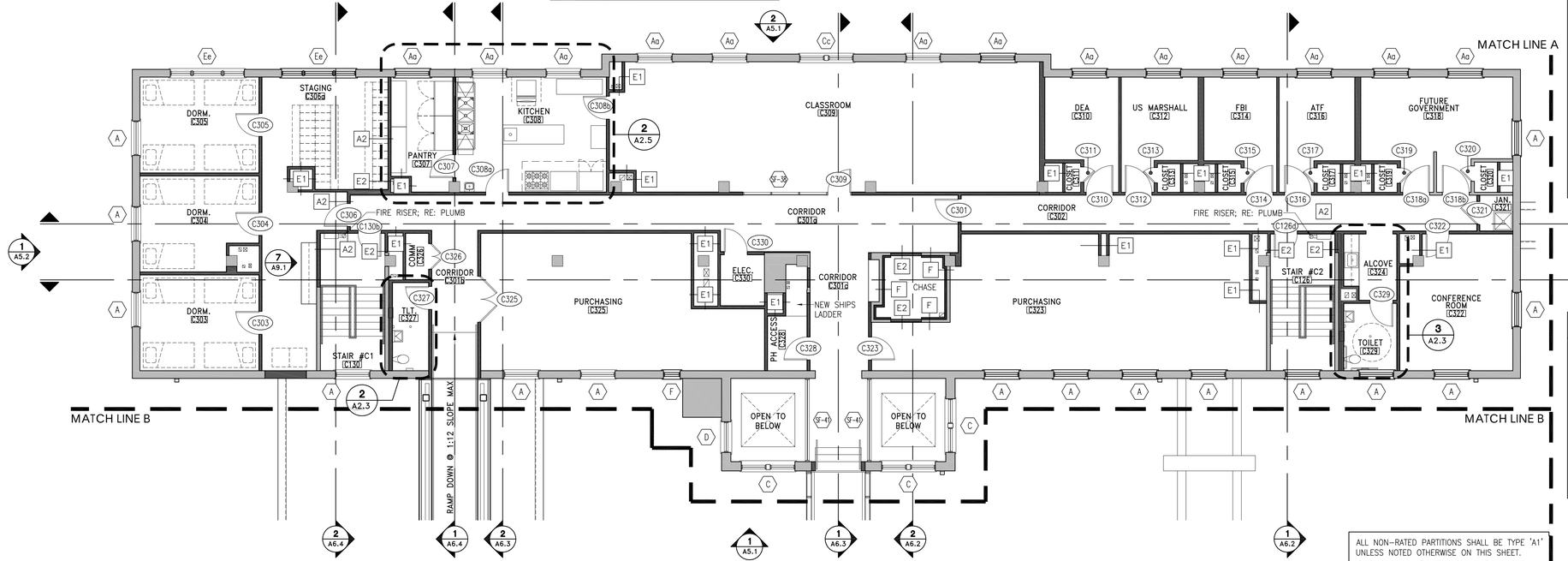


1 Penthouse Plan

SCALE: 1/8" = 1'-0"

General Plan Notes

1. SEE DIMENSION PLAN SHEET(S) FOR PLAN DIMENSIONS.
2. ALL DIMENSIONS ARE TO THE FACE OF FINISH OR FACE OF BRICK UNLESS NOTED OTHERWISE.
3. IN MASONRY WALL CONSTRUCTION DIMENSIONS ARE TO ROUGH OPENINGS.
4. IN STUD WALL CONSTRUCTION DIMENSIONS ARE TO CENTERLINE OF OPENINGS.
5. ALL DOORS ARE 6" FROM FACE OF STUD UNLESS DIMENSIONED OTHERWISE.
6. ALL ANGLES ARE 90° OR 45° UNLESS DIMENSIONED OTHERWISE.
7. SEE SHEETS T1.1 FOR GENERAL NOTES.
8. SEE SHEET A4.1–4.3 FOR RCP's.
9. SEE SHEET A5.1–A5.2 FOR BUILDING ELEVATIONS AND WINDOW SCHEDULES
10. SEE SHEET A7.1–A7.2 FOR DOOR & FRAME SCHEDULES.
11. SEE SHEET A8.1–A8.2 FOR FINISH SCHEDULE AND FINISH FLOOR PLANS.
12. SEE SHEET A2.3 FOR PARTITION TYPES REFERENCED ON FLOOR PLANS.
13. G.C. TO CONFIRM ALL AREAS ARE FINISHED AND ALL VOIDS OR RAISED AREAS ARE IN A FINISHED CONDITION.



Third Floor Plan

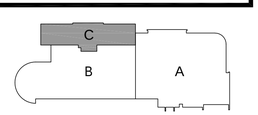
SCALE: 1/8" = 1'-0"

ALL NON–RATED PARTITIONS SHALL BE TYPE 'A1' UNLESS NOTED OTHERWISE ON THIS SHEET.

Existing & New Windows

THE NORTH FACADE OF THE HISTORIC HOSPITAL IS TO FEATURE THE ORIGINAL WOODEN WINDOWS THROUGHOUT. OPENINGS WHERE THE ORIGINAL WINDOWS HAVE BEEN REMOVED, OR ELEMENTS OF WINDOWS ARE DAMAGED BEYOND REPAIR, SHALL BE FILLED OR REPAIRED WITH SALVAGED WINDOWS FROM THE OTHER FACADES OF THE BUILDING. ALL HISTORIC WINDOWS ON THIS FACADE ARE TO BE RESTORED TO A "LIKE NEW" CONDITION. ALL LOOSE AND FLAKING PAINT IS TO BE REMOVED, AND THE WINDOWS ARE TO BE REPAINTED TO MATCH THE ORIGINAL COLOR.

ALL OTHER WINDOWS THROUGHOUT THE HISTORIC BUILDING SHALL BE NEW ENERGY EFFICIENT, METAL CLAD, WOOD WINDOWS WITH LOW–E, INSULATED GLAZING. THE NEW WINDOWS SHALL EXACTLY MATCH THE HISTORIC WINDOWS IN DIMENSION, PROFILE, DETAIL, AND COLOR. NEW WINDOWS SHALL BE JELD–WEN OR EQUAL.



CITY OF HATTIESBURG MISSISSIPPI 1884

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Historic Hospital (C)

Drawing Issued:

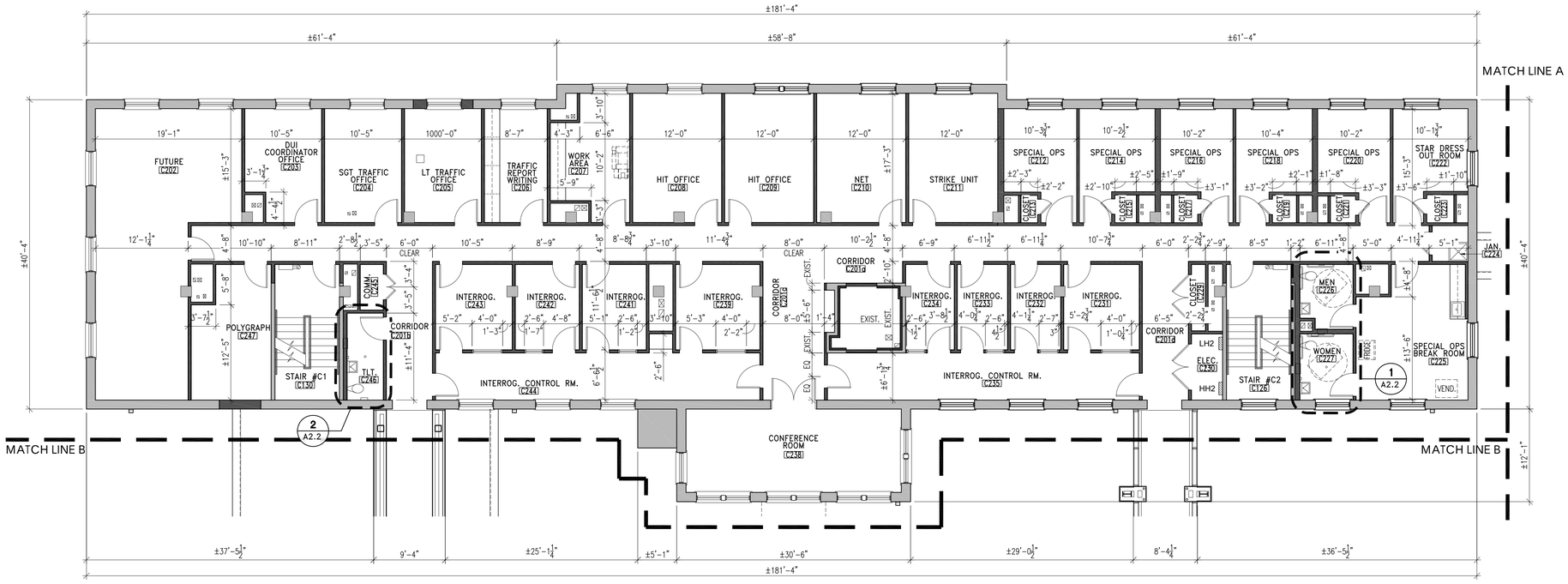
Date	Rev.	Description
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10-20-2015		75% Progress Set
11-02-2015		90% Pricing Set
11-19-2018		100% Bid Docs

Drawn By: SN,RB,AS
Checked By: CR,LA,CF
Client No: ------
Albert & Associates: 1257

REGISTERED ARCHITECT Larry A. Albert Hattiesburg, MS STATE OF MISSISSIPPI

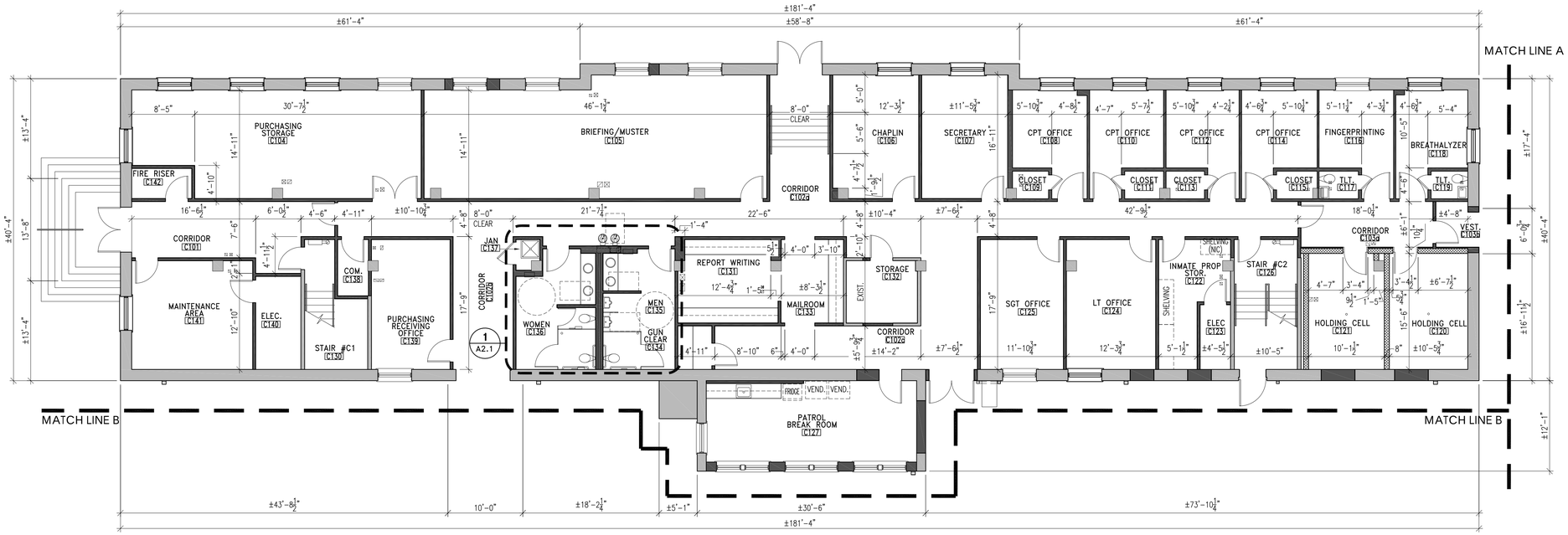
A2.3

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Albert & McCleskey Associates Architects



Second Floor Dimension Plan

SCALE: 1/8" = 1'-0"



First Floor Dimension Plan

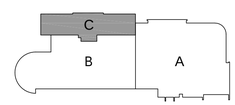
SCALE: 1/8" = 1'-0"

General Plan Notes

1. SEE DIMENSION PLAN SHEET(S) FOR PLAN DIMENSIONS.
2. ALL DIMENSIONS ARE TO THE FACE OF FINISH OR FACE OF BRICK UNLESS NOTED OTHERWISE.
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6. ALL ANGLES ARE 90° OR 45° UNLESS DIMENSIONED OTHERWISE.
7. SEE SHEETS T1.1 FOR GENERAL NOTES.
8. SEE SHEET A4.1–4.3 FOR RCP's.
9. SEE SHEET A5.1–A5.2 FOR BUILDING ELEVATIONS AND WINDOW SCHEDULES.
10. SEE SHEET A7.1–A7.2 FOR DOOR & FRAME SCHEDULES.
11. SEE SHEET A8.1–A8.2 FOR FINISH SCHEDULE AND FINISH FLOOR PLANS.
12. SEE SHEET A2.3 FOR PARTITION TYPES REFERENCED ON FLOOR PLANS.
13. G.C. TO CONFIRM ALL AREAS ARE FINISHED AND ALL VOIDS OR RAISED AREAS ARE IN A FINISHED CONDITION.

Legend

- A — PARTITION TYPE REFERENCE
- NEW WALL (SEE PARTITION TYPES ON SHEET A2.3)
- EXISTING WALL TO REMAIN



HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT

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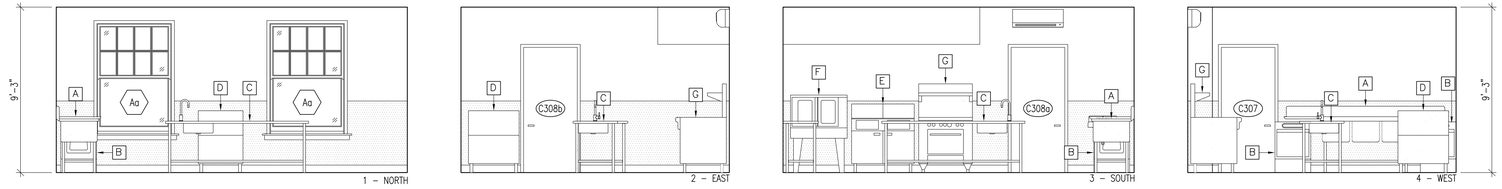
Drawn By: SN,RB,AS
Checked By: CR,LA,CF
Client No: ------
Albert & Associates: 1257

REGISTERED ARCHITECT — Larry A. Albert — Hattiesburg, MS — STATE OF MISSISSIPPI

A2.4

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Albert & McCleskey Associates Architects

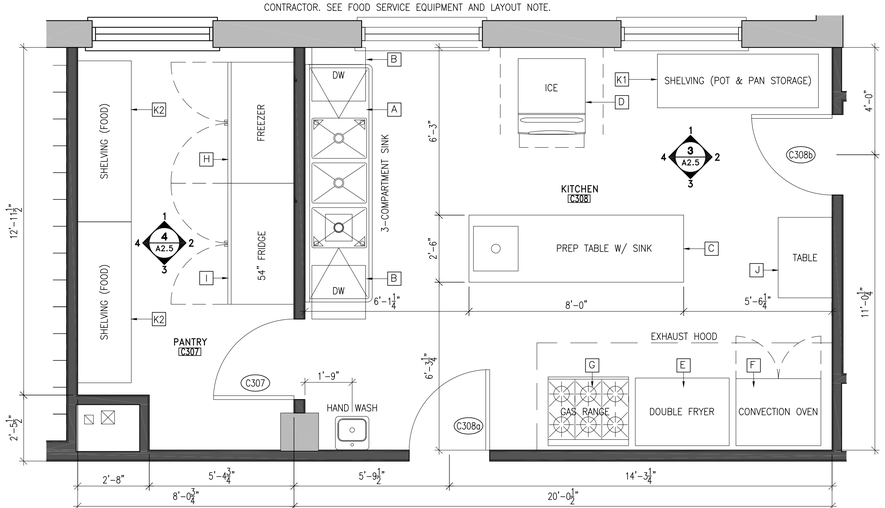
FIRST & SECOND DIMENSION PLANS



3 Interior Elevations

SCALE: 1/4" = 1'-0"

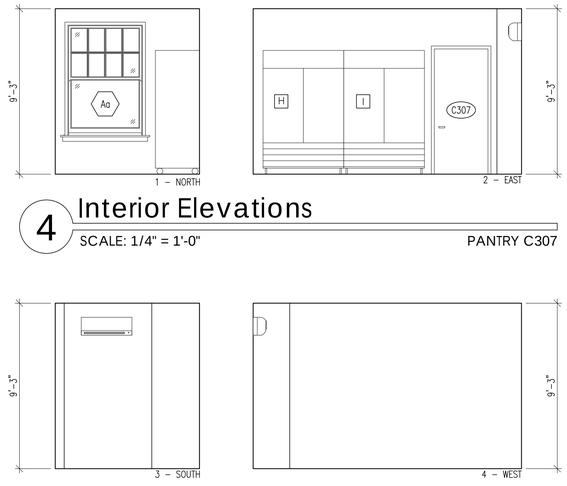
KITCHEN C308



2 Third Floor Dimension Plan

SCALE: 3/8" = 1'-0"

PANTRY C307, KITCHEN C308



4 Interior Elevations

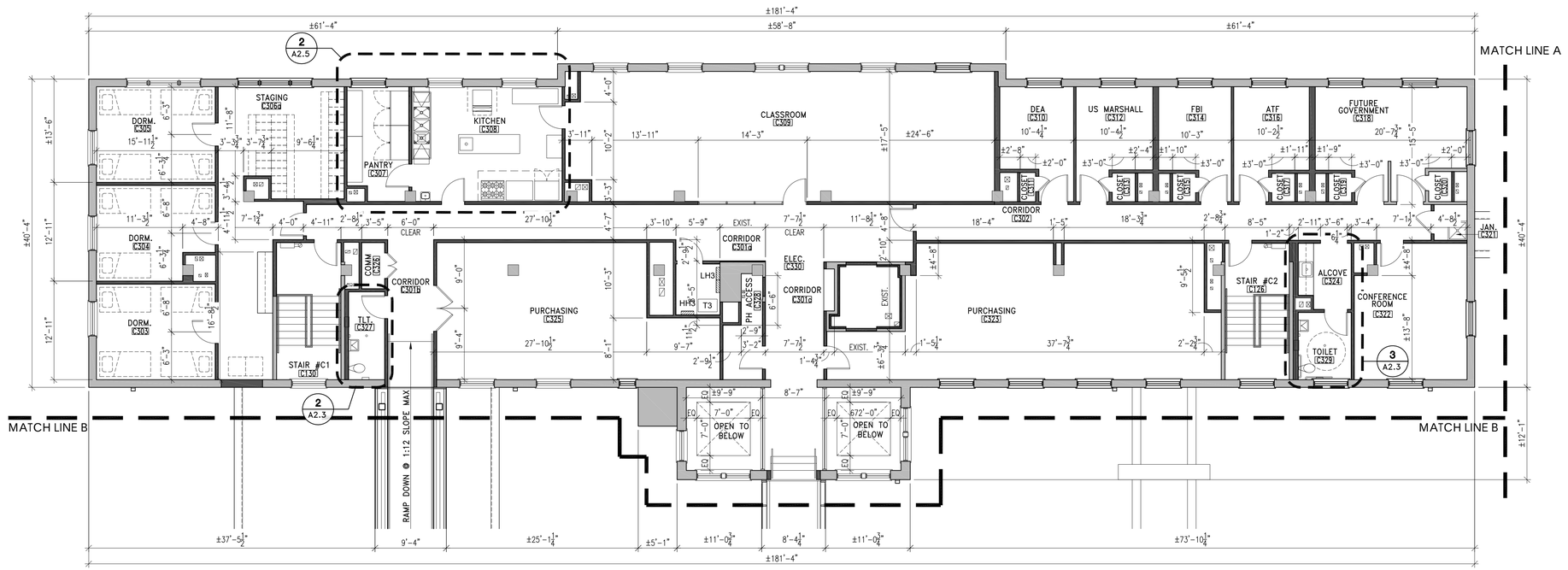
SCALE: 1/4" = 1'-0"

PANTRY C307

4 Interior Elevations (Cont.)

SCALE: 1/4" = 1'-0"

PANTRY C307



1 Third Floor Dimension Plan

SCALE: 1/8" = 1'-0"

Food Service Equipment Schedule

ITEM KEY	DESCRIPTION	QUANTITY	MANUFACTURER AND MODEL NO.	REMARKS
A	THREE COMPARTMENT SINK	1	FN2054–3–24–14/3 BY EAGLE GROUP OR EQUAL	----
B	UNDER COUNTER DISHWASHER	2	LXi DISHMACHINE BY HOBART OR EQUAL	----
C	PREP TABLE WITH SINK	1	PT 3096 BY EAGLE GROUP OR EQUAL	----
D	ICE MAKER	1	ID–0302A BY MANITOWOC OR EQUAL	----
E	DOUBLE FRYER	1	2GR65F BY VULCAN OR EQUAL	----
F	CONVECTION OVEN	1	SLGS/12 BY SOUTHBEND OR EQUAL	----
G	SIX BURNER RANGE	1	S36D BY SOUTHBEND OR EQUAL	----
H	FREEZER	1	T–49F BY TRUE FOOD SERVICE OR EQUAL	----
I	REFRIGERATOR	1	T–49 BY TRUE FOOD SERVICE OR EQUAL	----
J	WORK TABLE	1	T2436B–BS BY EAGLE GROUP OR EQUAL	----
K1	STAINLESS STEEL SHELVING UNIT	1	WG189478 BY GLOBAL EQUIPMENT CO. OR EQUAL	----
K2	STAINLESS STEEL SHELVING UNIT	2	WG189528 BY GLOBAL EQUIPMENT CO. OR EQUAL	----

• ALL FOOD SERVICE EQUIPMENT TO BE PROVIDED BY OWNER AND INSTALLED BY CONTRACTOR. SEE FOOD SERVICE EQUIPMENT AND LAYOUT NOTE.

General Kitchen Equipment Notes:

A. ALL KITCHEN EQUIPMENT AND CONNECTIONS ARE INCLUDED IN THE BASE BID. GENERAL CONTRACTOR IS TO INSTALL KITCHEN EQUIPMENT PER CONTRACT DOCUMENTS (SEE GUARANTEE OF WORK INFO BELOW).

B. GENERAL CONTRACTOR IS TO VERIFY ALL CONNECTIONS WITH NEW EQUIPMENT BEFORE INSTALLING NEW UTILITY HOOK–UPS.

C. GENERAL CONTRACTOR TO HOOK–UP ALL KITCHEN EQUIPMENT INCLUDED IN THE CONTRACT AND DEMONSTRATE THAT IT IS FULLY OPERATIONAL TO THE OWNER AS PART OF THIS CONTRACT. THE KITCHEN EQUIPMENT AND HOOK–UP FOR ALL KITCHEN EQUIPMENT WILL BE INCLUDED IN THE GENERAL CONTRACTOR'S GUARANTEE OF WORK.

D. SEE MECHANICAL, ELECTRICAL, AND PLUMBING FOR ADDITIONAL REQUIREMENTS.

Food Service Equipment and Layout Note:

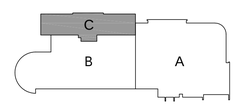
ALL FOOD SERVICE EQUIPMENT INDICATED IN THE 'FOOD SERVICE EQUIPMENT SCHEDULE' AND AND IN THE THIRD FLOOR PLAN ARE SHOWN FOR PLANNING PURPOSES ONLY AND ARE NOT TO BE INCLUDED IN THE CONTRACT. THESE ITEMS WILL BE PROVIDED BY THE OWNER AND INSTALLED BY THE GENERAL CONTRACTOR. CONTRACTOR TO REFERENCE THE PROVIDED LAYOUT AND THE ENGINEERING DRAWINGS FOR ROUGH–IN LOCATIONS.

General Plan Notes

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11. SEE SHEET A8.1–A8.2 FOR FINISH SCHEDULE AND FINISH FLOOR PLANS.
12. SEE SHEET A2.3 FOR PARTITION TYPES REFERENCED ON FLOOR PLANS.
13. G.C. TO CONFIRM ALL AREAS ARE FINISHED AND ALL VOIDS OR RAISED AREAS ARE IN A FINISHED CONDITION.

Legend

- A — PARTITION TYPE REFERENCE
- NEW WALL (SEE PARTITION TYPES ON SHEET A2.3)
- EXISTING WALL TO REMAIN



HATTIESBURG PUBLIC SAFETY COMPLEX

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HPSC Historic Hospital (C)

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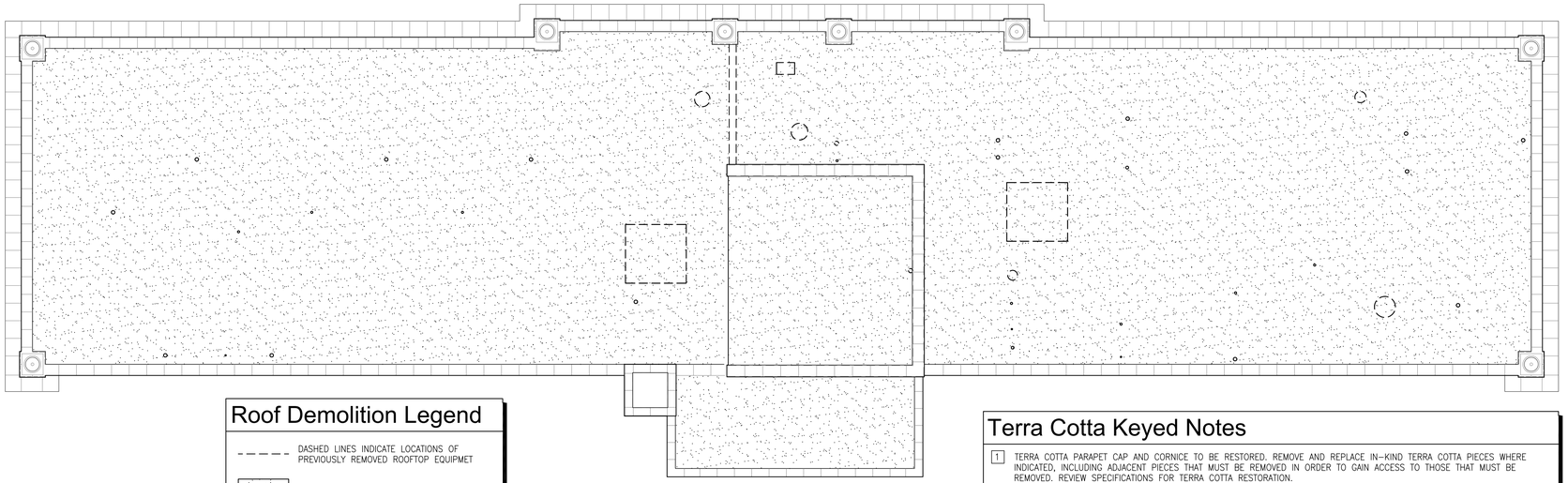
Drawn By: SN,RB,AS
Checked By: CR,LA,CF
Client No: ------
Albert & Associates: 1257

Larry A. Albert, Hattiesburg, MS

A2.5

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Albert & McCleskey Associates Architects

THIRD FLOOR DIMENSION PLAN



Roof Demolition Legend

- – – – – DASHED LINES INDICATE LOCATIONS OF PREVIOUSLY REMOVED ROOFTOP EQUIPMET
- EXISTING ROOF SYSTEM TO BE DEMOLISHED

Demolition Roof Plan

SCALE: 1/8" = 1'-0"

Terra Cotta Keyed Notes

1. TERRA COTTA PARAPET CAP AND CORNICE TO BE RESTORED. REMOVE AND REPLACE IN-KIND TERRA COTTA PIECES WHERE INDICATED, INCLUDING ADJACENT PIECES THAT MUST BE REMOVED IN ORDER TO GAIN ACCESS TO THOSE THAT MUST BE REMOVED. REVIEW SPECIFICATIONS FOR TERRA COTTA RESTORATION.
2. INSTALL LEAD TEE-CAP AND SEALANT AT EACH JOINT OF PARAPET AND CORNICE; RE: 7/A3.2. SEALANT IS ALLOWED ONLY AT TOP JOINTS. ALL OTHER JOINTS TO BE REPOINTED SHALL BE DONE SO WITH REPOINTING MORTAR. SEE SPECIFICATIONS.
3. RESTORE EXISTING TERRA COTTA URN.
4. REPLACE TERRA COTTA CORNICE TO EXACTLY MATCH EXISTING IN SIZE, STYLE, AND PROFILE. RE: EAST ELEVATION.

NOTE:
ALL TERRA COTTA REPLACEMENT MAY UTILIZE CEMENT CAST STUCCO TO MATCH THE SIZE, PROFILE, TEXTURE, AND COLOR OF REQUIRED PATCH AREAS. STUCCO CRAFTSMAN WHO HAVE AT LEAST FIVE PREVIOUS HISTORIC BUILDINGS UTILIZING THIS TECHNIQUE ARE REQUIRED FOR THIS WORK. SEE "RESTORATION BUILDING ENVELOPE NOTES" ON SHEET A5.2 FOR ADDITIONAL INFORMATION.

General Roof Repair Notes

1. DEMO EXISTING BUILT-UP ROOFING: REMOVE AND DISCARD ALL BUILT-UP ROOFING MATERIALS INCLUDING INSULATION, FLASHING, UNDERLAYMENT, AND ACCESSORIES TO EXPOSE THE ORIGINAL ROOF DECKING.
2. ROOF TOP EQUIPMENT: ALL ROOF TOP EQUIPMENT INCLUDING BUT NOT LIMITED TO HVAC EQUIPMENT, PIPING, AND CONDUIT HAS BEEN REMOVED DURING A RECENT DEMOLITION PROJECT. AREAS OF THE EXISTING ROOFING MEMBRANE HAVE BEEN TEMPORARILY PATCHED TO MAINTAIN WATER TIGHTNESS. ANY RESIDUAL ITEMS REMAINING DUE TO THE REMOVED ROOFTOP EQUIPMENT IS TO BE REMOVED WITH THE EXISTING BUILT-UP ROOF IN PREPARATION FOR INSTALLATION OF THE NEW ROOF.
3. REPAIR ROOF DECK: ANY REPAIRS TO DAMAGED OR MISSING AREAS OF ROOF DECKING SHALL BE MADE IN-KIND.
4. INSTALL NEW ROOFING SYSTEMS: INSTALL NEW 2-PLY MODIFIED BITUMINOUS ROOFING SYSTEM AS INDICATED IN THE ROOF ASSEMBLY NOTES AND WHERE SHOWN ON ROOF PLAN.
5. INSTALL NEW SCUPPERS AND DOWNSPOUTS WHERE SHOWN: REPLACE AND IN SOME CASES PROVIDE IN NEW LOCATIONS SCUPPERS, CONDUCTOR HEADS, DOWNSPOUTS, AND BOOTS AS SHOWN IN DRAWINGS. ALL CAST IRON BOOTS SHALL TIE DIRECTLY INTO UNDERGROUND STORM WATER DRAINAGE SYSTEM.

New Primary Roof Assembly

2-PLY REINFORCED SBS MODIFIED MEMBRANE ROOF SYSTEM

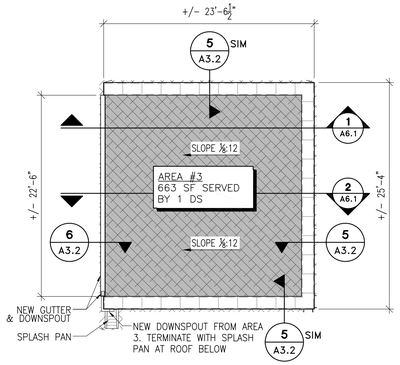
1. CAP SHEET (HEAT WELDED)
2. BASE PLY (MECHANICALLY ATTACHED)
3. 1/2" COVER BOARD
4. TAPERED ROOFING INSULATION (MIN. 1½" THICK & ¼":12 SLOPE)
5. 3" RIGID ROOFING INSULATION
6. VAPOR RETARDER / AIR BARRIER
7. EXISTING CONCRETE DECK

FASTENERS: GALVANIZED STEEL
FLASHING: METAL CLAD BITUMINOUS FLASHING
EXPOSED GUTTER: PRE-FINISHED ALUMINUM
DOWNSPOUTS: PRE-FINISHED ALUMINUM

Penthouse Roof Assembly

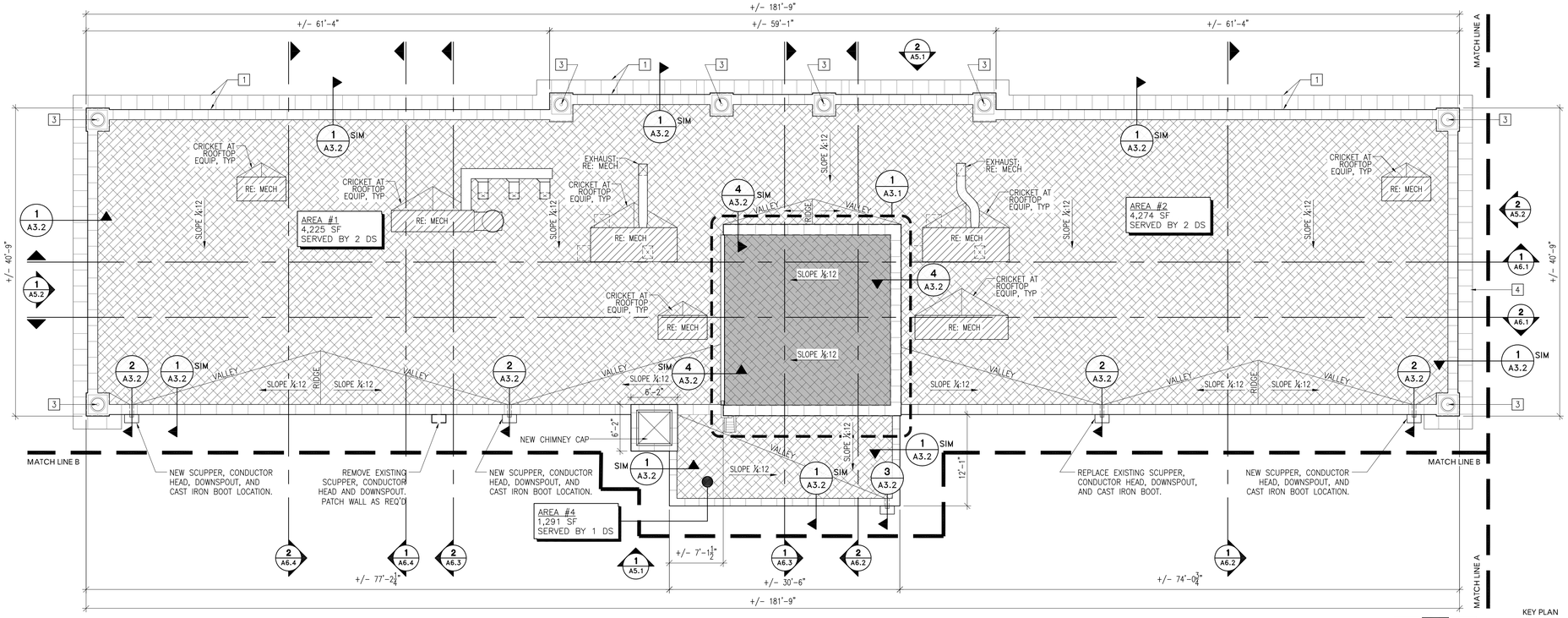
2-PLY REINFORCED SBS MODIFIED MEMBRANE ROOF SYSTEM

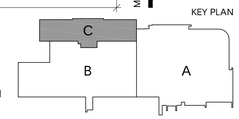
1. CAP SHEET (HEAT WELDED)
2. BASE PLY (MECHANICALLY ATTACHED)
3. 1/2" COVER BOARD
4. TAPERED ROOFING INSULATION (MIN. 1½" THICK & ¼":12 SLOPE)
5. VAPOR RETARDER / AIR BARRIER
6. EXISTING CONCRETE DECK



1 Penthouse Roof Plan

SCALE: 1/8" = 1'-0"





Renovated Roof Plan

SCALE: 1/8" = 1'-0"

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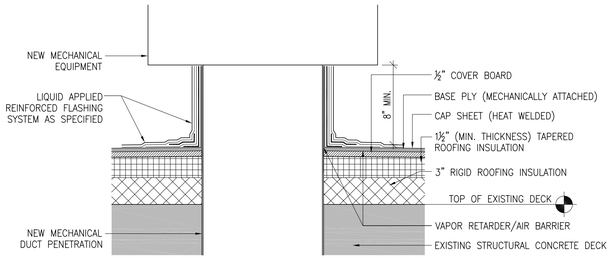
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Client No: ------
Albert & Associates: 1257

REGISTERED ARCHITECT Larry A. Albert Hattiesburg, MS STATE OF MISSISSIPPI

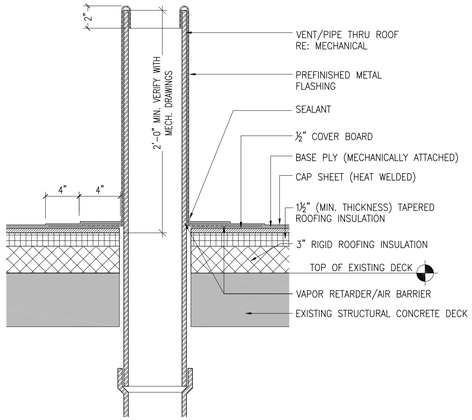
A3.1

ROOF PLANS



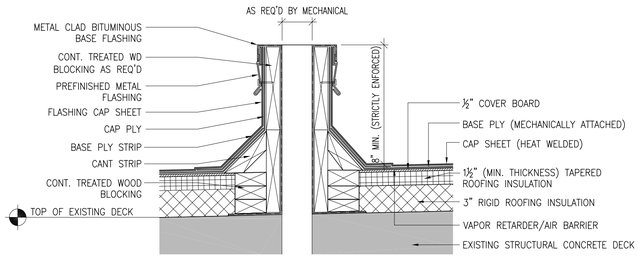
10 Mech. Duct Penetration

SCALE: 1-1/2" = 1'-0"



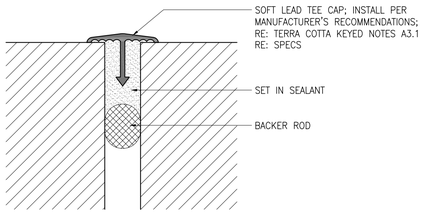
9 Typical Roof Penetration

SCALE: 1-1/2" = 1'-0"



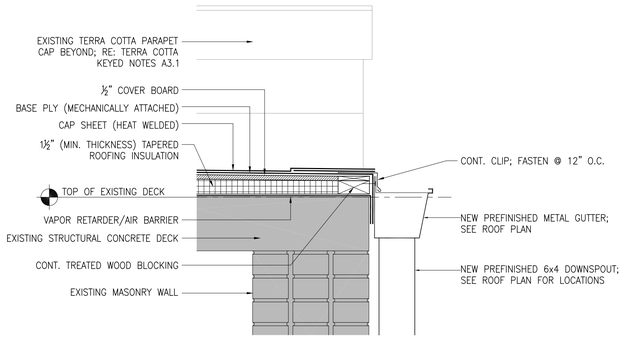
8 Typical Equipment Curb

SCALE: 1-1/2" = 1'-0"



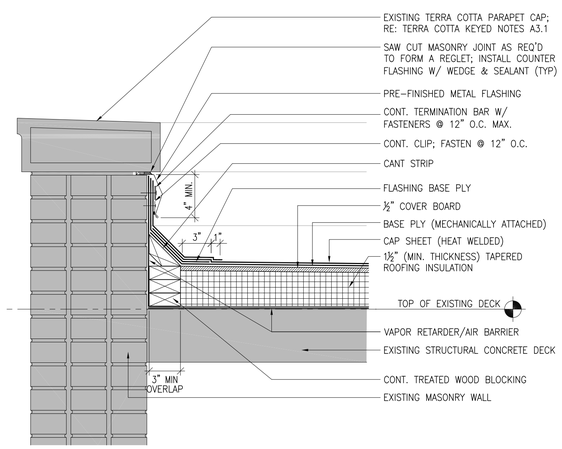
7 Soft Lead Tee Cap Detail

SCALE: 1'-0" = 1'-0"



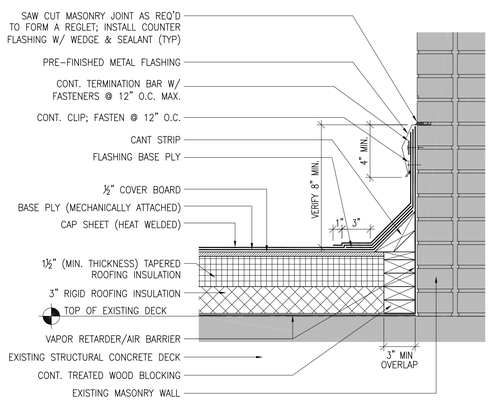
6 Gutter Detail at Penthouse

SCALE: 1-1/2" = 1'-0"



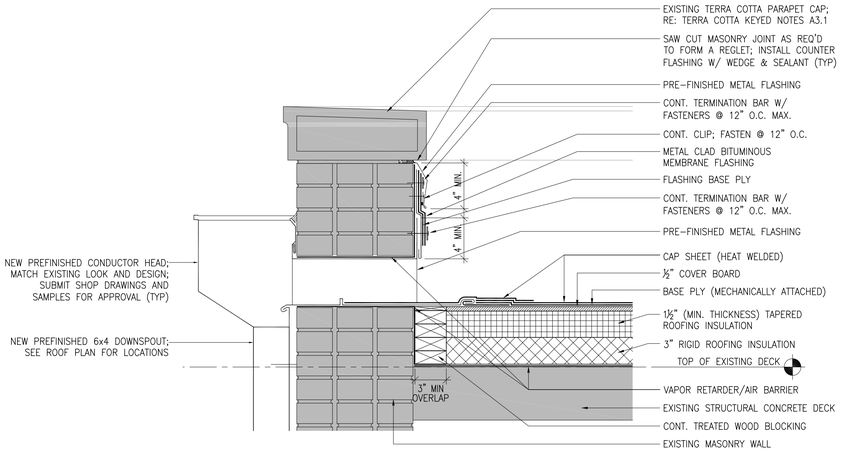
5 Typical Parapet Detail at Penthouse

SCALE: 1-1/2" = 1'-0"



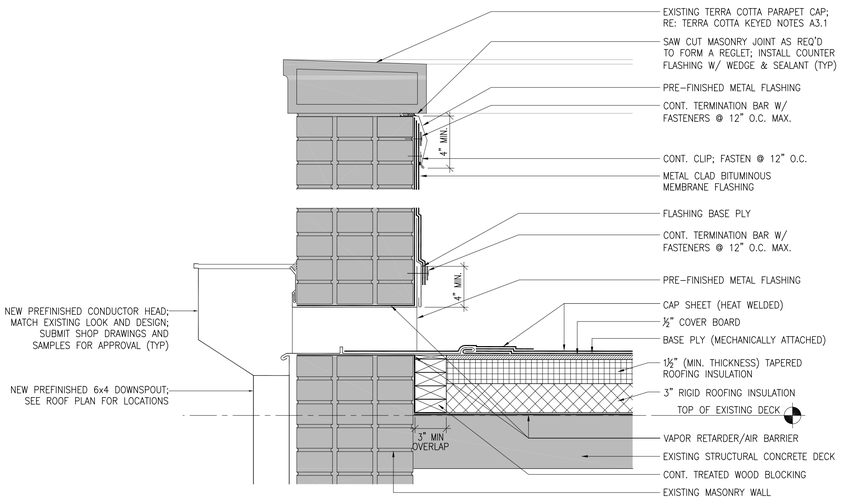
4 Typical Roof Detail at Masonry Wall

SCALE: 1-1/2" = 1'-0"



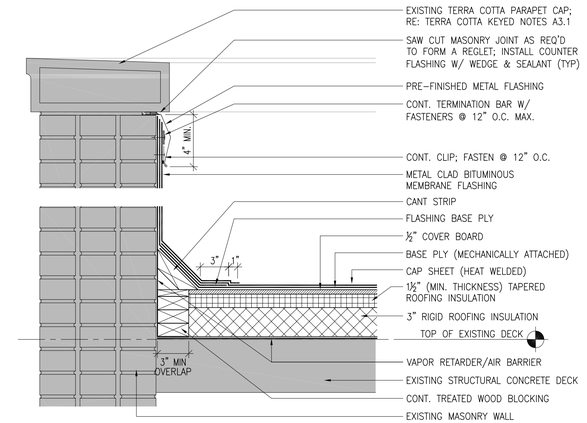
3 Scupper Detail at Roof Area 4

SCALE: 1-1/2" = 1'-0"



2 Typical Scupper Detail at Roof Areas 1 & 2

SCALE: 1-1/2" = 1'-0"



1 Typical Parapet Detail

SCALE: 1-1/2" = 1'-0"

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT

HPSC Historic Hospital (C)

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Albert & Associates: 1257

REGISTERED ARCHITECT Larry A. Albert 12855 Hattiesburg, MS STATE OF MISSISSIPPI

A3.2

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com
Albert & McCleskey Associates Architects

RCP Notes

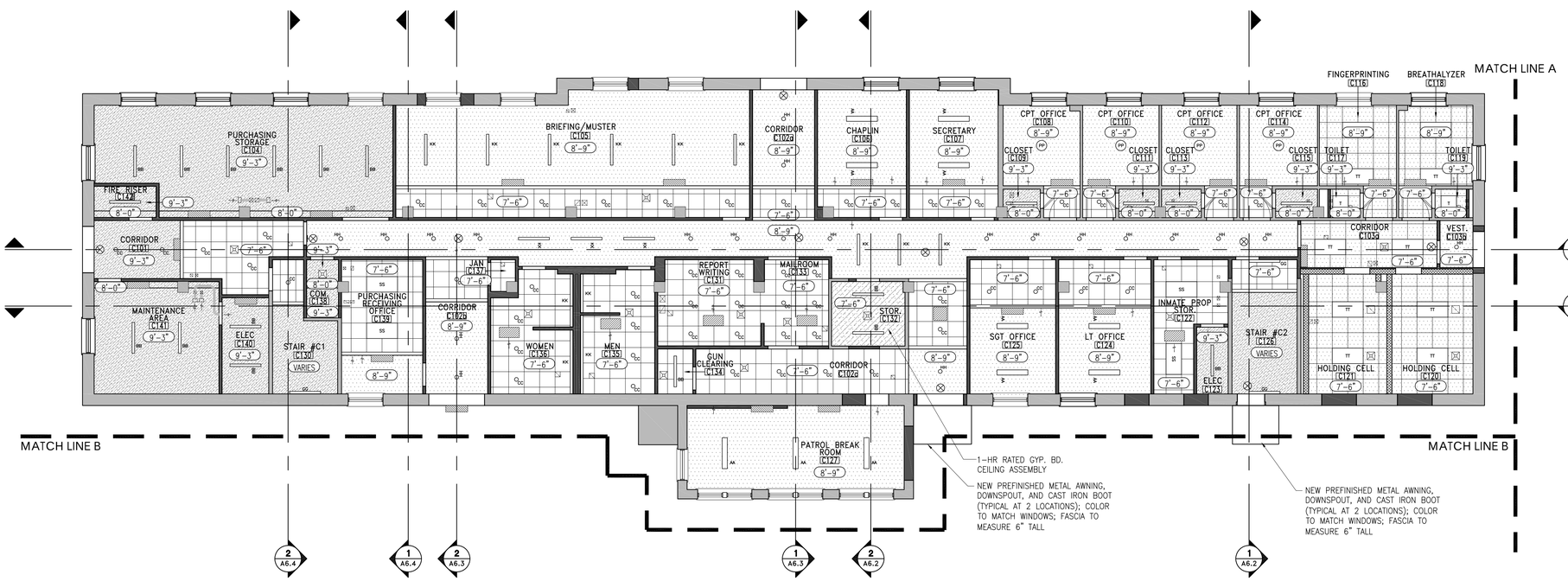
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RCP Legend

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- PLAS-2 EXISTING EXPOSED STRUCTURE W/PLASTER FINISH (RE: A8.1)
- 9'-0" CEILING HEIGHT SYMBOL

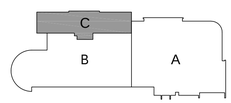
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- CC LED RECESSED DOWNLIGHT
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- GG WALL SURFACE MOUNT LED STRIP
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- KKW WALL MOUNTED LED LIGHT
- PP LED SCHOOLHOUSE PENDANT
- SS 2X4 LED TROFFER
- TT 2X4 LED TAMPER-RESISTANT LIGHT
- X LED EXIT SIGN

- HVAC 4-WAY CEILING CASSETTE (RE: MECH)
- HVAC 1-WAY CEILING CASSETTE (RE: MECH)
- HVAC WALL MOUNTED HVAC UNIT (RE: MECH)
- HVAC SUPPLY DIFFUSER (RE: MECH).
- HVAC RETURN/EXHAUST DIFFUSER (RE: MECH).



RCP Legend

- EXISTING WALL TO REMAIN
- NEW WALL (SEE SHEET A2.3 FOR PARTITION TYPES)



First Floor Reflected Ceiling Plan

SCALE: 1/8" = 1'-0"

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■ HATTIESBURG FIRE DEPARTMENT

HPSC Historic Hospital (C)

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Checked By:	CR,LA,CF
Client No:	------
Albert & Associates:	1257

REGISTERED ARCHITECT Larry A. Albert Hattiesburg, MS STATE OF MISSISSIPPI

A4.1

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com **Albert & McCleskey Associates Architects**

FIRST FLOOR REFLECTEI CEILING PLAN

RCP Notes

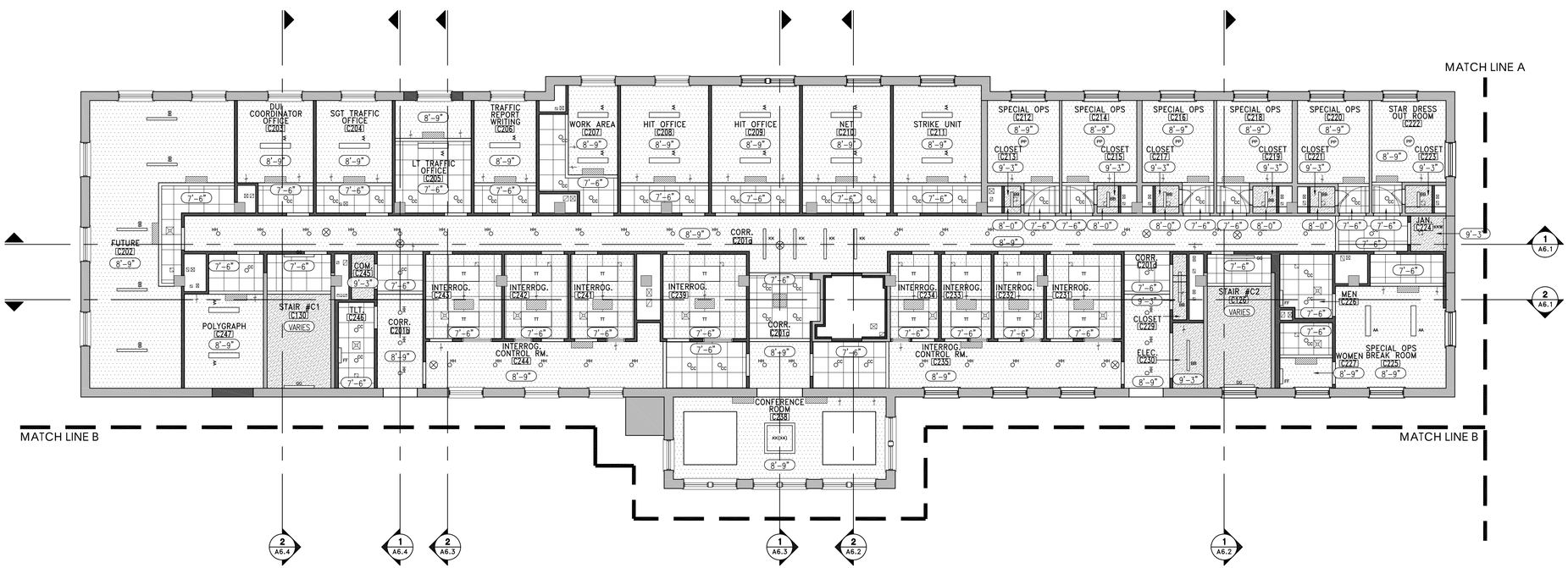
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- 9'-0" CEILING HEIGHT SYMBOL

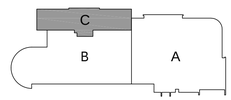
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RCP Legend

- EXISTING WALL TO REMAIN
- NEW WALL (SEE SHEET A2.3 FOR PARTITION TYPES)



Second Floor Reflected Ceiling Plan

SCALE: 1/8" = 1'-0"

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HATTIESBURG PUBLIC SAFETY COMPLEX
HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Historic Hospital (C)

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Checked By: CR,LA,CF
Client No: ------
Albert & Associates: 1257

REGISTERED ARCHITECT Larry A. Albert Hattiesburg, MS STATE OF MISSISSIPPI

A4.2

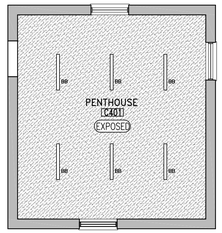
SECOND FLOOR REFLECTED CEILING PLA

RCP Notes

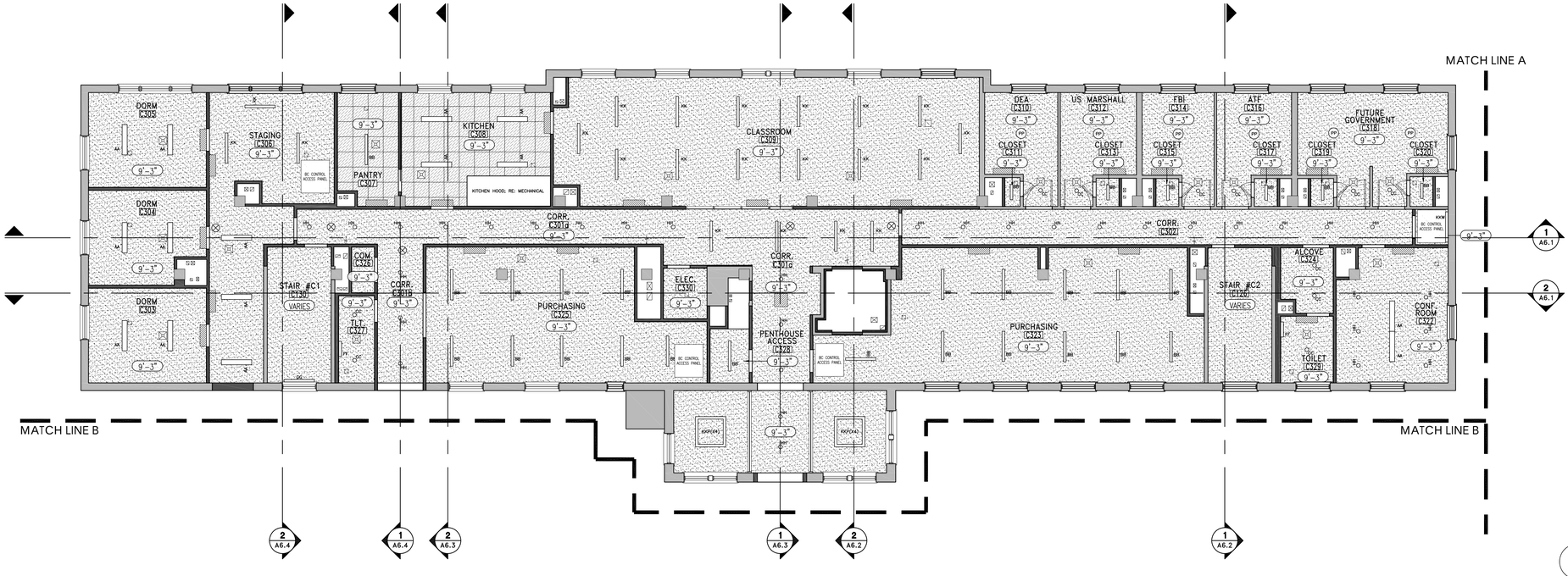
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- HVAC SUPPLY DIFFUSER (RE: MECH).
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1 Penthouse RCP
SCALE: 1/8" = 1'-0"



1 Third Floor Reflected Ceiling Plan
SCALE: 1/8" = 1'-0"

CITY OF HATTIESBURG MISSISSIPPI 1884

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

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REGISTERED ARCHITECT Larry A. Albert Hattiesburg, MS STATE OF MISSISSIPPI

A4.3

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Albert & McCleskey Associates Architects

THIRD FLOOR REFLECTEI CEILING PLAN

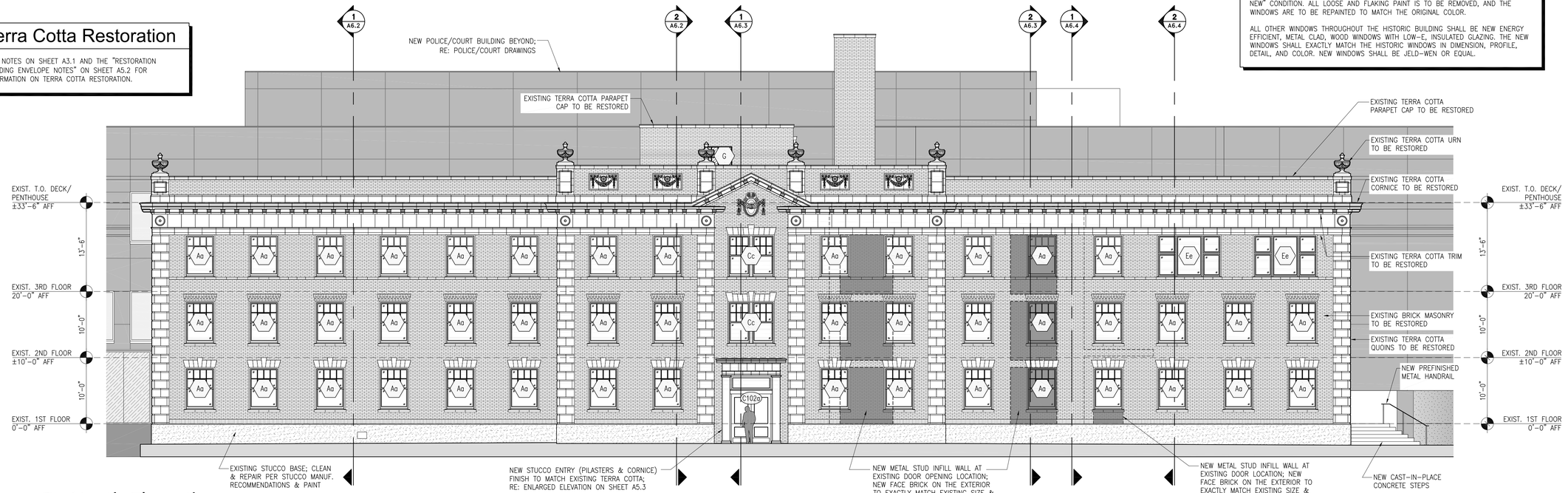
Terra Cotta Restoration

SEE NOTES ON SHEET A3.1 AND THE "RESTORATION BUILDING ENVELOPE NOTES" ON SHEET A5.2 FOR INFORMATION ON TERRA COTTA RESTORATION.

Existing & New Windows Note

THE NORTH FACADE OF THE HISTORIC HOSPITAL IS TO FEATURE THE ORIGINAL WOODEN WINDOWS THROUGHOUT. OPENINGS WHERE THE ORIGINAL WINDOWS HAVE BEEN REMOVED, OR ELEMENTS OF WINDOWS ARE DAMAGED BEYOND REPAIR, SHALL BE FILLED OR REPAIRED WITH SALVAGED WINDOWS FROM THE OTHER FACADES OF THE BUILDING. ALL HISTORIC WINDOWS ON THIS FACADE ARE TO BE RESTORED TO A "LIKE NEW" CONDITION. ALL LOOSE AND FLAKING PAINT IS TO BE REMOVED, AND THE WINDOWS ARE TO BE REPAINTED TO MATCH THE ORIGINAL COLOR.

ALL OTHER WINDOWS THROUGHOUT THE HISTORIC BUILDING SHALL BE NEW ENERGY EFFICIENT, METAL CLAD, WOOD WINDOWS WITH LOW-E, INSULATED GLAZING. THE NEW WINDOWS SHALL EXACTLY MATCH THE HISTORIC WINDOWS IN DIMENSION, PROFILE, DETAIL, AND COLOR. NEW WINDOWS SHALL BE JELD-WEN OR EQUAL.

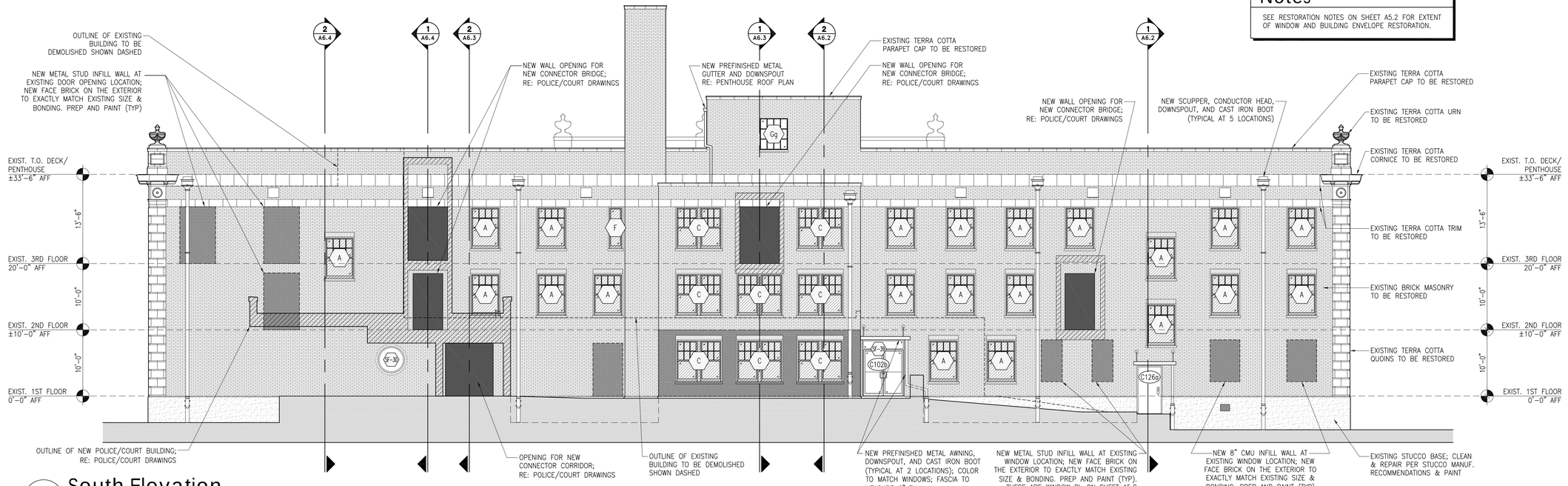


2 North Elevation

SCALE: 1/8" = 1'-0"

Notes

SEE RESTORATION NOTES ON SHEET A5.2 FOR EXTENT OF WINDOW AND BUILDING ENVELOPE RESTORATION.



1 South Elevation

SCALE: 1/8" = 1'-0"

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A5.1

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NORTH & SOUTH BUILDING ELEVATIONS

Restoration Window General Notes

1. THE NORTH FACADE OF THE HISTORIC HOSPITAL IS TO FEATURE THE ORIGINAL WOODEN WINDOWS THROUGHOUT. OPENINGS WHERE THE ORIGINAL WINDOWS HAVE BEEN REMOVED, OR ELEMENTS OF WINDOWS ARE DAMAGED BEYOND REPAIR, SHALL BE FILLED OR REPAIRED WITH SALVAGED WINDOWS FROM THE OTHER FACADES OF THE BUILDING.
2. CONTRACTOR AND SUBS SHALL BE FAMILIAR WITH ALL GENERAL NOTES LOCATED ON SHEET T1.1.
3. CONTRACTOR SHALL PAY VERY CLOSE ATTENTION TO FIELD CONDITIONS DURING BIDDING TO ENSURE THAT ALL CONDITIONS ARE ACCOUNTED FOR AT THAT TIME. OMISSIONS AND ERRORS SHALL BE BROUGHT TO THE ARCHITECT'S ATTENTION FOR CLARIFICATION PRIOR TO BIDDING.
4. THE CONTRACTOR SHALL PROVIDE ONE FULLY COMPLETED SAMPLE OF EACH OF THE FOLLOWING: ONE RESTORED WINDOW* AND ONE NEW WINDOW* FOR REVIEW BY THE ARCHITECT AND A REPRESENTATIVE FROM THE MISSISSIPPI DEPARTMENT OF ARCHIVES AND HISTORY PRIOR TO PROCEEDING ON WINDOW* RESTORATION AND REPLACEMENT. CONTRACTOR SHALL FINISH AND GLAZE BOTH SIDES OF EACH SAMPLE UNIT AS SCHEDULED. THE CONTRACTOR SHALL COORDINATE THIS REVIEW WITH THE EXTERIOR ENVELOPE RESTORATION REVIEW AND GIVE THE ARCHITECT A 5 DAY MINIMUM NOTICE AS TO WHEN THE REVIEW WILL OCCUR.
5. WINDOWS* VARY IN SIZE FROM UNIT TO UNIT. DIMENSIONS ARE PROVIDED AS ESTIMATES ONLY. NEW WINDOWS* SHALL BE SIZED TO FIT EXISTING ROUGH OPENINGS AND SHALL BE FABRICATED USING AN EXISTING SAMPLE AS APPROVED BY THE ARCHITECT.
6. ALL SURFACES THAT ARE TO REMAIN SHALL BE STRIPPED OF PAINT, VARNISH AND OTHER FINISHES AND COATINGS TO PROVIDE AN ADEQUATE SUBSTRATE FOR NEW PAINT. CONTRACTOR SHALL TAKE GREAT CARE NOT TO DAMAGE THE WINDOW* IN THE PROCESS AND SHALL REPLACE ANY DAMAGED WOOD WITH NEW WOOD TO EXACTLY MATCH AT THE CONTRACTOR'S EXPENSE.
7. CONTRACTOR SHALL PROTECT ALL ADJACENT SURFACES INCLUDING BRICK AND TERRA COTTA WHILE STRIPPING WINDOW* SURFACES. ANY DAMAGE CAUSED TO ADJACENT MATERIALS SHALL BE REPAIRED AT THE CONTRACTOR'S EXPENSE.
8. ALL EXTERIOR SURFACES EXPOSED TO THE WEATHER SHALL BE PAINTED AS SPECIFIED TO PRODUCE A LIKE NEW CONDITION. ALL INTERIOR SURFACES NOT EXPOSED TO THE WEATHER SHALL BE PREPPED AND PAINTED AS SCHEDULED.
9. CONTRACTOR SHALL GLAZE ALL LITES IN WINDOWS*. CONTRACTOR SHALL REPLACE ALL MISSING OR BROKEN GLASS AS INDICATED IN DRAWINGS. IF CONTRACTOR BREAKS ANY ORIGINAL GLASS, CONTRACTOR SHALL REPLACE THE BROKEN GLASS WITH RESTORATION GLASS OF THE EXACT SAME TYPE AT CONTRACTOR'S EXPENSE.
10. REMOVE ALL EXTRANEOUS ATTACHMENTS, PROTRUSIONS, PENETRATIONS, PIPES, FANS, GRILLES, BARS, SCREEN STOPS, SCREEN HINGES, AND MISC. HARDWARE IN, ON, AND AROUND WINDOWS*. PATCH AND REPAIR AS REQUIRED.
11. REMOVE AND REPLACE ALL DEFECTIVE CAULK AND SEALANT AS REQUIRED TO PROVIDE A WATERTIGHT FINISH.

*'WINDOW' REFERS TO THE ENTIRE UNIT INCLUDING FRAMES, SASHES, MULLIONS, MOLDINGS, AND TRIM.

Restoration Window Notes

1. CONTRACTOR SHALL VERIFY CONDITION OF EXISTING WINDOWS SCHEDULED TO BE RESTORED PRIOR TO BIDDING TO ENSURE THAT WINDOW CAN BE FULLY RESTORED AND NOTIFY THE ARCHITECT IF ANY WINDOW NEEDS TO BE FULLY REPLACED.
2. CONTRACTOR SHALL VERIFY CONDITION OF EXISTING WINDOWS SCHEDULED TO BE DEMOLISHED PRIOR TO BIDDING AND NOTIFY THE ARCHITECT OF ANY EXISTING WINDOW FRAMES THAT CAN BE SALVAGED FOR RESTORATION.
3. ALL EXISTING WINDOW TYPES 'Aa, Cc, Ee, Ff, & Gg' SHALL BE FULLY RESTORED; REMOVE AND DISPOSE OF ANY OPAQUE (WOOD OR METAL) PANELS IN WINDOWS AND REPLACE WITH TEMPERED GLASS. REMOVE ALL LOOSE MATERIAL AND CHIPPING PAINT, PREPARE SURFACE AND PAINT (PT-4).
4. ALL NEW WINDOW TYPES 'A, C, D, E, & G': REMOVE AND DISPOSE OF ANY EXISTING WINDOWS WHERE DAMAGE OR WEAR IS EXTENSIVE TO WARRANT FULL REPLACEMENT. RESTORE ORIGINAL WINDOW OPENING (AS NECESSARY) AND INSTALL NEW WINDOW AS SCHEDULED. PREPARE SURFACE AND PAINT (PT-4).
5. EXISTING WINDOW TYPE 'Bb' SHALL BE DEMOLISHED IN ITS ENTIRETY. INFILL OPENING ON THE INTERIOR WITH GYP. BD. ON METAL STUDS AT 16" O.C. FILLED WITH BATT INSULATION AND PAINT AS SCHEDULED. INFILL OPENING ON THE EXTERIOR WITH NEW BRICK TO EXACTLY MATCH ADJACENT CONDITION.

Restoration Building Envelope Notes

1. CONTRACTOR AND SUBS SHALL BE FAMILIAR WITH ALL GENERAL NOTES LOCATED ON SHEET T1.1.
2. CONTRACTOR SHALL PAY VERY CLOSE ATTENTION TO FIELD CONDITIONS DURING BIDDING TO ENSURE THAT ALL CONDITIONS ARE ACCOUNTED FOR AT THAT TIME. OMISSIONS AND ERRORS SHALL BE BROUGHT TO THE ARCHITECT'S ATTENTION FOR CLARIFICATION PRIOR TO BIDDING.
3. THE CONTRACTOR SHALL PROVIDE A FULLY COMPLETED 4'X4' MOCK-UP OF MASONRY (INCLUDING PAINTING) AND TERRA COTTA RESTORATION AND REPOINTING AS SPECIFIED FOR REVIEW BY THE ARCHITECT AND A REPRESENTATIVE FROM THE MISSISSIPPI DEPARTMENT OF ARCHIVES AND HISTORY PRIOR TO PROCEEDING WITH RESTORATION. THE CONTRACTOR SHALL COORDINATE THIS REVIEW WITH THE WINDOW SAMPLE REVIEW AND GIVE THE ARCHITECT A 5 DAY MINIMUM NOTICE AS TO WHEN THE REVIEW WILL OCCUR.
4. ALL EXISTING BRICK MASONRY WITH DAMAGED OR MISSING SKIM COAT SHALL BE PATCHED AND REPAIRED WITH NEW SKIM COAT TO PROVIDE A SMOOTH SURFACE. ANY DAMAGED OR MISSING BRICK SHALL BE REPLACED WITH NEW BRICK TO MATCH EXISTING.
5. ALL BRICK MASONRY SHALL BE THOROUGHLY CLEANED AND RESTORED TO A LIKE NEW CONDITION USING THE GENTLEST METHODS POSSIBLE. REPAIR AND REPOINT ALL AREAS WHERE CRACKS, SPACES, GAPS, AND HOLES OCCUR. ALL BRICK MASONRY SURFACES SHALL BE PREPPED AND PAINTED AS SPECIFIED. REVIEW ALL GENERAL NOTES AND SPECS AND PROVIDE SAMPLES PRIOR TO BEGINNING WORK.
6. ALL TERRA COTTA SHALL BE THOROUGHLY CLEANED AND RESTORED TO A LIKE NEW CONDITION USING THE GENTLEST MEANS POSSIBLE. THIS INCLUDES BUT IS NOT LIMITED TO SILLS, DRIPS, PARAPETS, COPINGS, SURROUNDS, ORNAMENT, AND SURFACES. REPAIR AND REPOINT ALL AREAS WHERE CRACKS, SPACES, GAPS, AND HOLES OCCUR. REVIEW ALL GENERAL NOTES AND SPECS AND PROVIDE SAMPLES PRIOR TO BEGINNING WORK. SEE ROOF PLAN SHEET A3.1 FOR ADDITIONAL INFORMATION AND SPECIFIC TERRA COTTA KEYED NOTES. ALL TERRA COTTA REPLACEMENT MAY UTILIZE CEMENT CAST STUCCO TO MATCH THE SIZE, PROFILE, TEXTURE, AND COLOR OF REQUIRED PATCH AREAS. STUCCO CRAFTSMAN WHO HAVE AT LEAST FIVE PREVIOUS HISTORIC BUILDINGS UTILIZING THIS TECHNIQUE ARE REQUIRED FOR THIS WORK.
7. REMOVE ALL MISC. OBJECTS ATTACHED TO THE BUILDING THAT ARE NOT PART OF THE ORIGINAL STRUCTURE. THIS INCLUDES BUT IS NOT LIMITED TO MECHANICAL AND ELECTRICAL EQUIPMENT, DEVICES, PIPES OR VENTS PENETRATING THE EXTERIOR ENVELOPE. REPAIR ANY DAMAGE CAUSED TO THE ENVELOPE CAUSED BY THE ATTACHMENT OF THE OBJECT BY REPLACING OR REPAIRING THE DAMAGED BRICK OR TERRA COTTA.

Restoration Window Schedule & Elevations

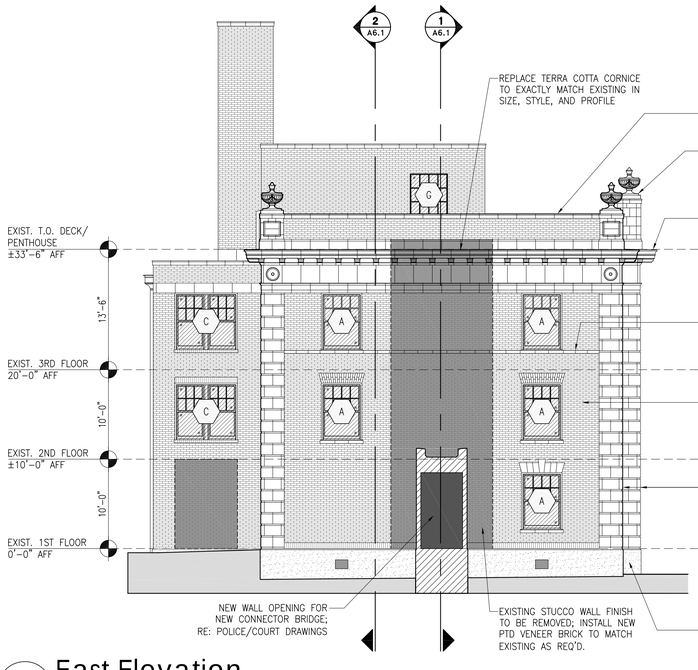
SCALE: 3/8" = 1'-0"

THE NORTH FACADE OF THE HISTORIC HOSPITAL IS TO FEATURE THE ORIGINAL WOODEN WINDOWS THROUGHOUT. OPENINGS WHERE THE ORIGINAL WINDOWS HAVE BEEN REMOVED, OR ELEMENTS OF WINDOWS ARE DAMAGED BEYOND REPAIR, SHALL BE FILLED OR REPAIRED WITH SALVAGED WINDOWS FROM THE OTHER FACADES OF THE BUILDING. ALL HISTORIC WINDOWS ON THIS FACADE ARE TO BE RESTORED PER THE RESTORATION WINDOW NOTES TO A "LIKE NEW" CONDITION. ALL OTHER WINDOWS THROUGHOUT THE HISTORIC BUILDING SHALL BE NEW ENERGY EFFICIENT, METAL CLAD, WOOD WINDOWS WITH LOW-E, INSULATED GLAZING. THE NEW WINDOWS SHALL EXACTLY MATCH THE HISTORIC WINDOWS IN DIMENSION, PROFILE, DETAIL, AND COLOR. NEW WINDOWS SHALL BE JELD-WEN OR EQUAL.

Aa	Bb	Cc		Ee	F	Gg
±4'-6" (FIELD VERIFY)	±3'-2" (FIELD VERIFY)	±7'-0" (FIELD VERIFY)	±4'-0" (FIELD VERIFY)	±9'-8" (FIELD VERIFY)	±2'-2" (FIELD VERIFY)	±4'-2½" (FIELD VERIFY)
±6'-4" (FIELD VERIFY)	±6'-4" (FIELD VERIFY)	±6'-4" (FIELD VERIFY)	±6'-4" (FIELD VERIFY)	±6'-4" (FIELD VERIFY)	±6'-4" (FIELD VERIFY)	±4'-9" (FIELD VERIFY)
±2'-2"	±2'-2"	±2'-2"	±2'-2"	±2'-2"	±2'-2"	±3'-9"
F.F.E.	F.F.E.	F.F.E.	F.F.E.	F.F.E.	F.F.E.	F.F.E.
EXISTING WOOD FRAMED WINDOW TO BE RESTORED	EXISTING WOOD FRAMED WINDOW TO BE REMOVED ENTIRELY SHOWN FOR REFERENCE ONLY	EXISTING WOOD FRAMED WINDOW TO BE RESTORED		ALL WOOD PANEL INSERTS TO BE REPLACED WITH GLASS & EXISTING WOOD FRAMED WINDOW TO BE RESTORED	NEW ENERGY EFFICIENT, METAL CLAD, WOOD WINDOWS WITH LOW-E, INSULATED GLAZING; EXACTLY MATCH THE HISTORIC WINDOWS IN DIMENSION, PROFILE, DETAIL, AND COLOR	EXISTING METAL FRAMED WINDOW TO BE RESTORED
A		C	D			G
NEW ENERGY EFFICIENT, METAL CLAD, WOOD WINDOWS WITH LOW-E, INSULATED GLAZING; EXACTLY MATCH THE HISTORIC WINDOWS IN DIMENSION, PROFILE, DETAIL, AND COLOR		NEW ENERGY EFFICIENT, METAL CLAD, WOOD WINDOWS WITH LOW-E, INSULATED GLAZING; EXACTLY MATCH THE HISTORIC WINDOWS IN DIMENSION, PROFILE, DETAIL, AND COLOR	NEW ENERGY EFFICIENT, METAL CLAD, WOOD WINDOWS WITH LOW-E, INSULATED GLAZING; EXACTLY MATCH THE HISTORIC WINDOWS IN DIMENSION, PROFILE, DETAIL, AND COLOR			NEW METAL FRAMED WINDOW TO MATCH EXISTING AS SHOWN, TYP.

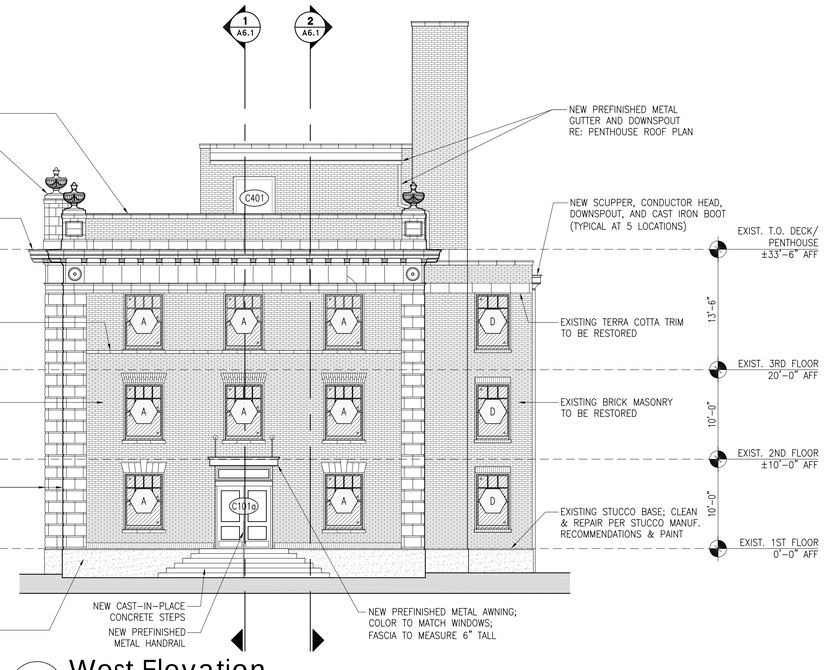
Terra Cotta Restoration

SEE NOTES ON SHEET A3.1 AND THE ADJACENT "RESTORATION BUILDING ENVELOPE NOTES" FOR INFORMATION ON TERRA COTTA RESTORATION.



2 East Elevation

SCALE: 1/8" = 1'-0"



1 West Elevation

SCALE: 1/8" = 1'-0"

CITY OF HATTIESBURG MISSISSIPPI 1884

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Historic Hospital (C)

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08-31-2015	DD Check Set
10-20-2015	75% Progress Set
11-02-2015	90% Pricing Set
11-19-2018	100% Bid Docs

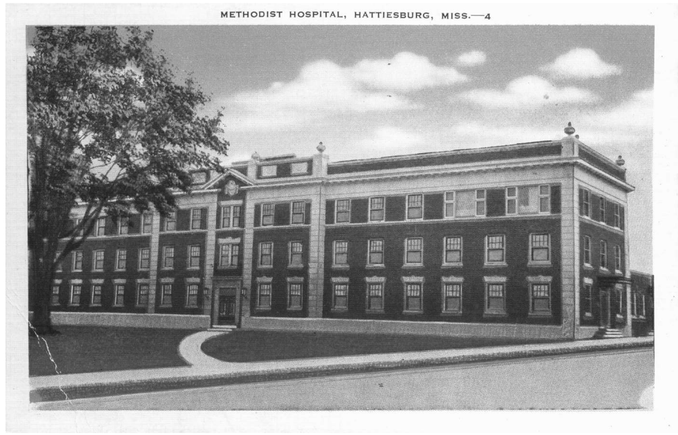
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A5.2

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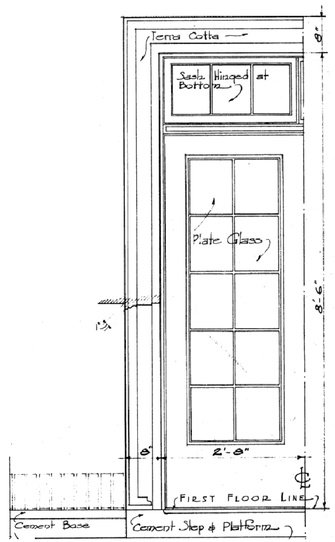
EAST & WEST BUILDING ELEVATIONS



HISTORIC POSTCARD DEPICTING THE ORIGINAL ENTRANCE



HISTORIC PHOTOGRAPH SHOWING THE ORIGINAL ENTRANCE



ONE-HALF ELEVATION

DETAIL OF SIDE ENTRANCE

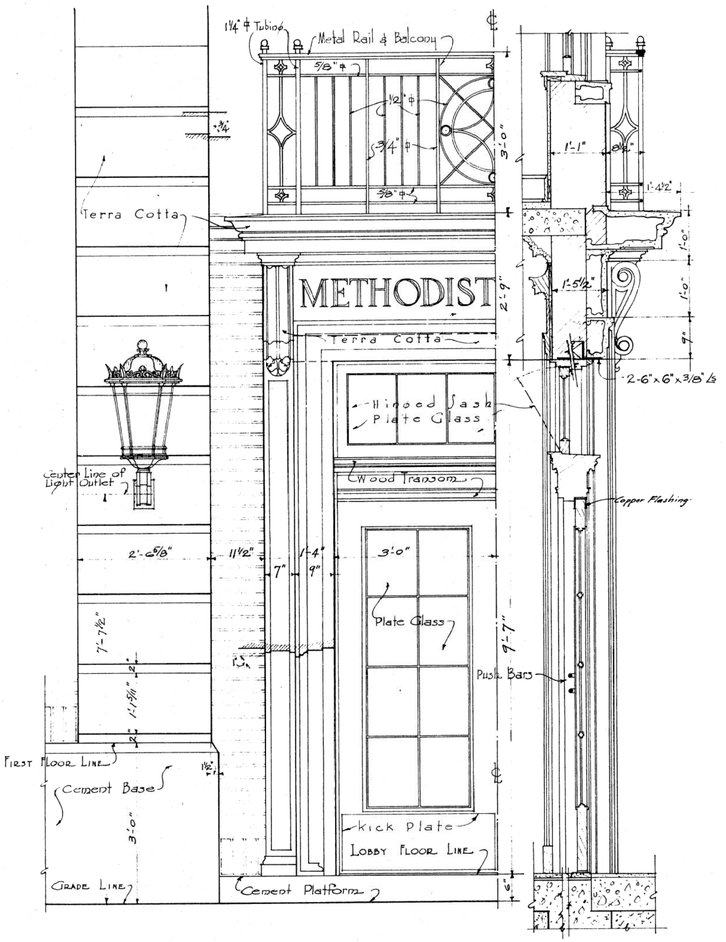
SCALE: 3/4" = 1'-0"

2 Enlarged West Entrance Elevation

SCALE: 3/4" = 1'-0"

Entrance Note

NEW ENTRANCES SHALL BE FORMED OF STUCCO. STUCCO IS TO BE TWO COAT FINISH WITH ½" MINIMUM THICKNESS APPLIED DIRECTLY TO EXISTING BRICK MASONRY WALL. STUCCO THICKNESS WILL VARY BASED ON LOCATION AND PROFILE; SEE ENLARGED ELEVATIONS AND PROFILES AND ADJUST THICKNESS AS REQUIRED. SURFACE FINISH AND COLOR OF STUCCO IS TO MATCH THE TEXTURE OF THE EXISTING TERRA COTTA FOUND ON THE BUILDING. FINISH AND COLOR IS TO BE APPROVED WITH MOCK-UP. ALL STUCCO ACCESSORIES SHALL BE STAINLESS STEEL.



ONE-HALF ELEVATION SECTION

DETAILS OF MAIN ENTRANCE

SCALE: 3/4" = 1'-0"

1 Enlarged North Entrance Elevation & Section

SCALE: 3/4" = 1'-0"

CITY OF HATTIESBURG MISSISSIPPI 1884

HATTIESBURG PUBLIC SAFETY COMPLEX

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HPSC Historic Hospital (C)

Drawing Issued:

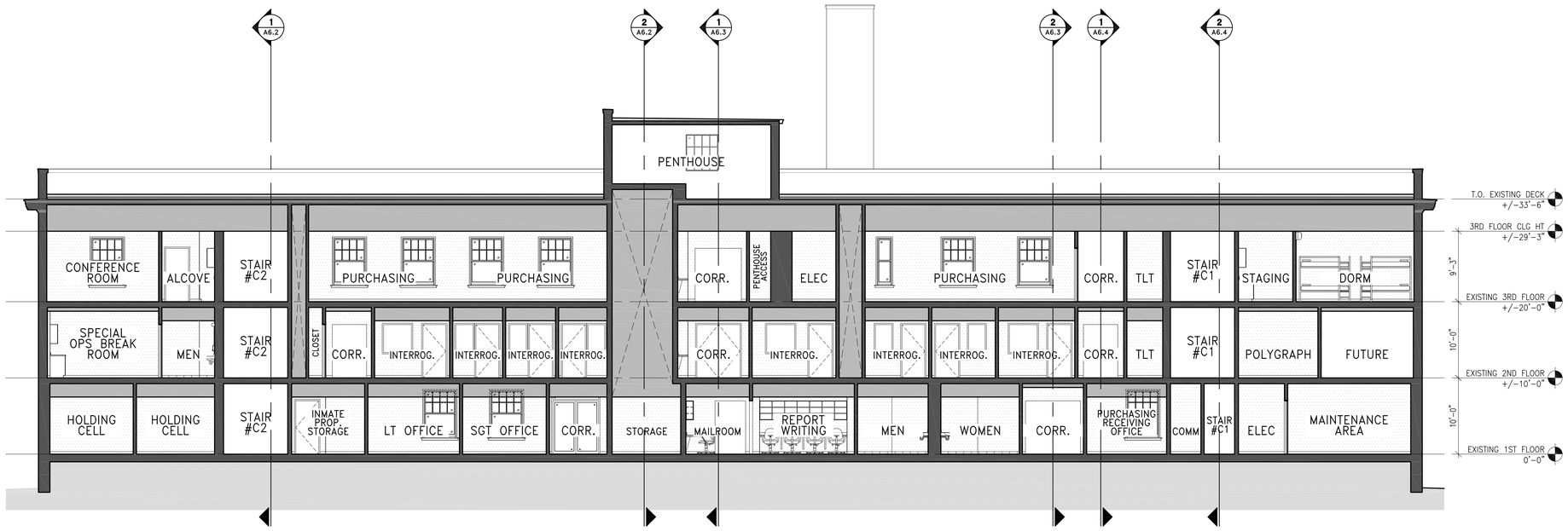
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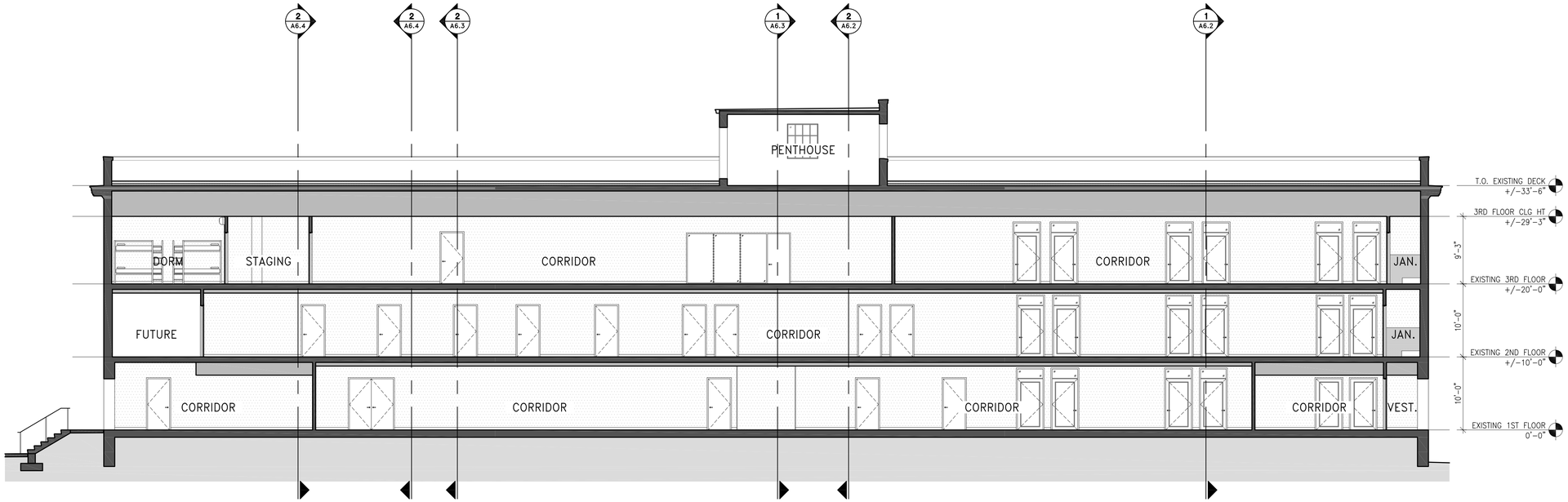
A5.3

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2 Longitudinal Section

SCALE: 1/8" = 1'-0"



1 Longitudinal Section

SCALE: 1/8" = 1'-0"

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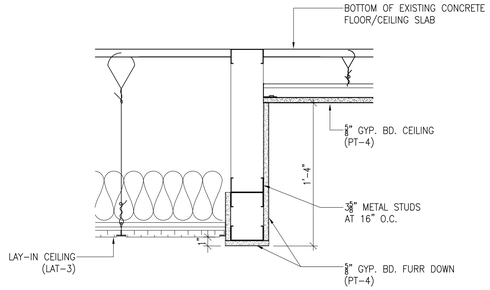
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A6.1

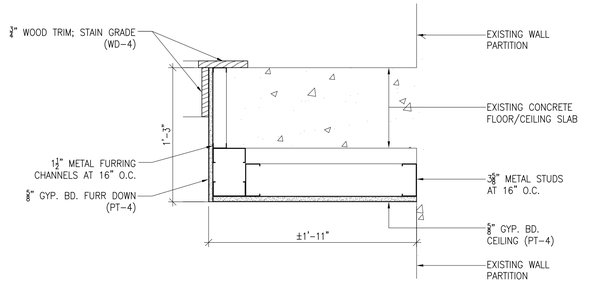
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LONGITUDINAL BUILDING SECTIONS



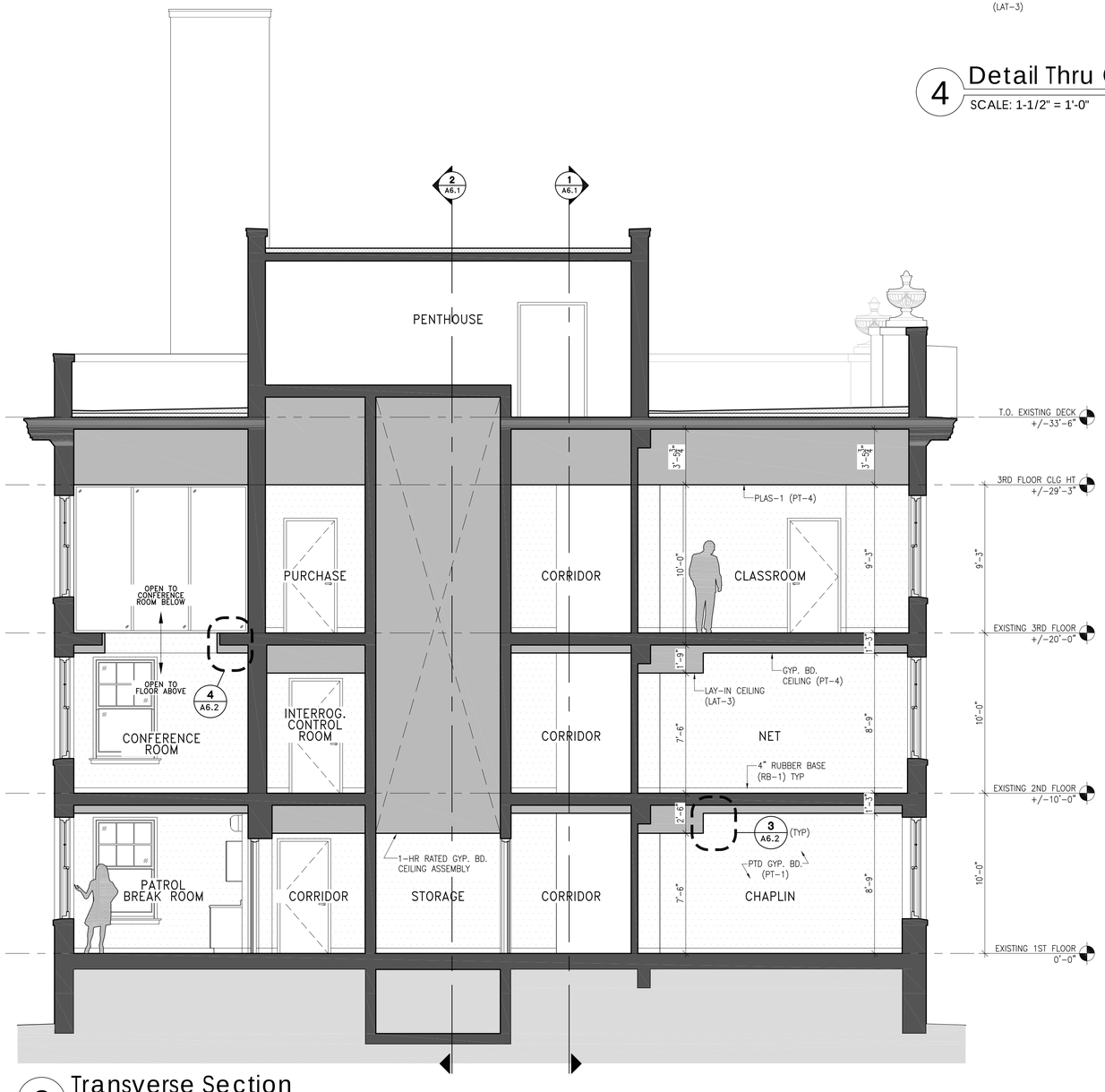
4 Detail Thru Gyp. Bd. Furr Down

SCALE: 1-1/2" = 1'-0"



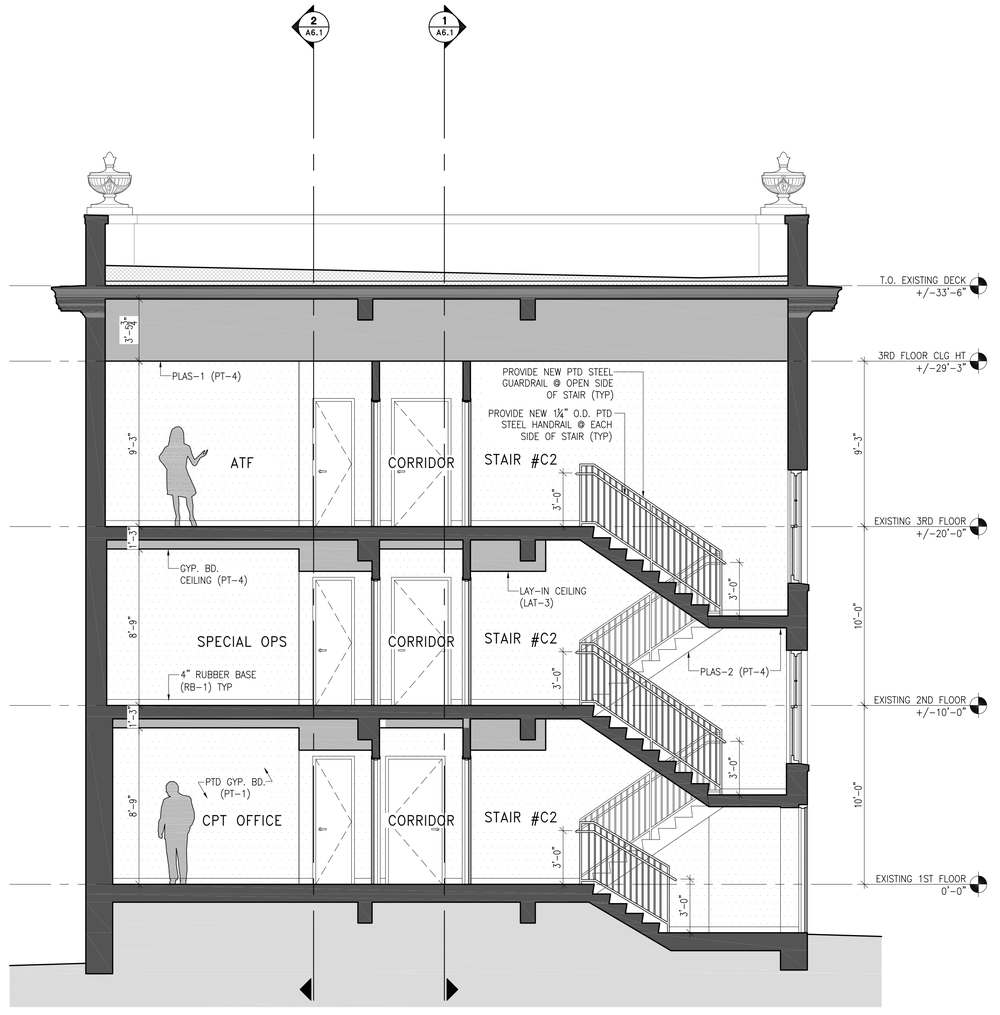
3 Detail Thru Floor Opening

SCALE: 1-1/2" = 1'-0"



2 Transverse Section

SCALE: 1/4" = 1'-0"



1 Transverse Section

SCALE: 1/4" = 1'-0"

CITY OF HATTIESBURG MISSISSIPPI 1884

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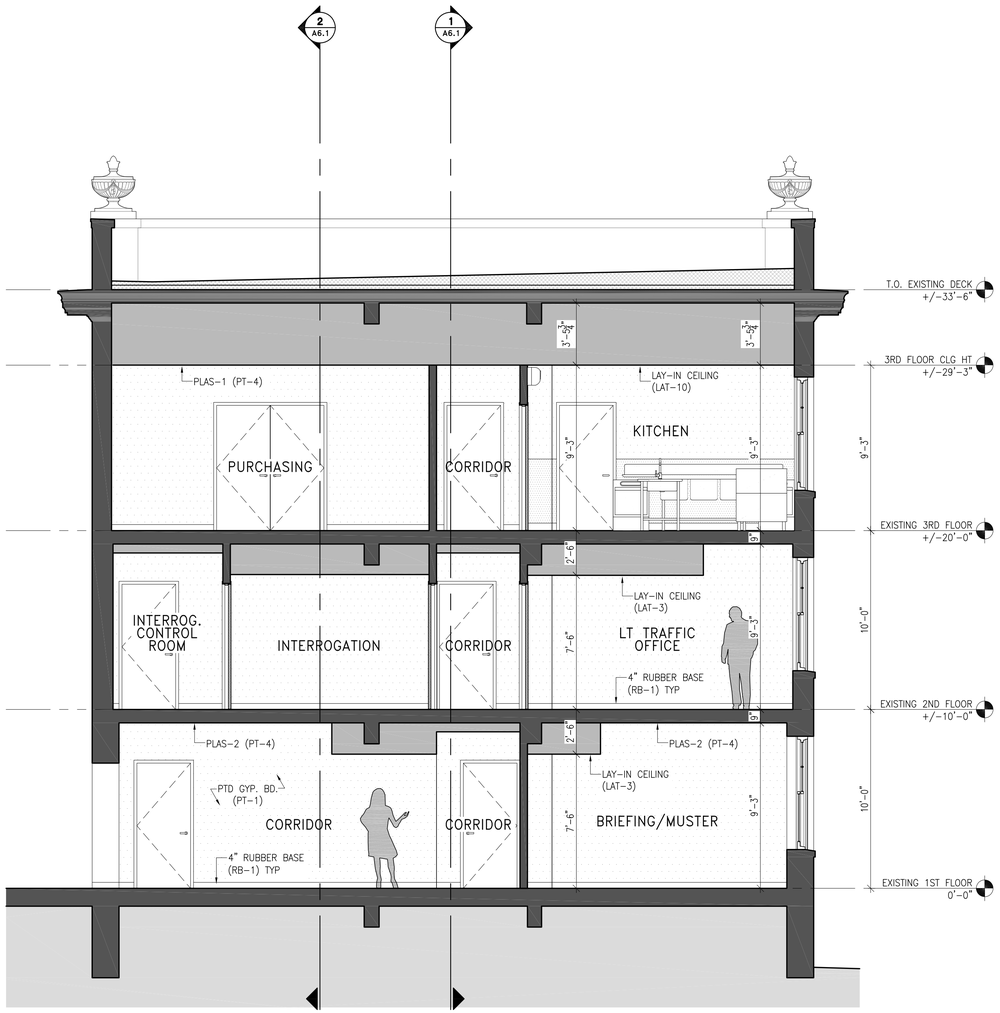
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A6.2

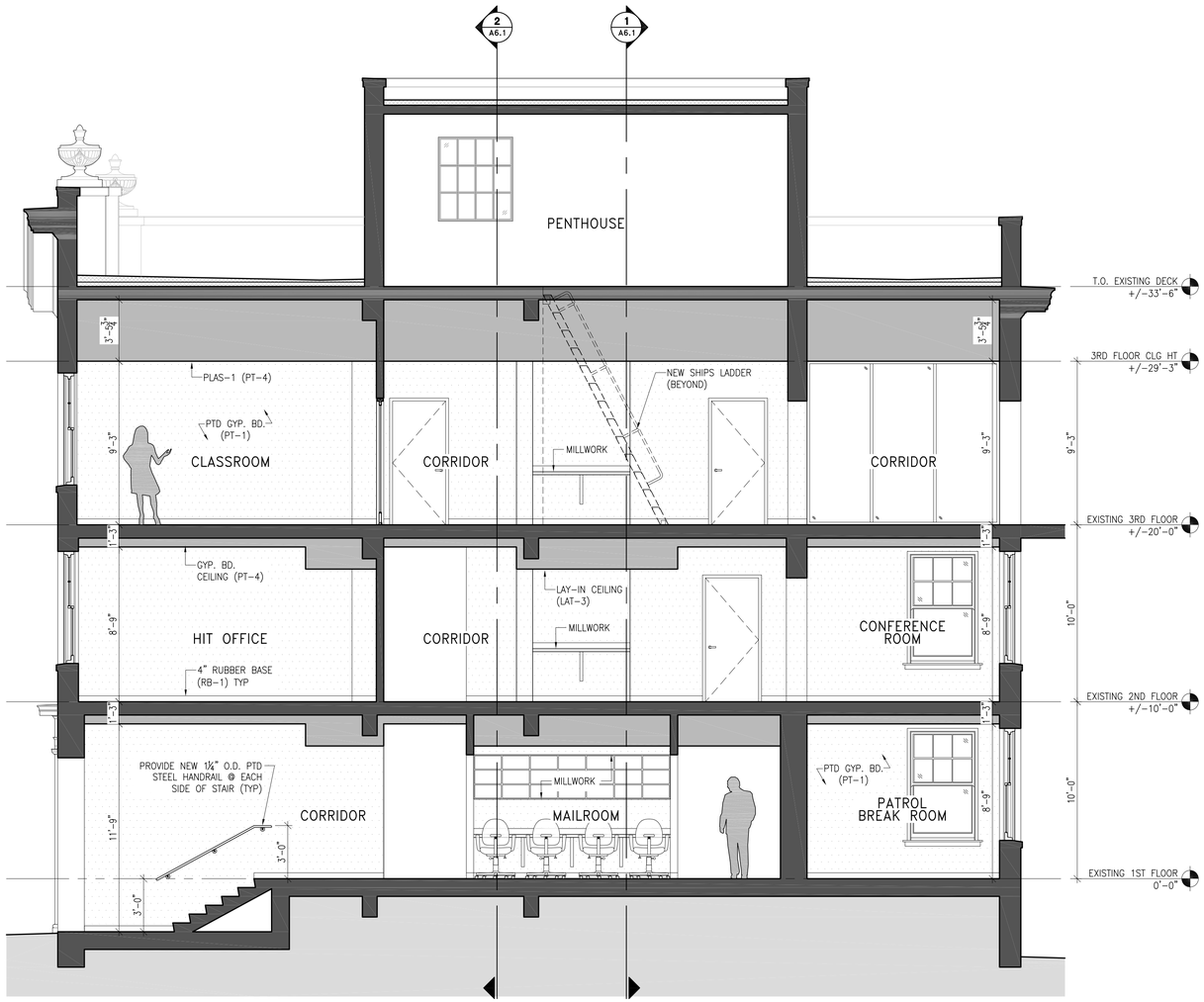
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TRANSVERSE BUILDING SECTIONS



2 Transverse Section

SCALE: 1/4" = 1'-0"



1 Transverse Section

SCALE: 1/4" = 1'-0"

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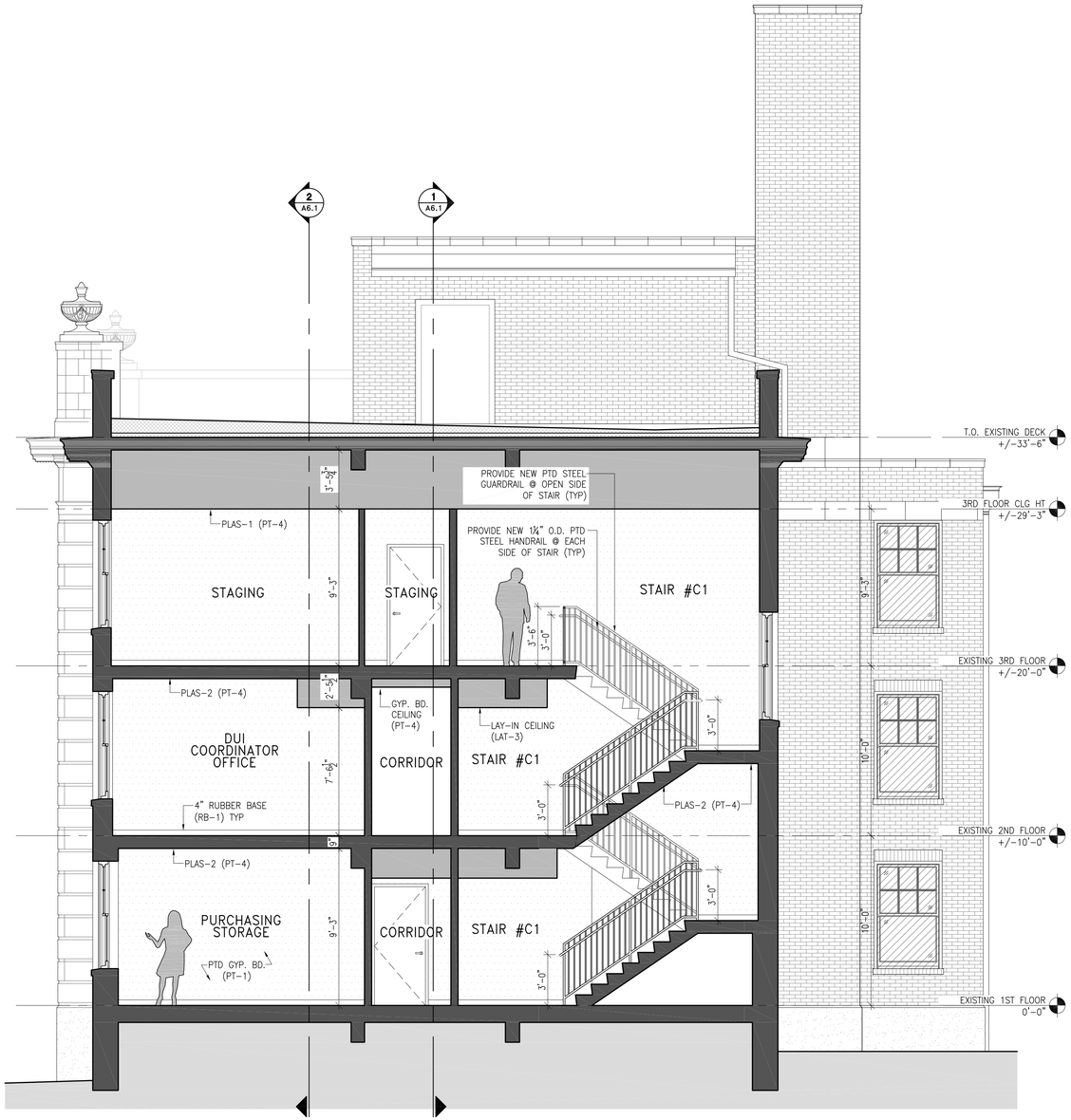
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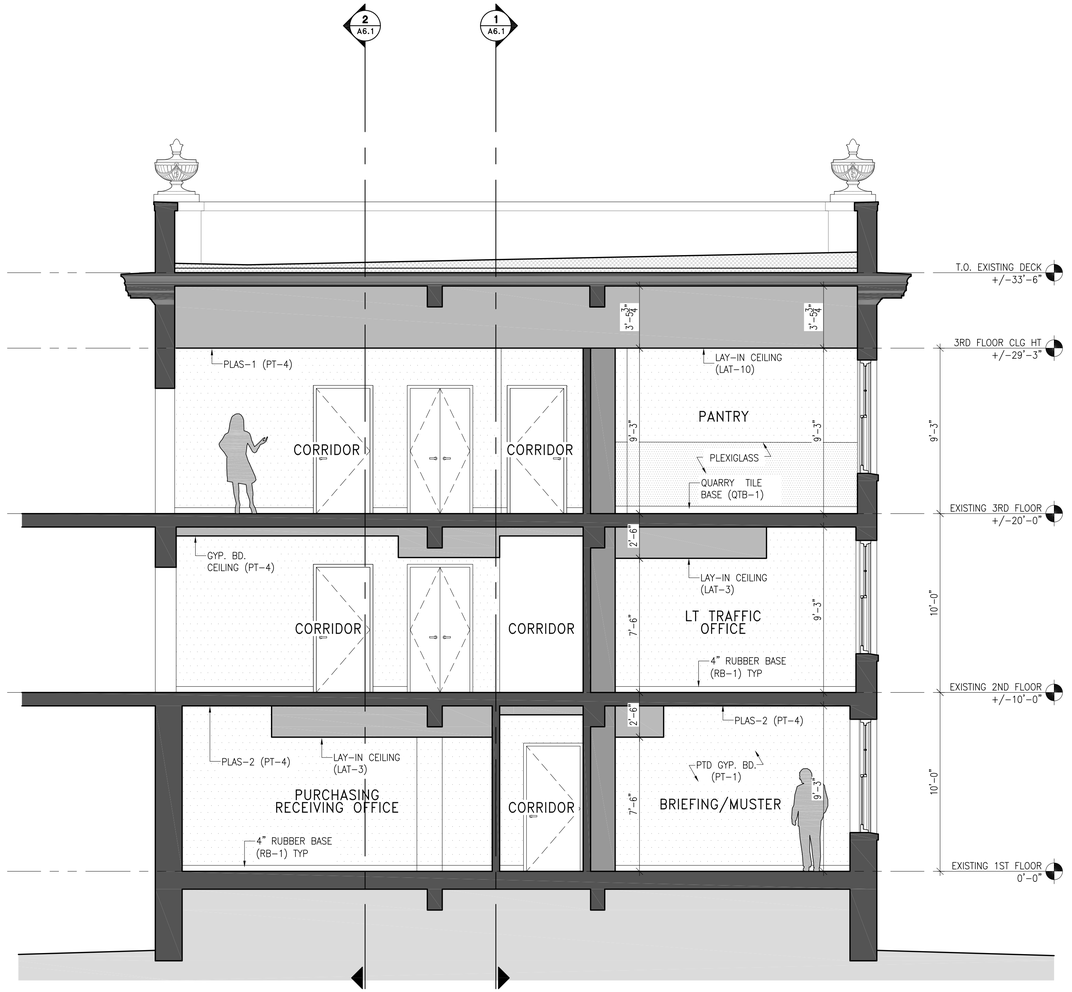
A6.3

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2 Transverse Section

SCALE: 1/4" = 1'-0"



1 Transverse Section

SCALE: 1/4" = 1'-0"

CITY OF HATTIESBURG MISSISSIPPI 1884

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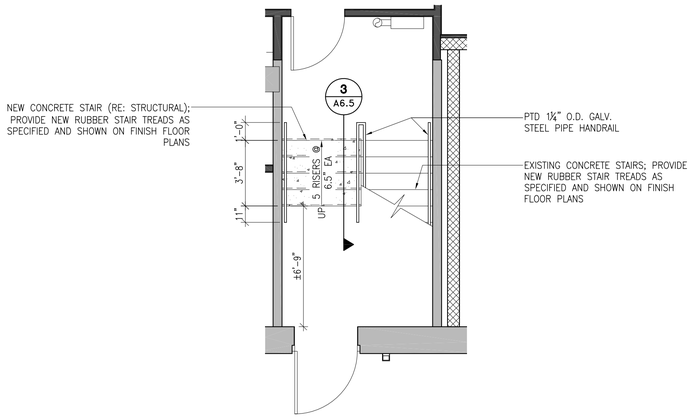
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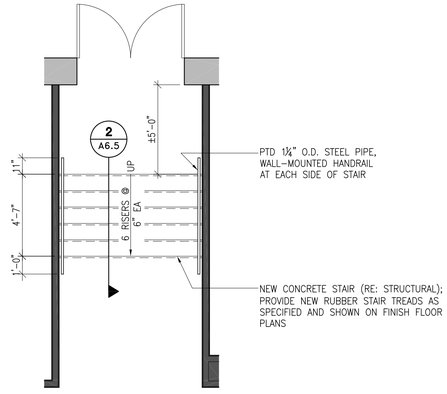
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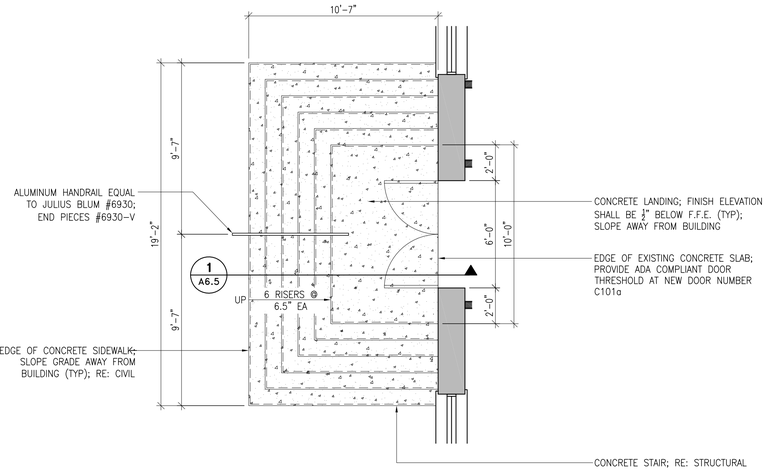
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A6.4

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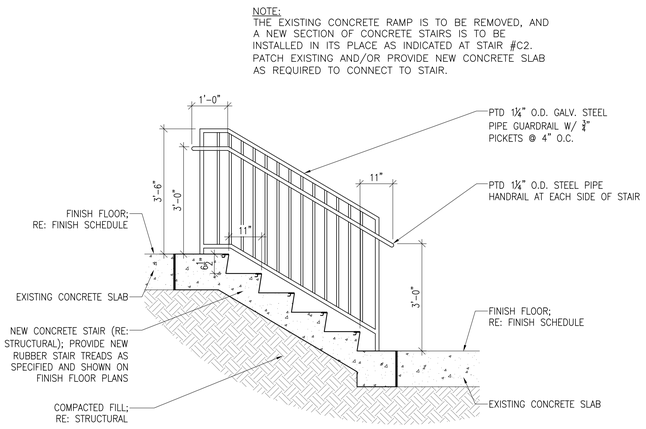






6 Enlarged Plan @ Stair #C2

SCALE: 1/4" = 1'-0"

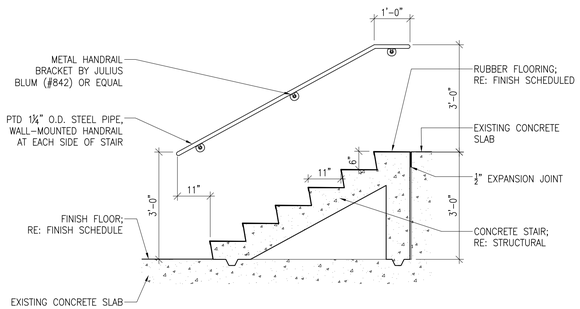


3 Stair Detail @ Stair #C2

SCALE: 1/2" = 1'-0"

5 Enlarged Plan @ Corridor C102a

SCALE: 1/4" = 1'-0"

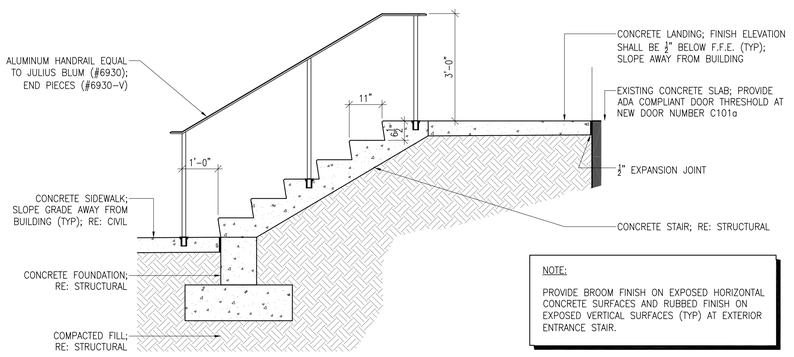


2 Stair Detail @ Corridor C102a

SCALE: 1/2" = 1'-0"

4 Enlarged Plan @ Exterior Entrance Stair

SCALE: 1/4" = 1'-0"



1 Stair Detail @ Exterior Entrance Stair

SCALE: 1/2" = 1'-0"

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REGISTERED ARCHITECT Larry A. Albert 13564 Hattiesburg, MS STATE OF MISSISSIPPI

A6.5

ENLARGED STAIR PLANS & DETAILS

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DOOR SCHEDULE - HISTORIC HOSPITAL BUILDING (C)

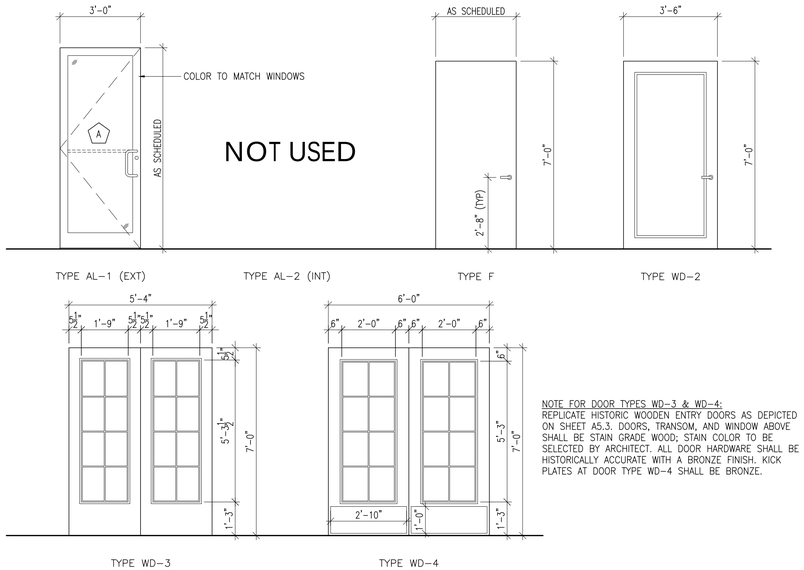
NO.	PAIR	TRANSOM	SIZE	DOOR				FRAME				DETAILS			HARDWARE				SECURITY HARDWARE							REMARKS	ROOM NAME
				ELEV.	MATERIAL	LABEL	FINISH	ELEV.	MATERIAL	LABEL	FINISH	T-HOLD	HEAD	JAMB	HARDWARE SET NUMBER	POWER ASSIST OPENER	MAGNETIC HOLD OPEN	NO HARDWARE OUTSIDE	DOOR VIEWER	CARD READER	BIOMETRIC READER	DOOR CONTACT SWITCH	DOOR RELEASE BUTTON / CALL BUTTON	TIME DELAY PANIC BAR	ALARMED EXIT DEVICE		
C101a	●	●	5'-4" x 7'-0"	WD-4	WOOD	–	ST/PT	WD-3	WOOD	–	ST/PT									●						#2	CORRIDOR C101
C101b			3'-0" x 7'-0"	F		60 MIN	STAINED	HM-1	HM	60 MIN	PAINTED																CORRIDOR C101
C101c			↓	↓	↓	60 MIN	↓	↓	↓	60 MIN	↓																CORRIDOR C101
C102a	●	●	6'-0" x 7'-6"	WD-3	↓	–	ST/PT	WD-2	WOOD	–	ST/PT									●						#2	CORRIDOR C102a
C102b	●	●	↓	AL-1	ALUM	↓	ANODIZED	SF-39	ALUM	↓	ANODIZED									●						#1,2,3	CORRIDOR C102c
C103a			3'-0" x 7'-0"	F	WOOD	60 MIN	STAINED	HM-1	HM	60 MIN	PAINTED									●						#2	CORRIDOR C103a
C103b			↓	↓	↓	60 MIN	↓	↓	↓	60 MIN	↓									●						#2	VESTIBULE
C104	●		6'-0" x 7'-0"			–				–																	PURCHASING STORAGE
C105			3'-0" x 7'-0"			45 MIN				45 MIN																	BRIEFING/MUSTER
C106			↓	↓	↓	–	↓	↓	↓	–	↓																CHAPLIN
C107			↓	↓	↓	↓	↓	↓	↓	↓	↓																SECRETARY
C108		●	3'-6" x 7'-0"	WD-2				EX-1	EXISTING																		CPT OFFICE
C109			2'-0" x 7'-0"	F				EX-2																			CLOSET
C110		●	3'-6" x 7'-0"	WD-2				EX-1																			CPT OFFICE
C111			2'-0" x 7'-0"	F				EX-2																			CLOSET
C112		●	3'-6" x 7'-0"	WD-2				EX-1																			CPT OFFICE
C113			2'-0" x 7'-0"	F				EX-2																			CLOSET
C114		●	3'-6" x 7'-0"	WD-2				EX-1																			CPT OFFICE
C115			2'-0" x 7'-0"	F				EX-2																			CLOSET
C116		●	3'-6" x 7'-0"	WD-2				EX-1																			FINGERPRINTING
C117			2'-0" x 7'-0"	F				EX-2																			CLOSET
C118		●	3'-6" x 7'-0"	WD-2				EX-1																			BREATHALYZER
C119			2'-0" x 7'-0"	F	↓	↓	↓	EX-2	↓	↓	↓																CLOSET
C120			3'-0" x 7'-0"					HM-1	HM																	#5	HOLDING CELL
C121			3'-0" x 7'-0"																							#5	HOLDING CELL
C122			3'-0" x 7'-0"	F	WOOD		STAINED	HM-1	HM																		INMATE PROPERTY STORAGE
C123			↓	↓	↓	↓	↓	↓	↓	↓	↓																ELECTRICAL
C124			↓	↓	↓	↓	↓	↓	↓	↓	↓																LT OFFICE
C125			↓	↓	↓	↓	↓	↓	↓	↓	↓																SGT OFFICE
C126a			3'-6" x 7'-0"		HM	↓	PAINT			↓										●						#2	STAIR #C2
C126b			3'-0" x 7'-0"		WOOD	60 MIN	STAINED			60 MIN																	STAIR #C2
C126c			↓	↓	↓	↓	↓	↓	↓	↓	↓																STAIR #C2
C126d			↓	↓	↓	↓	↓	↓	↓	↓	↓																STAIR #C2
C127			↓	↓	↓	–	↓	↓	↓	–	↓																PATROL BREAK ROOM
C130a			↓	↓	↓	60 MIN	↓	↓	↓	60 MIN	↓																STAIR #C1
C130b			↓	↓	↓	60 MIN	↓	↓	↓	60 MIN	↓																STAIR #C1
C132			↓	↓	↓	–	↓	↓	↓	–	↓																STORAGE
C134			↓	↓	↓	↓	↓	↓	↓	↓	↓																GUN CLEAR
C135			↓	↓	↓	↓	↓	↓	↓	↓	↓																MEN
C136			↓	↓	↓	↓	↓	↓	↓	↓	↓																WOMEN
C137			↓	↓	↓	↓	↓	↓	↓	↓	↓																JANITOR
C138			↓	↓	↓	↓	↓	↓	↓	↓	↓																COMMUNICATIONS
C139			↓	↓	↓	↓	↓	↓	↓	↓	↓																PURCHASING RECEIVING OFFICE
C140			↓	↓	↓	↓	↓	↓	↓	↓	↓																ELECTRICAL
C141			↓	↓	↓	45 MIN	↓	↓	↓	45 MIN	↓																MAINTENANCE AREA
C142			↓	↓	↓	45 MIN	↓	↓	↓	45 MIN	↓																FIRE RISER

DOOR REMARKS

1. SEE STOREFRONT MFR FOR MFR DETAILS.
2. DOOR TO HAVE ALARMED EXIT DEVICE W/ CARD READER OVERRIDE.
3. STOREFRONT TO BE TRIFAB VG 451 BY KAWNEER OR EQUAL (EXTERIOR APPLICATION) WITH 2" SIGHT LINE; 4½" FRAME DEPTH; ANODIZED ALUMINUM FINISH FRONT PLANE, OUTSIDE GLAZED.
4. STOREFRONT TO BE TRIFAB 450 KAWNEER OR EQUAL (INTERIOR APPLICATION) WITH 1¾" SIGHT LINE; 4½" FRAME DEPTH; ANODIZED ALUMINUM FINISH FRONT PLANE, OUTSIDE GLAZED.
5. DOOR AND FRAME EQUAL TO DETENTION SECURITY HOLLOW METAL DOOR AND FRAME BY TRUSSBILT.

DOOR GENERAL NOTES

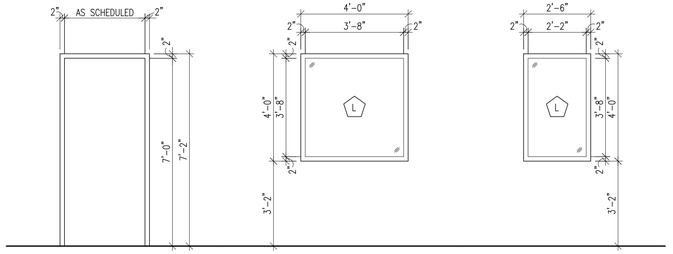
A. CAREFULLY FIELD MEASURE AND VERIFY ALL OPENINGS BEFORE ASSEMBLY OF PRODUCTS.
B. SEE DOOR ELEVATIONS AND DETAILS FOR THICKNESS, DIMENSIONS AND GENERAL CONSTRUCTION.
C. PAINT ALL TOPS AND BOTTOMS OF STEEL DOORS THAT ARE EXPOSED TO WEATHER.
D. PROVIDE FULL WIDTH MARBLE THRESHOLDS AT BATHROOM DOORS.
E. ALL HOLLOW METAL FRAMES ARE TO BE FIELD PAINTED. COLOR TO BE SELECTED.
F. ALL GLASS IN INTERIOR WALL FRAMING AND DOORS WILL BE TEMPERED GLASS.
G. REFER TO SPECIFICATIONS FOR DOOR HARDWARE.



NOTE FOR DOOR TYPES WD-3 & WD-4:
REPLICATE HISTORIC WOODEN ENTRY DOORS AS DEPICTED ON SHEET A5.3. DOORS, TRANSOM, AND WINDOW ABOVE SHALL BE STAIN GRADE WOOD; STAIN COLOR TO BE SELECTED BY ARCHITECT. ALL DOOR HARDWARE SHALL BE HISTORICALLY ACCURATE WITH A BRONZE FINISH. KICK PLATES AT DOOR TYPE WD-4 SHALL BE BRONZE.

2 Door Elevations

SCALE: 3/8" = 1'-0"

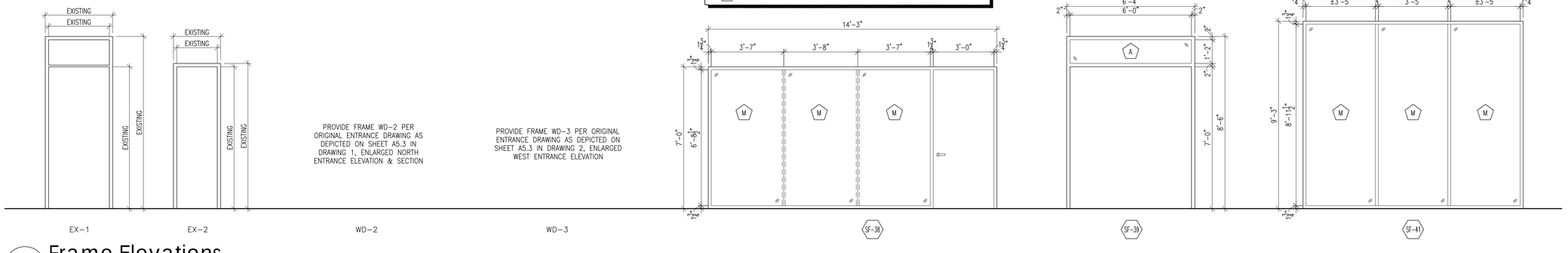


1 Frame Elevations (Cont.)

SCALE: 3/8" = 1'-0"

Glass Schedule

A	1" CLEAR INSULATED GLAZING [088000]
L	1/4" ONE-WAY REFLECTIVE GLAZING [088000]
M	1/4" CLEAR LAMINATED SAFETY GLASS [088000]



1 Frame Elevations

SCALE: 3/8" = 1'-0"

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Drawn By: SN,RB,AS
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Albert & Associates: 1257

REGISTERED ARCHITECT Larry A. Albert 12 Hattiesburg, MS STATE OF MISSISSIPPI

A7.1

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DOOR SCHEDULE - HISTORIC HOSPITAL BUILDING (C)

NO.	PAIR	TRANSOM	SIZE	DOOR				FRAME				DETAILS			HARDWARE				SECURITY HARDWARE							REMARKS	ROOM NAME
				ELEV.	MATERIAL	LABEL	FINISH	ELEV.	MATERIAL	LABEL	FINISH	T-HOLD	HEAD	JAMB	HARDWARE SET NUMBER	POWER ASSIST OPENER	MAGNETIC HOLD OPEN	NO HARDWARE OUTSIDE	DOOR VIEWER	CARD READER	BIOMETRIC READER	DOOR CONTACT SWITCH	DOOR RELEASE BUTTON / CALL BUTTON	TIME DELAY PANIC BAR	ALARMED EXIT DEVICE		
C202			3'-0" x 7'-0"	F	WOOD	–	STAINED	HM-1	HM	–	PAINTED																FUTURE
C203																											DUI COORDINATOR OFFICE
C204																											SGT TRAFFIC OFFICE
C205																											LT TRAFFIC OFFICE
C206																											TRAFFIC REPORT WRITING
C207																											WORK AREA
C208																											HIT OFFICE
C209																											HIT OFFICE
C210																											NET
C211			⌄	⌄				⌄	⌄																		STRIKE UNIT
C212			3'-6" x 7'-0"	WD-2				EX-1	EXISTING																		SPECIAL OPS
C213			2'-0" x 7'-0"	F				EX-2																			CLOSET
C214			3'-6" x 7'-0"	WD-2				EX-1																			SPECIAL OPS
C215			2'-0" x 7'-0"	F				EX-2																			CLOSET
C216			3'-6" x 7'-0"	WD-2				EX-1																			SPECIAL OPS
C217			2'-0" x 7'-0"	F				EX-2																			CLOSET
C218			3'-6" x 7'-0"	WD-2				EX-1																			SPECIAL OPS
C219			2'-0" x 7'-0"	F				EX-2																			CLOSET
C220			3'-6" x 7'-0"	WD-2				EX-1																			SPECIAL OPS
C221			2'-0" x 7'-0"	F				EX-2																			CLOSET
C222			3'-6" x 7'-0"	WD-2				EX-1																			STAR DRESS OUT ROOM
C223			2'-0" x 7'-0"	F				EX-2	⌄																		CLOSET
C224			3'-0" x 7'-0"					HM-1	HM																		JANITOR
C225																											SPECIAL OPS BREAK ROOM
C226																											MEN
C227			⌄																								WOMEN
C229	●		6'-0" x 7'-0"																								CLOSET
C230	●		⌄																								ELECTRIC
C231a			3'-0" x 7'-0"																								INTERROGATION
C231b																											INTERROGATION
C232a																											INTERROGATION
C232b																											INTERROGATION
C233a																											INTERROGATION
C233b																											INTERROGATION
C234a																											INTERROGATION
C234b																											INTERROGATION
C235a																				●							INTERROGATION CONTROL ROOM
C235b			⌄																	●							INTERROGATION CONTROL ROOM
C238	●		6'-0" x 7'-0"																								CONFERENCE ROOM
C239a			3'-0" x 7'-0"																								INTERROGATION
C239b																											INTERROGATION
C241a																											INTERROGATION
C241b																											INTERROGATION
C242a																											INTERROGATION
C242b																											INTERROGATION
C243a																											INTERROGATION
C243b																											INTERROGATION
C244a																				●							INTERROGATION CONTROL ROOM
C244b			⌄																	●							INTERROGATION CONTROL ROOM
C245	●		3'-4" x 7'-0"																								COMMUNICATION
C246			3'-0" x 7'-0"																								TOILET
C247			⌄	⌄	⌄	⌄	⌄	⌄	⌄	⌄	⌄																POLYGRAPH
C301			3'-0" x 7'-0"	F	WOOD	–	PAINTED	HM-1	HM	–	PAINTED																CORRIDOR
C303							STAINED																				DORMITORY
C304																											DORMITORY
C305						⌄				⌄																	DORMITORY
C306						45 MIN				45 MIN																	STAGING
C307						–				–																	PANTRY
C308a																											KITCHEN
C308b			⌄	⌄	⌄	⌄	⌄	⌄	⌄	⌄	⌄																KITCHEN
C309			VERIFY W/ MANUF.					SF-38	ALUM		ANODIZED																CLASSROOM
C310	●		3'-6" x 7'-0"	WD-2	WOOD	–	STAINED	EX-1	EXISTING	–	PAINTED																DEA
C311			2'-0" x 7'-0"	F				EX-2																			CLOSET
C312	●		3'-6" x 7'-0"	WD-2				EX-1																			US MARSHALL
C313			2'-0" x 7'-0"	F				EX-2																			CLOSET
C314	●		3'-6" x 7'-0"	WD-2				EX-1																			FBI
C315			2'-0" x 7'-0"	F				EX-2																			CLOSET
C316	●		3'-6" x 7'-0"	WD-2				EX-1																			ATF
C317			2'-0" x 7'-0"	F				EX-2																			CLOSET
C318a	●		3'-6" x 7'-0"	WD-2				EX-1																			FUTURE GOVERNMENT
C318b	●		3'-6" x 7'-0"	WD-2				EX-1																			FUTURE GOVERNMENT
C319			2'-0" x 7'-0"	F				EX-2																			CLOSET
C320			⌄					EX-2	⌄																		CLOSET
C321			3'-0" x 7'-0"					HM-1	HM																		JANITOR
C322																											CONFERENCE ROOM
C323			⌄																								PURCHASING
C325	●		6'-0" x 7'-0"																								PURCHASING
C326	●		3'-4" x 7'-0"																								COMMUNICATION
C327																											TOILET
C328																				●							PH ACCESS
C329																											TOILET
C330			⌄	⌄	⌄	⌄	⌄	⌄	⌄	⌄	⌄																ELECTRICAL
C401			4'-0" x 7'-0"	F	HM	–	PAINT	HM-1	HM	–	PAINTED																PENTHOUSE

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Albert & Associates: 1257

REGISTERED ARCHITECT Larry M Albert Hattiesburg, MS STATE OF MISSISSIPPI

A7.2

Finish Sched. Gen. Notes

1. CONTRACTOR TO CONSULT ARCHITECT IMMEDIATELY IF DISCREPANCIES ARE FOUND BETWEEN ARCHITECTURAL AND ENGINEERING DRAWINGS
2. SEE A2.x SHEETS FOR FLOOR PLANS.
3. SEE A3.x SHEETS FOR ROOF PLANS.
4. SEE A4.x SHEETS FOR REFLECTED CEILING PLANS.
5. SEE A5.x SHEETS FOR EXTERIOR ELEVATIONS AND WINDOW SCHEDULE/WINDOW ELEVATIONS.
6. SEE A6.x SHEETS FOR BUILDING SECTIONS.
7. SEE A7.x SHEETS FOR DOOR SCHEDULE/FRAME ELEVATIONS.
8. SEE A8.x SHEETS FOR FINISH SCHEDULE AND FINISH FLOOR PLANS.
9. SEE A9.x SHEETS FOR INTERIOR ELEVATIONS.

General Finish Notes

1. ALL FLOORS TO BE PROPERLY PREPPED AND FLOATED AS NECESSARY.
2. ALL EXPOSED LOUVERS, REGISTERS, VENTS, ETC. ARE TO BE PAINTED TO MATCH SURROUNDING CONDITIONS.
3. AT ALL FLOORING PRODUCT TRANSITIONS, PROVIDE NECESSARY ACCESSIBLE TRANSITION MATERIALS. RE: SHEET A8.2 FOR THRESHOLD/FLOORING TRANSITION DETAILS.
4. ALL PORCELAIN TILE FLOORING TO MEET OR EXCEED STATIC COEFFICIENT OF FRICTION (SLIP RESISTANCE) A.D.A. STANDARD OF 0.60 FOR ACCESSIBLE ROUTES.
5. APPLY THOROUGH WATERPROOFING MASTIC BEHIND ALL WALL TILE, FLOOR TILE, AND CURB TILE IN RESTROOMS.
6. ALL EXPOSED STEEL IS TO BE PRIMED AND PAINTED PER SECTION 9 SPECIFICATIONS; INCLUDING BUT NOT LIMITED TO: STAIRS INCLUDING HANDRAILS, STRINGERS, STAIR PANS, ETC.
7. SUBMIT COLOR SAMPLES FOR ALL PRODUCTS TO ARCHITECT FOR APPROVAL.

Numbered Finish Notes

1. MULTIPLE WALL FINISHES ARE USED IN THIS SPACE; SEE INTERIOR ELEVATIONS FOR PATTERNS AND LOCATIONS OF FINISHES.
2. MULTIPLE CEILING FINISHES ARE USED IN THIS SPACE; SEE REFLECTED CEILING PLANS FOR PATTERNS AND LOCATIONS OF FINISHES.
3. THIS SPACE CONTAINS FINISHED MILLWORK; SEE INTERIOR ELEVATIONS FOR FINISHES.
4. PROVIDE PLEXIGLASS WALL COVERING TO A HEIGHT OF 4'-0" AFF AND HORIZONTALLY 4'-0" FROM THE EDGE OF THE NEAREST WATER SOURCE.
5. MULTIPLE CEILING HEIGHTS EXIST IN THIS SPACE; SEE REFLECTED CEILING PLANS FOR HEIGHTS.
6. PROVIDE RETROFIT ALUMINUM STAIR NOSING BY BALCO OR EQUAL; TYPE RS-405LP IN 4 INCH WIDTH WITH TYPE 7 CAST-IN ANCHOR. PROVIDE AT EXISTING CONCRETE STAIRS.
7. PROVIDE EMBEDDED ALUMINUM STAIR NOSING BY BALCO OR EQUAL; TYPE T-213 IN 2 INCH WIDTH WITH TYPE 6 CAST-IN ANCHOR. PROVIDE AT NEW CONCRETE STAIR AT STAIR #C2.
8. ALL EXPOSED STRUCTURE AT CEILING (DECKS, BEAMS, STAIRS, ETC.) IS TO BE STRIPPED OF ALL LOOSE MATERIAL & CHIPPING PAINT, SURFACES PREPPED AND TEXTURED WITH STIPPLED PLASTER FINISH AND PAINTED.
9. SMOOTH, HARD, NONABSORBENT SURFACE NOT REQUIRED IN THIS RESTROOM AT SERVICE SINKS, URINALS, AND WATER CLOSETS PER IBC 2012, 1210.2.2, EXCEPTION #2.
10. SMOOTH, HARD, NONABSORBENT SURFACE REQUIRED AT ALL WALLS AND PARTITIONS WITHIN 2 FEET OF SERVICE SINKS, URINALS, AND WATER CLOSETS TO A HEIGHT NOT LESS THAN 48 INCHES ABOVE FLOOR PER IBC 2012, 1210.2.2.
11. SEE INTERIOR ELEVATIONS FOR SURFACE MOUNTED MIRROR LOCATIONS.
12. PROVIDE 1 HOUR RATED GYP. BD. CEILING ASSEMBLY (BASIS OF DESIGN UL G531).
13. THIS SPACE IS MARKED AS FUTURE AND WILL HAVE NO NEW FLOOR FINISH AT THIS TIME. CONTRACTOR SHALL LEAVE THE EXISTING RAW FLOOR FINISH AFTER DEMO WORK IN THIS SPACE IS COMPLETED AND EXISTING FLOOR CLEANED.
14. THIS SPACE HAS TWO OPENINGS IN THE CEILING THAT ARE OPEN TO THE THIRD FLOOR; CONTRACTOR SHALL FURR-OUT SIDES OF OPENING WITH GYP. BD. AND PAINT (PT-4). SEE REFLECTED CEILING PLANS FOR LOCATIONS AND SIZE OF OPENINGS.
15. PROVIDE NEW SHIPS LADDER AT FOR PENTHOUSE ACCESS. SEE SPECIFICATION SECTION 055133.
16. PROVIDE TRANSLUCENT GLAZING AT WINDOWS LOCATED IN RESTROOMS.

Finish Schedule

ROOM #	ROOM NAME	FLOORS	BASE	WALLS	CEILINGS	CEILING HGT 7'-6"	CEILING HGT 8'-9"	CEILING HGT 9'-3"	CABINETS	NOTE(S)
C101	CORRIDOR	EXISTING	RB-3	PT-1	PT-4/LAT-3/PLAS-2	●		●	----	#2,5,8
C102a	CORRIDOR				PT-4/LAT-3	●	●		----	#2,5
C102b	CORRIDOR					●	●		----	#2,5
C102c	CORRIDOR				↓	●	●		----	#2,5
C103a	CORRIDOR				LAT-9	●			----	----
C103b	VESTIBULE				PT-4	●			----	----
C104	PURCHASING STORAGE				PT-4/PLAS-2			●	----	#5,8
C105	BRIEFING/MUSTER				PT-4/LAT-3	●	●		----	#2,5
C106	CHAPLIN					●	●		----	#2,5
C107	SECRETARY					●	●		----	#2,5
C108	CAPTAIN OFFICE				↓	●	●		----	#2,5
C109	CLOSET				PT-4/PLAS-2			●	----	#5,8
C110	CAPTAIN OFFICE				PT-4/LAT-3	●	●		----	#2,5
C111	CLOSET				PT-4/PLAS-2			●	----	#5,8
C112	CAPTAIN OFFICE				PT-4/LAT-3	●	●		----	#2,5
C113	CLOSET				PT-4/PLAS-2			●	----	#5,8
C114	CAPTAIN OFFICE				PT-4/LAT-3	●	●		----	#2,5
C115	CLOSET				PT-4/PLAS-2			●	----	#5,8
C116	FINGERPRINTING		↓	↓	LAT-9	●	●		----	#2,5
C117	TOILET		PCTB-1	EPT-1	LAT-9/PLAS-2			●	----	#2,5,8
C118	BREATHALYZER		RB-3	PT-1	LAT-9	●	●		----	#2,5
C119	TOILET		PCTB-1	EPT-1	LAT-9/PLAS-2			●	----	#2,5,8
C120	HOLDING CELL		RB-3	EPT-1	LAT-9	●			----	----
C121	HOLDING CELL			↓	↓	●			----	----
C122	INMATE PROP STORAGE			PT-1	LAT-3	●			----	----
C123	ELECTRICAL				PT-4/PLAS-2			●	----	#8
C124	LT OFFICE				PT-4/LAT-3	●	●		----	#2,5
C125	SGT OFFICE				↓	●	●		----	#2,5
C126	STAIR #C2				PT-4/LAT-3/PLAS-2	●		●	----	#2,5,6,7,8
C127	PATROL BREAK ROOM				PT-4		●		PLAM-1, PLAM-2	#3
C130	STAIR #C1				PT-4/LAT-3/PLAS-2	●		●	----	#2,5,6,8
C131	REPORT WRITING				LAT-3	●			WD-4, PLAM-2	#3
C132	STORAGE				PT-4	●			----	#12
C133	MAIL ROOM				LAT-3	●			PLAM-1, PLAM-2	#3
C134	GUN CLEARING		↓	↓		●			----	----
C135	MEN		PCTB-1	PCT-1, EPT-1		●			QTZ-1, PLAM-1	#1,3,10,11
C136	WOMEN		↓	↓		●			QTZ-1, PLAM-1	#1,3,10,11
C137	JANITOR		----	EPT-1	↓	●			----	#1,4
C138	DATA/COM		RB-3	PT-1	PT-4/PLAS-2			●	----	#5,8
C139	PURCH/RECEIVE OFFICE				PT-4/LAT-3	●	●		----	#2,5
C140	ELECTRICAL				PT-4/PLAS-2			●	----	#5,8
C141	MAINTENANCE AREA							●	----	#5,8
C142	FIRE RISER	↓			↓			●	----	#5,8
201a	CORRIDOR	EXISTING			PT-4/LAT-3	●	●		----	#2,5
201b	CORRIDOR					●	●		----	#2,5
201c	CORRIDOR					●	●		----	#2,5
201d	CORRIDOR		↓			●	●		----	#2,5
C202	FUTURE		----			●	●		----	#2,5,13
C203	DUI COORDINATOR		RB-3			●	●		----	#2,5
C204	SGT TRAFFIC OFFICE					●	●		----	#2,5
C205	LT TRAFFIC OFFICE					●	●		----	#2,5
C206	TRAFFIC REPORT WRIT.					●	●		WD-4, PLAM-2	#2,3,5
C207	WORK AREA					●	●		PLAM-1, PLAM-2	#2,3,5
C208	HIT OFFICE					●	●		----	#2,5
C209	HIT OFFICE					●	●		----	#2,5
C210	NET					●	●		----	#2,5
C211	STRIKE UNIT					●	●		----	#2,5
C212	SPECIAL OPS				↓	●	●		----	#2,5
C213	CLOSET				PT-4/PLAS-2			●	----	#5,8
C214	SPECIAL OPS				PT-4/LAT-3	●	●		----	#2,5
C215	CLOSET				PT-4/PLAS-2			●	----	#5,8
C216	SPECIAL OPS				PT-4/LAT-3	●	●		----	#2,5
C217	CLOSET				PT-4/PLAS-2			●	----	#5,8
C218	SPECIAL OPS				PT-4/LAT-3	●	●		----	#2,5
C219	CLOSET				PT-4/PLAS-2			●	----	#5,8
C220	SPECIAL OPS				PT-4/LAT-3	●	●		----	#2,5
C221	CLOSET				PT-4/PLAS-2			●	----	#5,8
C222	STAR DRESS OUT RM				PT-4/LAT-3	●	●		----	#2,5
C223	CLOSET		↓	↓	PT-4/PLAS-2			●	----	#5,8
C224	JANITOR		----	EPT-1	↓			●	----	#1,4,8
C225	SPECIAL OPS BRKRM.		RB-3	PT-1	PT-4/LAT-3	●	●		PLAM-1, PLAM-2	#2,3,5
C226	MEN		PCTB-1	PCT-1, EPT-1	LAT-3	●			----	#1,9,11
C227	WOMEN		↓	↓	PT-4/LAT-3	●	●		----	#1,2,5,9,11,16
C229	CLOSET		RB-3	PT-1	PT-4/PLAS-2			●	----	#5,8
C230	ELECTRICAL				PT-4/PLAS-2			●	----	#8
C231	INTERROGATION				LAT-9	●			----	----
C232	INTERROGATION					●			----	----
C233	INTERROGATION					●			----	----
C234	INTERROGATION				↓	●			----	----
C235	INTERROG. CONROL				PT-4/LAT-3	●	●		----	#2,5
C238	CONFERENCE ROOM				PT-4		●		----	#14
C239	INTERROGATION				LAT-9	●			----	----
C241	INTERROGATION	↓	↓	↓	↓	●			----	----

Finish Schedule

ROOM #	ROOM NAME	FLOORS	BASE	WALLS	CEILINGS	CEILING HGT 7'-6"	CEILING HGT 8'-9"	CEILING HGT 9'-3"	CABINETS	NOTE(S)
C242	INTERROGATION	EXISTING	RB-3	PT-1	LAT-9	●			----	----
C243	INTERROGATION				↓	●			----	----
C244	INTERROG. CONTROL				PT-4/LAT-3	●	●		----	#2,5
C245	DATA/COM		↓	↓	PT-4/PLAS-2			●	----	#5,8
C246	TOILET		PCTB-1	PCT-1, EPT-1	LAT-3	●			----	#1,9,11
C247	POLYGRAPH	↓	RB-3	PT-1	PT-4/LAT-3	●	●		----	#2,5
C301a	CORRIDOR	EXISTING			PT-4/PLAS-1			●	----	----
C301b	CORRIDOR							●	----	----
C301c	CORRIDOR							●	----	----
C302a	CORRIDOR							●	----	----
C303	DORMITORY							●	----	----
C304	DORMITORY							●	----	----
C305	DORMITORY							●	----	----
C306	STAGING		↓	↓				●	PLAM-1, PLAM-2	#3
C307	PANTRY		QTB-1	EPT-1				●	----	#1,4
C308	KITCHEN		↓	↓				●	----	#1,4
C309	CLASSROOM		RB-3	PT-1				●	----	----
C310	DEA							●	----	----
C311	CLOSET							●	----	----
C312	US MARSHALL							●	----	----
C313	CLOSET							●	----	----
C314	FBI							●	----	----
C315	CLOSET							●	----	----
C316	ATF							●	----	----
C317	CLOSET							●	----	----
C318	FUTURE GOVERNMENT							●	----	----
C319	CLOSET							●	----	----
C320	CLOSET		↓	↓				●	----	----
C321	JANITOR		----	EPT-1				●	----	#1,4
C322	CONFERENCE ROOM		RB-3	PT-1				●	----	----
C323	PURCHASING							●	----	----
C324	ALCOVE							●	PLAM-1, PLAM-2	#3
C325	PURCHASING							●	----	----
C326	DATA/COM		↓	↓				●	----	----
C327	TOILET		PCTB-1	PCT-1, EPT-1				●	----	#1,9,11
C328	PENTHOUSE ACCESS		RB-3	PT-1				●	----	#15
C329	TOILET		PCTB-1	PCT-1, EPT-1				●	----	#1,9,11,16
C330	ELECTRICAL	↓	RB-3	PT-1	↓			●	----	----
C401	PENTHOUSE	EXISTING	↓	↓	PT-4/PLAS-2				----	#8,15

Finish Schedule Codes

FLOORING

PORCELAIN TILE
PCT-1 12"x12" TILE PER SECTION 093000 – COLOR: AV203 PENNSYLVANIA BLUE UPS
BLUESTONE SERIES BY CROSSVILLE OR EQUAL

QUARRY TILE
QT-1 6"X6" TILE PER SECTION 093000 – COLOR: NO1(1) LAVA RED
QUARRY NATURALS SERIES BY AMERICAN OLEAN OR EQUAL

RUBBER FLOORING
RF-6 NORAMENT ROUND STAIRTREADS – COLOR: TBD
NORA SYSTEMS INC. OR EQUAL

LUXURY VINYL TILE
LVT-1 4"x36" LUXURY VINYL FLOORING – COLOR: VERMONT CHERRY 3408
VENUE WOOD SERIES BY TANDUS CENTIVA OR EQUAL

LVT-2 18"x18" LUXURY VINYL FLOORING – COLOR: NIMBUS SP113
OPUS SERIES BY KARNDEAN DESIGN FLOORING OR EQUAL

CARPET
CPT-1 24x24 CARPET TILE PER SECTION 096813 – STYLE: T502 RESONATE; COLOR: 50208 AZORES; SPEAK COLLECTION BY MASLAND CONTRACT OR EQUAL

SEALED CONCRETE
SC-1 SEALED CONCRETE SURFACE PER SECTION 099123 – COLOR: CLEAR H&C SOLVENT BASED STAIN BY SHERWIN WILLIAMS OR EQUAL; SUBMIT COLOR SAMPLES TO ARCHITECT FOR APPROVAL

WALLS

PAINT
PT-1 FIELD COLOR – COLOR: TBD, EGG SHELL
SHERWIN-WILLIAMS OR EQUAL PER SECTION 099123
PT-2 ACCENT COLOR – COLOR: TBD, EGG SHELL
SHERWIN-WILLIAMS OR EQUAL PER SECTION 099123
PT-3 TRIM COLOR – COLOR: TBD, GLOSS
SHERWIN-WILLIAMS OR EQUAL PER SECTION 099123
PT-4 STANDARD WHITE, FLAT (CEILINGS)
SHERWIN-WILLIAMS OR EQUAL PER SECTION 099123
EPT-1 EPOXY – COLOR: TBD
SHERWIN-WILLIAMS OR EQUAL PER SECTION 099123

PORCELAIN TILE
PCT-1* 12"x12" TILE PER SECTION 09300 – COLOR: AV203 PENNSYLVANIA BLUE UPS FROM FLOOR TO CEILING AT WET WALLS; FLOOR TO 4'-0 A.F.F. (WITH CORRESPONDING BULLNOSE AT EXPOSED EDGES) AT WALLS 2 FEET FROM URINALS AND WATER CLOSETS; BLUESTONE SERIES BY CROSSVILLE OR EQUAL

*PCT-1 SHALL BE INSTALLED W/FLUSH, GROUTLESS JOINTS. CONTRACTOR SHALL PREPARE 4x4 MOCK-UP FOR APPROVAL

CEILINGS

ACOUSTIC TILE
LAT-3 24"x24" LAY-IN ACOUSTICAL TILE PER SECTION 095100 – DUNE 1775 BEVELED TEGULAR EDGE (24X24) W/ 9/16" SUPRAFINE SUSPENSION SYSTEM BY ARMSTRONG OR EQUAL

LAT-9 24"x24" SECURITY CEILING SYSTEM – SECUREDEK METAL PAN CEILING SYSTEM BY TRUSSBILT OR EQUAL

LAT-10 24"x24"x5/8" LAY-IN ACOUSTICAL TILE – KITCHEN ZONE
SQUARE LAY-IN SMOOTH TEXTURE W/ 15/16" PRELUDE SUSPENSION SYSTEM BY ARMSTRONG OR EQUAL

PAINT
PT-4 FIELD COLOR – COLOR: WHITE, FLAT
SHERWIN-WILLIAMS OR EQUAL PER SECTION 099123

PLASTER
PLAS-1 NEW SUSPENDED PLASTER CEILING; TEXTURE WITH STIPPLED FINISH AND PAINT (PT-4)

PLAS-2 EXISTING EXPOSED STRUCTURE AT CEILINGS (DECKS, BEAMS, STAIRS, ETC.); REMOVE ALL LOOSE MATERIAL & CHIPPING PAINT, PREPARE SURFACE & TEXTURE WITH STIPPLED FINISH AND PAINT (PT-4)

BASE

PORCELAIN TILE BASE
PCTB-1 4x12 BULLNOSE COVE BASE TO CORRESPOND WITH PCT-1. SEE FLOOR TILE.

QUARRY TILE BASE
QTB-1 5x6 COVE BASE TO CORRESPOND WITH QT-1. SEE FLOOR TILE.

RUBBER BASE
RB-3 4" RUBBER BASE – COLOR: 078 UMBER
FLEXCO OR EQUAL

MISCELLANEOUS

QTZ-1 QUARTZ COUNTERTOP PER SECTION 123600 – MYSTIC BLUE CT407 HANSTONE OR EQUAL

PLAM-1 PLASTIC LAMINATE CABINET FACING SURFACES BY SECTION 064100 COLOR: AS SELECTED – MATTE FINISH BY WILSONART OR EQUAL

PLAM-2 PLASTIC LAMINATE COUNTERTOP SURFACES BY SECTION 064100 COLOR: AS SELECTED – MATTE FINISH BY WILSONART OR EQUAL

WD-4 STAIN GRADE WOOD CABINETS – COLOR CHERRY; SUBMIT SAMPLES FOR APPROVAL

CITY OF HATTIESBURG MISSISSIPPI 1882

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Historic Hospital (C)

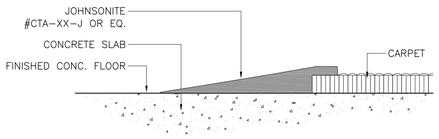
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Date	Rev.	Description
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10-20-2015		75% Progress Set
11-02-2015		90% Pricing Set
11-19-2018		100% Bid Docs

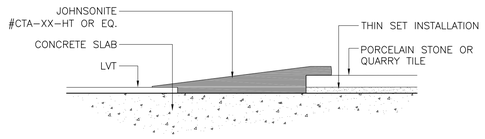
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Checked By: CR,LA,CP
Client No: ------
Albert & Associates: 1257

REGISTERED ARCHITECT Larry M Albert Hattiesburg, MS STATE OF MISSISSIPPI

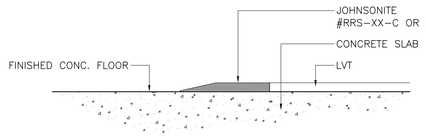
A8.1



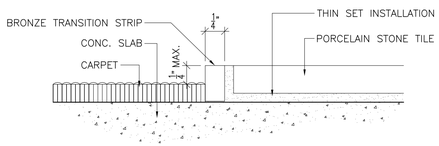
Transition 'A' - Sealed Concrete - Carpet



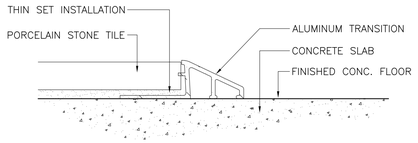
Transition 'B' - LVT - Porcelain/Quarry Tile



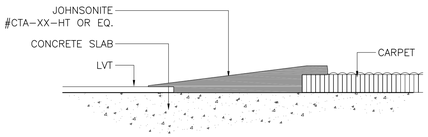
Transition 'C' - Sealed Concrete - LVT



Transition 'D' - Carpet - Porcelain Tile



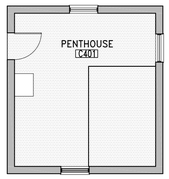
Transition 'E' - Porcelain Tile - Sealed Concrete



Transition 'F' -LVT - Carpet

1 Transition Details

SCALE: Not To Scale



Penthouse Floor Finish Plan

SCALE: 3/32" = 1'-0"

Existing Floor Finish Note

THE ORIGINAL FLOOR FINISHES EXISTS THROUGHOUT ALL FLOORS OF THE HISTORIC HOSPITAL BUILDING, AND GREAT CARE WAS TAKEN THROUGHOUT THE SELECTIVE DEMOLITION OF THE BUILDING'S INTERIOR TO PROTECT THESE FINISHES IN PLACE. ALL FLOORS ARE TERRAZZO WITH THE EXCEPTION OF ONE SMALL AREA OF BLACK AND WHITE, CHECKERBOARD MARBLE TILE AT THE PRIMARY ENTRANCE OF THE FIRST FLOOR; SEE ADJACENT FINISH FLOOR PLANS. THE ORIGINAL TERRAZZO FIELD COLOR IS A LIGHT TERRAZZO WITH A HEAVILY VARIEGATED AGGREGATE, WHILE THE ORIGINAL CORRIDORS OF THE BUILDING FEATURED A DARK TERRAZZO BAND ALONG THEIR PERIMETERS. ALL EXISTING FLOORING IS TO REMAIN IN PLACE, BE CLEANED APPROPRIATELY FOR THEIR TYPE, AND RESTORED TO A LIKE NEW CONDITION.

THERE ARE NUMEROUS LOCATIONS THROUGHOUT THE BUILDING WHERE PORTIONS OF THE TERRAZZO FLOORING IS MISSING DUE TO TWO PRIMARY CAUSES: 1. VARIOUS HOLES THROUGH THE FLOOR SLABS FOR MECHANICAL AND PLUMBING LINES/CHASES AND 2. VARIOUS TRENCHES EXTENDING THE FULL DEPTH OF THE TERRAZZO FINISH WHERE THE ORIGINAL INTERIOR PARTITIONS WERE LOCATED. IN LOCATIONS WHERE HOLES EXIST IN THE FLOOR SLABS THAT WILL NOT BE CONCEALED BY THE NEW CONSTRUCTION, THE CONCRETE SLABS MUST BE PATCHED FOR APPLICATION OF NEW FINISHED FLOORING. THE TRENCHES CAUSED THE ORIGINAL INTERIOR PARTITIONS RUNNING PARALLEL TO THE CORRIDOR OCCUR WITHIN THE DARK TERRAZZO PERIMETER BAND; THESE ARE TO BE PATCHED TO MATCH THE ORIGINAL DARK TERRAZZO COLOR AS CLOSELY AS POSSIBLE. ALL OTHER TRENCHES DUE TO THE ORIGINAL INTERIOR PARTITIONS ARE LOCATED IN A LIGHT TERRAZZO FIELD COLOR; THE COLOR OF THE PATCHING TERRAZZO IS NOT TO MATCH THIS EXISTING COLOR IN THESE LOCATIONS. THE LIGHT TERRAZZO PATCH COLOR IS TO BE A SIMILAR BUT SUBTLY DIFFERENT COLOR.

ALL INITIAL REPAIR TERRAZZO MIXES ARE TO BE PREPARED ON-SITE WITH THE ARCHITECT PRESENT FOR REVIEW OF COLORS TO MATCH/COMPLEMENT THE EXISTING TERRAZZO FINISHES. THE INSTALLER MUST BE ABLE TO ADJUST COLORS ON-SITE AS REQUIRED TO PRODUCE AN APPROPRIATE MIXTURE TO RECEIVE AN APPROVAL OF THE REQUIRED COLORS. ONCE COLORS HAVE BEEN APPROVED, A MOCKUP OF THE TERRAZZO PATCHING FOR ALL COLORS SHALL BE PROVIDED IN AN INCONSPICUOUS LOCATION, AS DIRECTED BY ARCHITECT, FOR APPROVAL OF THE FINISHED PRODUCT BEFORE WORK BEGINS ON THE REMAINING TERRAZZO REPAIRS.

Finish Floor Plan Legend

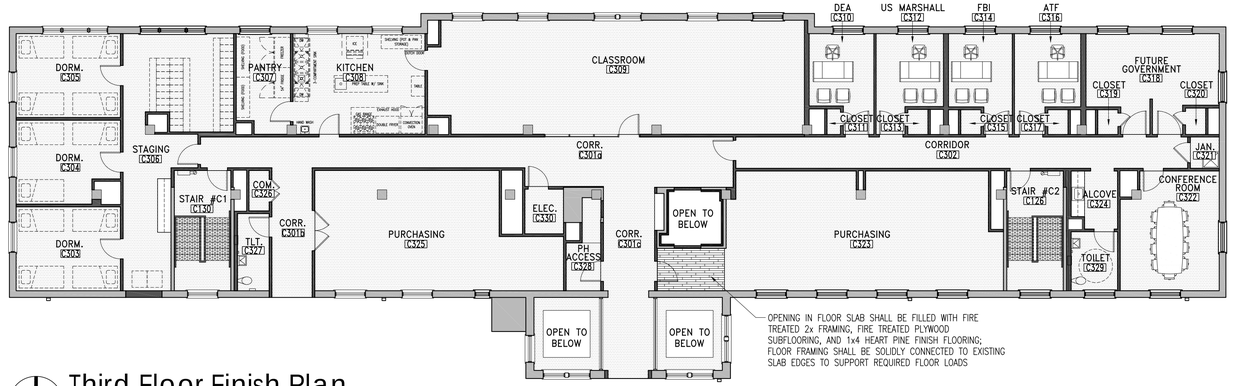
- EXISTING TERRAZZO FLOOR FINISH (SEE EXISTING FLOOR FINISH NOTE ON THIS SHEET)
- EXISTING MARBLE FLOOR FINISH (SEE EXISTING FLOOR FINISH NOTE ON THIS SHEET)
- RF-6 – RUBBER STAIR TREADS

General Finish Notes

1. ALL FLOORS TO BE PROPERLY PREPPED AND FLOATED AS NECESSARY.
2. ALL EXPOSED LOUVERS, REGISTERS, VENTS, ETC. ARE TO BE PAINTED TO MATCH SURROUNDING CONDITIONS.
3. AT ALL FLOORING PRODUCT TRANSITIONS, PROVIDE NECESSARY ACCESSIBLE TRANSITION MATERIALS. SEE THIS SHEET FOR THRESHOLD/FLOORING TRANSITION DETAILS.
4. ALL PORCELAIN TILE FLOORING TO MEET OR EXCEED STATIC COEFFICIENT OF FRICTION (SLIP RESISTANCE) A.D.A. STANDARD OF 0.60 FOR ACCESSIBLE ROUTES.
5. APPLY THOROUGH WATERPROOFING MASTIC BEHIND ALL WALL TILE, FLOOR TILE, AND CURB TILE IN RESTROOMS.
6. ALL EXPOSED STEEL IS TO BE PRIMED AND PAINTED PER SECTION 9 SPECIFICATIONS; INCLUDING BUT NOT LIMITED TO: STAIRS INCLUDING HANDRAILS, STRINGERS, STAIR PANS, ETC.
7. SUBMIT COLOR SAMPLES FOR ALL PRODUCTS TO ARCHITECT FOR APPROVAL.

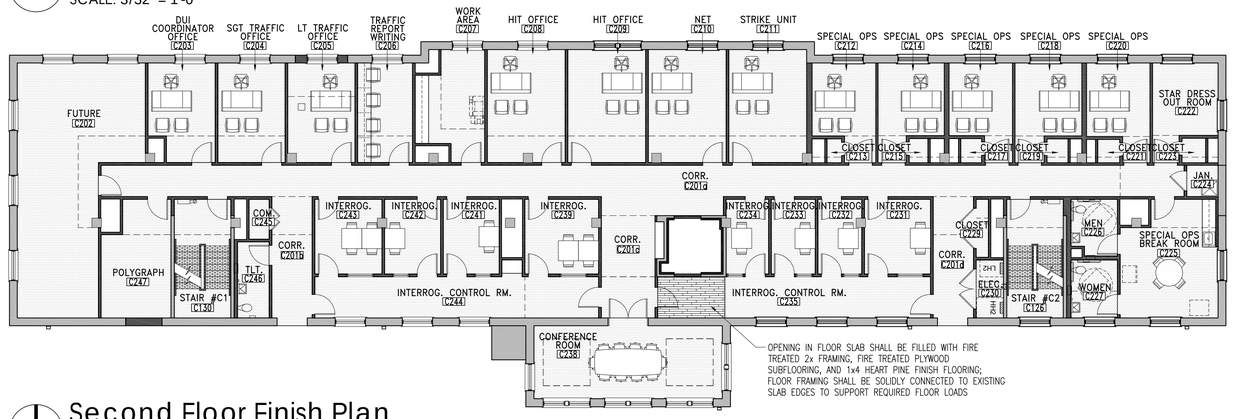
General Plan Notes

1. CONTRACTOR TO CONSULT ARCHITECT IMMEDIATELY IF DISCREPANCIES ARE FOUND BETWEEN ARCHITECTURAL AND ENGINEERING DRAWINGS
2. SEE A2.x SHEETS FOR FLOOR PLANS.
3. SEE A3.x SHEETS FOR ROOF PLANS.
4. SEE A4.x SHEETS FOR REFLECTED CEILING PLANS.
5. SEE A5.x SHEETS FOR EXTERIOR ELEVATIONS AND WINDOW SCHEDULE/WINDOW ELEVATIONS.
6. SEE A6.x SHEETS FOR BUILDING SECTIONS.
7. SEE A7.x SHEETS FOR DOOR SCHEDULE/FRAME ELEVATIONS.
8. SEE A8.x SHEETS FOR FINISH SCHEDULE AND FINISH FLOOR PLANS.
9. SEE A9.x SHEETS FOR INTERIOR ELEVATIONS.



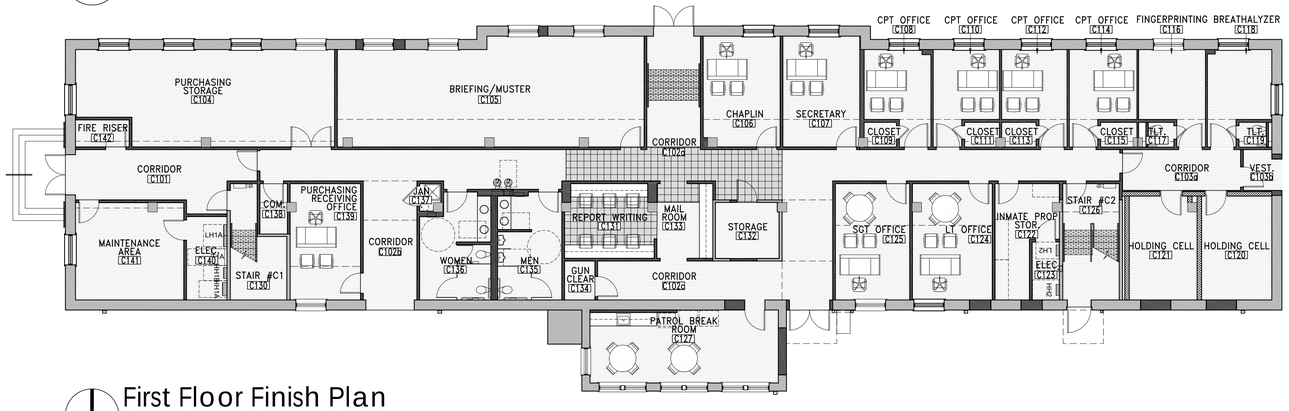
Third Floor Finish Plan

SCALE: 3/32" = 1'-0"



Second Floor Finish Plan

SCALE: 3/32" = 1'-0"



First Floor Finish Plan

SCALE: 3/32" = 1'-0"

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Historic Hospital (C)

Drawing Issued:

Date	Rev.	Description
08-31-2015		DD Check Set
10-20-2015		75% Progress Set
11-02-2015		90% Pricing Set
11-19-2018		100% Bid Docs

Drawn By:	SN,RB,AS
Checked By:	CR,LA,CP
Client No:	------
Albert & Associates:	12575

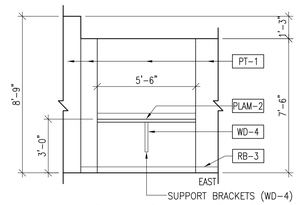
REGISTERED ARCHITECT Larry M Albert Hattiesburg, MS STATE OF MISSISSIPPI

A8.2

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com **Albert & McCleskey Associates Architects**

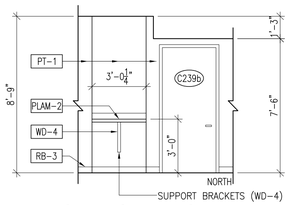
Interior Elevations Note

REFER TO SHEET A8.1 FOR FINISH SCHEDULE AND CODES



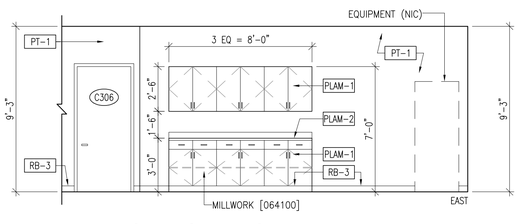
9 Interior Elevations

SCALE: 1/4" = 1'-0" CORRIDOR C201c



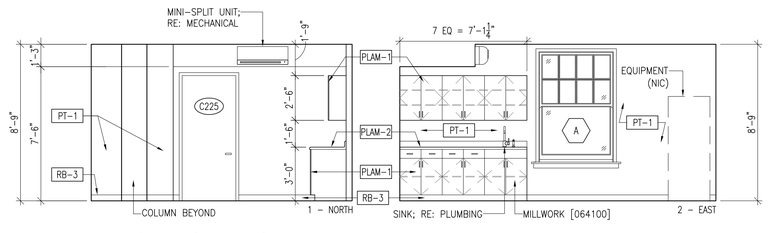
8 Interior Elevations

SCALE: 1/4" = 1'-0" INTERROG. CONTROL RM C244



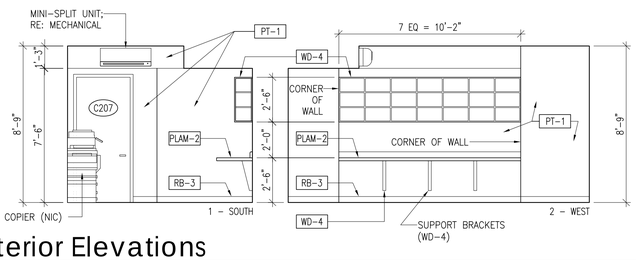
7 Interior Elevations

SCALE: 1/4" = 1'-0" STAGING C306a



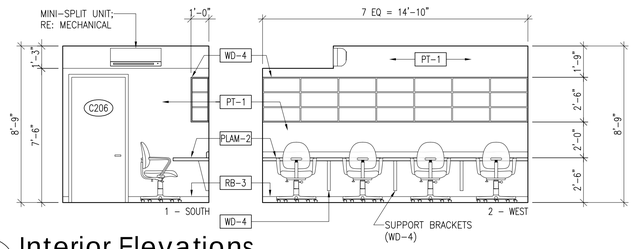
6 Interior Elevations

SCALE: 1/4" = 1'-0" BREAKROOM C225



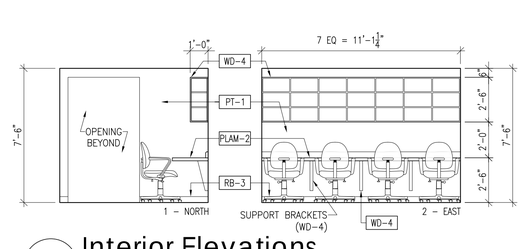
5 Interior Elevations

SCALE: 1/4" = 1'-0" WORK AREA C207



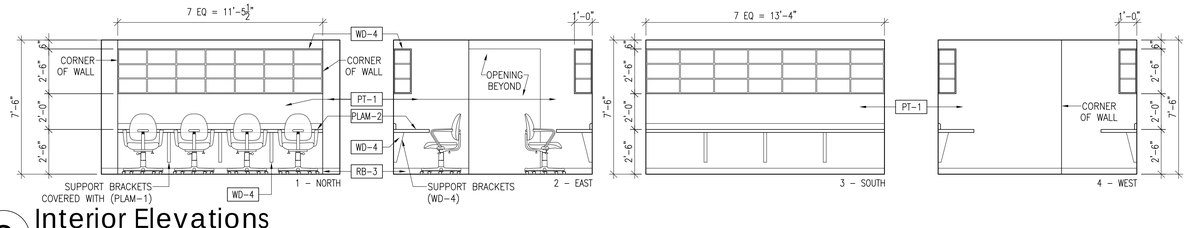
4 Interior Elevations

SCALE: 1/4" = 1'-0" TRAFFIC REPORT WRITING C206



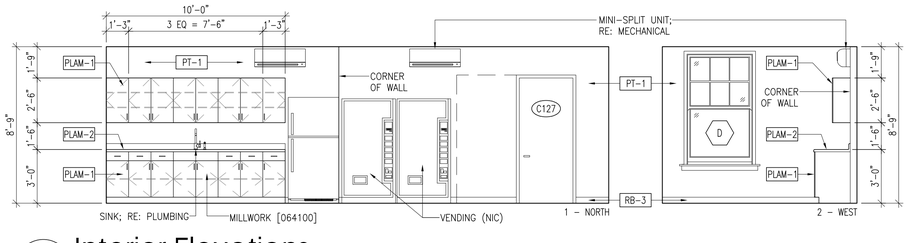
3 Interior Elevations

SCALE: 1/4" = 1'-0" MAILROOM C133



2 Interior Elevations

SCALE: 1/4" = 1'-0" REPORT WRITING C131



1 Interior Elevations

SCALE: 1/4" = 1'-0" PATROL BREAKROOM C127

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Checked By: CR,LA,CP

Client No: ------

Albert & Associates: 12575

REGISTERED ARCHITECT Larry A. Albert Jr. Hattiesburg, MS STATE OF MISSISSIPPI

A9.1

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com **Albert & McCleskey Associates Architects**

PLUMBING ABBREVIATIONS

ABBREVIATIONS – PLUMBING	
AAV	AIR ADMITTANCE VALVE
AD	ACCESS DOOR
AHU	AIR HANDLING UNIT
AS	AIR SEPARATOR
BTU	BRITISH THERMAL UNIT
CFM	CUBIC FEET PER MINUTE
CTG	CEILING TRANSFER GRILLE
CG	CEILING GRILLE
CO	CLEAN OUT
CU	CONDENSING UNIT
CW	DOMESTIC COLD WATER
DIA	DIAMETER
DN	DOWN
ET	EXPANSION TANK
EWH	ELECTRIC WATER HEATER
EWT	ENTERING WATER TEMPERATURE
°F	DEGREES FAHRENHEIT
FC	FLEXIBLE CONNECTION (DUCT OR PIPE)
FLR	FLOOR
FT	FEET
GF	GAS FURNACE
GPM	GALLONS PER MINUTE
GWH	GAS WATER HEATER
HP	HORSE POWER
HR	HOUR
HW	HOT WATER

ABBREVIATIONS – PLUMBING	
ID	INSIDE DIMENSION
KW	KILOWATT
LBS	POUNDS
MAX	MAXIMUM
MBH	THOUSAND BTU PER HOUR
MFG	MANUFACTURER
MIN	MINIMUM
MUA	MAKE UP AIR UNIT
NC	NORMALLY CLOSED
NIC	NOT IN THIS CONTRACT
NO	NORMALLY OPEN
NTS	NOT TO SCALE
P	PUMP
PRV	PRESSURE REDUCING VALVE
PSI	POUNDS PER SQUARE INCH (GAUGE)
RPM	REVOLUTIONS PER MINUTE
RP	RECIRC PUMP
SQFT	SQUARE FEET
TYP	TYPICAL
VTR	VENT THRU ROOF
W/	WITH
EW	EXISTING DOMESTIC WATER
EDCW	EXISTING DOMESTIC COLD WATER
EDHW	EXISTING DOMESTIC HOT WATER
EDHWR	EXISTING DOMESTIC HOT WATER RECIRC
EG	EXISTING GAS (NATURAL)

PLUMBING LEGEND

PIPING LEGEND

	DOMESTIC COLD WATER
	DOMESTIC HOT WATER (110°)
	DOMESTIC HOT WATER RECALCULATING LINE (110°)
	SANITARY WASTE
	PLUMBING VENT
	PRIMARY STORM DRAIN
—OF—	SECONDARY OVERFLOW STORM
—CD—	CONDENSATE DRAIN
—PC—	PUMPED CONDENSATE
—F—	FIRE PROTECTION
—F—	SIDEWALL SPRINKLER HEAD
	CONCEALED FIRE SPRINKLER HEAD
	FIRE SPRINKLER UPRIGHT PENDANT
WCO	WALL CLEANOUT
CO	CLEANOUT (ABOVE CEILING OR OVERHEAD)
FFCO	FLUSH FLOOR CLEANOUT
FGCO	FLUSH GRADE CLEANOUT
	2-WAY FLUSH GRADE CLEAN OUT
	HOSE BIBB
	CONCRETE THRUST BLOCK
FM	FLOW METER
FS	FLOW SWITCH
	FIRESTOPPING
	PIPE SLEEVE
	BEAM PENETRATION
	PIPE CAP
	PIPE BLIND FLANGE
	UNION
	SHUT-OFF VALVE
	NORMALLY CLOSED SHUT-OFF VALVE

PIPING LEGEND (CONT.)

	GLOBE VALVE
	CHECK VALVE
	AUTOMATIC THREE-WAY CONTROL VALVE
	AUTOMATIC TWO-WAY CONTROL VALVE
	RELIEF VALVE
	ANGLE RELIEF VALVE
	PRESSURE REDUCING VALVE (PRV)
	LUBRICATED PLUG VALVE
	SOLENOID VALVE
	BUTTERFLY VALVE (MANUAL)
	BALL VALVE
	PUMP
	REFRIGERANT EXPANSION VALVE
	SIGHT GLASS
	MANUAL AIR VENT
	AUTOMATIC AIR VENT
	THERMOMETER
	PIPE SENSOR WELL (THERMOMETER)
	PRESSURE GAUGE AND COCK
	PRESSURE GAUGE WITH LOOP
	TEMPERATURE-PRESSURE TEST FITTING
	CENTER LINE
P 1	PLUMBING RISER DESIGNATION
	NEW CONNECTION TO EXISTING PIPING, DUCTWORK AND/OR EQUIPMENT

SHEET INDEX – PLUMBING

SHEET	TITLE
P□□□	PLUMBING LEGEND AND ABBRE□IATIONS
P□□□	FIRST FLOOR PLAN PART C □PLUMBING DEMOLITION
P□□□	SECOND FLOOR PLAN PART C □PLUMBING DEMOLITION
P□□□	THIRD FLOOR PLAN PART C □PLUMBING DEMOLITION
P□□□	FIRST FLOOR PLAN PART C □PLUMBING
P□□□	SECOND FLOOR PLAN PART C □PLUMBING
P□□□	THIRD FLOOR PLAN PART C □PLUMBING
P□□□	ROOF PLAN PART C □PLUMBING
P□□□	PLUMBING RISERS
P□□□	COLD □ ATER SCHEMATIC
P□□□	HOT □ ATER SCHEMATIC
P□□□	PLUMBING DETAILS
P□□□	PLUMBING SCHEDULES
FP□□□	FIRST FLOOR PLAN PART C □FIRE PROTECTION
FP□□□	SECOND FLOOR PLAN PART C □FIRE PROTECTION
FP□□□	THIRD FLOOR PLAN PART C □FIRE PROTECTION
FP□□□	ROOF PLAN PART C □FIRE PROTECTION
FP□□□	FIRE PROTECTION DETAILS

GENERAL NOTES:

1 CONTRACTOR IS RESPONSIBLE FOR COORDINATING ALL PLUMBING AND FIRE PROTECTION INSTALLATIONS WITH OTHER TRADES SUCH AS ELECTRICAL, STRUCTURAL, HVAC, LIGHTING, CEILING CONSTRUCTION AND SUPPORTS, ETC. ANY CONFLICTS ARISING OUT OF A LACK OF CONSTRUCTION COORDINATION OR DUE TO LACK OF CONSIDERATION FOR THE NEEDS OF OTHER TRADES SHALL BE RESOLVED AT NO EXPENSE TO THE OWNER.

2 ALL PIPING SHALL BE INSTALLED IN SUCH A MANNER THAT CONFLICTS WITH AIR CONDITIONING DUCTS AND WITH CEILING LIGHTS WILL NOT OCCUR. IN SOME INSTANCES, WHERE INDICATED, PIPING SHALL BE INSTALLED WITH SLEEVES THROUGH BEAMS. CONTRACTOR SHALL BE RESPONSIBLE FOR FURNISHING THE SIZES OF SLEEVES AND THE ELEVATIONS AT WHICH OPENINGS ARE TO BE MADE PRIOR TO INSTALLATION OF STRUCTURAL MEMBERS.

3 FOR EVERY PIPE SLEEVE PENETRATING FIRE RATED WALLS AND SLABS, USE 3M OR EQUIVALENT FIRE BARRIER WRAP STRIP FS-165, 3M CAULK CP 25 AND 3M PUTTY 303, ASTM E-814, U.L. LISTED, CAPABLE OF RAPID EXPANSION WHEN EXPOSED TO HEAT. COMPLIES WITH BOCA, ICBO AND SSBC. PROVIDES 3 HOUR FIRE RATING.

4 ALL SANITARY AND STORM DRAINAGE PIPING SHALL BE INSTALLED AT 1/8" PER FOOT SLOPE UNLESS OTHERWISE NOTED. FIXTURE ARMS AND SMALL BRANCHES SHALL BE SLOPED IN ACCORDANCE WITH THE STANDARD PLUMBING CODE.

5 PROVIDE ACCESS PANELS FOR SHOCK ABSORBERS, VALVES AND CLEANOUT COVERS FOR CLEANOUT PLUGS AS SPECIFIED. EACH ITEM SHALL BE PROVIDED WITH ITS ACCESS PANEL OR COVER. ACCESS PANELS AND CLEANOUT COVERS SHALL BE EASILY ACCESSIBLE AND CONTRACTOR WILL BE RESPONSIBLE FOR LOCATING THESE ITEMS SO THAT SHOCK ABSORBER, VALVE OR CLEANOUT LIES WITHIN WALL OR CEILING IMMEDIATELY BEHIND COVER OR PANEL. CONTRACTOR SHALL COORDINATE THE LOCATION OF PANELS AND COVERS WITH OTHER TOILET ACCESSORIES AND FIXTURES AS WELL AS ARCHITECTURAL LAYOUT.

6 DURING FINAL PUNCH LIST INSPECTION, CONTRACTOR SHALL HAVE ALL CLEANOUT COVERS AND ACCESS PANELS OPENED AND ITEMS EXPOSED FOR VERIFICATION AS TO THEIR INSTALLATION BY CONTRACTING OFFICER.

7 PROVIDE AUTOMATIC RESEALS FOR ALL FLOOR DRAINS.

8 SPRINKLER HEAD LOCATIONS SHALL BE SYMMETRICAL WITH ROOM, LIGHTS, DIFFUSERS, ETC. AND COORDINATE WITH THE REFLECTIVE CEILING PLANS. HEADS SHALL BE AS FOLLOWS.

A. LAY-IN CEILING SHALL HAVE SEMI-RECESSED HEADS WITH ESCUTCHEON COLOR SELECTED BY THE ARCHITECT.

B. SHEET ROCK OR PLASTER CEILINGS SHALL HAVE FULLY CONCEALED HEADS WITH COLOR OF CAP SELECTED BY THE ARCHITECT.

9 ALL PIPING TO COMPLY WITH 2012 IBC SEISMIC DESIGN CATEGORY C, OCCUPANCY CATEGORY IV.

CITY OF HATTIESBURG MISSISSIPPI 1884

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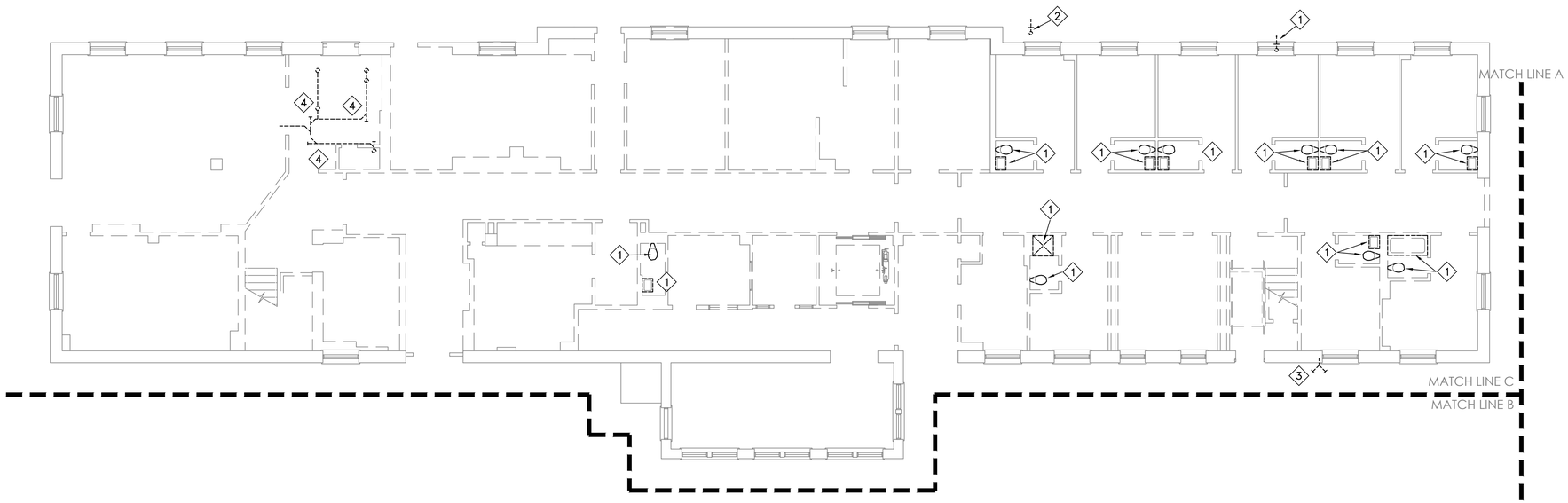
Engineering Resource Group, Inc.
350 Edgewood Terrace Drive
Jackson, MS 39206
Phone: (601) 362-3552
Fax: (601) 366-6418
ERG# 15-28.2

PLAN NOTES:

1. EXISTING PLUMBING FIXTURE AND ALL RELATED PIPING TO BE REMOVED.
2. EXISTING HOSE BIBB COMING UP FROM GROUND AND ALL RELATED PIPING TO BE REMOVED.
3. EXISTING FIRE DEPARTMENT CONNECTION ON SIDE OF BUILDING, AND ALL RELATED PIPING TO BE REMOVED.
4. INDICATES EXISTING PIPING SPOTTED DURING FIELD VISIT. REMOVE PIPING IN ITS ENTIRETY.

GENERAL NOTES:

1. DUE TO THE LACK OF EXISTING DRAWINGS THROUGH-OUT THE YEARS, REMOVE ALL EXISTING PIPING THROUGHOUT ENTIRE BUILDING INCLUDING DOMESTIC HOT AND COLD WATER SYSTEMS, WATER HEATERS, PUMPS, SANITARY SEWER AND VENT, FLOOR DRAINS, AND ANY PLUMBING FIXTURE NOT INDICATED ON THIS DRAWING. PRIOR VISIT TO THE SITE SHOULD BE CONSIDERED TO GET AN IDEA TO THE SCOPE OF WORK.



FIRST FLOOR PLAN PART C – PLUMBING DEMOLITION
SCALE: 1/8" = 1'-0"

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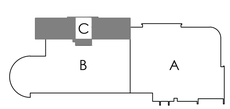
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11/3/2017
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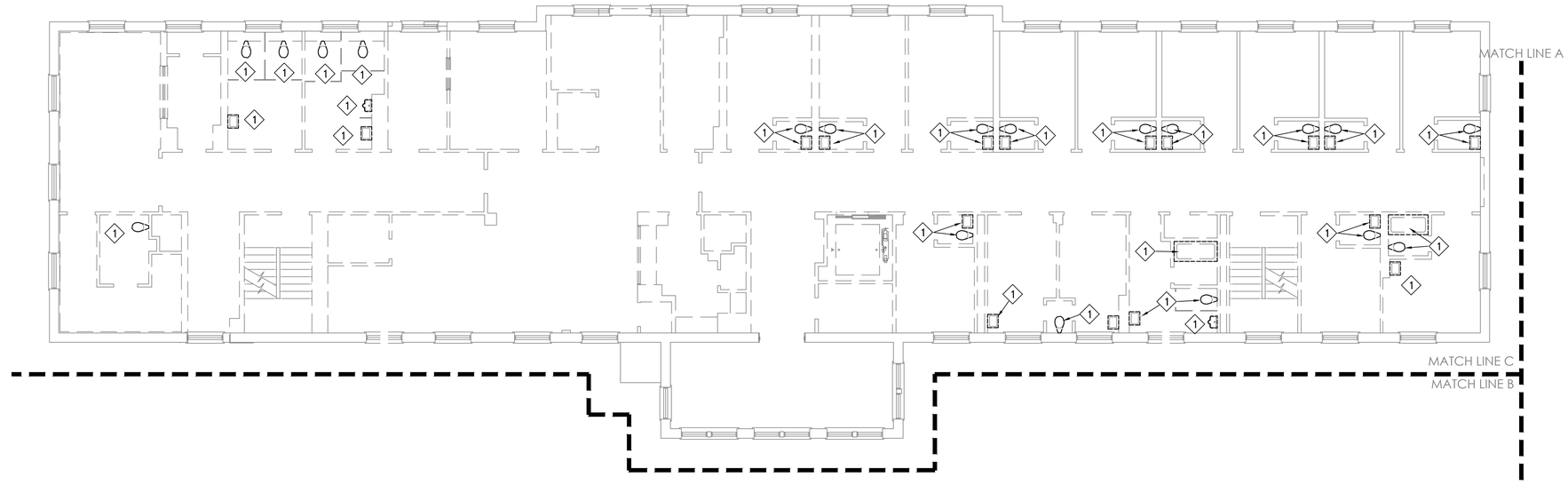
ERG# 15-28.2

PLAN NOTES:

1 EXISTING PLUMBING FIXTURE AND ALL RELATED PIPING TO BE REMOVED.

GENERAL NOTES:

1. DUE TO THE LACK OF EXISTING DRAWINGS THROUGH-OUT THE YEARS, REMOVE ALL EXISTING PIPING THROUGHOUT ENTIRE BUILDING INCLUDING DOMESTIC HOT AND COLD WATER SYSTEMS, WATER HEATERS, PUMPS, SANITARY SEWER AND VENT, FLOOR DRAINS, AND ANY PLUMBING FIXTURE NOT INDICATED ON THIS DRAWING. PRIOR VISIT TO THE SITE SHOULD BE CONSIDERED TO GET AN IDEA TO THE SCOPE OF WORK.



SECOND FLOOR PLAN PART C – PLUMBING DEMOLITION
SCALE: 1/8" = 1'-0"

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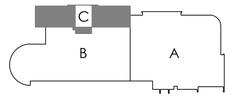
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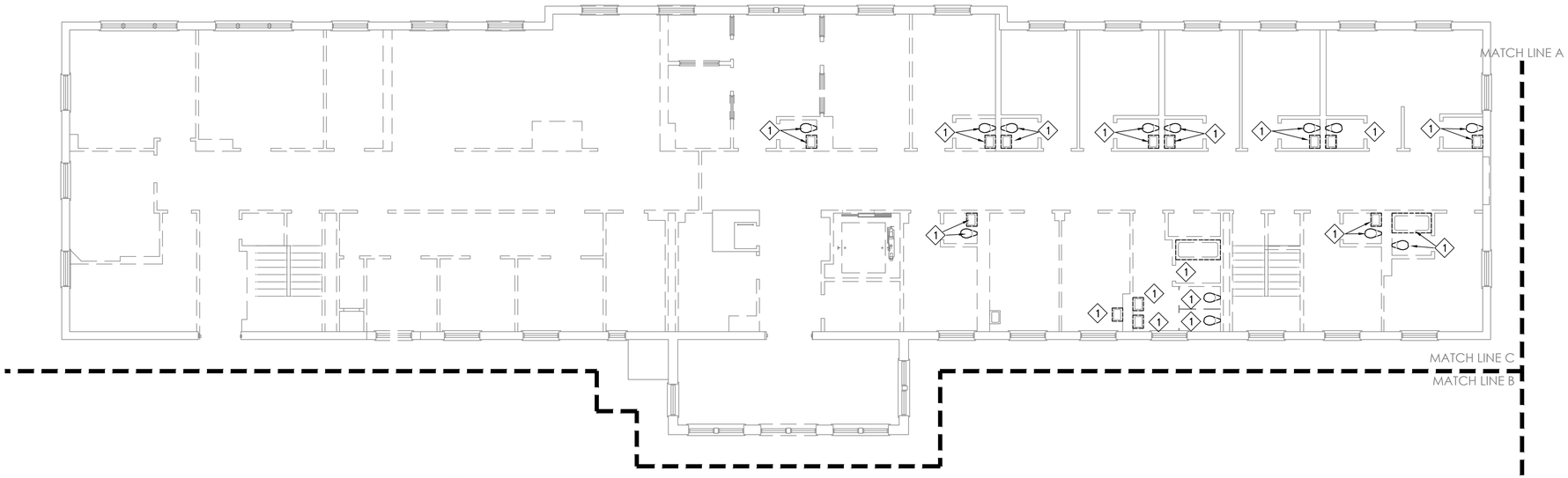
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PLAN NOTES:

1 EXISTING PLUMBING FIXTURE AND ALL RELATED PIPING TO BE REMOVED.

GENERAL NOTES:

1. DUE TO THE LACK OF EXISTING DRAWINGS THROUGH–OUT THE YEARS, REMOVE ALL EXISTING PIPING THROUGHOUT ENTIRE BUILDING INCLUDING DOMESTIC HOT AND COLD WATER SYSTEMS, WATER HEATERS, PUMPS, SANITARY SEWER AND VENT, FLOOR DRAINS, STORM WATER SYSTEM AND ANY PLUMBING FIXTURE NOT INDICATED ON THIS DRAWING. PRIOR VISIT TO THE SITE SHOULD BE CONSIDERED TO GET AN IDEA TO THE SCOPE OF WORK.



THIRD FLOOR PLAN PART C – PLUMBING DEMOLITION

SCALE: 1/8" = 1'-0"

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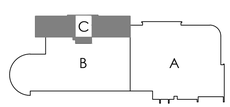
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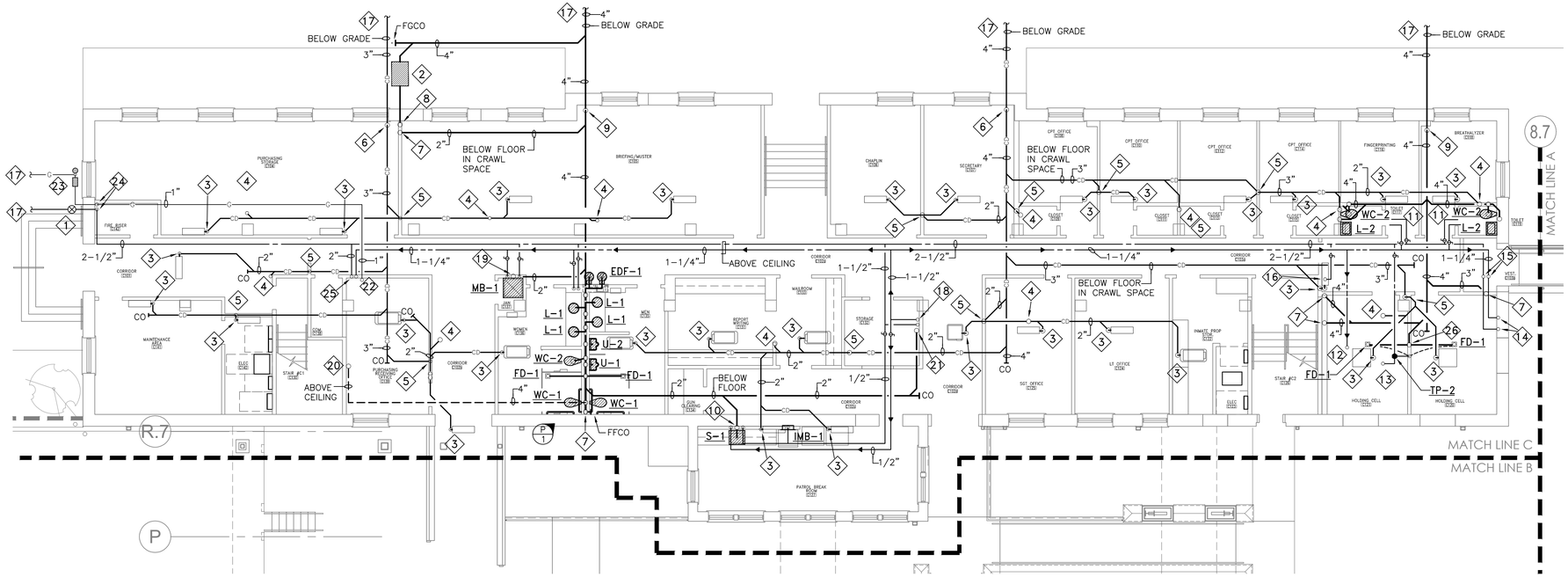
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NUMBERED NOTES:

1. DOMESTIC WATER HEATER AND CUT-OFF VALVE IN HEAVY DUTY BOX WITH COVER.
2. GREASE TRAP. SEE DETAIL.
3. 1-1/2" CONDENSATE FROM A/C UNIT. INSULATE PIPING PER SPECIFICATIONS.
4. CONDENSATE PIPING FROM FLOOR ABOVE. INSULATE PIPING PER SPECIFICATIONS.
5. 2" CONDENSATE PIPING DOWN TO BELOW FLOOR IN CRAWL SPACE.
6. CONDENSATE PIPE DOWN TO BELOW GRADE IN CRAWL SPACE.
7. WASTE FROM FLOOR ABOVE AND DOWN TO CRAWL SPACE.
8. GREASE WASTE FROM ABOVE. CONTINUE TO BELOW GRADE AND GREASE TRAP.
9. 4" WASTE IN CRAWL SPACE TO DROP DOWN TO BELOW FLOOR.
10. INSTALL AIR ADMITTANCE VALVE IN WALL BEHIND SINK.
11. 1-1/4" C.W. AND 1/2" H.W. TO CONTINUE TO WC-2 AND L-2.
12. 3/4" H.W. UP TO FLOOR ABOVE.
13. 1/2" C.W. UP TO ICE MAKER BOX.
14. 1/2" C.W. AND 1/2" H.W. UP TO SINK ON FLOOR ABOVE.
15. 1-1/4" H.W. AND 3/4" C.W. UP TO FLOOR ABOVE.
16. 2" C.W. UP TO FLOOR ABOVE.
17. CONTINUATION UNDER ANOTHER DIVISION.
18. 1-1/2" C.W. TO WATER HEATER IN PENTHOUSE AND 1-1/2" H.W. FROM WATER HEATER IN PENTHOUSE.
19. INSTALL AIR ADMITTANCE VALVE IN WASTE STACK ABOVE CLG.
20. 4" VENT UP TO FLOOR ABOVE.
21. 2"WASTE FROM ABOVE. CONTINUE TO CRAWL SPACE.
22. GAS PIPING UP TO ATTIC/PENTHOUSE LEVEL TO WATER HEATER.
23. GAS METER AND REGULATOR BY UTILITY COMPANY AT OWNER'S EXPENSE. SIZE FOR 1300 CFH. REGULATOR TO REDUCE PRESSURE TO 2 LBS. ENTER BUILDING ABOVE GRADE WITH GAS COCK.
24. COLD WATER AND GAS PIPING TO RISE TO ABOVE CEILING.
25. 1-1/4" HOT WATER AND 2" COLD WATER UP TO FLOOR ABOVE
26. INSTALL 2" AIR ADMITTANCE VALVE ABOVE CEILING.



FIRST FLOOR PLAN PART C – PLUMBING

SCALE: 1/8" = 1'-0"

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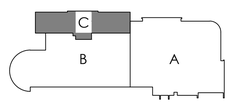
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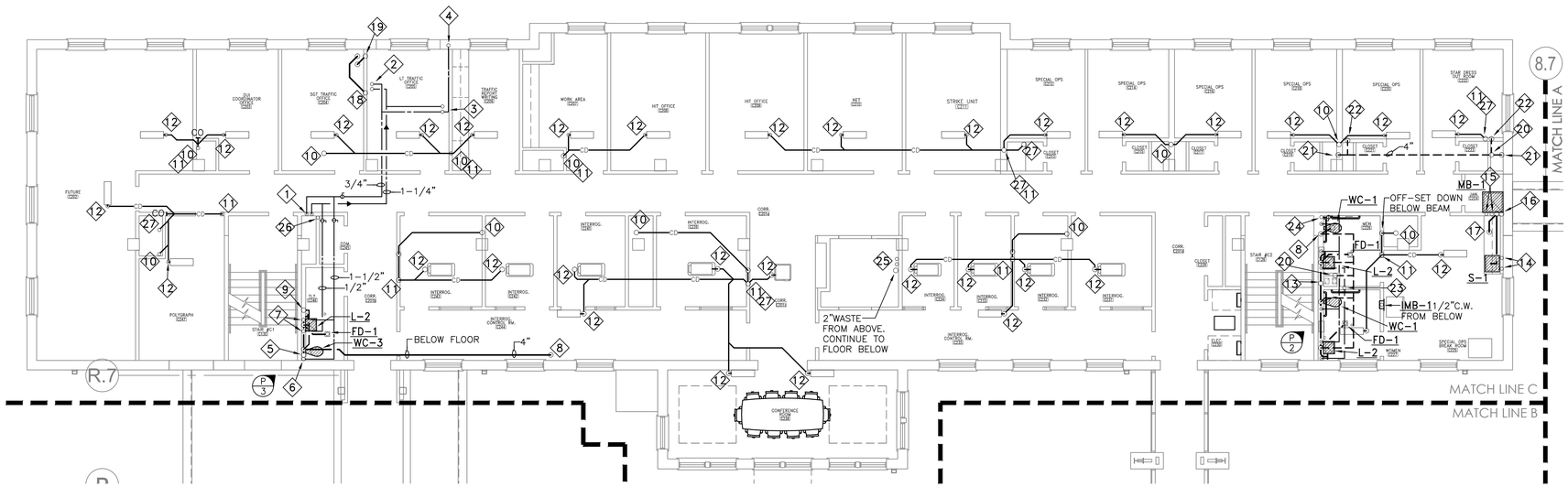


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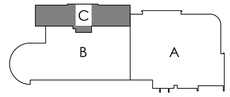
NUMBERED NOTES:

1. 1-1/2" C.W. AND 1-1/4" H.W. FROM FLOOR BELOW. RISE TO ABOVE CLG.
2. 1" H.W. AND 3/4" C.W. TO RISE TO FLOOR ABOVE.
3. 1/2" H.W. AND 1/2" C.W. TO RISE TO SINK IN KITCHEN ISLAND ON FLOOR ABOVE.
4. 1/2" C.W. TO RISE TO FLOOR ABOVE TO ICE MAKER BOX IN KITCHEN.
5. 4" WASTE FROM FLOOR ABOVE CONTINUE TO BELOW FLOOR AND OFFSET AS SHOWN.
6. 1-1/2" C.W. TO SUPPLY WATER CLOSETS ON THIS FLOOR AND THE FLOOR ABOVE. PROVIDE 1" C.W. TO EACH.
7. 1/2" H.W. AND C.W. TO SERVE THIS LAVATORY AND THE LAVATORY ON THE FLOOR ABOVE.
8. 4" WASTE DOWN TO FLOOR BELOW.
9. 4" VENT FROM FLOOR BELOW. CONTINUE TO FLOOR ABOVE.
10. 2" CONDENSATE FROM FLOOR ABOVE. INSULATE PER SPECIFICATIONS.
11. 2" CONDENSATE DOWN TO FLOOR BELOW. INSULATE PER SPECIFICATIONS.
12. 1-1/2" CONDENSATE FROM A/C UNIT. CONNECT TO PER MANUFACTURES RECOMMENDATIONS. INSULATE PER SPECIFICATIONS.
13. 4" WASTE STACK FROM ABOVE CONTINUE DOWN TO FLOOR BELOW.
14. 1/2" C.W. AND H.W. FROM FLOOR BELOW. CONNECT TO NEW SINK WITH CUT-OFF VALVES.
15. 1-1/4" H.W. AND 3/4" C.W. FROM BELOW, AND RISE TO FLOOR ABOVE. INSTALL NEW MB-1 AND CONNECT TO NEW SERVICES IN WALL AND PROVIDE NEW CUT-OFF VALVES.
16. 3" WASTE AND VENT STACK FROM ABOVE. CONNECT TO MB-1.
17. 3" WASTE DOWN TO FLOOR BELOW.
18. 4" GREASE WASTE FROM ABOVE. OFF-SET ABOVE CEILING AND DROP TO FLOOR BELOW.
19. 2" WASTE FROM ABOVE. OFF-SET ABOVE CEILING CEILING AND DROP TO FLOOR BELOW.
20. 4" VENT TO FLOOR ABOVE.
21. 2" VENT FROM FLOOR BELOW.
22. 4" VENT FROM FLOOR BELOW.
23. 3/4" HOT WATER FROM FLOOR BELOW. CONTINUE TO FLOOR ABOVE WITH 3/4".
24. 2" C.W. STACK FROM FLOOR BELOW. RISE TO FLOOR ABOVE. PROVIDE 1-1/2" COLD WATER OR THIS FLOOR. CONTINUE TO FLOOR ABOVE WITH 1-1/4".
25. 1-1/2" HOT WATER AND 1-1/2" COLD WATER FROM BELOW. CONTINUE TO FLOOR ABOVE.
26. GAS PIPING UP TO FLOOR ABOVE.
27. 1-1/2" CONDENSATE FROM FLOOR ABOVE.



SECOND FLOOR PLAN PART C – PLUMBING

SCALE: 1/8" = 1'-0"



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HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT

HPSC Historic Hospital (C)

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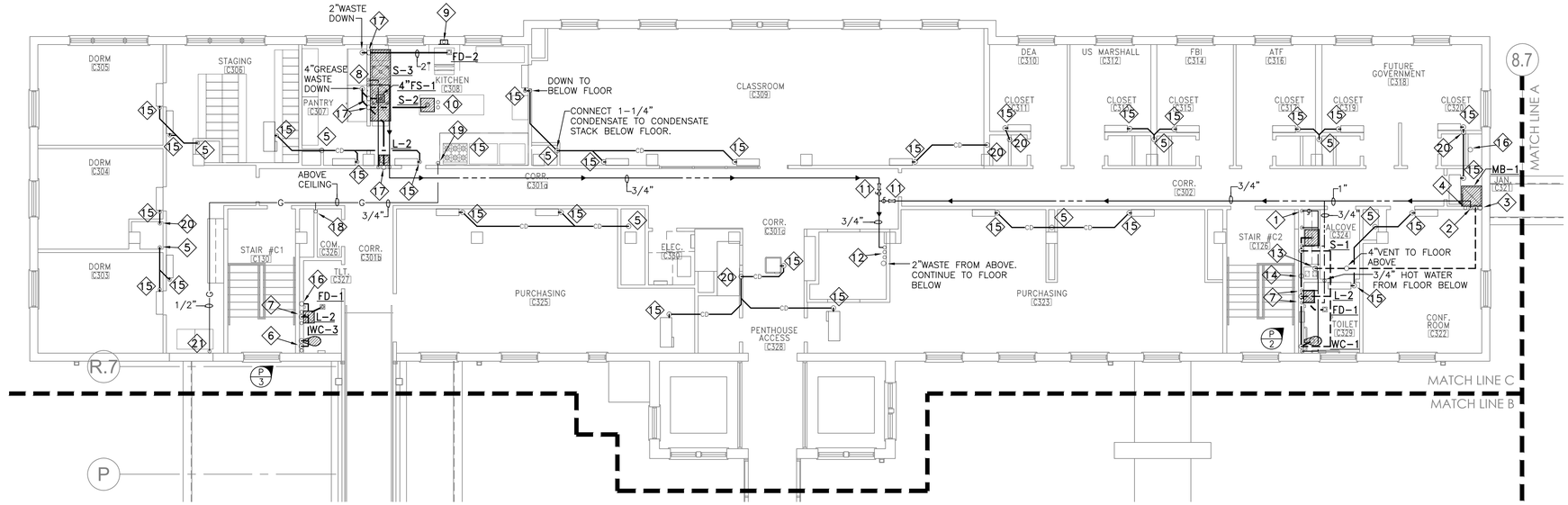
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P2.2

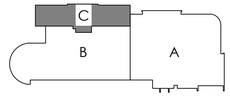
NUMBERED NOTES:

1. 1-1/4" C.W. FROM FLOOR BELOW. RISE TO ABOVE U
2. 1" H.W. FROM FLOOR BELOW. RISE TO ABOVE CLG. INSTALL 1/2" H.W. TO MB-1 W/ CUT-OFF VALVE.
3. 2" WASTE STACK AND 2" VENT STACK FROM BELOW, TO FLOOR ABOVE.
4. 1/2" C.W. FROM BELOW TO MB-1.
5. 2" CONDENSATE DOWN TO FLOOR BELOW. INSULATE WITH 3/4" ARMAFLEX.
6. 4" WASTE AND 4" VENT STACK FROM FLOOR BELOW. CONNECT WATER CLOSET TO SERVICES IN WALL. 1" C.W. FROM BELOW. CONNECT C.W. TO WC-3 F.V.
7. NEW 1/2" H.W. AND 1/2" C.W. FROM BELOW. 2" WASTE/VENT STACK FROM BELOW. CONTINUE VENT TO FLOOR ABOVE. CONNECT NEW L-2 TO SERVICES IN WALL.
8. 1-1/4" C.W. AND H.W. FROM BELOW. CONTINUE TO ABOVE CLG. PROVIDE 3/4" C.W. AND H.W. TAPS TO S-3 W/ CUT-OFF VALVES.
9. 1/2" C.W. FROM BELOW TO ICE MAKER BOX.
10. 1/2" C.W. AND H.W. FROM BELOW. CONNECT TO S-2 WITH CUT-OFF VALVES BELOW FIXTURE.
11. BALANCING VALVE W/ CIRCUIT SETTER IN H.W. RETURN LINES.
12. 3/4" H.W. CIRC., 1-1/2" H.W. AND 1-1/2" C.W. RISERS. H.W. AND C.W. RISERS FROM BELOW AND 3/4" RECIRC LINE FROM THIS FLOOR. ALL TO RISE TO FLOOR ABOVE TO WATER HEATER. SEE WATER HEATER.
13. 4" VENT FROM FLOOR BELOW.
14. 4" WASTE DOWN TO FLOOR BELOW.
15. 1-1/2" CONDENSATE PIPING FROM A/C UNIT.
16. 4" VENT FROM FLOOR BELOW. CONTINUE TO FLOOR ABOVE.
17. 2" VENT TO CONTINUE THROUGH TO FLOOR ABOVE.
18. GAS PIPING UP TO ATTIC/PENTHOUSE LEVEL.
19. DOWN TO COOKING EQUIPMENT WITH GAS COCK AND FIRE PROTECTION SHUT-OFF VALVE. INSTALL GAS REGULATOR TO REDUCE PRESSURE FROM 2LBS. TO 4oz. VENT REGULATOR UP THROUGH ROOF TO ATMOSPHERE. INSTALL DIRT LEG AND RUN FULL SIZE HORIZONTAL BEHIND EQUIPMENT. PROVIDE TAPS WITH CUT-OFF VALVES FOR EACH PIECE OF EQUIPMENT. MAIN GAS COCK AND FIRE PROTECTION SHUT-OFF VALVE SHALL BE LOCATED IN SPACE NEAR CEILING. DO NOT LOCATE ABOVE CEILING. INSTALL FLEXIBLE CONNECTION FROM TAPS TO EACH PIECE OF EQUIPMENT.
20. 1-1/2" CONDENSATE DOWN TO FLOOR BELOW.
21. 1/2" GAS (2LBS) DOWN TO DRYER CONNECTION WITH REGULATOR REDUCING PRESSURE FROM 2LBS TO 4oz. VENT REGULATOR TO ATMOSPHERE. INSTALL GAS COCK, UNION, DIRT LEG AND FLEXIBLE CONNECTION. INSTALL ACCORDING TO MFGR'S. INSTRUCTIONS.



THIRD FLOOR PLAN PART C – PLUMBING

SCALE: 1/8" = 1'-0"



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HPSC Historic Hospital (C□

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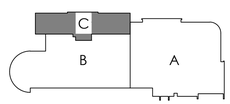
RICHARD E. MOORE — REGISTERED — ENGINEER — 20102 — 11/3/2017 — STATE OF MISSISSIPPI

P2.3

NUMBERED NOTES:

1. 4" VENT FROM FLOOR BELOW.
2. 2" VENT FROM FLOOR BELOW.
3. 3/4" H.W. CIRC., 1-1/2" H.W. AND 1-1/2" C.W. RISERS FROM FLOOR BELOW. ALL TO WATER HEATER. SEE WATER HEATER.
4. WATER HEATERS. SEE DETAIL AND SCHEDULE.
5. 3/4" (2lbs.) GAS PIPING FROM FLOOR BELOW.
6. 1/2" (2LBS.) GAS UP THROUGH ROOF TO OUTSIDE AIR UNIT. INSTALL GAS REGULATOR TO REDUCE PRESSURE FROM 2LBS. TO 4oz. INSTALL GAS COCK, UNION AND DIRT LEG. SEAL ROOF PENETRATION WATER TIGHT. INSTALL PIPING SUPPORT AS REQUIRED.
7. 3/4" (2lbs.) GAS PIPING TO GAS WATER HEATERS. INSTALL GAS REGULATOR TO REDUCE PRESSURE FROM 2LBS. TO 4oz. VENT REGULATOR TO ATMOSPHERE. INSTALL UNION, GAS COCK, AND DIRT LEG FOR EACH WATER HEATER. SEAL ANY ROOF PENETRATIONS WATER TIGHT.
8. 1/2" (2lbs.) GAS PIPING TO UNIT HEATER WITH REGULATOR TO REDUCE PRESSURE FROM 2LBS. DOWN TO 4oz. INSTALL UNION, GAS COCK, AND DIRT LEG. VENT REGULATOR TO ATMOSPHERE. SEAL ANY ROOF PENETRATIONS WATER TIGHT.

ATTIC PLAN PART C – PLUMBING
SCALE: 1/8" = 1'-0"



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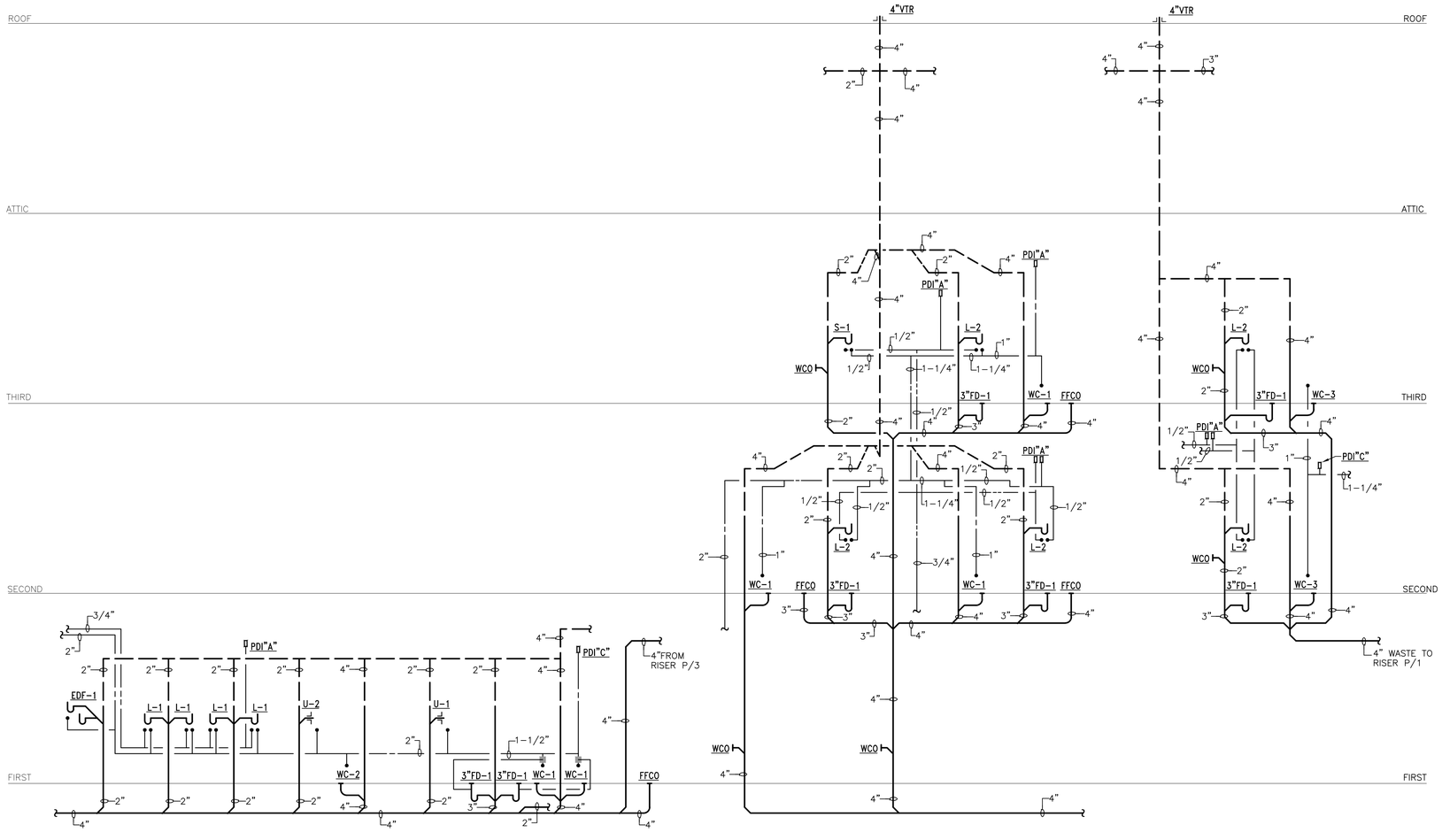
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EDWARD E. MOORE, JR. 20102 REGISTERED ENGINEER 1/13/2017 STATE OF MISSISSIPPI

P2.□



P/1 RISER

P/2 RISER

P/3 RISER

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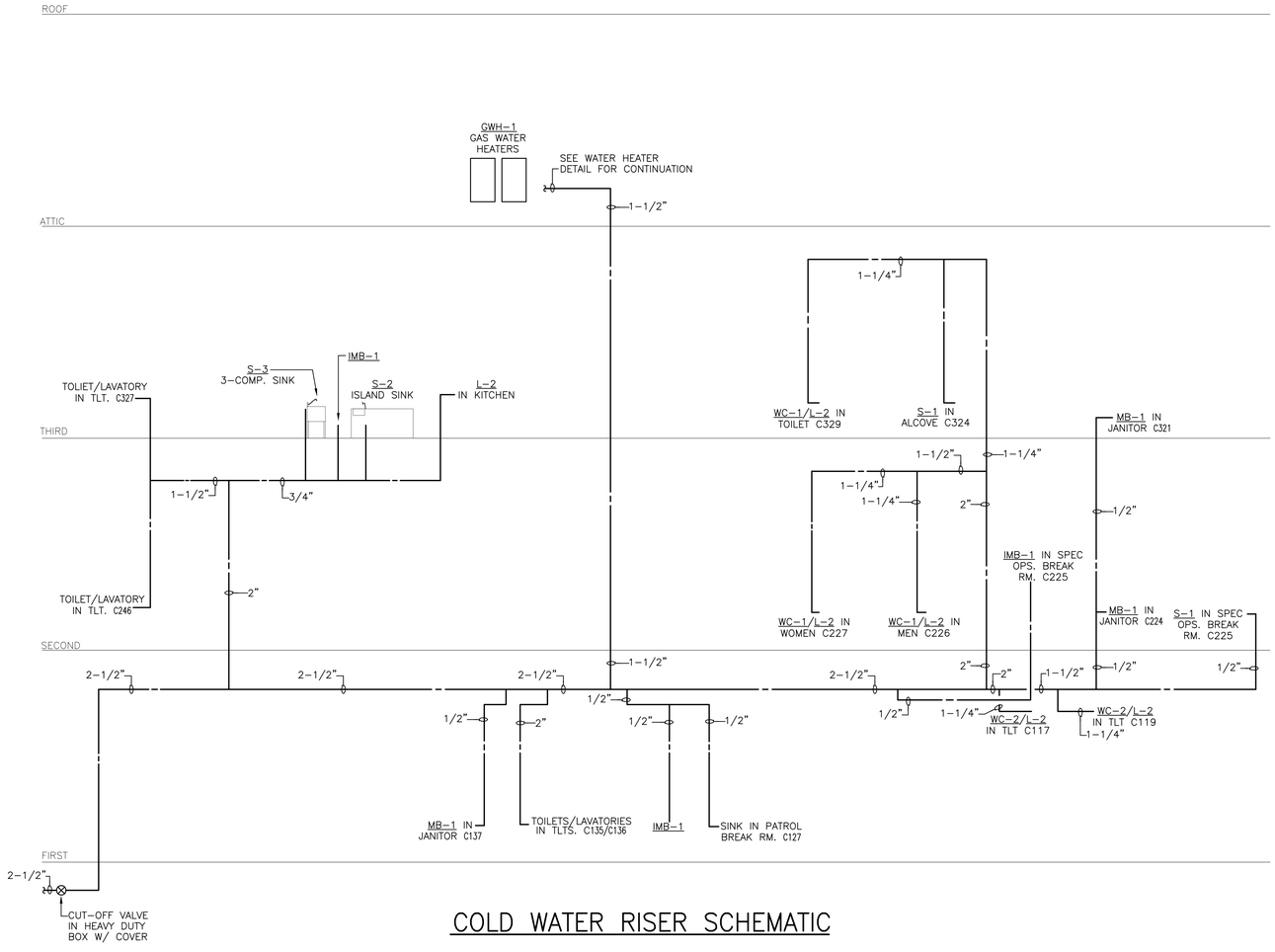
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P3.1

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COLD WATER RISER SCHEMATIC

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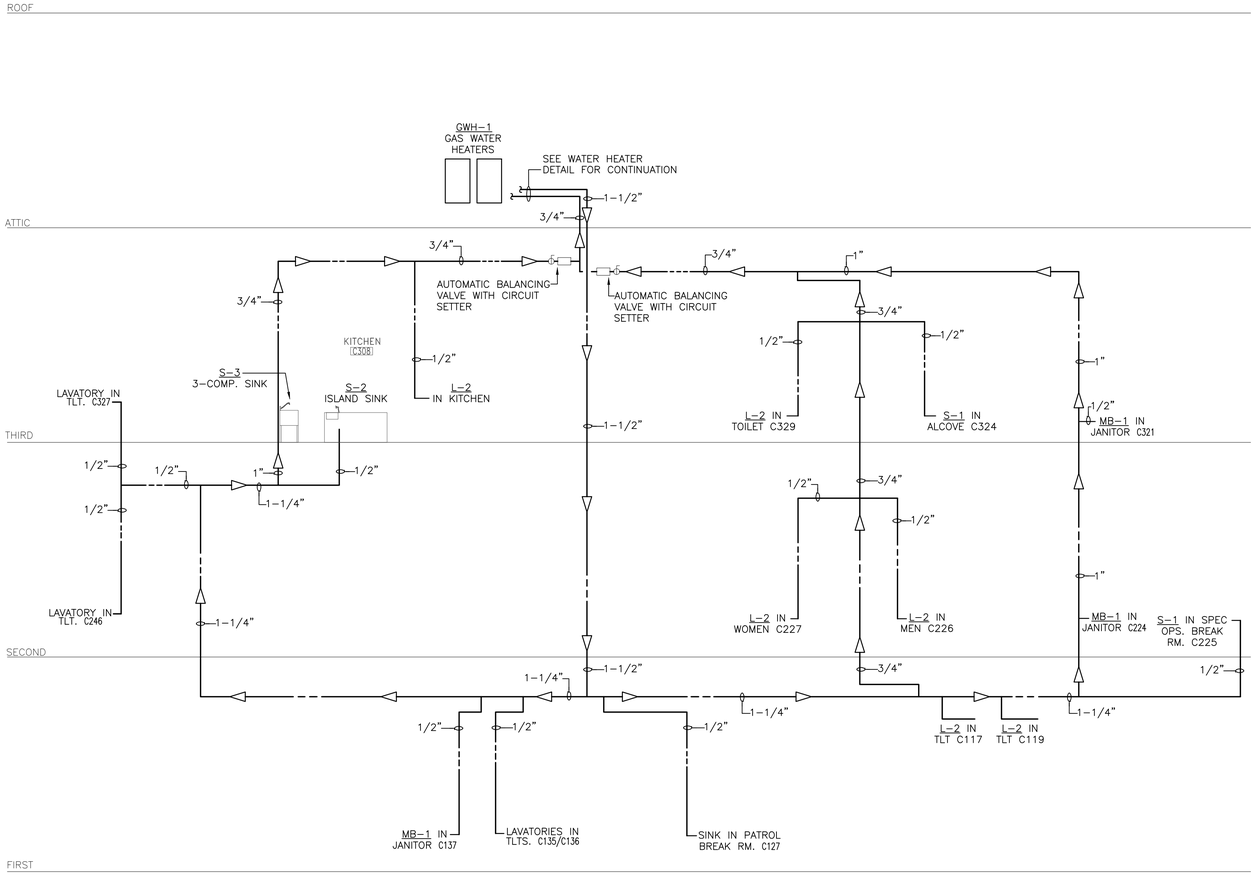
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HOT WATER RISER SCHEMATIC

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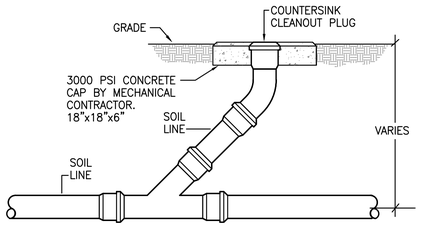
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20102
1/13/2017
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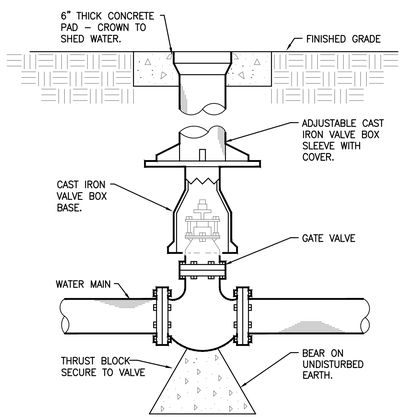
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1 CLEANOUT DETAIL (FGCO)

NOT TO SCALE

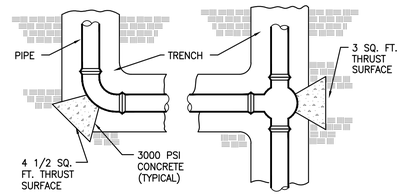


2 GATE VALVE BOX DETAL

NOT TO SCALE

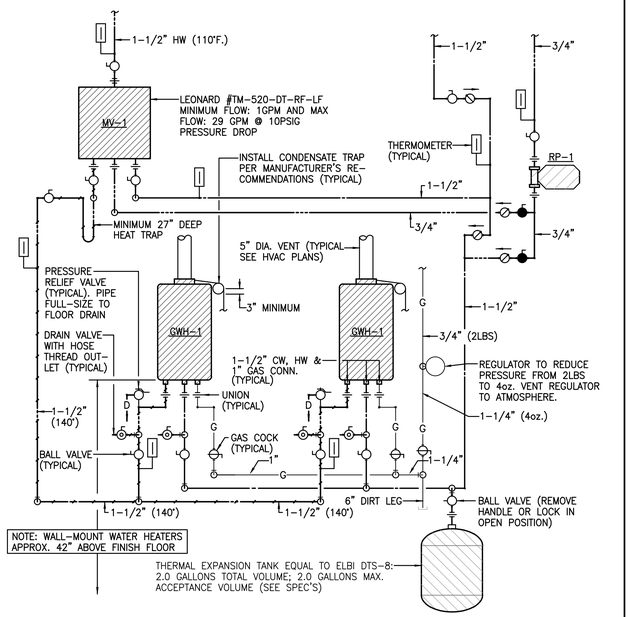
GENERAL NOTES:

1. PROVIDE THRUST BLOCKS AT ALL ELBOWS – BOTH VERTICAL AND HORIZONTAL
2. THRUST SURFACE SHALL BEAR ON UNDISTURBED EARTH.



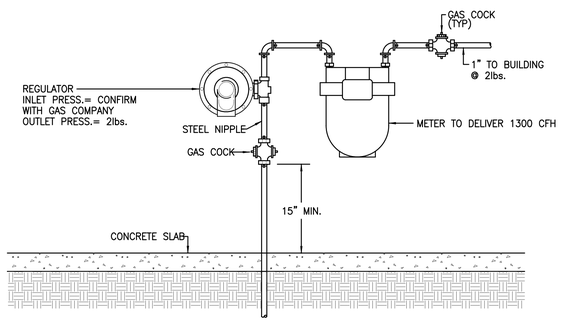
3 THRUST BLOCK DETAIL

NOT TO SCALE



5 GAS TANKLESS WATER HEATER DETAIL

NOT TO SCALE



6 GAS METER AND REGULATOR INSTALLATION DETAIL

NOT TO SCALE

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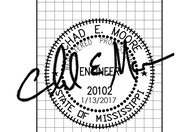
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PLUMBING FIXTURE SCHEDULE

MARK	DESCRIPITION	MAKE	MODEL	SUPPLY FITTING	SUPPLY PIPE(S)	DRAIN	TRAP	ROUGH-IN SIZES				REMARKS
								C.W.	H.W.	WASTE	VENT	
WC-1	WATER CLOSET, FLR MTD. F.V., A.D.A. TRAP PRIMER	KOHLER	K-4302	ZURN Z-6000-WS1 -YB-YC-TP	---	---	---	1"	--	4"	4"	W/ KOHLER K-4670-C OPEN FRONT SEAT, W/ TRAP PRIMER(TP-1) AND BOLT CAPS. DUAL FLUSH
WC-2	WATER CLOSET, FLR MTD. FLUSH VALVE	KOHLER	K-4330	ZURN Z-6000-WS1 -YB-YC	---	---	---	1"	--	4"	4"	W/ KOHLER K-4670-C OPEN FRONT SEAT, AND BOLT CAPS. DUAL FLUSH.
WC-3	WATER CLOSET, FLR MTD. FLUSH VALVE, TRAP PRIMER	KOHLER	K-4330	ZURN Z-6000-WS1 -YB-YC-TP	---	---	---	1"	--	4"	4"	W/ KOHLER K-4670-C OPEN FRONT SEAT, W/ TRAP PRIMER(TP-1) AND BOLT CAPS. DUAL FLUSH
L-1	LAVATORY, COUNTER MOUNTED	KOHLER	K-2196	KOHLER K-15243-4	ZURN Z8804-XL LRCE-PC	ZURN Z8743-PC	ZURN Z8700B-PC	1/2"	1/2"	2"	2"	COORDINATE ROUGH-IN WITH DRAIN ASSEMBLY. INSULATE P-TRAP AND SUPPLY PIPES W/ TRUEBRO 102G/105.
L-2	LAVATORY, WALL HUNG	KOHLER	K-2005	KOHLER K-15243-4	ZURN Z8804-XL LRCE-PC	ZURN Z8743-PC	ZURN Z8700B-PC	1/2"	1/2"	2"	2"	COORDINATE ROUGH-IN WITH DRAIN ASSEMBLY. INSULATE P-TRAP AND SUPPLY PIPES W/ TRUEBRO 102G/105.
S-1	BREAKROOM/KITCHEN SINK	ELKAY	DLR-2222-10	DELTA 27C1152	ZURN Z8804-XL LRCE-PC	LK-35	ZURN Z8700B-PC	1/2"	1/2"	2"	2"	
S-2	KITCHEN ISLAND SINK	ELKAY	DLR-2222-10	DELTA 23T644-R7	ZURN Z8804-XL LRCE-PC	LK-35	ZURN Z8700B-PC	1/2"	1/2"	2"	2"	
S-3	KITCHEN 3- COMPARTMENT	UNDER ANOTHER DIVISION	UNDER ANOTHER DIVISION	UNDER ANOTHER DIVISION	ZURN Z8804-XL LRCE-PC	LK-35	ZURN Z8700B-PC	1/2"	1/2"	2"	2"	
IMB-1	ICE MACHINE BOX	GUY GRAY	88133	---	---	---	---	1/2"	--	--	--	
FHB-1	HOSE BIBB, FREEZEPROOF	WOODFORD	B65	---	---	---	---	3/4"	--	--	--	WITH VACUUM BREAKER
FD-1	FLOOR DRAIN-POLISHED BRONZE WITH TRAP PRIMER CONNECTION	ZURN	ZB-415-B-P	---	---	---	---	--	--	SEE PLAN	SEE PLAN	WITH TRAP PRIMER CONNECTION
FD-2	FLOOR DRAIN-POLISHED BRONZE WITH RECESSED RIM	ZURN	ZB-415-I	---	---	---	---	--	--	SEE PLAN	SEE PLAN	
MB-1	SERVICE SINK	ZURN	Z1996-24-SDL -BS-MH-WG	Z843M1-CS	---	---	---	1/2"	1/2"	2"	2"	
TP-1	TRAP PRIMER	PPP	FVP-1VB	---	---	---	---	-	-	--	--	INSTALL WITH FLUSH VALVE FOR WC-1 AND PIPE TO FLOOR DRAIN
TP-2	TRAP PRIMER	PPP	P1-500	---	---	---	---	-	-	--	--	DISCHARGE FROM PRIMER TO DROP IN WALL DOWN TO BELOW FLOOR. CONTINUE TO FLR. DRAIN AND CONNECT TO PRIMER CONNECTION
EDF-1	ELECTRIC DRINKING FOUNTAIN	ELKAY	LRPBGRNM28K	---	ZURN Z8804-XL LRCE-PC	---	ZURN Z8700B-PC	1/2"	--	2"	2"	WITH WATER FILTER
FS-1	FLOOR SINK-NICKEL BRONZE 12"x12"x8" DEEP, 3/4 GRATE	ZURN	ZN-1902-K-3	---	---	---	---	--	--	SEE PLAN	SEE PLAN	

MIXING VALVE SCHEDULE

MARK	DESCRIPITION	MAKE	MODEL	MINIMUM FLOW (GPM)	MAXIMUM FLOW (GPM)	REMARKS
MV-1	WATER HEATER MIXING VALVE	LEONARD	TM-520-DT-RF-LF	1	29	

PUMPS

MARK	MAKE AND MODEL	DUTY	TYPE	LOCATION	GPM EACH	PSI	PUMP HEAD	VOLTAGE/ PHASE	MOTOR HP	RPM	EMERGENCY POWER	REMARKS
RP-1	TACO 133	DOMESTIC HW WATER	RECIRC PUMP	PENTHOUSE	15	40	32	115/1ø	3/4	1725	NO	SEE WATER HEATER DETAIL

WATER HEATER SCHEDULE

MARK	MAKE	MODEL	INPUT (MBH)	H.W. CAPACITY RANGE	VENT DIA.	CONTROLS	EFFICIENCY	REMARKS
GWH-1	RINNAI TANKLESS	RUC98	15.2-199	0.4 - 9.8 GPM	5"	120V/1PH	94%	TOTAL OF TWO (2) TANKLESS HEATERS INSTALL WITH MV-1 FURNISH VENT KITS & CONTROLS (SEE SPEC'S)

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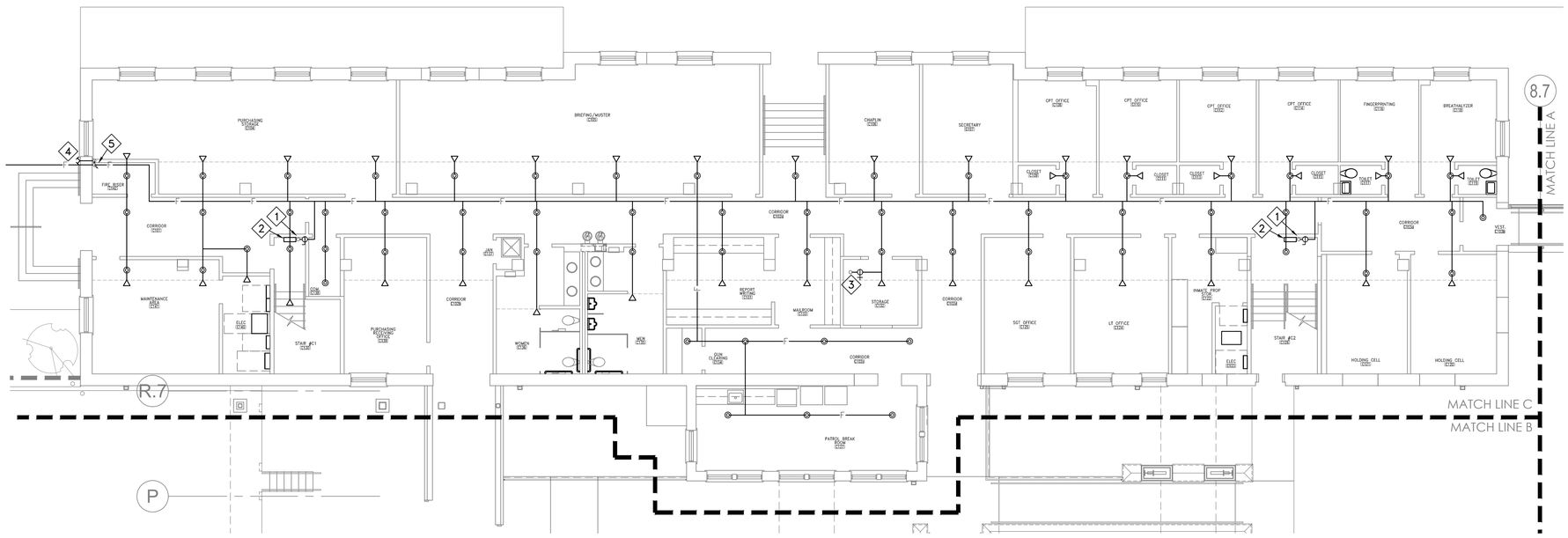
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PLAN NOTES:

1. FIRE RISER WITH OS&Y VALVE WITH TAMPER SWITCH AT BASE. RISER TO FLOOR ABOVE.
2. FIRE DEPARTMENT VALVE BOX EQUAL TO CROCKER 1700 SERIES WITH GLASS DOOR. 2–1/2" FIRE DEPARTMENT VALVE.
3. FIRE SPRINKLER RISER TO FLOOR ABOVE. OS&Y VALVE AT BASE.
4. SIAMESE FIRE DEPARTMENT CONNECTION.
5. FIRE PROTECTION BACKFLOW PREVENTER IN VERTICAL RISER EQUAL TO WATTS OSY747. SEE DETAIL..

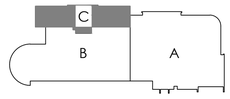
GENERAL NOTE:

FIRE PROTECTION SPRINKLER SYSTEM IS FOR SUGGESTION ONLY AND DOES NOT REPRESENT THE ACTUAL SPRINKLER SYSTEM LAYOUT. DRAWINGS INDICATE WHICH AREAS ARE "DRY PIPE" SYSTEMS AND WET SYSTEMS, EXPOSED PENDANTS OR RECESSED. FIRE SPRINKLER CONTRACTOR WILL SUBMIT CALCULATED SPRINKLER SHOP DRAWINGS FOR APPROVAL.



FIRST FLOOR PLAN PART C – FIRE PROTECTION

SCALE: 1/8" = 1'–0"



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HVAC LEGEND AND ABBREVIATIONS

PIPING LEGEND

	CONCRETE THRUST BLOCK
FM	FLOW METER
FS	FLOW SWITCH
	FIRESTOPPING
	PIPE SLEEVE
	BEAM PENETRATION
	PIPE CAP
	PIPE BLIND FLANGE
	HOT WATER FLOW DESIGNATION
CWS / CWS	CONDENSER WATER SUPPLY
CWR / CWR	CONDENSER WATER RETURN
HWS / HWS	HOT WATER SUPPLY
HWR / HWR	HOT WATER RETURN
CHS / CHS	CHILLED WATER SUPPLY
CHR / CHR	CHILLED WATER RETURN
G	GAS (NATURAL)
LP	GAS (PROPANE)
RS	REFRIGERANT SUCTION
RL	REFRIGERANT LIQUID
	ARROW INDICATES DIRECTION OF FLOW
	PITCH PIPE DOWN IN DIRECTION OF ARROW
D / D	CONDENSATE DRAIN LINE
	PIPE GUIDE
	EXPANSION COMPENSATOR
	CONCENTRIC REDUCER (INCREASER)
	ECCENTRIC REDUCER (INCREASER)
	UNION
	CAPPED PIPE WITH SHUT-OFF VALVE
	"Y" TYPE STRAINER WITH HOSE END BLOW OFF VALVE
	"Y" TYPE STRAINER
	ELBOW TURNED UP
	ELBOW TURNED DOWN
	BOTTOM PIPE CONNECTION
	TOP PIPE CONNECTION
	SLOPED CHANGE IN PIPE ELEVATION

PIPING LEGEND (CONT.)

	SHUT-OFF VALVE
	AUTOMATIC FLOW CONTROL VALVE
	ORIFICE TYPE FLOW MEASURING DEVICE
	VENTURI TYPE FLOW MEASURING DEVICE
	BALL VALVE WITH HOSE THREAD CONNECTION
	GAS COCK
	BALANCING VALVE
	GLOBE VALVE
	CHECK VALVE
	AUTOMATIC THREE-WAY CONTROL VALVE
	AUTOMATIC TWO-WAY CONTROL VALVE
	RELIEF VALVE
	ANGLE RELIEF VALVE
	PRESSURE REDUCING VALVE (PRV)
	LUBRICATED PLUG VALVE
	SOLENOID VALVE
	BUTTERFLY VALVE (MANUAL)
	BALL VALVE
	BALL VALVE, NORMALLY CLOSED
	SIGHT GLASS
	MANUAL AIR VENT
A	AUTOMATIC AIR VENT
	THERMOMETER
	PIPE SENSOR WELL (THERMOMETER)
	PRESSURE GAUGE AND COCK
	PRESSURE GAUGE WITH LOOP
	TEMPERATURE-PRESSURE TEST FITTING

DUCTWORK LEGEND

	RADIUS ELBOW
	ELBOW WITH TURNING VANES
	RECTANGULAR BRANCH TAKEOFF WITH BALANCING DAMPER
	RECTANGULAR SUPPLY DUCT UP
	RECTANGULAR SUPPLY DUCT DOWN
	RECTANGULAR RETURN OR EXHAUST DUCT UP
	RECTANGULAR RETURN OR EXHAUST DUCT DOWN
	ROUND DUCT, UP
	ROUND DUCT, DOWN
R	SLOPING RISE IN DUCTWORK
D	SLOPING DROP IN DUCTWORK
18x12 / 18x12	DUCT SIZE (CLEAR INSIDE DIMENSION) FIRST FIGURE INDICATES PLAN SIZE
18ϕ / 18ϕ	ROUND DUCT DIAMETER SIZE (CLEAR INSIDE DIMENSION)
18/12 / 18/12	OVAL DUCT SIZE
	SIDE, TOP OR BOTTOM DUCT ACCESS DOOR
	RECTANGULAR OR SQUARE TO ROUND OR OVAL TRANSITION
	DOUBLE-WALL DUCT IS INDICATED BY SHADING
	FLEXIBLE DUCT
	VOLUME DAMPER IN DUCT
M	MOTORIZED DAMPER
F	FIRE DAMPER
	1A - 1 WAY
	2A - 2 WAY
	3A - 3 WAY
	4A - 4 WAY
	2C - 2 WAY CORNER
	4C - 4 WAY CORNER
	LINEAR DIFFUSER
	LINEAR DIFFUSER WITH PLENUM

DUCTWORK LEGEND (CONT.)

	RETURN/EXHAUST REGISTER OR GRILLE
	FIRE RATED ENCASED DUCT
	SUPPLY REGISTER WITH AIR OUTLET DEVICE DESIGNATION
	RETURN OR EXHAUST REGISTER OR GRILLE WITH AIR INLET DEVICE DESIGNATION
	DUCT END/CAP

CONTROLS LEGEND

CO2	CARBON DIOXIDE SENSOR
H	HUMIDITY SENSOR
T	TEMPERATURE SENSOR/THERMOSTAT
Tp	PROGRAMMABLE THERMOSTAT
S	TEMPERATURE SENSOR
P#	STATIC PRESSURE SENSOR WITH DESIGNATION
TN	NIGHT SET-BACK THERMOSTAT
WS	WALL SWITCH
RC	REMOTE CONTROLLER
ORT	0-6 HOUR OVERRIDE TIMER
T/C	TIME CLOCK
E/S	EMERGENCY SHUTOFF SWITCH
	WALL OR CEILING MOTION HEAT SENSOR

MISCELLANEOUS

DP	DIFFERENTIAL PRESSURE SENSOR
DP	DIFFERENTIAL PRESSURE SWITCH
ϕ	DIAMETER
HW / 1	RISER DESIGNATION (RISER SERVICE / RISER NUMBER)
2 / M3.1	SECTION DESIGNATION (SECTION NUMBER / DRAWING NUMBER)
1 / M2.1	DETAIL DESIGNATION (DETAIL NUMBER / DRAWING NUMBER)
CT / 1-1	EQUIPMENT DESIGNATION (EQUIPMENT TYPE / EQUIPMENT NUMBER)
T-3.24	TERMINAL DESIGNATION (3-24: THE NUMBER ON SYSTEM / SYSTEM)
	EXISTING EQUIPMENT, PIPING, OR DUCTWORK TO REMAIN IN SERVICE.
	EXISTING EQUIPMENT, PIPING, OR DUCTWORK TO BE REMOVE.
	NEW CONNECTION TO EXISTING PIPING, DUCTWORK AND/OR EQUIPMENT

TAG (SEE SCHEDULE) — NECK SIZE; CFM OR "--" (-- MEANS NO BALANCE REQUIRED)

DIFFUSER, RETURN, & EXHAUST GRILLE TAG

ABBREVIATIONS - MECHANICAL

AAV	AIR ADMITTANCE VALVE
ACU	AIR CONDITIONING UNIT
AD	ACCESS DOOR
AHU	AIR HANDLING UNIT
AS	AIR SEPARATOR
AVTR	ACID VENT THRU ROOF
B	BOILER
BMS	BUILDING MANAGEMENT SYSTEM
BHP	BRAKE HORSE POWER
BTU	BRITISH THERMAL UNIT
CC	COOLING COIL
CD	CEILING DIFFUSER
CER	CEILING EXHAUST REGISTER
CRG	CEILING RETURN GRILLE
CH	CHILLER
CFM	CUBIC FEET PER MINUTE
CTG	CEILING TRANSFER GRILLE
CG	CEILING GRILLE
CO	CLEAN OUT
CRA	CONDITIONING RETURN AIR
CSA	CONDITIONING SUPPLY AIR
CT	COOLING TOWER
CHS	CHILLED WATER SUPPLY
CHR	CHILLED WATER RETURN
DB	DRY BULB
DG	DOOR GRILLE
DIA	DIAMETER
DN	DOWN
DX	DIRECT EXPANSION
EA	EXHAUST AIR
EAT	ENTERING AIR TEMPERATURE
EDB	ENTERING DRY BULB
EDH	ELECTRICAL DUCT HEATER
EF	EXHAUST FAN
EFF	EFFICIENCY
ET	EXPANSION TANK
EWB	ENTERING WET BULB
EWH	ELECTRIC WATER HEATER
EWT	ENTERING WATER TEMPERATURE
°F	DEGREES FAHRENHEIT
FC	FLEXIBLE CONNECTION (DUCT OR PIPE)

ABBREVIATIONS - MECHANICAL

FCU	FAN COIL UNIT
FD	FUSIBLE LINK FIRE DAMPER W/ DUCT ACCESS DOOR
FLR	FLOOR
FLA	FULL LOAD AMPS
FT	FEET
GF	GAS FURNACE
GPM	GALLONS PER MINUTE
GWH	GAS WATER HEATER
HC	HEATING COIL
HP	HORSE POWER
HR	HOUR
HRU	HEAT RECOVERY UNIT
HWS	HEATING WATER SUPPLY
HWR	HEATING WATER RETURN
ID	INSIDE DIMENSION
KW	KILOWATT
LAT	LEAVING AIR TEMPERATURE
LBS	POUNDS
LD	LINEAR DIFFUSER (CEILING, WALL, SILL OR FLOOR)
LRA	LOCK ROTOR AMPS
LFD	LOUVER FACE DIFFUSER
LWT	LEAVING WATER TEMPERATURE
MA	MIXED AIR
MAT	MIXED AIR TEMPERATURE
MAX	MAXIMUM
MBH	THOUSAND BTU PER HOUR
MFG	MANUFACTURER
MFS	MAXIMUM FUSE SIZE
MIN	MINIMUM
MUA	MAKE UP AIR UNIT
MOCP	MAXIMUM OVERCURRENT PROTECTION
NC	NORMALLY CLOSED
NFA	NET FREE AREA
NIC	NOT IN THIS CONTRACT
NO	NORMALLY OPEN
NTS	NOT TO SCALE
OA	OUTSIDE AIR INTAKE
OBD	OPPOSED BLADE DAMPER
OD	OUTSIDE DIMENSION
P	PUMP
PD	PRESSURE DROP

ABBREVIATIONS - MECHANICAL

PRV	PRESSURE REDUCING VALVE
PSI	POUNDS PER SQUARE INCH (GAUGE)
PSA	PRIMARY SUPPLY AIR
RA	RELIEF AIR
RH	RELATIVE HUMIDITY
RHC	REHEAT COIL
RPM	REVOLUTIONS PER MINUTE
RP	RECIRC PUMP
SA	SUPPLY AIR
SD	SMOKE DAMPER
SENS	SENSIBLE
SP	STATIC PRESSURE
SQFT	SQUARE FEET
TA	TRANSFER AIR DUCT
TYP	TYPICAL
VAV	VARIABLE AIR VOLUME
VD	VOLUME DAMPER
VEA	VENTILATION EXHAUST AIR
VFD	VARIABLE FREQUENCY DRIVE
VRF	VARIABLE REFRIGERANT FLOW
VSA	VENTILATION SUPPLY AIR
VTR	VENT THRU ROOF
W/	WITH
WSR	WALL SUPPLY REGISTER
WSHP	WATER SOURCE HEAT PUMP
WB	WET BULB
EW	EXISTING DOMESTIC WATER
ECS	EXISTING CONDENSER WATER SUPPLY
ECR	EXISTING CONDENSER WATER RETURN
ECHS	EXISTING CHILLED WATER SUPPLY
ECHR	EXISTING CHILLED WATER RETURN
EHWS	EXISTING HEATING WATER SUPPLY
EHWR	EXISTING HEATING WATER RETURN
ECHWS	EXISTING CHILLED/HEATING WATER SUPPLY
ECHWR	EXISTING CHILLED/HEATING WATER RETURN
EDCW	EXISTING DOMESTIC COLD WATER
EDHW	EXISTING DOMESTIC HOT WATER
EDHWR	EXISTING DOMESTIC HOT WATER RECIRC
EG	EXISTING GAS (NATURAL)
ERL	EXISTING REFRIGERANT LIQUID
ERS	EXISTING REFRIGERANT SUCTION

GENERAL NOTES - HVAC

GENERAL DEMOLITION AND SALVAGE REQUIREMENTS

A. IT IS THE INTENT OF THE DEMOLITION PLANS TO AID THE CONTRACTOR IN BIDDING THE PROJECT BY PROVIDING INFORMATION ABOUT EXISTING HVAC EQUIPMENT, PIPING, AND ASSOCIATED MATERIALS AND THEIR REMOVAL.

B. ALL PIPING, DUCTWORK AND EQUIPMENT LOCATIONS SHOWN ON THESE DRAWINGS WERE TAKEN FROM EXISTING RECORD DRAWINGS AND SITE INVESTIGATION.

C. CONTRACTOR SHALL VISIT PROJECT SITE AND OBSERVE ALL EXISTING CONDITIONS AFFECTING THE WORK AND MAKE NECESSARY ADJUSTMENTS, TO FACILITATE INSTALLATION OF COMPLETE, OPERABLE SYSTEMS AT NO ADDITIONAL COST TO THE USING AGENCY.

D. THE MECHANICAL CONSTRUCTION SHALL INCLUDE ALL WORK REQUIRED FOR THE REMOVAL OF EXISTING MECHANICAL EQUIPMENT, PIPING, ETC. WHERE INDICATED OR REQUIRED TO FACILITATE NEW CONSTRUCTION. THE CONTRACTOR SHALL REMOVE FROM THE PREMISES OTHER DEVICES AND MATERIALS NOT REUSED IN THE BUILDING. USING AGENCY SHALL HAVE FIRST RIGHTS TO SALVAGED ITEMS.

GENERAL RENOVATION REQUIREMENTS

A. ALL PIPING SHOWN WITH DASHED LINES - DASHED LINES REPRESENT OUTSIDE DIMENSION OF PIPE INCLUDING INSULATION.

B. ANY INDICATED MOUNTING HEIGHTS ARE APPROXIMATE. FINAL MOUNTING HEIGHT SHALL BE DETERMINED IN FIELD.

C. INSTALLATION OF ALL EQUIPMENT AND SYSTEMS SHALL BE IN ACCORDANCE WITH, MANUFACTURER'S REQUIREMENTS, STANDARD DETAILS, SECTIONS AND ELEVATIONS SHOWN ON THE DRAWINGS.

D. CONTRACTOR SHALL MAINTAIN A CLEAR SERVICE AREA AROUND ALL EQUIPMENT FOR MAINTENANCE.

SHEET INDEX - HVAC

SHEET	TITLE
M□□□	MECHANICAL LEGEND AND ABBRE□IATIONS
MD□□□	FIRST FLOOR PLAN PART C - HVAC DEMOLITION
MD□□□	SECOND FLOOR PLAN PART C - HVAC DEMOLITION
MD□□□	THIRD FLOOR PLAN PART C - HVAC DEMOLITION
MD□□□	ROOF PLAN PART C - HVAC DEMOLITION
M□□□	FIRST FLOOR PLAN PART C □H□AC
M□□□	SECOND FLOOR PLAN PART C □H□AC
M□□□	THIRD FLOOR PLAN PART C □H□AC
M□□□	ROOF PLAN PART C □H□AC
M□□□	FIRST FLOOR PLAN PART C □H□AC PIPING
M□□□	SECOND FLOOR PLAN PART C □H□AC PIPING
M□□□	THIRD FLOOR PLAN PART C □H□AC PIPING
M□□□	ROOF PLAN PART C □H□AC PIPING
M□□□	H□AC SUPPL□ AND E□HAUST DUCT RISERS
M□□□	MECHANICAL DETAILS
M□□□	MECHANICAL DETAILS
M□□□	MECHANICAL DETAILS
M□□□	MECHANICAL SCHEDULES
M□□□	MECHANICAL SCHEDULES
M□□□	MECHANICAL SCHEDULES
M□□□	CONTROL SCHEMATIC
M□□□	CONTROL SCHEMATIC
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CITY OF HATTIESBURG MISSISSIPPI 1884

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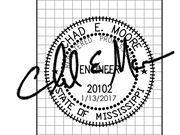
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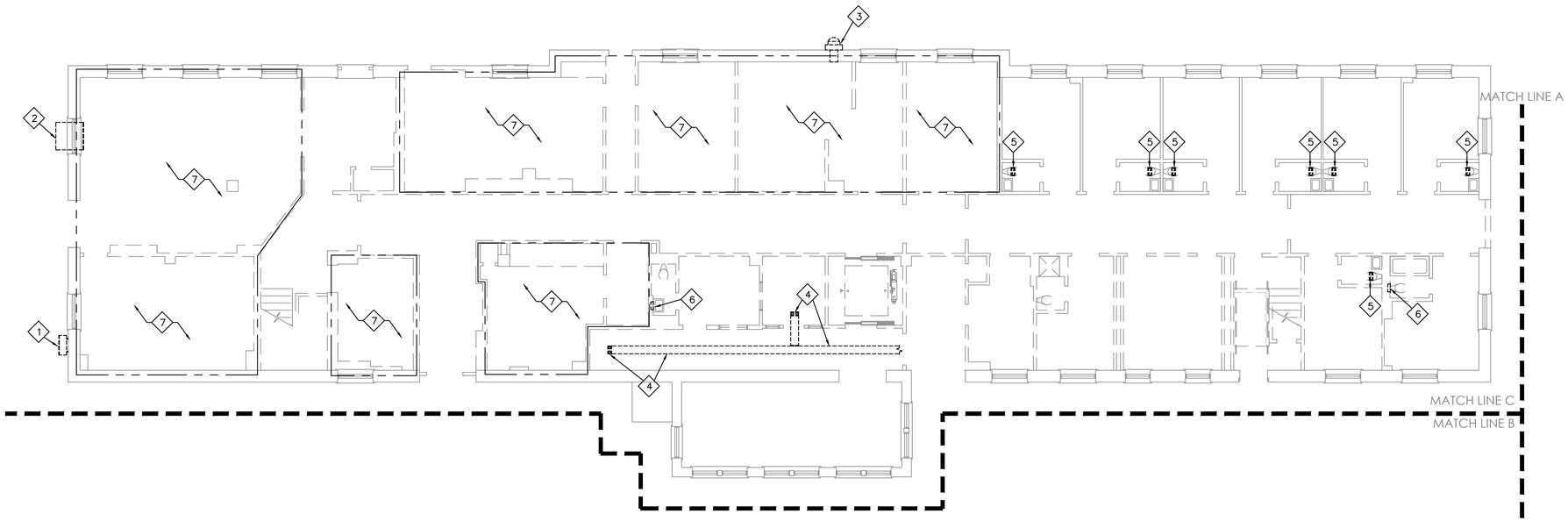
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FIRST FLOOR PLAN PART C – HVAC DEMOLITION

SCALE: 1/8" = 1'-0"

PLAN NOTES:

1. REMOVE EXISTING WALL MOUNTED CONDENSING UNIT, REFRIGERANT PIPING, CONTROLS AND ALL APPURTENANCES.
2. REMOVE EXISTING THROUGH WALL CONDENSING UNIT, CONTROLS AND ALL APPURTENANCES.
3. REMOVE EXISTING SIDEWALL EXHAUST FAN, CONTROLS, DUCTWORK AND ALL APPURTENANCES.
4. REMOVE EXISTING SUPPLY AIR DUCTWORK, CEILING DIFFUSERS AND ALL APPURTENANCES.
5. REMOVE EXISTING CEILING EXHAUST GRILLE, AND ALL APPURTENANCES.
6. REMOVE EXISTING SIDEWALL EXHAUST GRILLE, AND ALL APPURTENANCES.
7. AREA INDICATES WHERE WE HADE NO ACCESS IN THE FIELD. REMOVE ANY AIR HANDING UNITS, DUCTWORK, DIFFUSERS, PIPING, CONTROLS, AND ALL APPURTENANCES.

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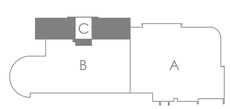
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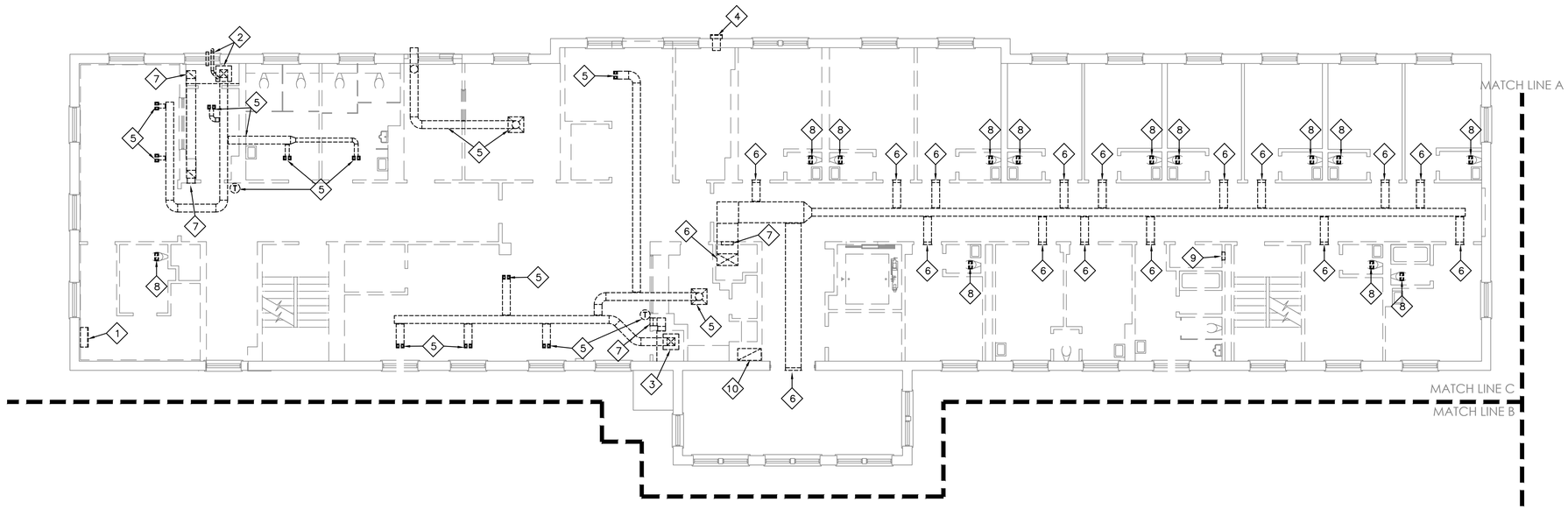
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SECOND FLOOR PLAN PART C – HVAC DEMOLITION

SCALE: 1/8" = 1'-0"

PLAN NOTES:

1. REMOVE EXISTING WALL MOUNTED DUCTLESS SPLIT SYSTEM, REFRIGERANT PIPING, CONTROLS AND ALL APPURTENANCES.
2. REMOVE EXISTING GAS FURNACE, REFRIGERANT PIPING, CONDENSING UNIT, SIDE WALL FLUE, CONTROLS AND ALL APPURTENANCES.
3. REMOVE EXISTING DX AIR HANDLER, REFRIGERANT PIPING, CONDENSING UNIT, CONTROLS AND ALL APPURTENANCES.
4. REMOVE EXISTING SIDEWALL EXHAUST FAN, CONTROLS, DUCTWORK AND ALL APPURTENANCES.
5. REMOVE EXISTING SUPPLY AIR DUCTWORK, CEILING DIFFUSERS AND ALL APPURTENANCES.
6. REMOVE EXISTING SUPPLY AIR DUCTWORK, SIDEWALL GRILLES AND ALL APPURTENANCES.
7. REMOVE EXISTING RETURN AIR DUCTWORK, SIDEWALL GRILLES AND ALL APPURTENANCES.
8. REMOVE EXISTING CEILING EXHAUST GRILLE, AND ALL APPURTENANCES.
9. REMOVE EXISTING SIDEWALL EXHAUST GRILLE, AND ALL APPURTENANCES.
10. REMOVE EXISTING EXHAUST DUCT FROM ABOVE TO FLOOR BELOW, AND ALL APPURTENANCES.

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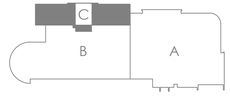
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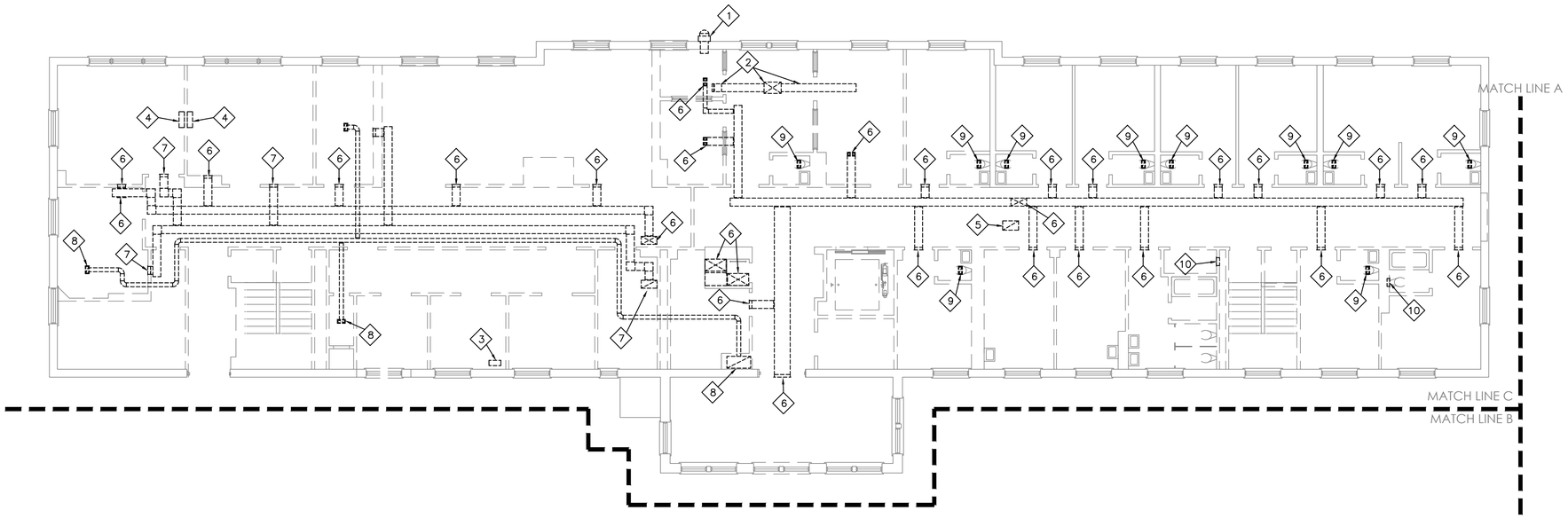
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THIRD FLOOR PLAN PART C – HVAC DEMOLITION

SCALE: 1/8" = 1'-0"

PLAN NOTES:

1. REMOVE EXISTING SIDEWALL EXHAUST FAN, CONTROLS, DUCTWORK AND ALL APPURTENANCES.
2. REMOVE EXISTING HOT WATER COIL, DUCTWORK, CONTROLS AND ALL APPURTENANCES.
3. REMOVE EXISTING FLOOR MOUNTED HOT WATER RADIATOR, PIPING, CONTROLS AND ALL APPURTENANCES.
4. REMOVE EXISTING WALL MOUNTED HOT WATER RADIATOR, PIPING, CONTROLS AND ALL APPURTENANCES.
5. REMOVE EXISTING RETURN AIR DUCTWORK AND ALL APPURTENANCES.
6. REMOVE EXISTING SUPPLY AIR DUCTWORK, SIDEWALL GRILLES, CEILING DIFFUSERS AND ALL APPURTENANCES.
7. REMOVE EXISTING RETURN AIR DUCTWORK, SIDEWALL GRILLES AND ALL APPURTENANCES.
8. REMOVE EXISTING EXHAUST AIR DUCTWORK, CEILING GRILLES AND ALL APPURTENANCES.
9. REMOVE EXISTING CEILING EXHAUST GRILLE, AND ALL APPURTENANCES.
10. REMOVE EXISTING SIDEWALL EXHAUST GRILLE, AND ALL APPURTENANCES.

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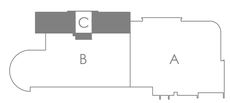
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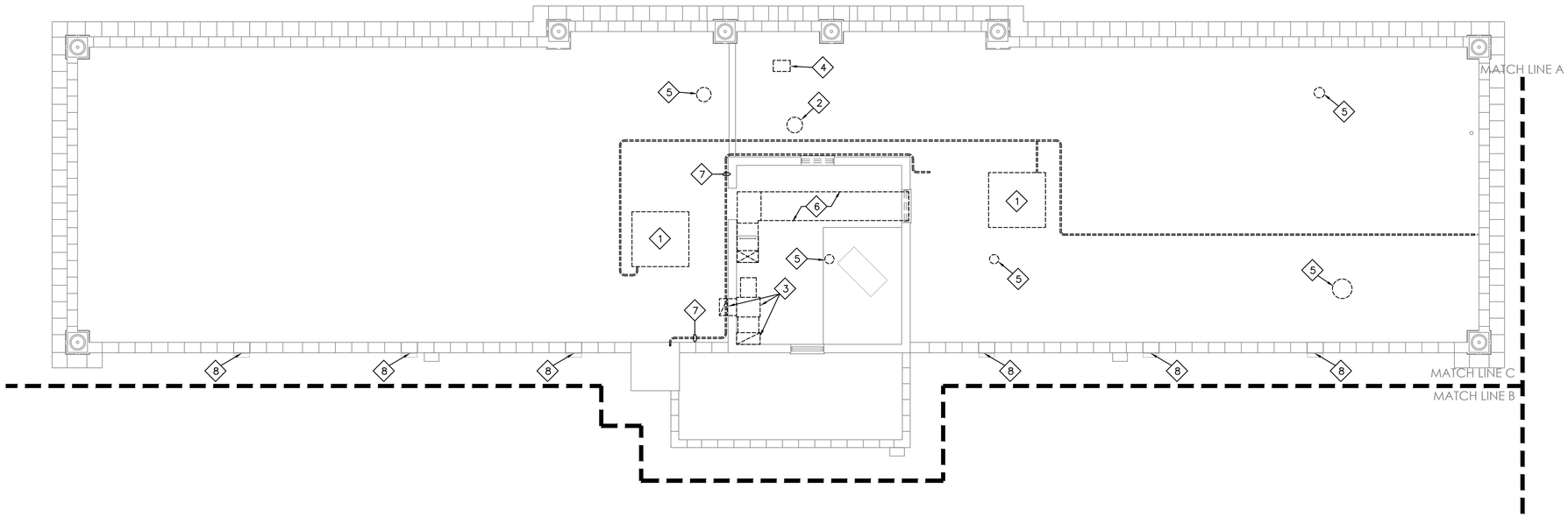
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ROOF PLAN PART C – HVAC DEMOLITION

SCALE: 1/8" = 1'-0"

PLAN NOTES:

1. REMOVE EXISTING AIR HANDLING UNIT, CONTROLS, DUCTWORK, GAS PIPING AND ALL APPURTENANCES.
2. REMOVE EXISTING ROOF MOUNTED EXHAUST FAN, CONTROLS, DUCTWORK, AND ALL APPURTENANCES.
3. REMOVE EXISTING INLINE FAN, CONTROLS, DUCTWORK, ROOF CAP, SIDEWALL GOOSE NECK AND ALL APPURTENANCES.
4. REMOVE EXISTING DUCTWORK THROUGH ROOF AND ALL APPURTENANCES.
5. REMOVE EXISTING GRAVITY VENTILATION DUCTWORK THROUGH ROOF AND ALL APPURTENANCES.
6. REMOVE EXISTING SUPPLY DUCTWORK IN MECHANICAL ROOM AND ALL APPURTENANCES.
7. REMOVE EXISTING PIPING RACKED ON WALL OF THE MECHANICAL ROOM AND ALL APPURTENANCES.
8. EXISTING SIDEWALL GRAVITY VENTILATION GRILLS TO REMAIN. CONTRACTOR TO PROVIDE INSULATED BLAKS-OFF PANELS IN ATTIC.

HATTIESBURG PUBLIC SAFETY COMPLEX

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HPSC Historic Hospital (C)

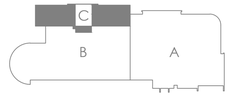
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Date	Rev.	Description
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10-20-2015		75% Progress Set
11-02-2015		90% Pricing Set
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Client No:	-------
Albert & Associates:	12575

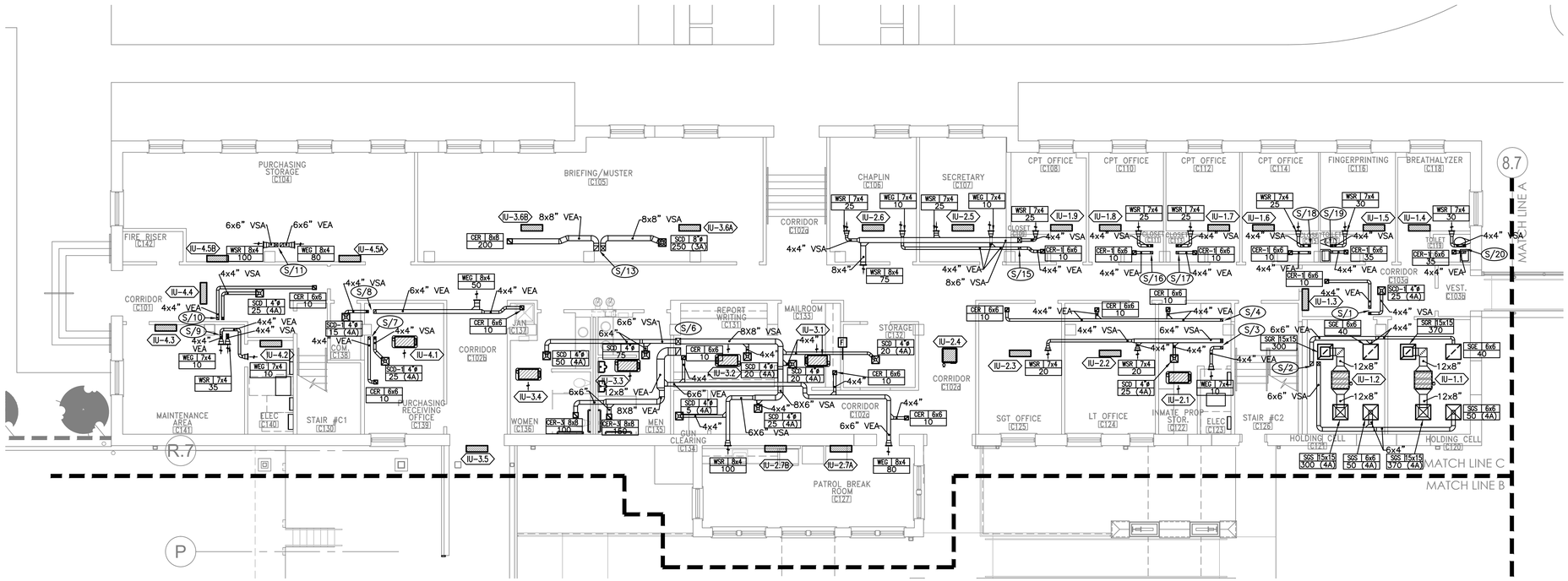
DAVID E. MOORE — REGISTERED — ENGINEER — 20102 — 1/13/2017 — STATE OF MISSISSIPPI

MD1.□



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Phone: (601) 362-3552
Fax: (601) 366-6418

ERG# 15-28.2



FIRST FLOOR PLAN PART C – HVAC

SCALE: 1/8" = 1'-0"

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT

HPSC Historic Hospital [C□]

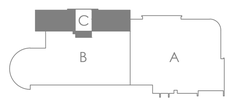
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11-02-2015		90% Pricing Set
11-19-2018		100% Bid Docs

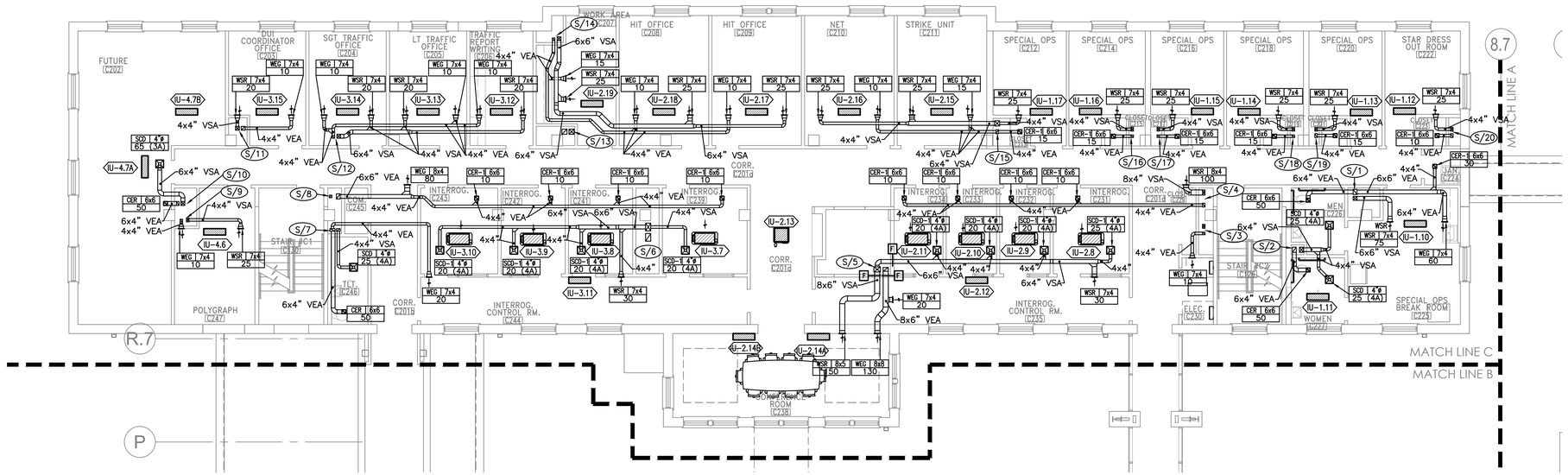
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SECOND FLOOR PLAN PART C – HVAC

SCALE: 1/8" = 1'-0"

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

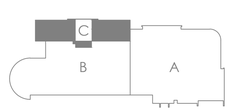
HPSC Historic Hospital [C]

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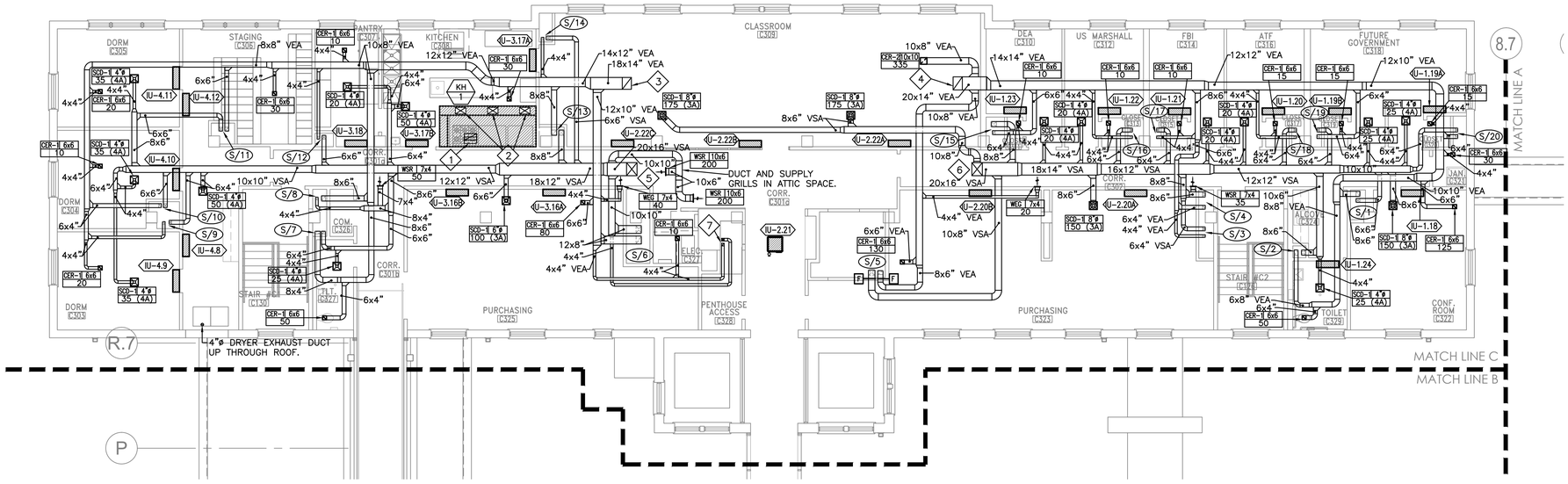
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RICHARD E. MOORE 20102 REGISTERED PROFESSIONAL ENGINEER STATE OF MISSISSIPPI 11/13/2017

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THIRD FLOOR PLAN PART C – HVAC

SCALE: 1/8" = 1'-0"

PLAN NOTES:

1. 20x10" GREASE EXHAUST DUCT UP TO EF-1 ON ROOF. OFFSET AS REQUIRED.
2. (3) 16x10" MAKE-UP SUPPLY AIR DUCTS DOWN FROM MAU-1 ON ROOF. FLASH AND COUNTER FLASH AS REQUIRED FOR A WATER TIGHT SEAL.
3. 18x14" VEA UP THROUGH ROOF. FLASH AND COUNTER FLASH AS REQUIRED FOR A WATER TIGHT SEAL.
4. 20x14" VEA UP THROUGH ROOF. FLASH AND COUNTER FLASH AS REQUIRED FOR A WATER TIGHT SEAL.
5. 20x16" VSA DOWN FROM OAU-2 ON ROOF.
6. 20x16" VSA DOWN FROM OAU-1 ON ROOF.
7. 4x4" VSA AND 4x4" VEA UP TO PENTHOUSE ABOVE.

CITY OF HATTIESBURG MISSISSIPPI 1884

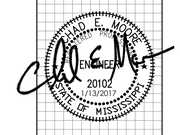
HATTIESBURG PUBLIC SAFETY COMPLEX

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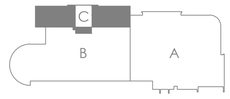
HPSC Historic Hospital □C□

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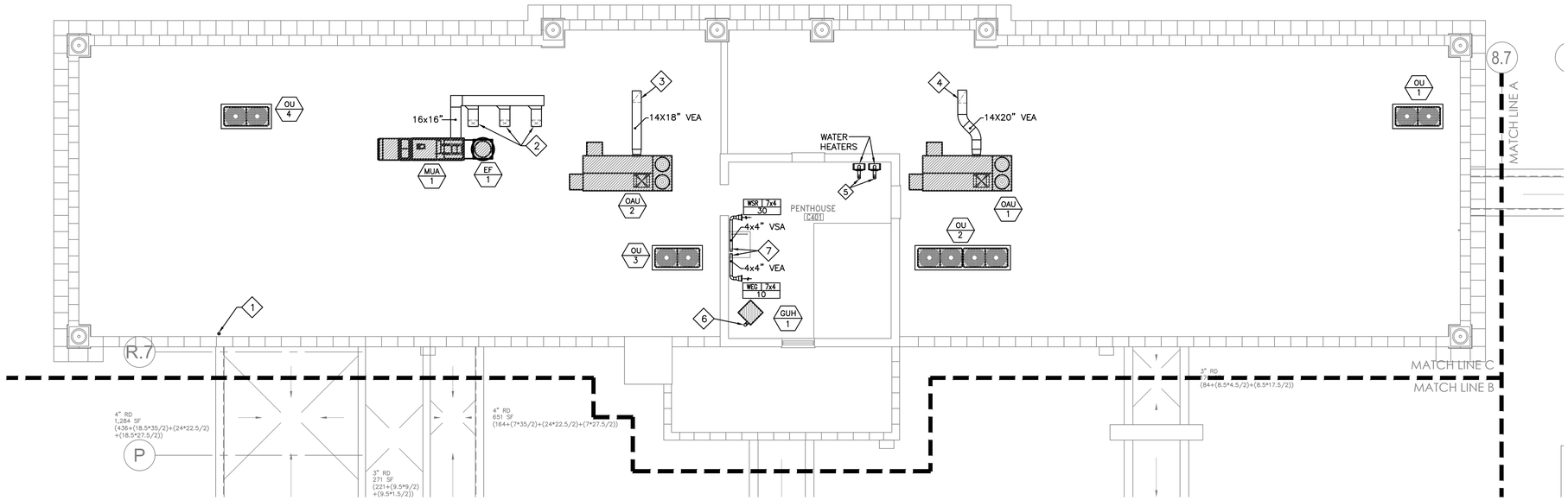
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ROOF PLAN PART C – HVAC

SCALE: 1/8" = 1'-0"

PLAN NOTES:

1. 4"ø DRYER EXHAUST DUCT UP FROM FLOOR BELOW. PROVIDE FLASHING AND COUNTER FLASHING FOR A WATER TIGHT SEAL. SEE DETAIL.
2. (3) 16x10" MAKE-UP SUPPLY AIR DUCTS ON ROOF DOWN TO KH-1 BELOW. FLASH AND COUNTER FLASH AS REQUIRED FOR A WATER TIGHT SEAL.
3. 14x18" VEA DOWN THROUGH ROOF. FLASH AND COUNTER FLASH AS REQUIRED FOR A WATER TIGHT SEAL.
4. 14x20" VEA DOWN THROUGH ROOF. FLASH AND COUNTER FLASH AS REQUIRED FOR A WATER TIGHT SEAL.
5. 6"ø CONCENTRIC VENT UP THRU ROOF. SEE DETAIL.
6. PROVIDE CONCENTRIC VENT KIT ADAPTER VERIFY SIZE AS PER MANUFACTURER'S RECOMMENDATION. "SEE CONCENTRIC VENTING DETAIL AT ROOF".
7. 4x4" VSA AND 4x4" VEA DOWN TO THIRD FLOOR CEILING.

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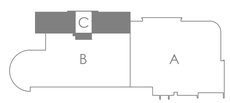
HPSC Historic Hospital C

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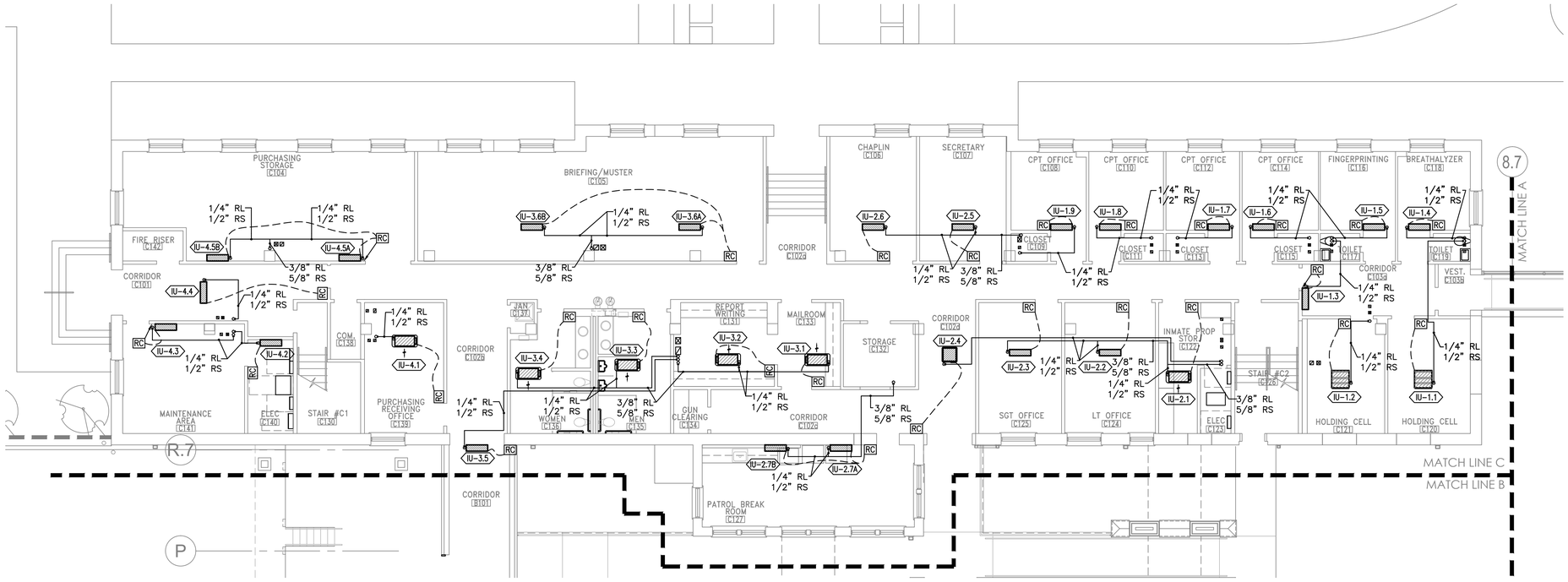
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FIRST FLOOR PLAN PART C – HVAC PIPING

SCALE: 1/8" = 1'-0"

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HPSC Historic Hospital □C□

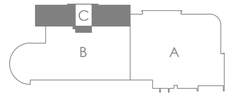
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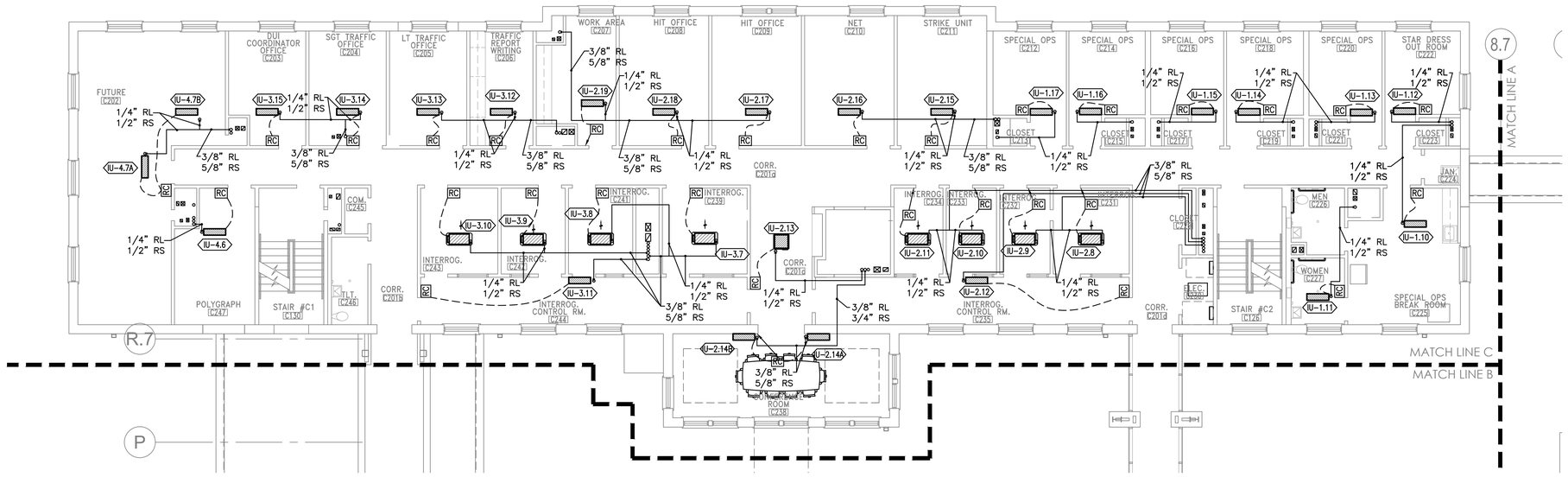
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SECOND FLOOR PLAN PART C – HVAC PIPING

SCALE: 1/8" = 1'-0"

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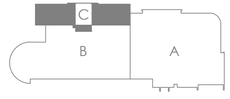
HPSC Historic Hospital C

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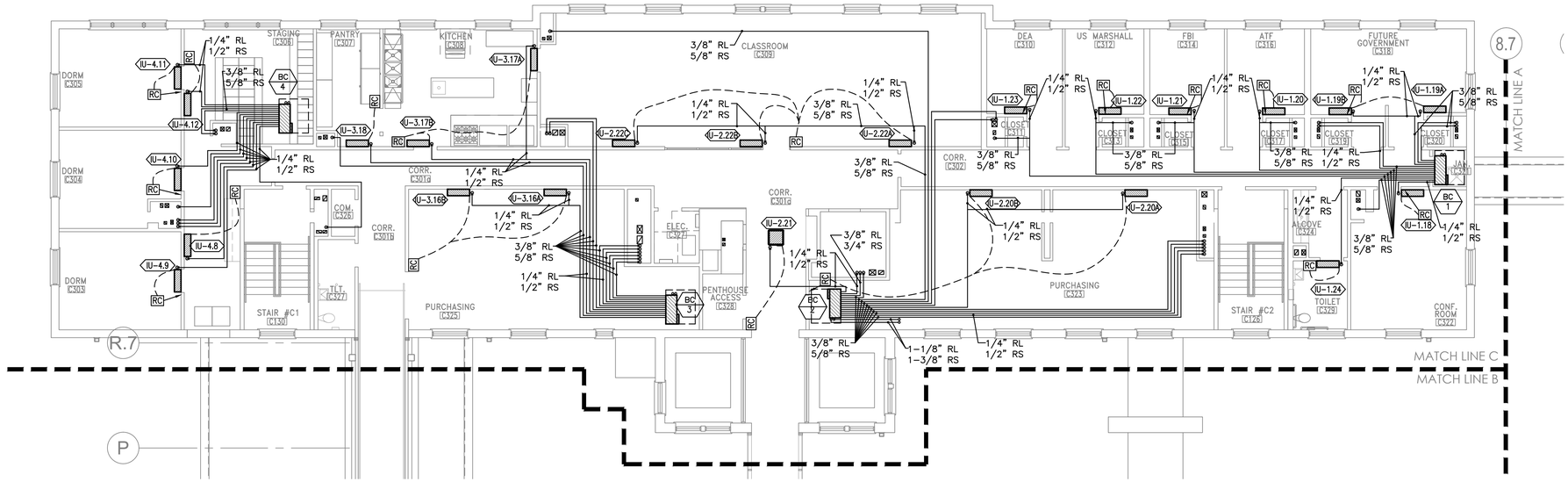
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THIRD FLOOR PLAN PART C – HVAC PIPING

SCALE: 1/8" = 1'-0"

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HPSC Historic Hospital [C]

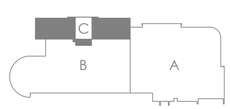
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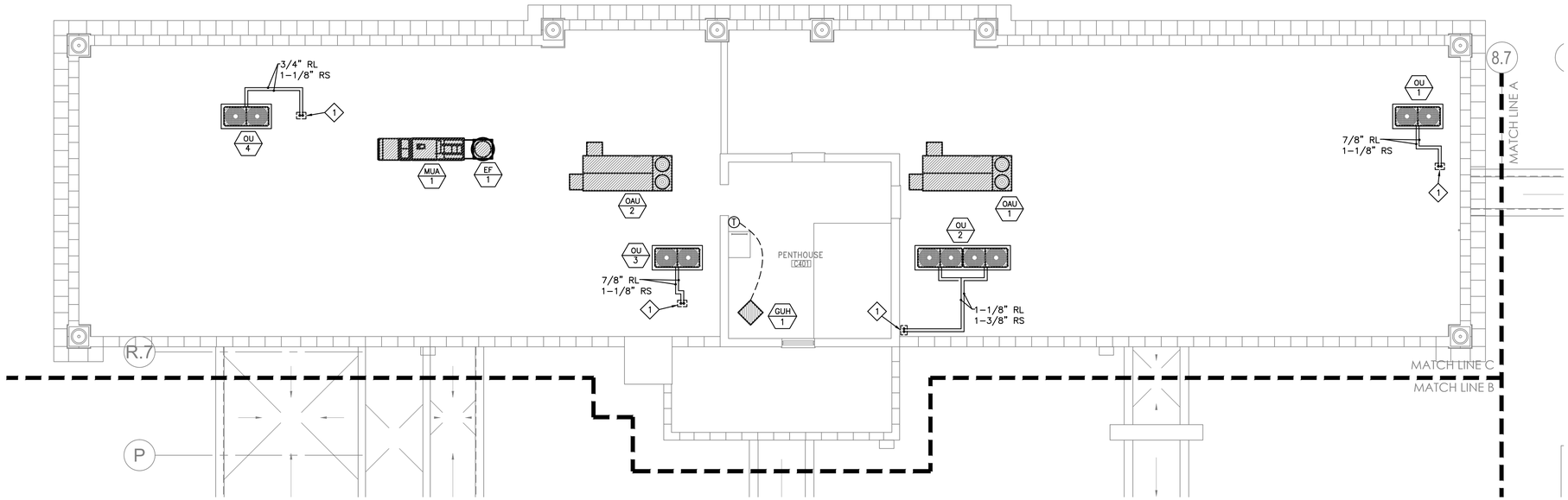
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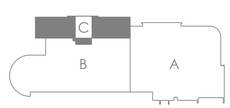


ROOF PLAN PART C – HVAC PIPING

SCALE: 1/8" = 1'-0"

PLAN NOTES:

1. REFRIGERANT PIPING DOWN THROUGH ROOF IN PIPE BOX TO BRANCH CONTROLLER BELOW.



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HPSC Historic Hospital (C)

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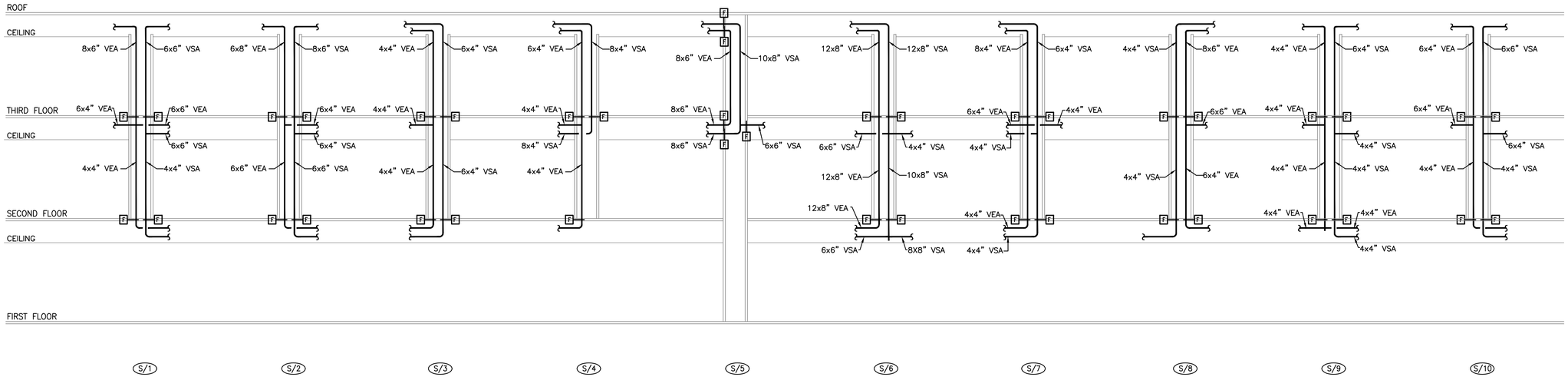
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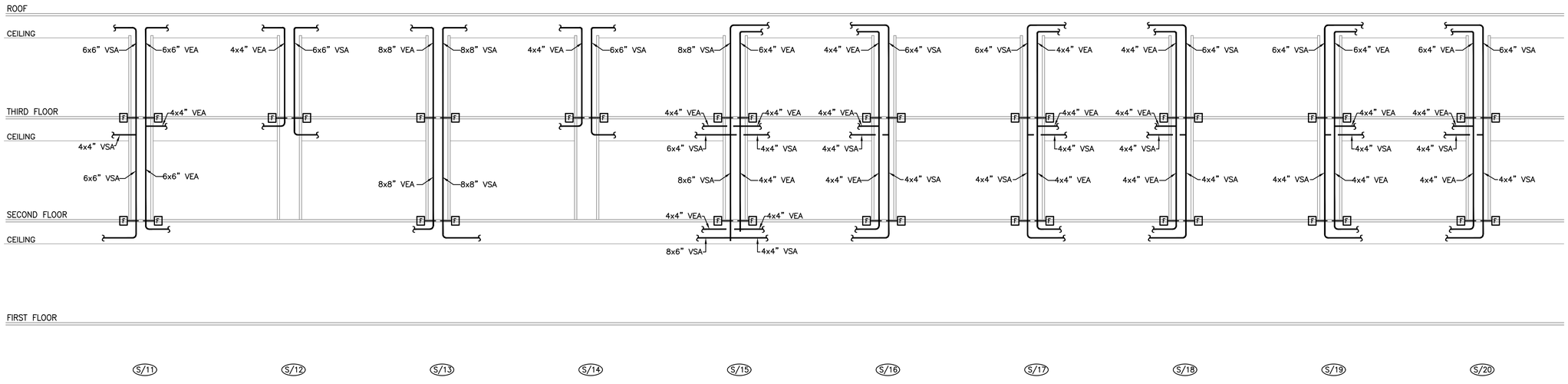
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514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com
Albert & McCleskey Associates Architects

ROOF PLAN PART C - HVAC PIPING





HVAC SUPPLY AND EXHAUST DUCT RISERS

SCALE: N.T.S.

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HPSC Historic Hospital □C□

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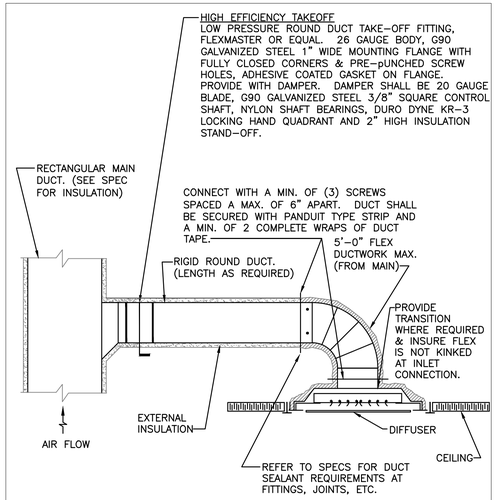
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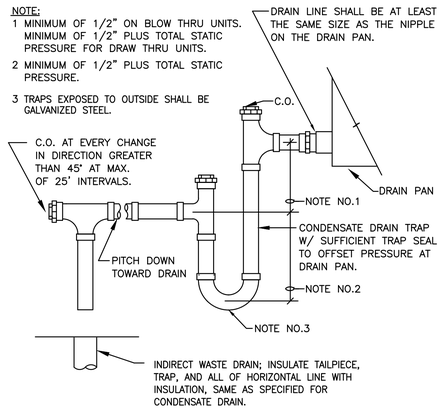
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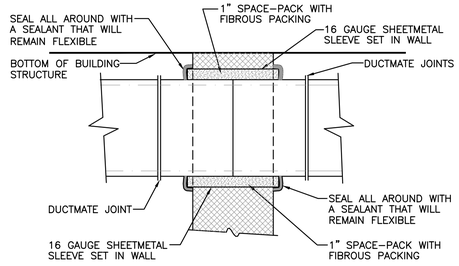
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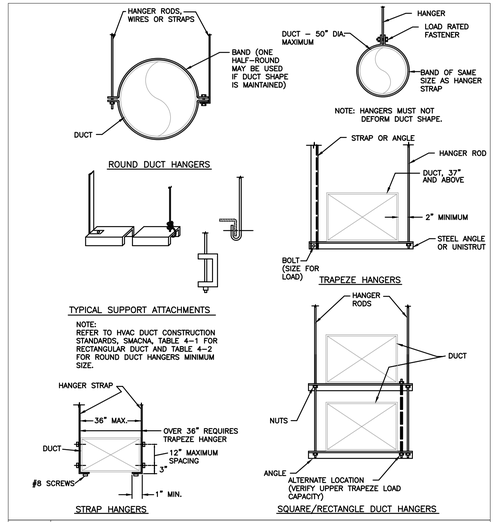
1 TYPICAL ROUND SUPPLY BRANCH DUCT DETAIL — NO SCALE



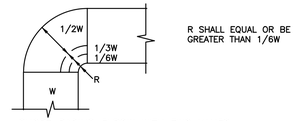
2 CONDENSATE DRAIN TRAP DETAIL — NO SCALE



3 DUCT PASSING THRU WALLS — NO SCALE

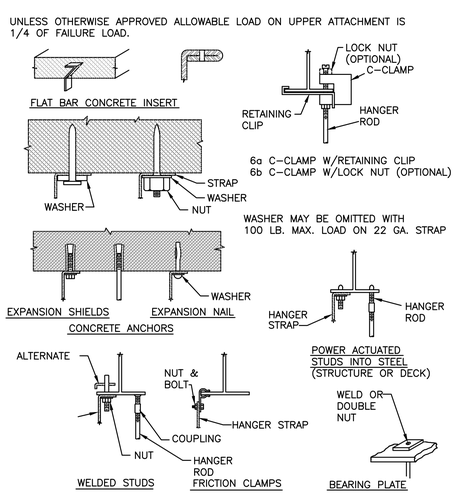


4 DETAILS OF DUCTWORK LOWER HANGER ATTACHMENTS — NO SCALE

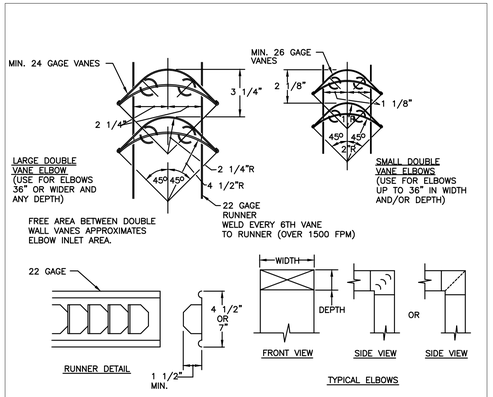


NOTES:
1. THE INTERIOR SURFACE OF ALL RADIUS ELBOWS SHALL BE MADE ROUND.
2. ALL RADIUS ELBOWS SHOWN ON PLANS SHALL BE STANDARD RADIUS ELBOWS. SHORT RADIUS ELBOWS SHALL BE USED ONLY WHERE APPROVED BY THE ENGINEER. ALL SHORT RADIUS ELBOWS SHALL HAVE VANES. VANES SHALL BE CONSTRUCTED, SUPPORTED AND FASTENED AS RECOMMENDED BY SMACNA.

5 DETAILS OF RADIUS ELBOWS — NO SCALE



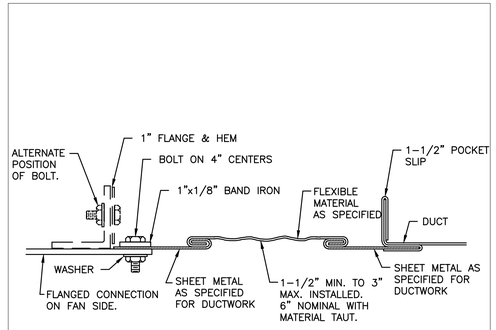
6 UPPER ATTACHEMENT DEVICES — NO SCALE



SQUARE OR RECTANGULAR ELBOWS

NOTES:
1. ALL SQUARE OR RECTANGULAR ELBOWS SHALL HAVE ONE OF THE TWO TYPES OF TURNING VANES SHOWN ABOVE. SINGLE VANE ELBOWS WILL NOT BE PERMITTED.
2. VANES SHALL BE CONSTRUCTED, SUPPORTED AND FASTENED AS RECOMMENDED BY SMACNA.
3. ALL ELBOWS SHOWN ON PLANS SHALL BE MADE RADIUS ELBOWS PROVIDED SPACE PERMITS RADIUS INSTALLATION. SQUARE OR RECTANGULAR ELBOWS SHALL BE USED ONLY WITH APPROVAL OF THE PROFESSIONAL.

7 TURNING VANES - TYPICAL — NO SCALE



8 RECTANGULAR FLEXIBLE CONNECTION — NO SCALE

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11-02-2015		90% Pricing Set
11-19-2018		100% Bid Docs

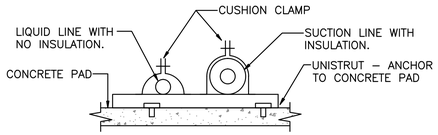
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Client No: -------
Albert & Associates: 12575

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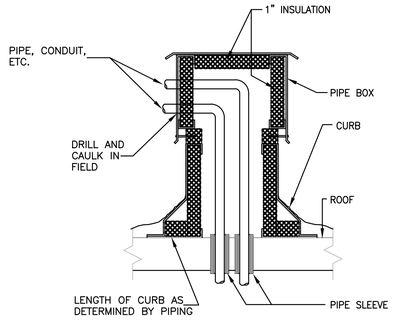
M5.1

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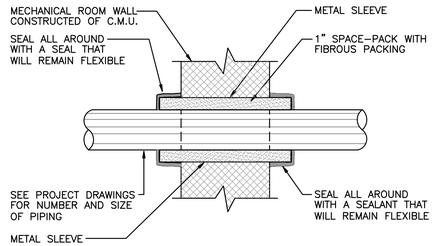
ERG# 15-28.2



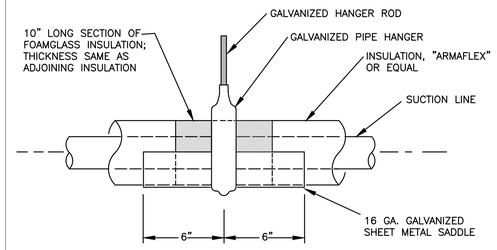
9 DETAIL OF EXTERIOR REFRIGERANT PIPE SUPPORT — NO SCALE



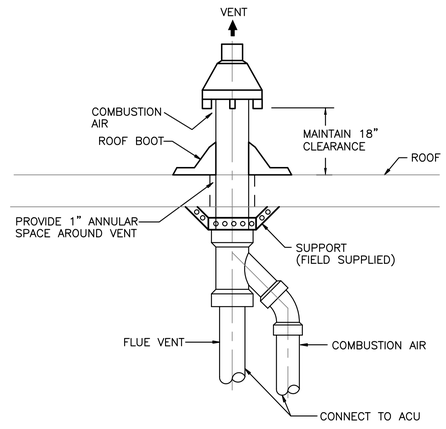
10 PIPE BOX AND ROOF CURB DETAIL — NO SCALE



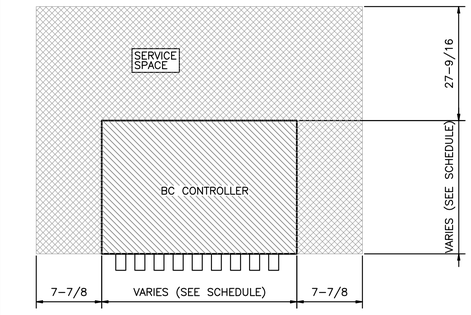
11 DETAIL OF PIPES AND CONDUITS PASSING THRU WALLS — NO SCALE



12 DETAIL OF HANGER FOR INSULATED SUCTION LINE — NO SCALE



13 DETAIL OF CONCENTRIC VENT THRU ROOF INSTALLATION — NO SCALE

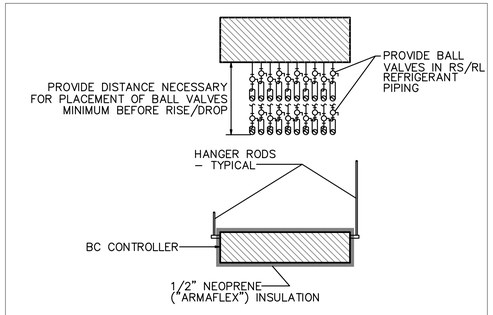


NOTES:

A. ALL DIMENSIONS ARE IN INCHES

B. REFER TO BC CONTROLLER SCHEDULE FOR OVERALL SIZE AND WEIGHT OF UNIT

14 BC CONTROLLER SERVICE ACCESS DETAIL — NO SCALE



NOTES:

A. SUPPORTING STRUCTURE MUST BE STRONG ENOUGH TO SUPPORT WEIGHT OF BC CONTROLLER(S).

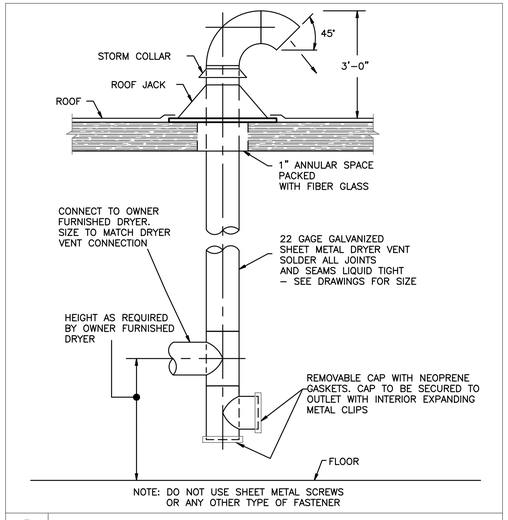
B. BOTTOM OF BC CONTROLLER TO BE ABOVE CEILING.

C. BC CONTROLLER(S) MUST BE MOUNTED LEVEL.

D. BC CONTROLLER(S) SHALL BE INSULATED IN A MANNER THAT DOES NOT INTERFERE WITH EXTERNAL CONNECTIONS. FASTENERS AND PANELS THAT ALLOW FOR INTERNAL SERVICING MUST BE ACCOUNTED FOR IN A A MANNER THAT PRODUCES MINIMAL DAMAGE TO INSULATION.

E. SEE PLUMBING DRAWINGS FOR CONDENSATE DRAIN ROUTING.

15 BC CONTROLLER MOUNTING AND REFRIGERANT CONTROL DETAIL — NO SCALE



NOTE: DO NOT USE SHEET METAL SCREWS OR ANY OTHER TYPE OF FASTENER

16 DRYER VENT – TYPICAL — NO SCALE

CITY OF HATTIESBURG MISSISSIPPI 1884

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Historic Hospital (C)

Drawing Issued:

Date	Rev.	Description
08-31-2015		DD Check Set
10-20-2015		75% Progress Set
11-02-2015		90% Pricing Set
11-19-2018		100% Bid Docs

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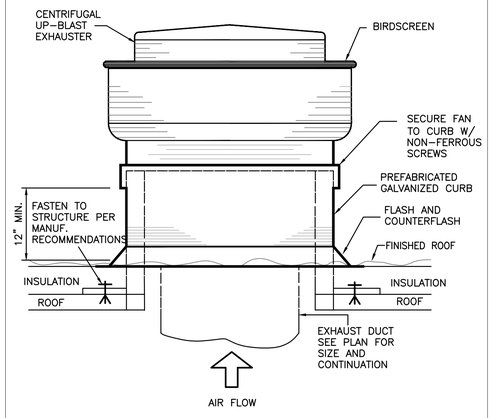
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ERG# 15-28.2

NOTE:
TOP OF CURB SHALL BE LEVEL, PROVIDE PITCHED ROOF CURB AS REQ'D.



17 CENTRIFUGAL UP–BLAST EXHAUSTER — NO SCALE

PIPE SIZE SCHEDULE

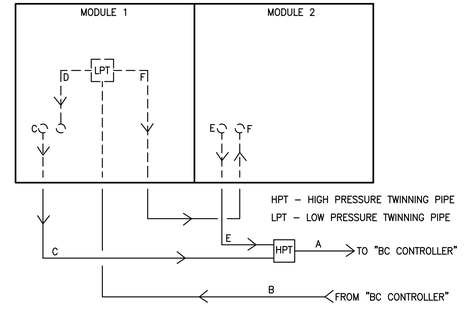
TAG	MANUFACTURER & MODEL NO.	A	B	C	D	E	F
OU 1	MITSUBISHI PURY–P168YLMU–A	7/8	1–1/8	N/A	N/A	N/A	N/A
OU 2	MITSUBISHI PURY–P264YSLMU–A	1–1/8	1–3/8	7/8	③	3/4	1–1/8
OU 3	MITSUBISHI PURY–P168YLMU–A	7/8	1–1/8	N/A	N/A	N/A	N/A
OU 4	MITSUBISHI PURY–P120YKMU–A	3/4	1–1/8	N/A	N/A	N/A	N/A

NOTES:

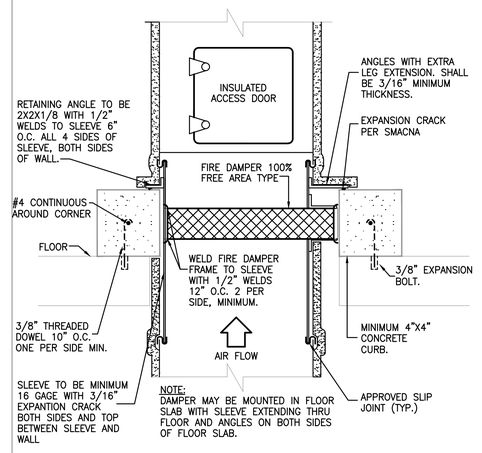
① TWINNING PIPE (HIGH PRESSURE) SHOULD NOT BE TILTED MORE THAN 15 DEGREES FROM THE HORIZONTAL PLANE.

② THE PIPE SECTION BEFORE THE TWINNING PIPE (SECTION "A") MUST HAVE AT LEAST 19–11/16" OF STRAIGHT SECTION.

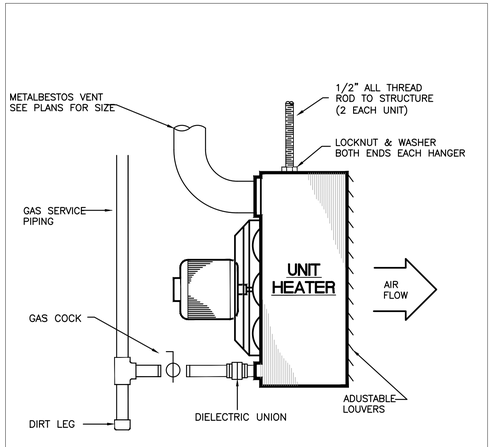
③ CONNECT MODULE 1 WITH THE TWINNING PIPE (LOW PRESSURE).



18 DETAIL FOR HP AND LP REFRIGERANT CONNECTIONS AT OUTDOOR (CONDENSING) UNITS — NO SCALE



19 HORIZONTAL FIRE DAMPER – LOW VELOCITY DUCT — NO SCALE



20 UNIT HEATER PIPING — NO SCALE

HATTIESBURG PUBLIC SAFETY COMPLEX

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HPSC Historic Hospital □C□

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Albert & Associates:	12575

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OUTDOOR AIR HANDLING UNIT SCHEDULE (PART 1 OF 2)

TAG	MANUFACTURER AND MODEL NO.	SERVES	SUPPLY FAN										EXHAUST FAN										COOLING COIL						RE-HEAT COIL			HEATING (MBH)						CONTINUED BELOW	TAG
			TYPE	FAN QTY	CFM	ESP / TSP	RPM	ISOLATION TYPE	ISOLATION DEFL	ELEC (PER FAN) BHP	ELEC (PER FAN) HP	ELEC (PER FAN) V/ø	TYPE	FAN QTY	CFM	ESP / TSP	RPM	ISOLATION TYPE	ISOLATION DEFL	ELEC (PER FAN) BHP	ELEC (PER FAN) HP	ELEC (PER FAN) V/ø	FV	EDB / EWB	LDB / LWB	APD	CAPACITY (MBH) TOTAL	CAPACITY (MBH) SENS	NO. ROWS FINS/IN.	CAPACITY	EAT	LAT	FUEL	TYPE	CAPACITY IN	CAPACITY OUT	EAT	LAT		
OAU 1	GREENHECK ERCH-20-30L	DEDICATED BUILDING OUTDOOR AIR	FORWARD CURVED	1	2005	1.50 / 2.77	2364	SPRING	SEE SPECS	2.97	3.00	460/3	FORWARD CURVED	1	1525	1.25 / 1.37	1800	SPRING	SEE SPECS	1.61	2.00	460/3	446	82.4 / 69.9	56.6 / 55.8	0.602	92.5	56.1	6 / 10	26.8	56.6	69.0	NATURAL GAS	INDIRECT FIRED	150	120	54	109		OAU 1
OAU 2	GREENHECK ERCH-20-30L	DEDICATED BUILDING OUTDOOR AIR	FORWARD CURVED	1	1975	1.50 / 2.69	2307	SPRING	SEE SPECS	2.66	3.00	460/3	FORWARD CURVED	1	1375	1.25 / 1.35	1800	SPRING	SEE SPECS	1.38	1.50	460/3	417	82.6 / 70.1	55.8 / 55.0	0.609	92.0	54.6	6 / 10	26.0	55.8	68.6	NATURAL GAS	INDIRECT FIRED	100	80	53	93		OAU 2

OUTDOOR AIR HANDLING UNIT SCHEDULE (PART 2 OF 2)

TAG	MANUFACTURER AND MODEL NO.	SERVES	ENERGY WHEEL AIR P.D. (INS. WATER) SUPPLY	ENERGY WHEEL AIR P.D. (INS. WATER) EXHAUST	ENERGY WHEEL (SUMMER PERFORMANCE) FRESH AIR EAT(Fdb-Fwb)	ENERGY WHEEL (SUMMER PERFORMANCE) FRESH AIR LAT(Fdb-Fwb)	ENERGY WHEEL (SUMMER PERFORMANCE) STALE AIR EAT(Fdb-Fwb)	ENERGY WHEEL (SUMMER PERFORMANCE) STALE AIR LAT(Fdb-Fwb)	EFFICIENCY OA	EFFICIENCY EA	ENERGY WHEEL (WINTER PERFORMANCE) FRESH AIR EAT(Fdb-Fwb)	ENERGY WHEEL (WINTER PERFORMANCE) FRESH AIR LAT(Fdb-Fwb)	ENERGY WHEEL (WINTER PERFORMANCE) STALE AIR EAT(Fdb-Fwb)	ENERGY WHEEL (WINTER PERFORMANCE) STALE AIR LAT(Fdb-Fwb)	EFFICIENCY OA	EFFICIENCY EA	APPROXIMATE OPERATING WT. (LBS.)	REMARKS	TAG
OAU 1	GREENHECK ERCH-20-30L	DEDICATED BUILDING OUTDOOR AIR	2005	1525	95.6 - 79.8	82.4 - 69.9	75.0 - 63.0	92.3 - 77.9	63.9	84.0	22.0 - 18.3	54.0 - 44.9	72.0 - 55.0	30.0 - 26.1	63.9	84.0	2500	MOTORIZED LOW LEAKAGE DAMPERS, FROST CONTROL MODULATING WHEEL, INSULATED DOUBLE WALL CONSTUCTION, PLEATED MERV 8 FILTERS, MODULATING HOT GAS REHEAT COIL, MERV 8 FILTER, FAN VFD's, MICROPROCESSOR CONTROLS, 4:1 MODULATING S/S GAS FURNACE, INTERNALLY MOUNTED CONTROL CENTER, DOWNTURN WEATHERHOOD, UNWIRED 120V NEMA 3R OUTLET	OAU 1
OAU 2	GREENHECK ERCH-20-30L	DEDICATED BUILDING OUTDOOR AIR	1975	1375	95.6 - 79.8	82.6 - 70.1	75.0 - 63.0	92.7 - 78.2	63.0	85.9	22.0 - 18.3	53.5 - 44.7	72.0 - 55.0	29.1 - 25.2	63.0	85.9	2500	MOTORIZED LOW LEAKAGE DAMPERS, FROST CONTROL MODULATING WHEEL, INSULATED DOUBLE WALL CONSTUCTION, PLEATED MERV 8 FILTERS, MODULATING HOT GAS REHEAT COIL, MERV 8 FILTER, FAN VFD's, MICROPROCESSOR CONTROLS, 4:1 MODULATING S/S GAS FURNACE, INTERNALLY MOUNTED CONTROL CENTER, DOWNTURN WEATHERHOOD, UNWIRED 120V NEMA 3R OUTLET	OAU 2

POWER VENTILATOR SCHEDULE

TAG	MANUFACTURER AND MODEL NO.	TYPE	SERVES	CAPACITY, CFM	STATIC PRESS., IN. W.C.	MOTOR HP(AMPS) - V - PH	FAN SPEED RPM	SOUND POWER dBA	ON/OFF	INTERLOCK	APPROXIMATE OPERATING WEIGHT, LBS	REMARKS	TAG
EF 1	GREENHECK CUBE-180-5	BELT DRIVE CENTRIFUGAL UP-BLAST	KH 1	2000	0.75	1/2 - 208 - 1	897	59	HOOD CONTROL PANEL	MOTORIZED DAMPER	100	FACTORY WIRED DISCONNECT, SEE MUA-1 FOR COMBINATION CURB INFORMATION	EF 1

REFRIGERANT CONTROLLER SCHEDULE

TAG	MANUFACTURER AND MODEL NO.	SERVES	# PORTS	RLA - V - PH	MCA (AMPS)	MOCP (AMPS)	APPROXIMATE OPERATING WEIGHT, LBS	SIZE (INCHES) H x W x D	REMARKS	TAG
BC 1	MITSUBISHI CMB-P1016NU-GA	OU-1	16	1.04 - 208 - 1	1.30	15.0	150	12 x 44 x 21	PROVIDE 1-1/4" CONDENSATE DRAIN W/FLEXIBLE HOSE AND INSULATION, R 410A REFRIGERANT, CAP UNUSED PORTS, SEE BC CONTROLLER DETAILS FOR MORE INFORMATION	BC 1
BC 2	MITSUBISHI CMB-P1016NU-HA	OU-2	16	1.32 - 208 - 1	1.65	15.0	175	12 x 44 x 21	PROVIDE 1-1/4" CONDENSATE DRAIN W/FLEXIBLE HOSE AND INSULATION, R 410A REFRIGERANT, CAP UNUSED PORTS, SEE BC CONTROLLER DETAILS FOR MORE INFORMATION	BC 2
BC 3	MITSUBISHI CMB-P1016NU-GA	OU-3	16	1.04 - 208 - 1	1.30	15.0	150	12 x 44 x 21	PROVIDE 1-1/4" CONDENSATE DRAIN W/FLEXIBLE HOSE AND INSULATION, R 410A REFRIGERANT, CAP UNUSED PORTS, SEE BC CONTROLLER DETAILS FOR MORE INFORMATION	BC 3
BC 4	MITSUBISHI CMB-P1016NU-GA	OU-4	16	1.04 - 208 - 1	1.30	15.0	150	12 x 44 x 21	PROVIDE 1-1/4" CONDENSATE DRAIN W/FLEXIBLE HOSE AND INSULATION, R 410A REFRIGERANT, CAP UNUSED PORTS, SEE BC CONTROLLER DETAILS FOR MORE INFORMATION	BC 4

MULTIZONE (VRF) SPLIT SYSTEM HEAT PUMP EQUIPMENT SCHEDULE (PART 1 OF 3)

SYSTEM NO.	OUTDOOR UNIT: MANUFACTURER AND MODEL NO.	AMBIENT TEMPERATURE SUMMER °Fdb - °Fwb	AMBIENT TEMPERATURE WINTER °Fdb - °Fwb	CAPACITY, MBH COOLING	CAPACITY, MBH HEATING	ELECTRICAL DATA VOLTAGE-PHASE	ELECTRICAL DATA MCA, AMPS	ELECTRICAL DATA MOCP, AMPS	ELECTRICAL DATA CRANKCASE HEATER, WATTS	ELECTRICAL DATA UNIT RLA COOLING	ELECTRICAL DATA UNIT RLA HEATING	UNIT OPERATING WEIGHT
OU 1	MITSUBISHI PURY-P168YLMU-A	95.0 75.0	47.0 43.0	168.0	188.0	460 - 3	31	50	--	--	--	730

TAG	SERVES	TYPE	BASIS OF DESIGN	INDOOR AIR TEMP. SUMMER °Fdb °Fwb	INDOOR AIR TEMP. WINTER °Fdb.	MIN. CAPACITY, MBH COOLING	MIN. CAPACITY, MBH HEATING	ELECTRICAL DATA VOLTAGE-PHASE	ELECTRICAL DATA MCA, AMPS	ELECTRICAL DATA RLA	FAN AIRFLOW, CFM LOW	FAN AIRFLOW, CFM HIGH	FINAL PIPING RUNOUT SIZE RL(IN)	FINAL PIPING RUNOUT SIZE RS(IN)	REMARKS
IU-1.1	C120 HOLDING CELL	HORIZONTAL DUCTED	MITSUBISHI PEFY-P12NMAU-E3	80.0 - 67.0	70.0	12.0	13.5	208 - 1	1.20	--	265	370	1/4	1/2	R410A REFRIGERANT, INTEGRAL CONDENSATE PUMP
IU-1.2	C121 HOLDING CELL	HORIZONTAL DUCTED	MITSUBISHI PMFY-P08NBMU-E	80.0 - 67.0	70.0	8.0	9.0	208 - 1	1.05	--	210	300	1/4	1/2	R410A REFRIGERANT, INTEGRAL CONDENSATE PUMP
IU-1.3	C103a CORRIDOR	WALL MOUNTED	MITSUBISHI PKFY-P06NBMU-E	80.0 - 67.0	70.0	6.0	6.7	208 - 1	0.19	0.15	170	210	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-1.4	C118 BREATHALYZER	WALL MOUNTED	MITSUBISHI PKFY-P08NHMU-E	80.0 - 67.0	70.0	8.0	9.0	208 - 1	0.38	0.30	320	410	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-1.5	C116 FINGERPRINTING	WALL MOUNTED	MITSUBISHI PKFY-P06NBMU-E	80.0 - 67.0	70.0	6.0	6.7	208 - 1	0.19	0.15	170	210	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-1.6	C114 CPT OFFICE	WALL MOUNTED	MITSUBISHI PKFY-P06NBMU-E	80.0 - 67.0	70.0	6.0	6.7	208 - 1	0.19	0.15	170	210	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-1.7	C112 CPT OFFICE	WALL MOUNTED	MITSUBISHI PKFY-P06NBMU-E	80.0 - 67.0	70.0	6.0	6.7	208 - 1	0.19	0.15	170	210	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-1.8	C110 CPT OFFICE	WALL MOUNTED	MITSUBISHI PKFY-P06NBMU-E	80.0 - 67.0	70.0	6.0	6.7	208 - 1	0.19	0.15	170	210	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-1.9	C108 CPT OFFICE	WALL MOUNTED	MITSUBISHI PKFY-P06NBMU-E	80.0 - 67.0	70.0	6.0	6.7	208 - 1	0.19	0.15	170	210	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-1.10	C225 BREAKROOM	WALL MOUNTED	MITSUBISHI PKFY-P15NHMU-E	80.0 - 67.0	70.0	15.0	17.0	208 - 1	0.38	0.30	320	410	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-1.11	C227 TOILET	WALL MOUNTED	MITSUBISHI PKFY-P06NBMU-E	80.0 - 67.0	70.0	6.0	6.7	208 - 1	0.19	0.15	170	210	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-1.12	C222 POLYGRAPH	WALL MOUNTED	MITSUBISHI PKFY-P08NHMU-E	80.0 - 67.0	70.0	8.0	9.0	208 - 1	0.38	0.30	320	410	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-1.13	C220 SPECIAL OPS	WALL MOUNTED	MITSUBISHI PKFY-P06NBMU-E	80.0 - 67.0	70.0	6.0	6.7	208 - 1	0.19	0.15	170	210	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-1.14	C218 SPECIAL OPS	WALL MOUNTED	MITSUBISHI PKFY-P06NBMU-E	80.0 - 67.0	70.0	6.0	6.7	208 - 1	0.19	0.15	170	210	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-1.15	C216 SPECIAL OPS	WALL MOUNTED	MITSUBISHI PKFY-P06NBMU-E	80.0 - 67.0	70.0	6.0	6.7	208 - 1	0.19	0.15	170	210	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-1.16	C214 SPECIAL OPS	WALL MOUNTED	MITSUBISHI PKFY-P06NBMU-E	80.0 - 67.0	70.0	6.0	6.7	208 - 1	0.19	0.15	170	210	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-1.17	C212 SPECIAL OPS	WALL MOUNTED	MITSUBISHI PKFY-P06NBMU-E	80.0 - 67.0	70.0	6.0	6.7	208 - 1	0.19	0.15	170	210	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-1.18	C322 CONF. ROOM	WALL MOUNTED	MITSUBISHI PKFY-P24NKMU-E	80.0 - 67.0	70.0	24.0	27.0	208 - 1	0.37	0.29	570	710	3/8	5/8	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-1.19A	C318 FUTURE GOV.	WALL MOUNTED	MITSUBISHI PKFY-P08NHMU-E	80.0 - 67.0	70.0	8.0	9.0	208 - 1	0.38	0.30	320	410	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-1.19B	C318 FUTURE GOV.	WALL MOUNTED	MITSUBISHI PKFY-P08NHMU-E	80.0 - 67.0	70.0	8.0	9.0	208 - 1	0.38	0.30	320	410	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-1.20	C316 ATF	WALL MOUNTED	MITSUBISHI PKFY-P06NBMU-E	80.0 - 67.0	70.0	6.0	6.7	208 - 1	0.19	0.15	170	210	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-1.21	C314 FBI	WALL MOUNTED	MITSUBISHI PKFY-P06NBMU-E	80.0 - 67.0	70.0	6.0	6.7	208 - 1	0.19	0.15	170	210	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-1.22	C312 US MARSHALL	WALL MOUNTED	MITSUBISHI PKFY-P06NBMU-E	80.0 - 67.0	70.0	6.0	6.7	208 - 1	0.19	0.15	170	210	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-1.23	C310 DEA	WALL MOUNTED	MITSUBISHI PKFY-P06NBMU-E	80.0 - 67.0	70.0	6.0	6.7	208 - 1	0.19	0.15	170	210	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-1.24	C328 TOILET	WALL MOUNTED	MITSUBISHI PKFY-P06NBMU-E	80.0 - 67.0	70.0	6.0	6.7	208 - 1	0.19	0.15	170	210	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT

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HPSC Historic Hospital

Drawing Issued:	
Date	Rev. Description
08-31-2015	DD Check Set
10-20-2015	75% Progress Set
11-02-2015	90% Pricing Set
11-19-2018	100% Bid Docs

Drawn By: DB,CM
Checked By: CM,TP
Client No: -------
Albert & Associates: 12575

CHRISTOPHER M. MCCLESKEY ENGINEER 20102 1/13/2017 REGISTERED PROFESSIONAL STATE OF MISSISSIPPI

M6.1

Engineering Resource Group Inc.
350 Edgewood Terrace Drive
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Phone: (601) 362-3552
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ERG# 15-28.2

MULTIZONE (VRF) SPLIT SYSTEM HEAT PUMP EQUIPMENT SCHEDULE (PART 2 OF 3)

SYSTEM NO.	OUTDOOR UNIT: MANUFACTURER AND MODEL NO.	AMBIENT TEMPERATURE: SUMMER °Fdb – °Fwb	AMBIENT TEMPERATURE: WINTER °Fdb – °Fwb	CAPACITY, MBH: COOLING	CAPACITY, MBH: HEATING	ELECTRICAL DATA: VOLTAGE–PHASE	ELECTRICAL DATA: MCA, AMPS	ELECTRICAL DATA: MOCP, AMPS	ELECTRICAL DATA: CRANKCASE HEATER, WATTS	ELECTRICAL DATA: UNIT RLA COOLING	ELECTRICAL DATA: UNIT RLA HEATING	UNIT OPERATING WEIGHT
OU 2	MITSUBISHI PURY–P264YSLMU–A (MODULE 1) MITSUBISHI PURY–P144YLMU–A	95.0 75.0	47.0 43.0	144.0	160.0	460 – 3	24	35	--	--	--	730
	(MODULE 2) MITSUBISHI PURY–P120YLMU–A	95.0 75.0	47.0 43.0	120.0	135.0	460 – 3	19	30	--	--	--	730
OU 3	MITSUBISHI PURY–P168YLMU–A	95.0 75.0	47.0 43.0	168.0	188.0	460 – 3	31	50	--	--	--	730

TAG	SERVES	TYPE	BASIS OF DESIGN	INDOOR AIR TEMP. SUMMER °Fdb °Fwb	INDOOR AIR TEMP. WINTER °Fdb	MIN. CAPACITY, MBH COOLING	MIN. CAPACITY, MBH HEATING	ELECTRICAL DATA VOLTAGE–PHASE	ELECTRICAL DATA MCA, AMPS	ELECTRICAL DATA RLA	FAN AIRFLOW, CFM LOW	FAN AIRFLOW, CFM HIGH	FINAL PIPING RUNOUT SIZE RL(IN)	FINAL PIPING RUNOUT SIZE RS(IN)	REMARKS
IU-2.1	C122 INMATE STOR.	CEILING CASSETTE	MITSUBISHI PMFY–P06NBMU–E	80.0 – 67.0	70.0	6.0	6.7	208 – 1	0.25	0.20	230	307	1/4	1/2	R410A REFRIGERANT, INTEGRAL CONDENSATE PUMP
IU-2.2	C124 LT OFFICE	WALL MOUNTED	MITSUBISHI PKFY–P15NHMU–E	80.0 – 67.0	70.0	15.0	17.0	208 – 1	0.38	0.30	320	410	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-2.3	C125 SGT OFFICE	WALL MOUNTED	MITSUBISHI PKFY–P08NHMU–E	80.0 – 67.0	70.0	8.0	9.0	208 – 1	0.38	0.30	320	410	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-2.4	C102a CORRIDOR	CEILING CASSETTE	MITSUBISHI PLFY–P08NCMU–E	80.0 – 67.0	70.0	8.0	9.0	208 – 1	0.29	0.23	280	350	1/4	1/2	R410A REFRIGERANT, INTEGRAL CONDENSATE PUMP
IU-2.5	C107 SECRETARY	WALL MOUNTED	MITSUBISHI PKFY–P06NBMU–E	80.0 – 67.0	70.0	6.0	6.7	208 – 1	0.19	0.15	170	210	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-2.6	C106 CHAPLIN	WALL MOUNTED	MITSUBISHI PKFY–P06NBMU–E	80.0 – 67.0	70.0	6.0	6.7	208 – 1	0.19	0.15	170	210	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-2.7A	C127 BREAKROOM	WALL MOUNTED	MITSUBISHI PKFY–P18NHMU–E	80.0 – 67.0	70.0	18.0	20.0	208 – 1	0.38	0.30	320	425	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-2.7B	C127 BREAKROOM	WALL MOUNTED	MITSUBISHI PKFY–P18NHMU–E	80.0 – 67.0	70.0	18.0	20.0	208 – 1	0.38	0.30	320	425	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-2.8	C231 INTERROG.	CEILING CASSETTE	MITSUBISHI PMFY–P06NBMU–E	80.0 – 67.0	70.0	6.0	6.7	208 – 1	0.25	0.20	230	307	1/4	1/2	R410A REFRIGERANT, INTEGRAL CONDENSATE PUMP
IU-2.9	C232 INTERROG.	CEILING CASSETTE	MITSUBISHI PMFY–P06NBMU–E	80.0 – 67.0	70.0	6.0	6.7	208 – 1	0.25	0.20	230	307	1/4	1/2	R410A REFRIGERANT, INTEGRAL CONDENSATE PUMP
IU-2.10	C233 INTERROG.	CEILING CASSETTE	MITSUBISHI PMFY–P06NBMU–E	80.0 – 67.0	70.0	6.0	6.7	208 – 1	0.25	0.20	230	307	1/4	1/2	R410A REFRIGERANT, INTEGRAL CONDENSATE PUMP
IU-2.11	C234 INTERROG.	CEILING CASSETTE	MITSUBISHI PMFY–P06NBMU–E	80.0 – 67.0	70.0	6.0	6.7	208 – 1	0.25	0.20	230	307	1/4	1/2	R410A REFRIGERANT, INTEGRAL CONDENSATE PUMP
IU-2.12	C235 INT. CONTROL RM	WALL MOUNTED	MITSUBISHI PKFY–P24NKMU–E	80.0 – 67.0	70.0	24.0	27.0	208 – 1	0.37	0.29	570	710	3/8	5/8	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-2.13	C201c CORRIDOR	CEILING CASSETTE	MITSUBISHI PLFY–P08NCMU–E	80.0 – 67.0	70.0	8.0	9.0	208 – 1	0.29	0.23	280	350	1/4	1/2	R410A REFRIGERANT, INTEGRAL CONDENSATE PUMP
IU-2.14A	C238 CONFERENCE RM	WALL MOUNTED	MITSUBISHI PKFY–P30NKMU–E	80.0 – 67.0	70.0	30.0	34.0	208 – 1	0.54	0.43	710	850	3/8	5/8	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-2.14B	C238 CONFERENCE RM	WALL MOUNTED	MITSUBISHI PKFY–P30NKMU–E	80.0 – 67.0	70.0	30.0	34.0	208 – 1	0.54	0.43	710	850	3/8	5/8	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-2.15	C211 STRIKE UNIT	WALL MOUNTED	MITSUBISHI PKFY–P06NBMU–E	80.0 – 67.0	70.0	6.0	6.7	208 – 1	0.19	0.15	170	210	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-2.16	C210 NET	WALL MOUNTED	MITSUBISHI PKFY–P06NBMU–E	80.0 – 67.0	70.0	6.0	6.7	208 – 1	0.19	0.15	170	210	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-2.17	C209 HIT OFFICE	WALL MOUNTED	MITSUBISHI PKFY–P06NBMU–E	80.0 – 67.0	70.0	6.0	6.7	208 – 1	0.19	0.15	170	210	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-2.18	C208 HIT OFFICE	WALL MOUNTED	MITSUBISHI PKFY–P06NBMU–E	80.0 – 67.0	70.0	6.0	6.7	208 – 1	0.19	0.15	170	210	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-2.19	C207 WORK AREA	WALL MOUNTED	MITSUBISHI PKFY–P06NBMU–E	80.0 – 67.0	70.0	6.0	6.7	208 – 1	0.19	0.15	170	210	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-2.20A	C323 PURCHASING	WALL MOUNTED	MITSUBISHI PKFY–P15NHMU–E	80.0 – 67.0	70.0	15.0	17.0	208 – 1	0.38	0.30	320	410	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-2.20B	C323 PURCHASING	WALL MOUNTED	MITSUBISHI PKFY–P15NHMU–E	80.0 – 67.0	70.0	15.0	17.0	208 – 1	0.38	0.30	320	410	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-2.21	C301c CORRIDOR	CEILING CASSETTE	MITSUBISHI PLFY–P08NCMU–E	80.0 – 67.0	70.0	8.0	9.0	208 – 1	0.29	0.23	280	350	1/4	1/2	R410A REFRIGERANT, INTEGRAL CONDENSATE PUMP
IU-2.22A	C309 CLASS ROOM	WALL MOUNTED	MITSUBISHI PKFY–P12NHMU–E	80.0 – 67.0	70.0	12.0	13.5	208 – 1	0.38	0.30	320	410	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-2.22B	C309 CLASS ROOM	WALL MOUNTED	MITSUBISHI PKFY–P12NHMU–E	80.0 – 67.0	70.0	12.0	13.5	208 – 1	0.38	0.30	320	410	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-2.22C	C309 CLASS ROOM	WALL MOUNTED	MITSUBISHI PKFY–P12NHMU–E	80.0 – 67.0	70.0	12.0	13.5	208 – 1	0.38	0.30	320	410	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-3.1	C131 REPORT WRITING	CEILING CASSETTE	MITSUBISHI PMFY–P06NBMU–E	80.0 – 67.0	70.0	6.0	6.7	208 – 1	0.25	0.20	230	307	1/4	1/2	R410A REFRIGERANT, INTEGRAL CONDENSATE PUMP
IU-3.2	C133 MAIL ROOM	CEILING CASSETTE	MITSUBISHI PMFY–P06NBMU–E	80.0 – 67.0	70.0	6.0	6.7	208 – 1	0.25	0.20	230	307	1/4	1/2	R410A REFRIGERANT, INTEGRAL CONDENSATE PUMP
IU-3.3	C135 MEN	CEILING CASSETTE	MITSUBISHI PMFY–P06NBMU–E	80.0 – 67.0	70.0	6.0	6.7	208 – 1	0.25	0.20	230	307	1/4	1/2	R410A REFRIGERANT, INTEGRAL CONDENSATE PUMP
IU-3.4	C136 WOMEN	CEILING CASSETTE	MITSUBISHI PMFY–P06NBMU–E	80.0 – 67.0	70.0	6.0	6.7	208 – 1	0.25	0.20	230	307	1/4	1/2	R410A REFRIGERANT, INTEGRAL CONDENSATE PUMP
IU-3.5	B101 CORRIDOR	WALL MOUNTED	MITSUBISHI PKFY–P12NHMU–E	80.0 – 67.0	70.0	12.0	13.5	208 – 1	0.38	0.30	320	410	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-3.6A	C105 BRIEFING/MUSTER	WALL MOUNTED	MITSUBISHI PKFY–P15NHMU–E	80.0 – 67.0	70.0	15.0	17.0	208 – 1	0.38	0.30	320	410	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-3.6B	C105 BRIEFING/MUSTER	WALL MOUNTED	MITSUBISHI PKFY–P15NHMU–E	80.0 – 67.0	70.0	15.0	17.0	208 – 1	0.38	0.30	320	410	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-3.7	C239 INTERROG.	CEILING CASSETTE	MITSUBISHI PMFY–P06NBMU–E	80.0 – 67.0	70.0	6.0	6.7	208 – 1	0.25	0.20	230	307	1/4	1/2	R410A REFRIGERANT, INTEGRAL CONDENSATE PUMP
IU-3.8	C241 INTERROG.	CEILING CASSETTE	MITSUBISHI PMFY–P06NBMU–E	80.0 – 67.0	70.0	6.0	6.7	208 – 1	0.25	0.20	230	307	1/4	1/2	R410A REFRIGERANT, INTEGRAL CONDENSATE PUMP
IU-3.9	C242 INTERROG.	CEILING CASSETTE	MITSUBISHI PMFY–P06NBMU–E	80.0 – 67.0	70.0	6.0	6.7	208 – 1	0.25	0.20	230	307	1/4	1/2	R410A REFRIGERANT, INTEGRAL CONDENSATE PUMP
IU-3.10	C243 INTERROG.	CEILING CASSETTE	MITSUBISHI PMFY–P06NBMU–E	80.0 – 67.0	70.0	6.0	6.7	208 – 1	0.25	0.20	230	307	1/4	1/2	R410A REFRIGERANT, INTEGRAL CONDENSATE PUMP
IU-3.11	C244 INT. CONTROL RM	WALL MOUNTED	MITSUBISHI PKFY–P24NKMU–E	80.0 – 67.0	70.0	24.0	27.0	208 – 1	0.37	0.29	570	710	3/8	5/8	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-3.12	C206 TRAFFIC REPORT	WALL MOUNTED	MITSUBISHI PKFY–P06NBMU–E	80.0 – 67.0	70.0	6.0	6.7	208 – 1	0.19	0.15	170	210	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-3.13	C205 LT TRAF. OFFICE	WALL MOUNTED	MITSUBISHI PKFY–P06NBMU–E	80.0 – 67.0	70.0	6.0	6.7	208 – 1	0.19	0.15	170	210	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-3.14	C204 SGT TRAF. OFFICE	WALL MOUNTED	MITSUBISHI PKFY–P06NBMU–E	80.0 – 67.0	70.0	6.0	6.7	208 – 1	0.19	0.15	170	210	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-3.15	C203 DUI OFFICE	WALL MOUNTED	MITSUBISHI PKFY–P06NBMU–E	80.0 – 67.0	70.0	6.0	6.7	208 – 1	0.19	0.15	170	210	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-3.16A	C325 PURCHASING	WALL MOUNTED	MITSUBISHI PKFY–P12NHMU–E	80.0 – 67.0	70.0	12.0	13.5	208 – 1	0.38	0.30	320	410	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-3.16B	C325 PURCHASING	WALL MOUNTED	MITSUBISHI PKFY–P12NHMU–E	80.0 – 67.0	70.0	12.0	13.5	208 – 1	0.38	0.30	320	410	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-3.17A	C308 KITCHEN	WALL MOUNTED	MITSUBISHI PKFY–P08NHMU–E	80.0 – 67.0	70.0	8.0	9.0	208 – 1	0.38	0.30	320	410	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-3.17B	C308 KITCHEN	WALL MOUNTED	MITSUBISHI PKFY–P08NHMU–E	80.0 – 67.0	70.0	8.0	9.0	208 – 1	0.38	0.30	320	410	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU-3.18	C307 PANTRY	WALL MOUNTED	MITSUBISHI PKFY–P06NBMU–E	80.0 – 67.0	70.0	6.0	6.7	208 – 1	0.19	0.15	170	210	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP

CITY OF HATTIESBURG MISSISSIPPI

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11-02-2015		90% Pricing Set
11-19-2018		100% Bid Docs

Drawn By: DB,CM

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Client No: -------

Albert & Associates: 12575

STATE OF MISSISSIPPI CHARLES E. MCCLESKEY 20100 ENGINEER 1/13/2017

M6.2

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ERG# 15-28.2

MULTIZONE (VRF) SPLIT SYSTEM HEAT PUMP EQUIPMENT SCHEDULE (PART 3 OF 3)

SYSTEM NO.	OUTDOOR UNIT: MANUFACTURER AND MODEL NO.	AMBIENT TEMPERATURE: SUMMER °Fdb – °Fwb	AMBIENT TEMPERATURE: WINTER °Fdb – °Fwb	CAPACITY, MBH: COOLING	CAPACITY, MBH: HEATING	ELECTRICAL DATA: VOLTAGE–PHASE	ELECTRICAL DATA: MCA, AMPS	ELECTRICAL DATA: MOCP, AMPS	ELECTRICAL DATA: CRANKCASE HEATER, WATTS	ELECTRICAL DATA: UNIT RLA COOLING	ELECTRICAL DATA: UNIT RLA HEATING	UNIT OPERATING WEIGHT
OU 4	MITSUBISHI PURY–P120YKMU–A	95.0 75.0	47.0 43.0	120.0	135.0	460 – 3	21	25	--	--	--	750

TAG	INDOOR UNIT (AIR HANDLING UNIT): SERVES	TYPE	BASIS OF DESIGN	INDOOR AIR TEMP. SUMMER °Fdb °Fwb	INDOOR AIR TEMP. WINTER °Fdb	MIN. CAPACITY, MBH: COOLING	MIN. CAPACITY, MBH: HEATING	ELECTRICAL DATA: VOLTAGE–PHASE	ELECTRICAL DATA: MCA, AMPS	ELECTRICAL DATA: RLA	FAN: AIRFLOW, CFM LOW	FAN: AIRFLOW, CFM HIGH	FINAL PIPING RUNOUT SIZE: RL(IN)	FINAL PIPING RUNOUT SIZE: RS(IN)	REMARKS
IU–4.1	C139 PURCHASING	CEILING CASSETTE	MITSUBISHI PMFY–P08NBMU–E	80.0 – 67.0	70.0	8.0	9.0	208 – 1	0.25	0.20	258	328	1/4	1/2	R410A REFRIGERANT, INTEGRAL CONDENSATE PUMP
IU–4.2	C140 ELECTRICAL	WALL MOUNTED	MITSUBISHI PKFY–P06NBMU–E	80.0 – 67.0	70.0	6.0	6.7	208 – 1	0.19	0.15	170	210	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU–4.3	C141 MAINTENANCE	WALL MOUNTED	MITSUBISHI PKFY–P08NHMU–E	80.0 – 67.0	70.0	8.0	9.0	208 – 1	0.38	0.30	320	410	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU–4.4	C101 CORRIDOR	WALL MOUNTED	MITSUBISHI PKFY–P06NBMU–E	80.0 – 67.0	70.0	6.0	6.7	208 – 1	0.19	0.15	170	210	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU–4.5A	C104 PURCHASING STO.	WALL MOUNTED	MITSUBISHI PKFY–P08NHMU–E	80.0 – 67.0	70.0	8.0	9.0	208 – 1	0.38	0.30	320	410	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU–4.5B	C104 PURCHASING STO.	WALL MOUNTED	MITSUBISHI PKFY–P08NHMU–E	80.0 – 67.0	70.0	8.0	9.0	208 – 1	0.38	0.30	320	410	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU–4.6	C247 STAR DRESS RM	WALL MOUNTED	MITSUBISHI PKFY–P08NHMU–E	80.0 – 67.0	70.0	8.0	9.0	208 – 1	0.38	0.30	320	410	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU–4.7A	C202 FUTURE	WALL MOUNTED	MITSUBISHI PKFY–P15NHMU–E	80.0 – 67.0	70.0	15.0	17.0	208 – 1	0.38	0.30	320	410	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU–4.7B	C202 FUTURE	WALL MOUNTED	MITSUBISHI PKFY–P15NHMU–E	80.0 – 67.0	70.0	15.0	17.0	208 – 1	0.38	0.30	320	410	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU–4.8	C306 STAGING	WALL MOUNTED	MITSUBISHI PKFY–P12NHMU–E	80.0 – 67.0	70.0	12.0	13.5	208 – 1	0.38	0.30	320	410	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU–4.9	C303 DORM	WALL MOUNTED	MITSUBISHI PKFY–P12NHMU–E	80.0 – 67.0	70.0	12.0	13.5	208 – 1	0.38	0.30	320	410	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU–4.10	C304 DORM	WALL MOUNTED	MITSUBISHI PKFY–P12NHMU–E	80.0 – 67.0	70.0	12.0	13.5	208 – 1	0.38	0.30	320	410	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU–4.11	C305 DORM	WALL MOUNTED	MITSUBISHI PKFY–P12NHMU–E	80.0 – 67.0	70.0	12.0	13.5	208 – 1	0.38	0.30	320	410	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP
IU–4.12	C306 STAGING	WALL MOUNTED	MITSUBISHI PKFY–P12NHMU–E	80.0 – 67.0	70.0	12.0	13.5	208 – 1	0.38	0.30	320	410	1/4	1/2	R410A REFRIGERANT, PROVIDE CONDENSATE LIFT PUMP

MAKEUP AIR UNIT SCHEDULE (UNTEMPERED)

TAG	MANUFACTURER AND MODEL NO.	SERVES	CAPACITY, CFM	EXTERNAL STATIC PRESSURE, IN. WG	MOTOR HP – V – PH	INPUT, MBH	FUEL	APPROXIMATE OPERATING WEIGHT, LBS	REMARKS	TAG
MAU 1	GREENHECK DGX–109–H12	KH 1	1600	0.327	0.62 – 460 – 3	90.2	NATURAL GAS	725	30" HIGH COMBINATION CURB FOR MOUNTING WITH EF–1, CURB TO HAVE 1" INSULATION, FACTORY WIRED DISCONNECT, MERV 8 FILTER, DOWNBLAST	MAU 1

KITCHEN EQUIPMENT HOOD SCHEDULE

TAG	BASIS OF DESIGN	MODEL/STYLE/ CONFIGURATION	HOOD DIMENSIONS: SECTION LENGTH	HOOD DIMENSIONS: WIDTH	HOOD DIMENSIONS: HEIGHT	GREASE CUP OR DRAIN	HOOD TEMP. RATING	TOTAL WEIGHT	ILLUMINATION DETAILS: FIXTURE TYPE	ILLUMINATION DETAILS: QTY.	ILLUMINATION DETAILS: INTENSITY FT CANDLES	GREASE FILTRATION DETAILS: TYPE/MODEL MATERIAL	GREASE FILTRATION DETAILS: QTY.	GREASE FILTRATION DETAILS: LENGTH	GREASE FILTRATION DETAILS: HEIGHT	EXHAUST PLENUM COLLARS: QTY	EXHAUST PLENUM COLLARS: DISTANCE TO END (IN.)	EXHAUST PLENUM COLLARS: WIDTH (IN.)	EXHAUST PLENUM COLLARS: LENGTH (IN.)	EXHAUST PLENUM COLLARS: DIAMETER (IN.)	EXHAUST PLENUM COLLARS: VOLUME (CFM)	EXHAUST PLENUM COLLARS: S.P. (IN. WC)	EXHAUST PLENUM COLLARS: VELOCITY (FT/MIN)	TOTAL EXHAUST CFM – SECTION 1	REMARKS	TAG
KH 1	GREENHECK	GXDW–132–S DOUBLE WALL EXHAUST ONLY WALL CANOPY	11'–0"	4'–0"	2'–0"	RIGHT	600 °F	500	INCANDESCENT	4	44.07	STAINLESS STEEL X–TRACTOR	7 1	16" 20"	20" 20"	1	66	10	19	N/A	2000	0.632	1516	2000 = 185 CFM/FT	UL 710 LISTED FUSIBLE LINK EXHAUST FIRE DAMPER, 430 S/S WHERE EXPOSED, PERFORMANCE ENHANCING LIP, RIGHT UTILITY CABINET (48"x12"x24")	KH 1

EXTERNAL SUPPLY PLENUM DATA

SERVES	BASIS OF DESIGN	TYPE	LENGTH (IN)	WIDTH (IN)	HEIGHT (IN)	VOLUME (CFM)	SP (IN WC)	DUCT COLLAR SIZE (IN)	DUCT COLLAR VEL. (FT/M)	REMARKS	SERVES
KH 1	GREENHECK	AIR CURTAIN	147	14	10	1600	.077	(3) 16x10	480		KH 1

FIRE SUPPRESSION SYSTEM SCHEDULE

SERVES	BASIS OF DESIGN	SUPPRESSANT TYPE	SUPPLY LINE	NUMBER OF FLOW POINTS: MAXIMUM	NUMBER OF FLOW POINTS: UTILIZED	DETECTION	MOUNTING	REMARKS	SERVES
KH 1	ANSUL	R–102 WET CHEMICAL	CONTINUOUS	22	14	FUSIBLE LINK	RIGHT END UTILITY CABINET ON HOOD	TWO(2) 3 GALLON TANKS WITH SUPPRESSION AGENT, HIGH TEMP METAL BLOW OFF CAPS, 2" MECH. SHUTOFF VALVE	KH 1

AIR DISTRIBUTION DEVICE SCHEDULE

TAG	BASIS OF DESIGN	DESCRIPTION	FACE SIZE	MOUNT	DAMPER	FINISH	PATTERN	REMARKS
SCD	PRICE SCD	SQUARE CONE DIFFUSER	12x12	LAY–IN	FACE OPERATED	WHITE	4 WAY	
SCD–1	PRICE SCD	SQUARE CONE DIFFUSER	12X12	SURFACE	FACE OPERATED	WHITE	4 WAY	
WSR	PRICE 620	LOUVERED SUPPLY	VARIES	SURFACE	FACE OPERATED	WHITE	DOUBLE DEFLECTION	FRONT BLADES PARALLEL TO SHORT DIMENSION AND 22.5° DEFLECTION.
WEG	PRICE 630	LOUVERED EXHAUST	VARIES	SURFACE	FACE OPERATED	WHITE	SINGLE DEFLECTION	BLADES PARALLEL TO SHORT DIMENSION AND 45° DOWNWARD DEFLECTION.
CER	PRICE 80	EGGCRATE GRILLE EXHAUST	6X6	LAY–IN	FACE OPERATED	WHITE	--	
CER–1	PRICE 80	EGGCRATE GRILLE EXHAUST	6x6	SURFACE	FACE OPERATED	WHITE	--	
CER–2	PRICE 80	EGGCRATE GRILLE EXHAUST	10x10	SURFACE	FACE OPERATED	WHITE	--	
CER–3	PRICE 80	EGGCRATE GRILLE EXHAUST	8x8	SURFACE	FACE OPERATED	WHITE	--	
SGS	KEES SDP3L	SECURITY GRILLE SUPPLY	24x24"	LAY–IN	FACE OPERATED	WHITE	4 WAY	
SGR	KEES SDP3LR	SECURITY GRILLE RETURN	24x24"	LAY–IN	FACE OPERATED	WHITE	--	
SGE	KEES SDP3LR	SECURITY GRILLE EXHAUST	24x24"	LAY–IN	FACE OPERATED	WHITE	--	

GAS–FIRED UNIT HEATER SCHEDULE

TAG	MANUFACTURER & MODEL NO.	TYPE	INPUT, BTUH	OUTPUT, BTUH	ELECTRICAL: HP	ELECTRICAL: VOLT/PH	OP WT (LBS.)	REMARKS	TAG
GUH 1	MODINE HDS 30	NAT. GAS FIRED, SEPARATED COMBUTION	30,000	24,000	1/15	115/1	60	TWO STAGE, DIRECT SPARK IGNITION, CONCENTRIC VENT KIT	GUH 1

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Historic Hospital (C)

Drawing Issued:

Date	Rev.	Description
08-31-2015		DD Check Set
10-20-2015		75% Progress Set
11-02-2015		90% Pricing Set
11-19-2018		100% Bid Docs

Drawn By: DB,CM

Checked By: CM,TP

Client No: -------

Albert & Associates: 12575

STATE OF MISSISSIPPI CHARLES E. MCCLESKEY 20100 REGISTERED ENGINEER 1/13/2017

M6.3

Engineering Resource Group, Inc.
350 Edgewood Terrace Drive
Jackson, MS 39206
Phone: (601) 362-3552
Fax: (601) 366-6418
ERG# 15-28.2

CONTROL POINTS

Points List Table Column Definitions:

1. Point Description.
2. Type (number in point list schedule after each type refers to tag on schematics).
   - 2.1. AO: analog output
   - 2.2. AI: analog input
   - 2.3. DO: digital or binary output
   - 2.4. DI: digital or binary input
3. Device description.
   - 3.1. See Specification Section 230913 EMCS Basic Materials and Devices for device definitions and specifications.
4. Trend Logging.
   - 4.1. Commissioning: Where listed, point is to be trended at the basis listed for commissioning and performance verification purposes.
   - 4.2. Continuous: Where listed, point is to be trended at the basis listed continuously, initiated after system acceptance, for the purpose of future diagnostics.
   - 4.3. Trend Basis
     - 4.3.1. Where range of engineering units is listed, trend on a change of value (COV) basis (in other words record time stamp and value when point value changes by engineering unit listed).
     - 4.3.2. Where time interval is listed, trend on a time basis (in other words record time stamp and value at interval listed). All points related to a specific piece of equipment shall be trended at the same initiation time of day so data can be compared in text format.
5. Calibration.
   - 5.1. F = factory calibration only is required (no field calibration)
   - 5.2. HH = field calibrate with handheld device. Test/calibration equipment shall be at least twice as accurate as respective field device (for example if field device is ±0.5% accurate, test equipment shall be ±0.25% accurate over same range).

Note that points lists herein are for each system of like kind. Refer to Drawings for quantity of each.

SEQUENCES OF OPERATION – GENERAL

1. General:
   - 1.1. Contractor shall review sequences prior to programming and suggest modifications where required to achieve the design intent. Contractor may also suggest modifications to improve performance and stability or to simplify or reorganize logic in a manner that provides equal or better performance. Proposed changes in sequences shall be included as a part of Submittal Package 2.
   - 1.2. Include costs for program modifications if required to provide proper performance of the system.
   - 1.3. Unless otherwise indicated in SOOs, control loops shall be enabled and disabled based on the status of the system being controlled to prevent wind-up. Loops shall be initiated with the output set to a neutral (deadband) condition, e.g. valves and dampers close, VFDs at minimum speed, etc.
   - 1.4. When SOOs use outdoor air temperature present value and there are multiple outdoor air sensors, the physically closest sensor reading shall be used.
   - 1.5. The term "proven on" / "proven off") shall mean that the equipment's DI status point matches the state set by the equipment's DO command point.
   - 1.6. The term "PID loop" or "control loop" is used generically for all control loops and shall not be interpreted as requiring proportional plus integral plus derivative gains on all loops. Unless specifically indicated otherwise, the following guidelines shall be followed:
     - 1.6.1. Use proportional only (P–only) loops for limiting loops (such as zone CO2 limiting loops, etc.) to ensure there is no integral windup.
     - 1.6.2. Do not use the derivative term on any loops unless field tuning is not possible without it.
   - 1.7. All setpoints, timers, deadbands, PID gains, etc. listed in sequences shall be capable of being adjusted by the operator (with full administrative access) without having to access programming whether indicated as adjustable in sequences or not. Software (virtual) points shall be used for these setpoints. Fixed scalar numbers shall not be imbedded in programs unless the value will never need to be adjusted.
   - 1.8. Values for all points, including real (hardware) points used in control sequences shall be capable of being overridden by the user (e.g. for testing and commissioning). If hardware design prevents this for hardware points, they shall be added to a software point and the software point shall be used in all sequences. Exception: Not required for ASC hardware points.
   - 1.9. VFD speed points:
     - 1.9.1. The speed analog output sent to VFDs shall be configured such that 0% speed corresponds to 0 HZ and 100% speed corresponds to maximum speed configured in the VFD.
     - 1.9.2. Minimum speed setpoints for all VFD–driven equipment shall be determined in accordance with the following:
       - 1.9.2.1. Tests shall be done for each piece of equipment, except that for multiple pieces of identical equipment used for identical applications, only one piece of equipment need be tested with results applied to all. Note that for fans, there is no minimum speed required for motor cooling. Power drops with cube of speed, causing motor losses to be minimal at low speeds.
       - 1.9.2.2. The work shall be done only after fan system is fully installed and operational.
       - 1.9.2.3. Determine minimum speed setpoint as follow:
         - 1.9.2.3.1. Start the fan.
         - 1.9.2.3.2. Manually set speed to 6 Hz (10%) unless otherwise indicated in control sequences. For cooling towers with gear boxes, use 20% or whatever minimum speed is recommended by tower manufacturer.
         - 1.9.2.3.3. Observe fan in field to ensure it is visibly rotating. If not, gradually increase speed until it is.
         - 1.9.2.3.4. The speed at this point shall be the minimum speed setpoint for this piece of equipment.
         - 1.9.2.3.5. Record minimum speeds in log and store in software point as indicated in Specifications.
     - 1.9.3. For each piece of equipment the minimum speed shall be stored in a single software point. This value shall be written to the VFD's minimum speed setpoint via the drive's network interface. In this way there is only one minimum setpoint, rather than setpoints both in the drive and in software which could differ.
   - 1.10. Trim & Respond Setpoint Reset Logic:
     - 1.10.1. Trim & Respond setpoint reset logic and zone/system reset requests where referenced in sequences shall be implemented as described below.
     - 1.10.2. "Requests" are pressure, cooling, or heating setpoint reset requests generated by zones or air handling systems.
       - 1.10.2.1. For each zone or system, and for each setpoint reset request type listed for the zone/system, provide he following software points:
         - 1.10.2.1.1. Importance Multiplier (default = 1). This point is used to scale the number of requests the zone/system is generating. A value of zero causes the zone/system's requests to be ignored. A value greater than zero can be used to effectively increase the number of requests from the zone/system based on the critical nature of the spaces served, or to increase the requests beyond the number of ignored requests (defined below) in the Trim & Respond reset block. Request–hours:
         - 1.10.2.1.2.
           - 1.10.2.1.2.1. This point accumulates the integral of requests (prior to adjustment of Importance Multiplier) to help identify zones/systems that are driving the reset logic. Every x minutes (adjustable, default 5 minutes), add x/60 times the current number of requests to this request–hours accumulator point.
           - 1.10.2.1.2.2. The request–hours point is reset to zero upon a global command from the system serving the zone/system – this global point simultaneously resets the request–hours point for all zones/systems served by this system/plant.
           - 1.10.2.1.2.3. Cumulative %–request–hours is the zone request–hours divided by the zone run–hours (the hours in any Mode other than Unoccupied Mode) since the last reset, expressed as a percentage.
           - 1.10.2.1.2.4. A Level 4 alarm is generated if the zone Importance Multiplier is greater than zero, the zone %–request–hours exceeds 70%, and the total number of zone run–hours exceeds 40.
       - 1.10.2.2. See zone and air handling system control sequences for logic to generate requests.
       - 1.10.2.3. Multiply the number of requests determined from zone/system logic times the Importance Multiplier and send to the system/plant that serves the zone/system. See system/plant logic to see how requests are used in Trim & Respond logic.
     - 1.10.3. Variables. All variables below shall be adjustable from a reset graphic accessible from a hyperlink on the associated system/plant graphic. Initial values are defined in system/plant sequences herein. Values from trim, respond, time step, etc. shall be tuned to provide stable control.

Variable	Definition
Device	Associated device (e.g. fan)
SP0	Initial setpoint
SPmin	Minimum setpoint
SPmax	Maximum setpoint
Td	Delay timer
T	Time step
I	Number of ignored requests
R	Number of requests from zones/systems
SPtrim	Trim amount
SPres	Respond amount
SPres–max	Maximum response per time interval

     - 1.10.4. Trim & Respond logic shall reset setpoint within the range SPmin to SP max. When the associated device is off, the setpoint shall be SP0. The reset logic shall be active while the associated device is proven on, starting Td after initial device start command. When active, every time step T, trim the setpoint by SPtrim. If there are more than I Requests, respond by changing the setpoint by SPres times (R – I), i.e. (the number of Requests minus the number of Ignored requests). But the net response shall be no more than SPres–max. The sign of SPtrim must be the opposite of SPres and SPres–max. For example, if SPtrim = –0.1, SPres = +0.15, SPres–max = +0.35, R = 3, I = 2, then each time step, the setpoint change = –0.1 + (3 – 2)*0.15 = +0.05. If R = 10, then setpoint change = –0.1 + (10 – 2)*0.15 = 1.1 but limited to a maximum of 0.35. If R = 2, the setpoint change is –0.1.
   - 1.11. Lead/lag and lead/standby alternation:
     - 1.11.1. Even wear:
       - 1.11.1.1. Lead/lag: Unless otherwise noted, parallel staged devices (such as fans, pumps, towers) shall be lead/lag alternated when more than one is off or more than one is on so that the device with the most operating hours is made the later stage device and the one with the least number of hours is made the earlier stage device. For example, assuming there are three devices, if all three are off or all are on, the staging order will simply be based on run hours from lowest to highest. If two devices are on, the one with the most hours will be set to be stage 2 while the other is set to stage 1; this may be the reverse of the operating order when the devices were started. If two devices are off, the one with the most hours will be set to be stage 3 while the other is set to stage 2; this may be the reverse of the operating order when the devices were stopped.
       - 1.11.1.2. Lead/standby: Unless otherwise noted, parallel devices (such as pumps, towers) that are 100% redundant shall be lead/standby alternated when more than one is off so that the device with the most operating hours is made the later stage device and the one with the least number of hours is made the earlier stage device. For example, assuming there are three devices, if all three are off, the staging order will be based on run hours from lowest to highest. If devices run continuously, lead/standby shall switch at an adjustable runtime; standby device shall first be started and proven on before former lead device is changed to standby and shut off.

SEQUENCES OF OPERATION – GENERAL CONT'D

   - 1.11.2. Exceptions:
     - 1.11.2.1. Operators shall be able to manual fix staging order via software points on graphics overriding the Even Wear logic above, but not overriding the Failure or Hand Operation logic below.
     - 1.11.2.2. Failure: If the lead device fails or has been manually switched off, the device shall be placed into high level alarm (Level 2) and set to the last stage position in the lead/lag order until alarm is reset by operator. Staging position of remaining devices shall follow the Even Wear logic. A failed device in alarm can only automatically move up in the staging order if another device fails. Note that a device in alarm will be commanded to run if the sequence calls for it to run. In this way the EMCS will keep trying to run device(s) until if finds enough that will operate. Failure is determined by:
       - 1.11.2.2.1. Variable Speed Fans and Pumps:
         - 1.11.2.2.1.1. VFD critical fault is ON.
         - 1.11.2.2.1.2. Status point not matching its on/off point for 15 seconds when device is commanded on.
         - 1.11.2.2.1.3. Supervised HOA at control panel is OFF position.
         - 1.11.2.2.1.4. Loss of power (e.g. VFD DC Bus voltage = zero).
       - 1.11.2.2.2. Constant Speed Fans and Pumps:
         - 1.11.2.2.2.1. Status point not matching its on/off point for 15 seconds when device is commanded on.
         - 1.11.2.2.2.2. Supervised HOA at control panel is OFF position.
     - 1.11.2.3. Hand Operation. If a device is on in Hand (for example via an HOA switch or local control of VFD), the device shall be set to the lead device and a low level alarm (Level 4) shall be generated. The device will remain as lead until the alarm is reset by the operator. Hand operation is determined by:
       - 1.11.2.3.1. Variable Speed Fans and Pumps:
         - 1.11.2.3.1.1. Status point not matching its on/off point for 15 seconds.
         - 1.11.2.3.1.2. VFD in local "hand" mode.
         - 1.11.2.3.1.3. Supervised HOA at control panel in ON position.
       - 1.11.2.3.2. Constant Speed Fans and Pumps:
         - 1.11.2.3.2.1. Status point not matching its on/off point for 15 seconds when device is commanded off.
         - 1.11.2.3.2.2. Supervised HOA at control panel in ON position.
   - 1.12. VAV Box Controllable Minimum:
     - 1.12.1. This section is used to determine the lowest possible VAV box airflow setpoint allowed by the controls (Vm) used in VAV box control sequences. The minimums shall be stored as software points that may be adjusted by the user but need not be adjustable via the graphical user interface.
     - 1.12.2. Option 1: If the VAV box controls simply stop moving the damper when the airflow reading becomes too low to register and then re–enables the damper when the airflow reading rises above that threshold, Vm shall be equal to zero.
     - 1.12.3. Option 2: The minimum setpoint Vm shall be determined as follows:
       - 1.12.3.1. Determine the velocity pressure sensor reading VPm in inches H20 that results in a digital reading from the transducer and A/D converter of 12 bits or counts (assuming a 10 bit A/D converter). This is considered sufficient resolution for stable control. See Specification Section 230929.
       - 1.12.3.2. Using the velocity pressure sensor amplification factor provided by the sensor manufacturer for each VAV box sensor size, calculate the minimum velocity vm for each VAV box size as:

$$vm = 4005*\sqrt{(VPm/F)}$$

Where F is not known it can be calculated from the measured CFM at 1 inch signal from the VP sensor:

$$F = (4005*A/CFM)^2$$

where A is the nominal duct area (square feet), equal to:

$$A = \pi(D/24)^2$$

where D is the nominal duct diameter (inches).

       - 1.12.3.3. Calculate the minimum airflow setpoint allowed by the controls (Vm) for each VAV box size as:

$$Vm = vm*A$$

2. Zones:
   - 2.1. This section applies to all single zone systems and sub–zones of air handling systems, such as VAV boxes, fan–powered boxes, etc.
   - 2.2. Setpoints:
   - 2.3.
     - 2.3.1. Each zone shall have separate unoccupied and occupied setpoints, and separate heating and cooling setpoints. As a default:

Zone Type	Occupied		Unoccupied	
	Heat	Cool	Heat	Cool
Exterior	70°F	74°F	60°F	90°F
Interior	70°F	73°F	60°F	90°F
Circulation	69°F	76°F	60°F	90°F
Mech/Elec Rooms	60°F	85°F	60°F	85°F
Network/IT	65°F	75°F	65°F	75°F

     - 2.3.2. The software shall prevent:
       - 2.3.2.1. The heating setpoint from exceeding the cooling setpoint minus 1°F (in other words the minimum deadband shall be 1°F).
       - 2.3.2.2. The unoccupied heating setpoint from exceeding the occupied heating setpoint; and
       - 2.3.2.3. The unoccupied cooling setpoint from being less than the occupied cooling setpoint.
     - 2.3.3. Where the zone has a local occupant adjustable setpoint adjustment knob/button:
       - 2.3.3.1. The adjustment shall be capable of being limited in software.
         - 2.3.3.1.1. As a default, occupied cooling setpoint shall be limited between 72°F and 80°F.
         - 2.3.3.1.2. As a default, occupied heating setpoint shall be limited between 65°F and 72°F.
       - 2.3.3.2. The adjustment shall move both the existing heating and cooling setpoints upwards or downwards by the same amount unless the limit has been reached.
       - 2.3.3.3. The adjustment shall only be active in Occupied mode.
     - 2.3.4. The operative setpoint shall be determined by the Zone Group's mode:
       - 2.3.4.1. The setpoints shall be the occupied setpoint during Occupied mode, Warm–up mode, and Cool–down mode.
       - 2.3.4.2. The setpoints shall be the unoccupied setpoints during Unoccupied mode, Setback mode, and Setup mode.
     - 2.3.5. Hierarchy of Setpoint Adjustments: The following adjustment restrictions shall prevail in order from highest to lowest priority:
       - 2.3.5.1. Setpoint overlap restriction specified herein.
       - 2.3.5.2. Local setpoint adjustment.
       - 2.3.5.3. Scheduled setpoints based on Zone Group mode.
   - 2.4. Local override: When thermostat override buttons are depressed, the request for Occupied Mode operation shall be sent up to the Zone Group control for 60 minutes. (This will cause all zones in the Zone Group to operate in Occupied Mode to ensure that the system has adequate load to operate stably.)
   - 2.5. Control Loops:
     - 2.5.1. Two separate control loops shall operate to maintain space temperature at setpoint, the Cooling Loop and the Heating Loop. Both loops shall be continuously active.
     - 2.5.2. The Cooling Loop shall maintain the space temperature at the active cooling setpoint. The output of the loop shall be a virtual point ranging from 0% (no cooling) to 100% (full cooling).
     - 2.5.3. The Heating Loop shall maintain the space temperature at the active heating setpoint. The output of the loop shall be a virtual point ranging from 0% (no heating) to 100% (full heating).
     - 2.5.4. Loops shall use proportional + integral logic or fuzzy logic. Proportional–only control is not acceptable, although the integral gain shall be small relative to the proportional gain. P and I gains shall be adjustable from the Operator Workstation.
     - 2.5.5. See other sections for how the outputs from these loops are used.
   - 2.6. Zone Modes:
     - 2.6.1. Heating Mode: when the output of the space heating control loop is greater than zero.
     - 2.6.2. Cooling Mode: when the output of the space cooling control loop is greater than zero and the output of the heating loop is equal to zero.
     - 2.6.3. Deadband Mode: when not in either the Heating or Cooling Mode.

SEQUENCES OF OPERATION – GENERAL CONT'D

   - 2.7. Alarms:
     - 2.7.1. Zone temperature alarms:
       - 2.7.1.1. If the zone is 3°F above cooling or below heating setpoints for 10 minutes, generate Level 3 alarm.
       - 2.7.1.2. If the zone is 5°F above cooling or below heating setpoints for 10 minutes, generate Level 2 alarm.
       - 2.7.1.3. Suppress zone temperature alarms as follows:
         - 2.7.1.3.1. After zone setpoint is changed for a period of 10 minutes per degree of difference between the zone temperature at the time of the change and the new setpoint. This suppression period applies any time that the zone setpoint is changed.
         - 2.7.1.3.2. While Zone Group is in Warm–up or Cool–down Modes.
         - 2.7.1.3.3. For zones with an Importance multiplier (see Trim & Respond sequences above) of zero.
     - 2.7.2. For zones with CO2 sensors:
       - 2.7.2.1. If the CO2 concentration is less than 300 ppm, or the zone is in unoccupied mode for more than 2 hours and zone CO2 concentration exceeds 600 ppm, generate a Level 4 alarm, indicating sensor may be out of calibration.
       - 2.7.2.2. If the CO2 concentration exceeds setpoint plus 10% for more than 10 minutes generate a Level 3 alarm.
3. Zone Groups (aka Isolation Areas):
   - 3.1. Each system shall be broken into separate Zone Groups composed of a collection of one or more zones served by the air handling system.
   - 3.2. Each Zone Group shall have separate occupancy schedules and operating modes from other Zone Groups served by the air handling system. All zones in the Zone Group shall be in the same operating mode.
   - 3.3. Individual Zone Groups shall be as follows:

Zone Group Name	Default Schedule
First Floor	WD: 6am to 8pm WE: 6 am to 8pm HOL: off
Second Floor	WD: 6am to 8pm WE: 8 am to 10pm HOL: off
Third Floor	WD: 6am to 8pm WE: 8 am to 10pm HOL: off

   - 3.4. Provide testing/commissioning software switches to override all zones served by the Zone Group. Provide a single software switch for each of the zone override switches listed under terminal box control above. When the Zone Group override switch value is changed, the terminal box zone override switch value for each zone in the Zone Group shall change to the same value. This only occurs when the switch changes value; the switch at each zone shall be capable of being changed to a different value from the Zone Group switch. These software switches are for commissioning and need not be shown on graphics.
   - 3.5. Zone Group Operating Modes: Each Zone Group shall have the following modes:
     - 3.5.1. Occupied Mode: A Zone Group is in the occupied mode when any of the following is true:
       - 3.5.1.1. The time of day is between the Zone Group's scheduled occupied start and stop times.
       - 3.5.1.2. Manual override from zone temperature sensor.
     - 3.5.2. Warm–up mode. Warm–up start time shall be determined based on the zone in the Zone Group whose space temperature is furthest below its occupied heating temperature setpoint, the outside air temperature (using global outdoor air temperature sensor, not any associated with AHUs), and a building mass/capacity factor. This factor shall be manually adjusted or self–tuned by the program based on internal trending so that all zones in the Zone Group are brought up to their occupied setpoint by the scheduled occupied start hour. The tuning period mode shall be turned on or off by a software switch (to allow tuning to be stopped after the system has been trained). Warm–up mode shall start no earlier than 3 hours before the scheduled occupied start hour and shall end at the scheduled occupied start hour. occupied start hour.
     - 3.5.3. Cool–down mode. Cool–down shall be determined based on the zone in the Zone Group whose space temperature is furthest above its occupied cooling temperature setpoint, the outside air temperature (using global outdoor air temperature sensor, not any associated with AHUs), and a building mass/capacity factor. This factor shall be manually adjusted or self–tuned by the program based on internal trending so that all zones in the Zone Group are brought down to their occupied setpoint by the scheduled occupied start hour. The tuning period mode shall be turned on or off by a software switch (to allow tuning to be stopped after the system has been trained). Cool–down mode shall start no earlier than 3 hours before the scheduled occupied start hour and shall end at the scheduled occupied start hour.
     - 3.5.4. Setback mode. During other than normal mode, and warm–up mode, if any 2 (adjustable; set to all zones if there are fewer in Zone Group) zone(s) in the Zone Group falls 2°F below its active unoccupied setback setpoint, until all spaces in the Zone Group are above their active setback setpoints.
     - 3.5.5. Setup mode. During other than normal mode, warm–up mode, and setback mode, if any 2 (adjustable; set to all zones if there are fewer in Zone Group) zone(s) in the Zone Group rises 2°F above its active unoccupied setup setpoint until all spaces in the Zone Group are below their active setup setpoints.
     - 3.5.6. Unoccupied Mode: When the Zone Group is not in any other mode.
4. Air Handling Unit, Fan Coil Unit, Blower Coil Unit, Split–System Unit System Modes:
   - 4.1. AHU, FCU, BCU, and/or Split–System modes are the same as the mode of the Zone Groups served by the system. When Zone Groups served by an air handling system are in different modes, the following hierarchy applies (highest one sets AHU mode):
     - 4.1.1. Occupied mode.
     - 4.1.2. Cool–down mode.
     - 4.1.3. Setup mode.
     - 4.1.4. Warm–up mode.
     - 4.1.5. Setback mode.
     - 4.1.6. Unoccupied mode.
5. Miscellaneous Alarms:
   - 5.1. Points in Hand (Operator Override) via Workstation command (including name of operator who made the command) or via supervised HOA switch at output: Level 4.
   - 5.2. Equipment alarm (for equipment with alarm contacts such as VFDs): Level 2.
   - 5.3. Failure or disconnection of a sensor as indicated by signal widely out of range: Level 2.
   - 5.4. Panel or LAN failure: Level 2.
   - 5.5. Loss of communication with any device via Gateway (e.g. VFD) for more than 30 seconds: Level 2 (alarm shall indicate which specific device is not responding).

CONTROLS LEGEND

GENERAL

- SA — SUPPLY AIR
- OA — OUTSIDE/OUTDOOR AIR
- RA — RETURN AIR
- EA — EXHAUST AIR

EQUIPMENT

- 2–WAY VALVE
- 3–WAY VALVE
- SD — SMOKE DETECTOR
- FAN – PROPELLER
- FAN – CENTRIFUGAL HOUSED
- FAN – PLUG / PLENUM
- FURNACE
- FILTER
- AFMS–X — AIR FLOW MEASURING STATION
- C / C — COIL
- OPPOSED BLADE DAMPER
- PARALLEL BLADE DAMPER
- ENABLE / RUN / SPEED / NETWORK / VFD — VARIABLE SPEED DRIVE

SENSORS

- STATIC PRESSURE TIP
- SENSOR WELL
- T — TEMPERATURE SENSOR & SENSOR WELL
- HT–X / TS–X — HUMIDITY TRANSMITTER (HT) OR TEMPERATURE SENSOR (TS) – DUCT MTD. (SINGLE POINT)
- TS–X — AVERAGING TEMPERATURE SENSOR
- M — MODULATING ACTUATOR
- M2 — 2–POSITION ACTUATOR
- DPS–X — DIFFERENTIAL PRESSURE SWITCH
- DPT–X — DIFFERENTIAL PRESSURE TRANSMITTER
- FM–X — FLOW METER
- TS–X — TEMPERATURE SENSOR – WALL MTD.
- HT–X — HUMIDITY TRANSMITTER – WALL MTD.
- CO2–X — CARBON DIOXIDE SENSOR – WALL MTD.
- OCC — OCCUPANCY SENSOR
- CS — CURRENT SWITCH
- CT — CURRENT TRANSFORMER
- WLD–X — WATER LEAK DETECTOR
- RC — VARIABLE REFRIGERANT FLOW SYSTEM INDOOR UNIT REMOTE CONTROLLER

CONTROLS LEGEND

- DIGITAL POINT — DO — HARDWIRED DIGITAL OUTPUT (DO) OR DIGITAL INPUT (DI)
- ANALOG POINT — AO — HARDWIRED ANALOG OUTPUT (AO) OR ANALOG INPUT (AI)
- NETWORK CONNECTION BETWEEN CONTROLLER AND DEVICE — NETWORK

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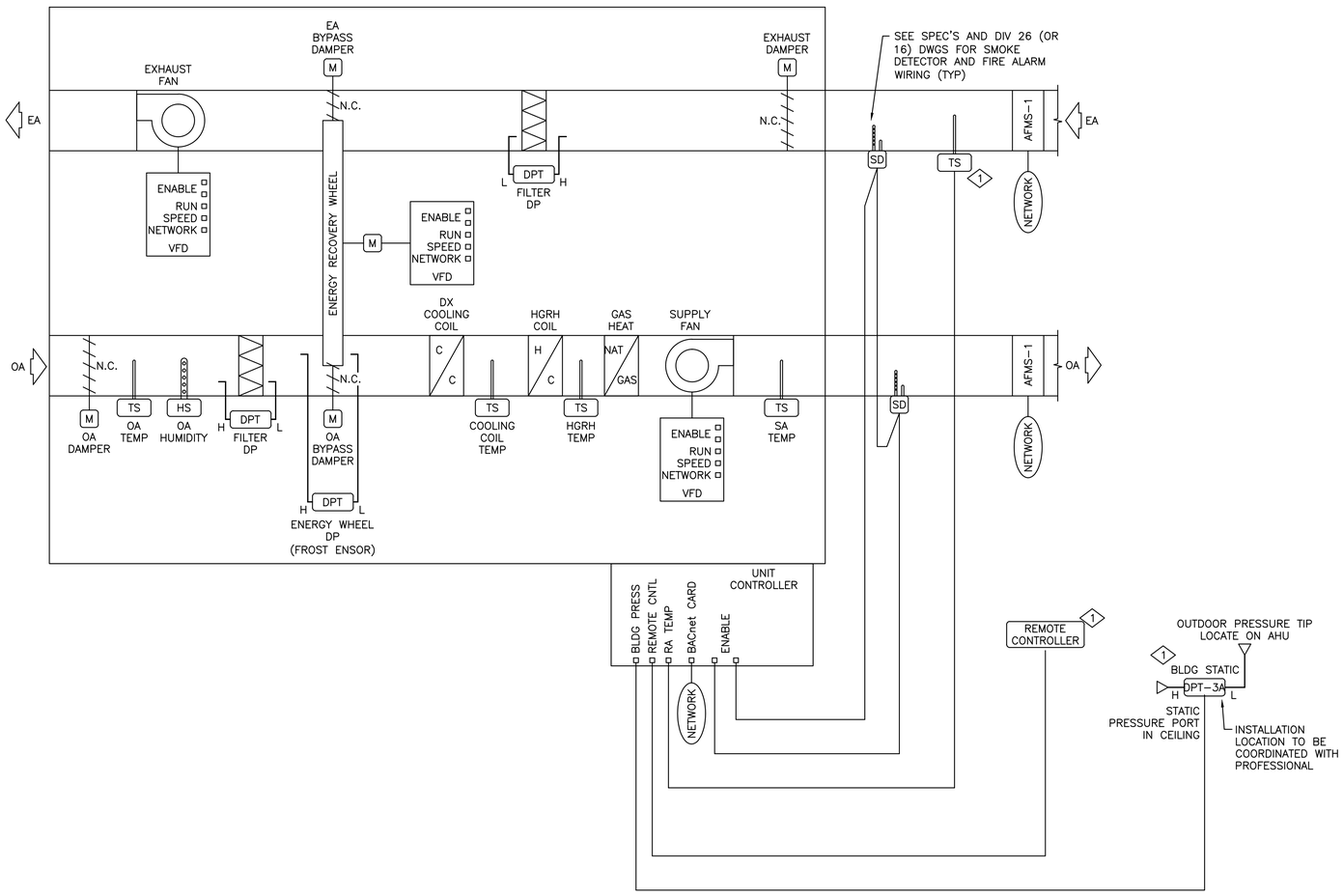
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Albert & Associates:	12575

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ERG# 15-28.2



1 M7.2 OUTDOOR AIR UNIT (OAU) CONTROL SCHEMATIC

NO SCALE

NOTES

1. CONTROL DEVICES PROVIDED BY OAU MANUFACTURER, FIELD INSTALLED AND WIRED BY DIVISION 23C CONTRACTOR.

POINTS MAPPED FROM OAU BACNET CARD

Description	Type	Device	Trend Logging		Calibration
			Commissioning	Continuous	
Cooling status	DI	Through network	COV	COV	–
Heating status	DI	Through network	COV	COV	–
Reheat status	DI	Through network	COV	COV	–
Airflow status	DI	Through network	COV	COV	–
Supply air temp sensor failure	DI	Through network	COV	COV	–
Outdoor air temp sensor failure	DI	Through network	COV	COV	–
Cooling alarm	DI	Through network	COV	COV	–
Heating alarm	DI	Through network	COV	COV	–
Filter alarm	DI	Through network	COV	COV	–
High supply air temp alarm	DI	Through network	COV	COV	–
Low supply air temp alarm	DI	Through network	COV	COV	–
Compressor failure	DI	Through network	COV	COV	–
Control mode	DI/DO	Through network	COV	COV	–
Control status	DI	Through network	COV	COV	–
HVAC system mode	DI/DO	Through network	COV	COV	–
Supply air temp setpoint	AO	Through network	1 min	15 min	–
Supply air temp	AI	Through network	1 min	15 min	–
Cooling coil temp	AI	Through network	1 min	15 min	–
HGRH temp	AI	Through network	1 min	15 min	–
Outdoor air temp	AI	Through network	1 min	15 min	–
Outdoor air humidity	AI	Through network	1 min	15 min	–
Modulating cooling position	AI	Through network	1 min	15 min	–
Modulating heating position	AI	Through network	1 min	15 min	–
Reheat position	AI	Through network	1 min	15 min	–
Compressor signal (%)	AI	Through network	1 min	15 min	–
Condenser signal (%)	AI	Through network	1 min	15 min	–
Compressor suction pressure	AI	Through network	1 min	15 min	–
Compressor head pressure	AI	Through network	1 min	15 min	–
Compressor coil temp	AI	Through network	1 min	15 min	–
Compressor superheat	AI	Through network	1 min	15 min	–
Alarm status	DI	Through network	COV	COV	–
Cooling lockout outdoor air temp	AO	Through network	1 min	15 min	–
Supply air sensor calibration offset	AO	Through network	1 min	15 min	–
Outdoor air sensor calibration offset	AO	Through network	1 min	15 min	–
Schedule	DI	Through network (convert code to plain English text)	COV	COV	–
HVAC mode override	DI	Through network (convert code to plain English text)	COV	COV	–

POINTS MAPPED FROM AFMS–1 BACNET CARD

Description	Type	Device	Trend Logging		Calibration
			Commissioning	Continuous	
Average flow	AI	Through network	1 min	60 min	–
Average temp	AI	Through network	1 min	60 min	–
Alarm Status	DI	Through network	COV	COV	–
Area	AV	Through network	–	–	–
Traverse data status	AV	Through network	–	–	–
Flow traverse	AV	Through network	–	–	–
Temp traverse	AV	Through network	–	–	–

OAU SEQUENCE OF OPERATION

General: Constant Volume (CV) Outdoor Air Unit (OAU) with energy recovery wheel, Direct Expansion (DX) cooling coil, hot–gas reheat coil, natural gas furnace, supply fan and exhaust fan. Unit shall be controlled by its internal Direct–Digital Controller.

OAU System Modes: OAU system modes are the same as the mode of the Zone Group served by the system. When Zone Groups served by the OAU are in different modes, the following hierarchy applies (highest one sets OAU mode):

1. Occupied mode
2. Unoccupied mode

Fan Control:

1. Supply Fan and Exhaust Fan Start/Stop
   - 1.1. OAU supply fan and exhaust fans shall run when the system is Occupied and shall be off in Unoccupied Mode.
   - 1.2. OAU unit controller shall command the outdoor and exhaust air dampers open whenever the OAU is enabled. Dampers shall be closed when unit is disabled.
   - 1.3. OAU shall be hard–wire interlocked through smoke detectors. Unit shall be shutdown when the smoke detector auxiliary contacts are energized.
   - 1.4. Outdoor air flow rate from OA AFMS–1 shall be displayed on the OAU graphic at discharge duct.
   - 1.5. Exhaust air flow rate from EA AFMS–1 shall be displayed on the OAU graphic at inlet duct.
   - 1.6. EMCS shall use the OAU status point to accumulate runtime.
2. Supply Fan Speed Control:
   - 2.1. Supply fan VFD speed shall be set to run at the speed corresponding to its design air flow rate when the fan is proven on. Division 23C contractor shall coordinate with Testing, Adjusting, and Balancing Agency to determine exact VFD speed setpoint.
3. Exhaust Fan Speed Control:
   - 3.1. Exhaust fan VFD speed shall be set to run at the speed corresponding to its design air flow rate when the fan is proven on. Division 23C contractor shall coordinate with Testing, Adjusting, and Balancing Agency to determine exact VFD speed setpoint. Exact exhaust air flow rate shall be determined by TAB Agency that provides both code required exhaust and a positive building pressurization of 0.05 inches w.c. (adjustable).

Enthalpy Wheel Control:

1. Energy recovery wheel control shall be enabled when the supply fan is proven on.
2. Energy recovery wheel control logic:
   - 2.1. OA temperature < 55°F (adjustable): Leaving energy recovery wheel air temperature (outdoor air side) shall be controlled to the supply air temperature setpoint using a PID loop whose output is mapped to sequence the energy recovery wheel and wheel bypass dampers.
   - 2.2. 55°F ≥ OA temperature ≥ 69°F (adjustable): Energy recovery wheel is off and bypass dampers open.
   - 2.3. OA temperature > 69°F (adjustable): Energy recovery wheel shall be at full speed and bypass dampers closed.

Supply Air Temperature Control:

1. Control loop is enabled when the supply fan is proven on, and disabled and output set to zero otherwise. When loop is disabled, slowly reduce loop output to zero to prevent sudden pressure changes.
2. Supply Air Temperature Setpoint: 55°F (adjustable) when outdoor air temperature is greater than or equal to 65°F (adjustable).
3. Supply Air Temperature Setpoint: 70°F (adjustable) when outdoor air temperature is less than 65°F (adjustable).
4. DX Cooling Coil Control: The DX cooling coil leaving air temperature control loop shall be mapped to stage the multiple cooling stages to maintain the cooling coil leaving air temperature setpoint, 55°F (adjustable).
5. Reheat Coil Control: When the outdoor air temperature is less than 65°F (adjustable), the reheat coil control loop output shall be mapped to modulate the reheat coil output to maintain the supply air temperature setpoint.
6. Natural Gas Heat Exchanger: When the outdoor air temperature is less than 65°F (adjustable), the heat exchanger control loop output shall be mapped to modulate the natural gas heat exchanger output to maintain the supply air temperature setpoint.

Safeties and Interlocks:

1. Supply fan shall be hardwire interlocked through the unit smoke detector(s) to shut down the unit upon smoke detection.

EMCS Alarms: Provide the following EMCS alarms:

1. Maintenance interval alarm when unit has operated for more than 2000 hours: Level 5. Reset interval counter when alarm is acknowledged.
2. Unit alarm is indicated by the status being different from the command for a period of 60 seconds.
   - 2.1. Commanded on, status off: Level 2
   - 2.2. Commanded off, status on: Level 4
3. Filter pressure drop exceeds alarm limit: Level 5. The alarm limit shall vary with fan speed as follows:
4. High supply air temperature (more than 5 °F above setpoint) when control loop is active for longer than 15 minutes: Level 3.
5. Low supply air temperature (more than 5 °F below setpoint) when control loop is active for longer than 15 minutes: Level 3.
6. High building pressure (more than 0.1") for 5 minutes. Level 3.
7. Low building pressure (less than 0.0") for 5 minutes. Level 4.
8. Outdoor airflow less than setpoint by 10% for 10 minutes when loop is active: Level 3.

Testing/Commissioning Overrides: Provide software points that interlock to a chilled water and hot water plant level point to:

Force all stages of cooling on.
Force all stages of cooling off.
Force all stages of heating on.
Force all stages of heating off.

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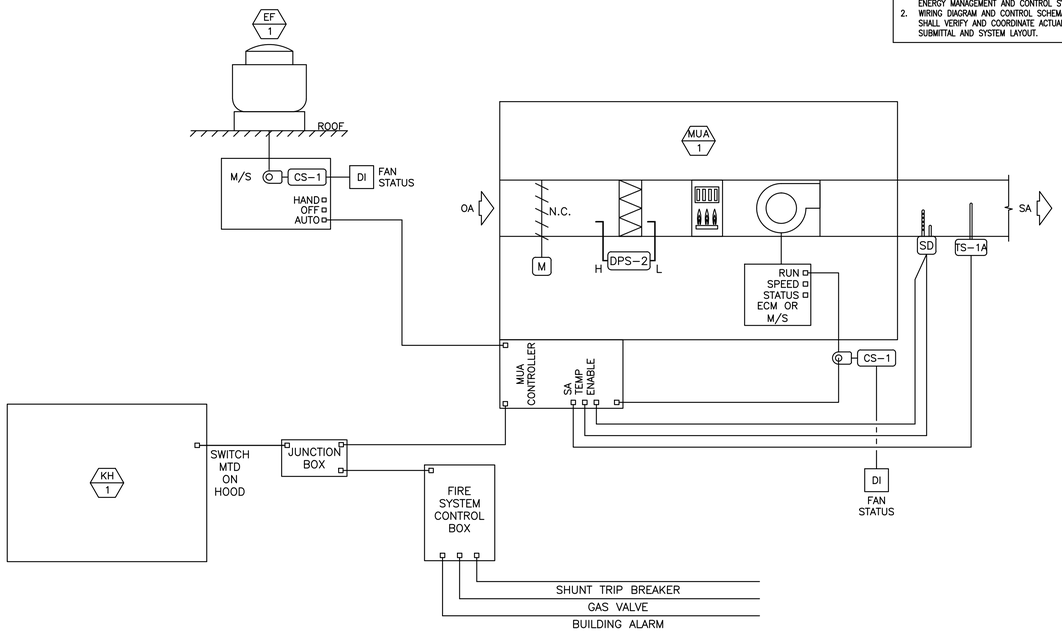
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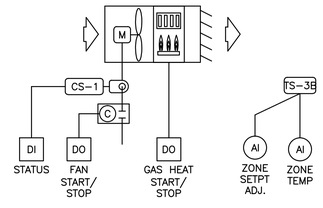
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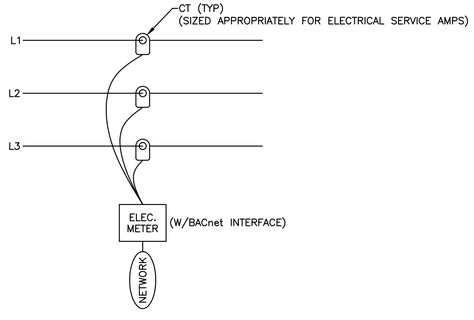
1. KITCHEN HOOD EXHAUST/MAKE-UP SYSTEM CONTROL SYSTEM WIRING IS SPECIFIED UNDER DIVISION 23C ENERGY MANAGEMENT AND CONTROL SYSTEM.
2. WIRING DIAGRAM AND CONTROL SCHEMATIC IS PROVIDED FOR REFERENCE ONLY. DIVISION 23C CONTRACTOR SHALL VERIFY AND COORDINATE ACTUAL SYSTEM AND WIRING REQUIREMENTS WITH FINAL EQUIPMENT SUBMITTAL AND SYSTEM LAYOUT.



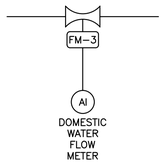
1 / M7.3 KITCHEN EXHAUST AND MAKE-UP AIR SYSTEM CONTROL SCHEMATIC
NO SCALE



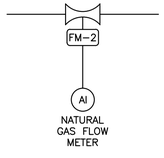
2 / M7.3 GAS FIRED UNIT HEATER CONTROL SCHEMATIC
NO SCALE



3 / M7.3 BUILDING ELECTRIC METER CONTROL SCHEMATIC
NO SCALE



4 / M7.3 DOMESTIC WATER FLOW METER
NO SCALE



5 / M7.3 NATURAL GAS FLOW METER
NO SCALE

MISCELLANEOUS POINTS LIST

Description	Type	Device	Trend Logging: Comm-issioning	Trend Logging: Contin-uous	Calibra-tion
Sump Pump Alarm	DI	Connect to Sump Pump Control Panel Alarm Contact	COV	COV	–
RP-1 Status	DI	CS-1	COV	COV	–
RP-2 Status	DI	CS-1	COV	COV	–
RP-1 Start/Stop	DO	Dry contact to 120V or 24V control circuit	COV	COV	–
RP-2 Start/Stop	DO	Dry contact to 120V or 24V control circuit	COV	COV	–
Natural Gas Flow Meter	AI	FM-2	1 min	15 min	–
Domestic Water Flow Meter	AI	FM-3	1 min	15 min	–
DHW Supply Temperature (110°F)	AI	TS-2A	1 min	15 min	–
DHW Supply Temperature (140°F)	AI	TS-2A	1 min	15 min	–

KITCHEN HOOD SYSTEM SEQUENCE OF OPERATION

General: Constant volume exhaust and make-up air system. Make-up air unit with filters, damper, natural gas heat and supply fan.

1. Kitchen hood exhaust and make-up air system shall be enabled by the hood mounted on/off switch.
2. Make-up air unit shall be controlled by its internal Direct-Digital Controller. DDC controller shall maintain supply air temperature at a minimum of 60°F (adjustable).
3. Alarms:
   - 3.1. Generate a Level 5 maintenance alarm when fan has operated for more than 3000 hours. Reset interval counter when alarm is acknowledged.

HOOD EXHAUST/MAKE-UP SYSTEM POINTS LIST

Description	Type	Device	Trend Logging: Comm-issioning	Trend Logging: Contin-uous	Calibra-tion
Supply Fan Status	DI	CS-1	COV	COV	–
Exhaust Fan Status	DI	CS-1	COV	COV	–

GAS FIRED UNIT HEATER SEQUENCE OF OPERATION

General: Hot water unit heater.

1. Unit heater shall be enabled when zone is in Heating Mode. It shall be disabled otherwise.
2. Fan shall run when unit heater is enabled.
3. Gas heat shall cycle on and off to maintain the zone heating setpoint temperature.
4. Alarms:
   - 4.1. Low zone temperature (more than 10°F below setpoint) for more than 15 minutes when unit heater has been enabled for longer than 15 minutes: Level 3.

GAS FIRED UNIT HEATER POINTS LIST

Description	Type	Device	Trend Logging: Comm-issioning	Trend Logging: Contin-uous	Calibra-tion
Supply Fan Status	DI	CS-1	COV	COV	–
Supply Fan Start/Stop	DO	Dry contact to 120V or 24V control circuit or control relay	COV	COV	–
Gas Heat	DO	Dry contact to 120V or 24V control circuit or control relay	COV	COV	–
Zone Temperature	AI	TS-3B	15 min	60 min	–
Zone Temperature Setpoint Adjustment	AI	TS-3B	15 min	60 min	–

POINTS MAPPED FROM ELEC. METER BACNET CARD

Description	Type	Device	Trend Logging: Comm-issioning	Trend Logging: Contin-uous	Calibra-bration
Real power (kW)	AI	Through network	15 min	60 min	–
Reactive power (kVAR)	AI	Through network	15 min	60 min	–
Apparent power (kVA)	AI	Through network	15 min	60 min	–
Power Factor, 3-phase average and per phase	AI	Through network	15 min	60 min	–
Demand, real (kW)	AI	Through network	15 min	60 min	–
Demand reactive (kVAR)	AI	Through network	15 min	60 min	–
Demand apparent (kVA)	AI	Through network	15 min	60 min	–
Peak demand, real (kW)	AI	Through network	15 min	60 min	–
Peak demand, reactive (kVAR)	AI	Through network	15 min	60 min	–
Peak demand, apparent (kVA)	AI	Through network	15 min	60 min	–
Current, 3-phase average and per phase	AI	Through network	15 min	60 min	–
Voltage, 3-phase average and per phase	AI	Through network	15 min	60 min	–
Frequency	AI	Through network	15 min	60 min	–
Accumulated energy, real (kWh)	AI	Through network	15 min	60 min	–
Accumulated energy reactive (kVARh)	AI	Through network	15 min	60 min	–
Accumulated energy apparent (kVAh)	AI	Through network	15 min	60 min	–
Demand interval configuration	AI	Through network	15 min	60 min	–
Alarm	AI	Through network	15 min	60 min	–

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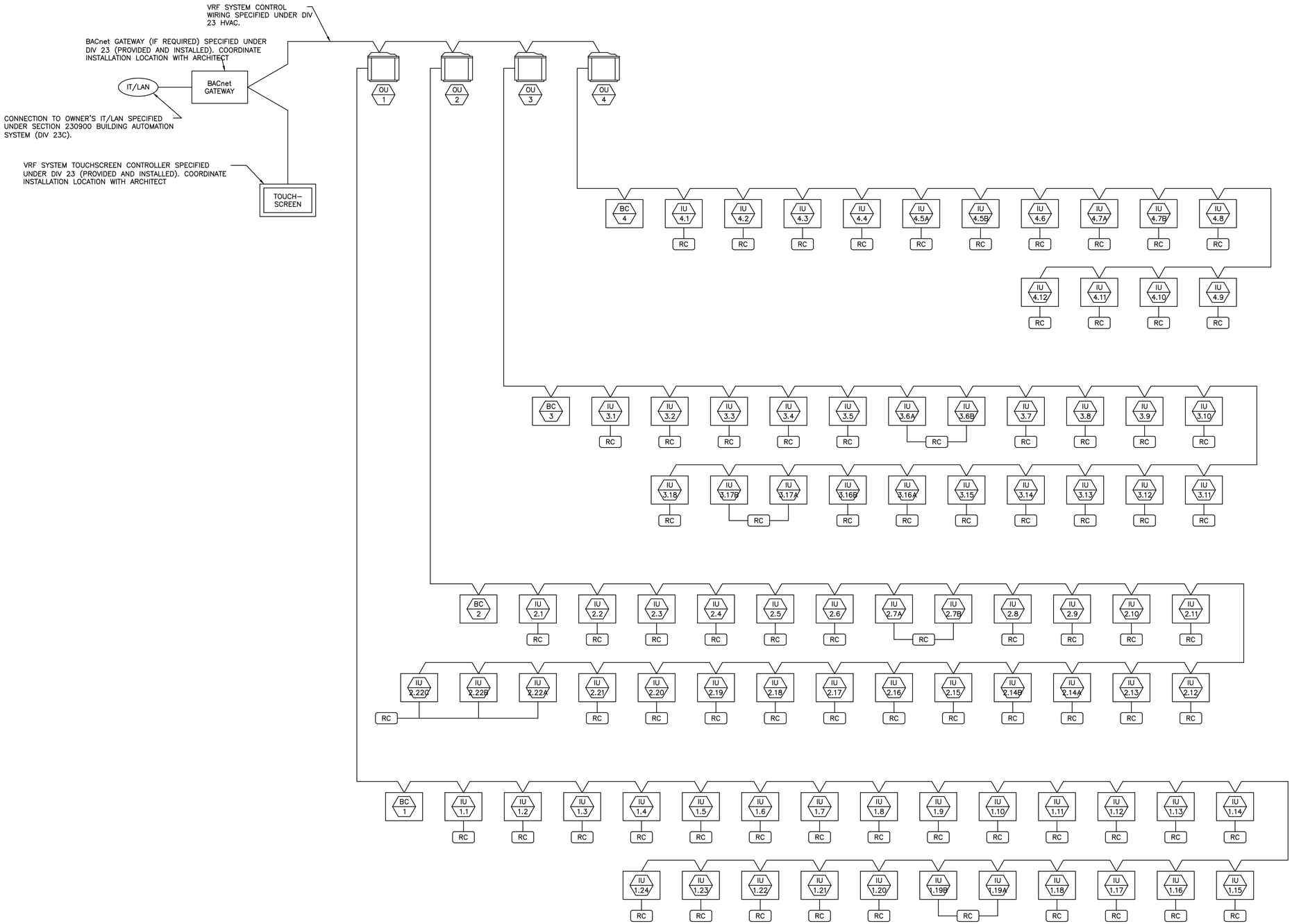
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ERG# 15-28.2



1 / M7.4 VARIABLE REFRIGERANT FLOW (VRF) SYSTEM CONTROL SCHEMATIC
NO SCALE

NOTES

1. VRF SYSTEM WIRING DIAGRAM AND CONTROL SCHEMATIC IS PROVIDED FOR REFERENCE ONLY. DIVISION 23 HVAC CONTRACTOR SHALL VERIFY AND COORDINATE ACTUAL SYSTEM WIRING WITH FINAL EQUIPMENT SUBMITTAL AND SYSTEM LAYOUT.

POINT MAPPED FROM VRF SYSTEM

Description	Type	Device	Trend Logging		Calibration
			Commissioning	Continuous	
Outdoor Unit Status	DI	Through network	COV	COV	–
Branch Controller Status	DI	Through network	COV	COV	–
Indoor Unit Mode	DI	Through network	COV	COV	–
Alarms	DI	Through network	COV	COV	–
Indoor Unit Enable	DO	Through network	COV	COV	–
Zone Temperature	AI	Through network	15 min	60 min	–
Zone Temperature Setpoint Adjustment	AO	Through network	COV	COV	–
Zone Temperature Limits	AO	Through network	–	–	–
Time-of-Day Scheduling	AO	Through network	–	–	–
Fan Speed Setting	AO	Through network	COV	–	–
Air Flow Direction	AO	Through network	–	–	–
Permit/Prohibit Function	AO	Through network	COV	–	–

VRF SYSTEM SEQUENCE OF OPERATION

General: Once enabled via the Building Automation System (BAS), the Variable Refrigerant Flow (VRF) system shall operate subject to its own internal controls and safeties.

1. See Sequence of Operation – General for setpoints, loops, control modes, alarms, etc.
2. BAS shall enable/disable, schedule system modes, monitor system parameters, and change setpoints for the VRF system via the BACnet gateway.
3. Division 23 HVAC Contractor shall be responsible for initial VRF system setup, programming, point naming, schedules, setpoints, etc (system configuration). Division 23 HVAC Contractor and VRF system vendor shall provide technical support to the Section 230900 BAS (Division 23C) Contractor in mapping across BAS points.
4. Zone Temperature Control: Zone temperature shall be controlled via each indoor unit's remote controller within the temperature limits specified.
5. BAS Alarms:
   - 5.1. Maintenance interval alarm when unit has operated for more than 1500 hours: Level 5. Reset interval counter when alarm is acknowledged.

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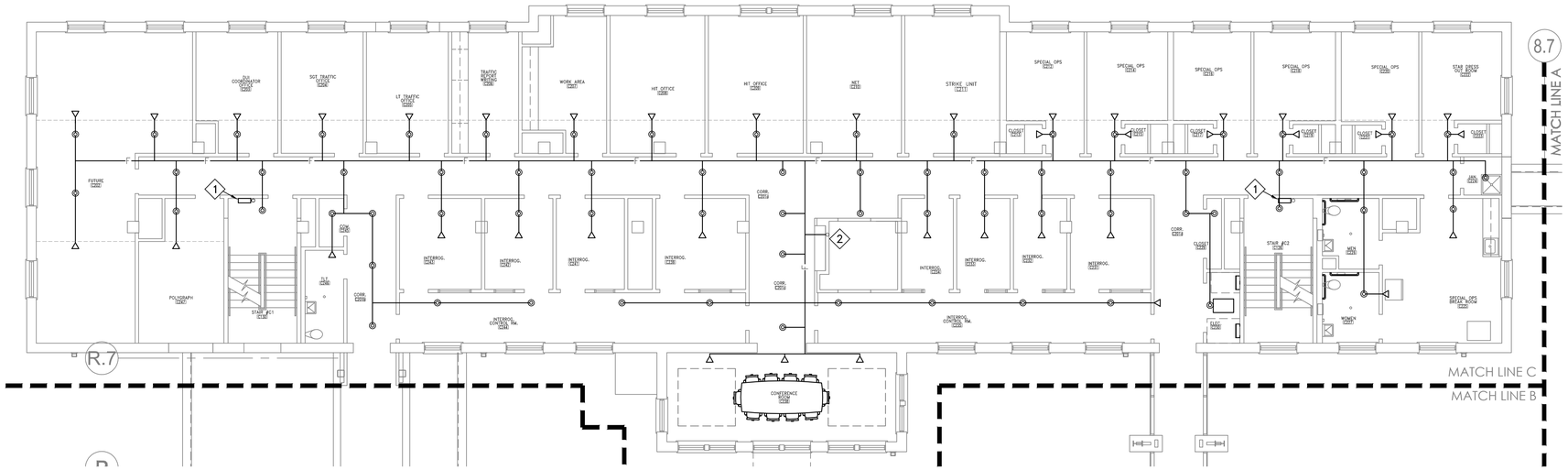
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ERG# 15-28.2

PLAN NOTES:

1. FIRE DEPARTMENT VALVE BOX EQUAL TO CROCKER 1700 SERIES WITH GLASS DOOR. 2-1/2" FIRE DEPARTMENT VALVE FROM FIRE RISER FROM FLOOR BELOW.
2. FIRE SPRINKLER RISER FROM FLOOR BELOW. CONTINUE TO FLOOR ABOVE.

GENERAL NOTE:

FIRE PROTECTION SPRINKLER SYSTEM IS FOR SUGGESTION ONLY AND DOES NOT REPRESENT THE ACTUAL SPRINKLER SYSTEM LAYOUT. DRAWINGS INDICATE WHICH AREAS ARE "DRY PIPE" SYSTEMS AND WET SYSTEMS, EXPOSED PENDANTS OR RECESSED. FIRE SPRINKLER CONTRACTOR WILL SUBMIT CALCULATED SPRINKLER SHOP DRAWINGS FOR APPROVAL.



SECOND FLOOR PLAN PART C – FIRE PROTECTION

SCALE: 1/8" = 1'-0"

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

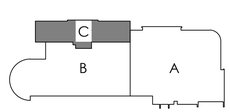
HPSC Historic Hospital (C)

Drawing Issued:

Date	Rev.	Description
08-31-2015		DD Check Set
10-20-2015		75% Progress Set
11-02-2015		90% Pricing Set
11-19-2018		100% Bid Docs

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Client No:	-------
Albert & Associates:	12575

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FP2.2

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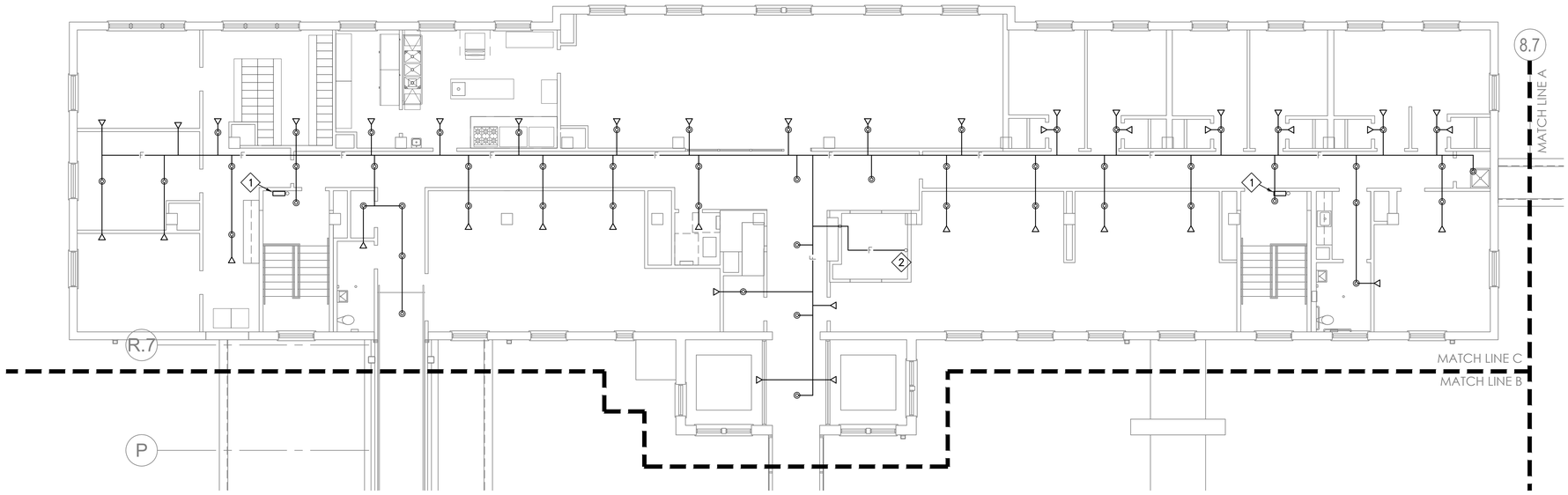
SECOND FLOOR PLAN PART C - FIRE PROT.

PLAN NOTES:

1. FIRE DEPARTMENT VALVE BOX EQUAL TO CROCKER 1700 SERIES WITH GLASS DOOR. 2-1/2" FIRE DEPARTMENT VALVE FROM FIRE RISER FROM FLOOR BELOW.
2. FIRE SPRINKLER RISER FROM FLOOR BELOW. CONTINUE TO FLOOR ABOVE.

GENERAL NOTE:

FIRE PROTECTION SPRINKLER SYSTEM IS FOR SUGGESTION ONLY AND DOES NOT REPRESENT THE ACTUAL SPRINKLER SYSTEM LAYOUT. DRAWINGS INDICATE WHICH AREAS ARE "DRY PIPE" SYSTEMS AND WET SYSTEMS, EXPOSED PENDANTS OR RECESSED. FIRE SPRINKLER CONTRACTOR WILL SUBMIT CALCULATED SPRINKLER SHOP DRAWINGS FOR APPROVAL.



THIRD FLOOR PLAN PART C – FIRE PROTECTION

SCALE: 1/8" = 1'-0"

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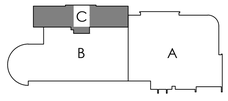
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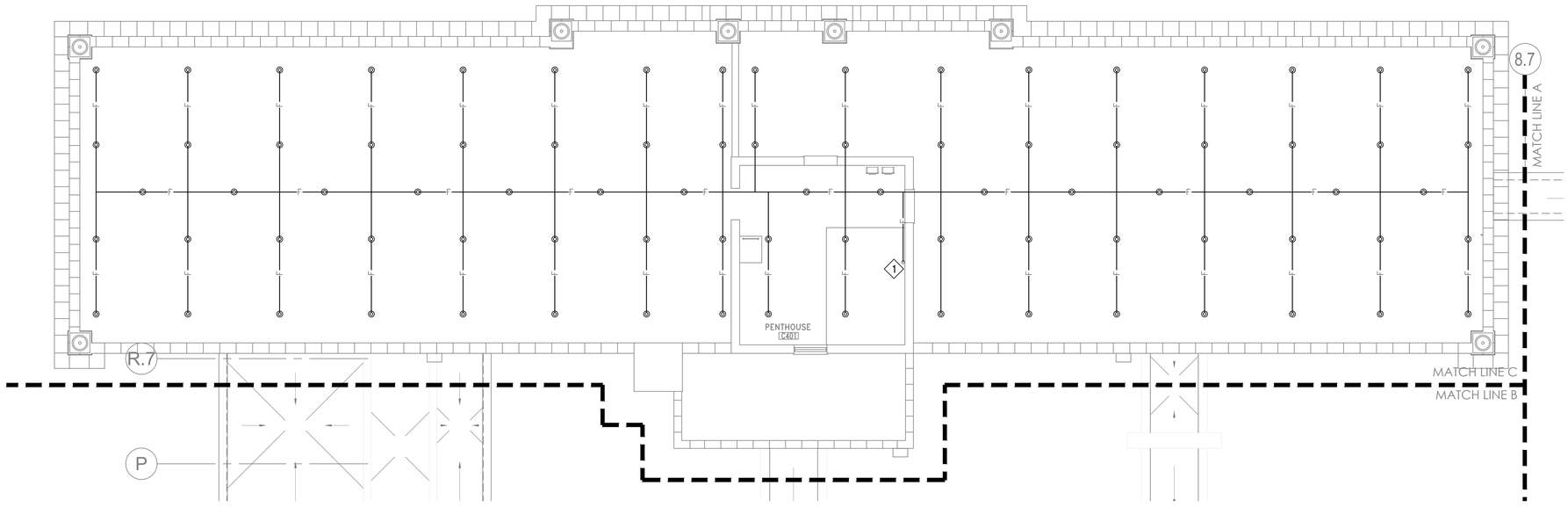
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PLAN NOTES:

1. FIRE SPRINKLER RISER FROM FLOOR BELOW.

GENERAL NOTE:

FIRE PROTECTION SPRINKLER SYSTEM IS FOR SUGGESTION ONLY AND DOES NOT REPRESENT THE ACTUAL SPRINKLER SYSTEM LAYOUT. DRAWINGS INDICATE WHICH AREAS ARE "DRY PIPE" SYSTEMS AND WET SYSTEMS, EXPOSED PENDANTS OR RECESSED. FIRE SPRINKLER CONTRACTOR WILL SUBMIT CALCULATED SPRINKLER SHOP DRAWINGS FOR APPROVAL.



ROOF PLAN PART C – FIRE PROTECTION

SCALE: 1/8" = 1'-0"

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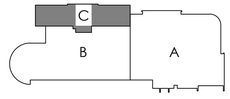
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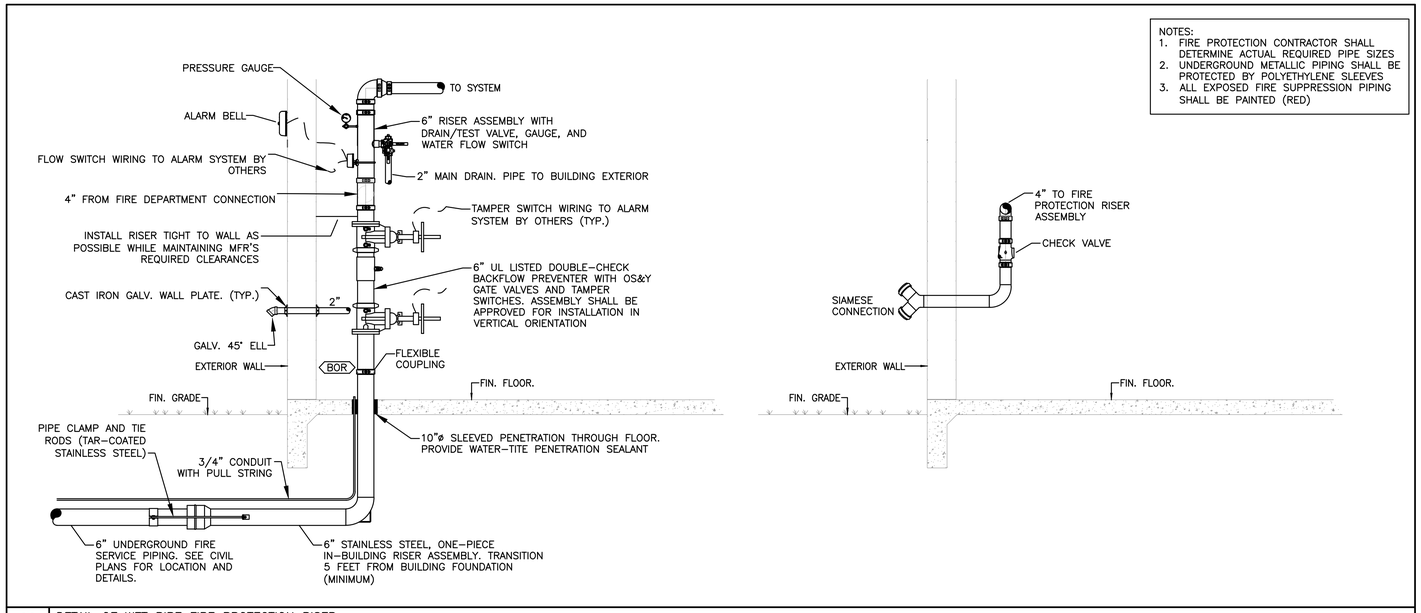
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1 DETAIL OF WET PIPE FIRE PROTECTION RISER — NO SCALE

FIRE PROTECTION GENERAL NOTES

1. INCLUDE ALL LABOR, MATERIAL, E□UIPMENT AND SER□ICE NECESSARY FOR AND REASONABLY INCIDENTAL TO THE DESIGN, FABRICATION AND INSTALLATION OF THE COMPLETE AUTOMATIC FIRE PROTECTION SYSTEMS AS INDICATED ON THE CONTRACT DRA□INGS AND AS SPECIFIED IN THE CONTRACT SPECIFICATIONS.

2. THE FIRE SPRIN□LER SYSTEM DESCRIBED ON THE DRA□INGS AND IN THE SPECIFICATIONS SHALL BE FULLY DESIGNED BY THE FIRE PROTECTION CONTRACTOR'S□. THE FIRE SUPPRESSION SYSTEM DRA□INGS AND SPECIFICATIONS ARE PERFORMANCE BASED ONLY. THE DESIGN BUILD CONTRACTOR'S□ SHALL BE FULLY RESPONSIBLE FOR THE DESIGN AND TO PRO□IDE ALL NECESSARY E□UIPMENT, HARD□ ARE, CONTROLS, SENSOR, ETC. PER LOCAL FIRE PROTECTION CODES.

3. IN GENERAL, □ OR□ SHALL INCLUDE, BUT NOT BE LIMITED TO:
   A. COMPLETE O□ERHEAD AUTOMATIC SPRIN□LER SYSTEMS AS INDICATED ON THE CONTRACT DRA□INGS AND CONTRACT SPECIFICATIONS.
   B. CONNECTION TO UNDERGROUND FIRE SER□ICE.
   C. SYSTEMS AND DE□ICE TESTING.
   D. ALL NECESSARY PERMITS.

4. THE FIRE SPRIN□LER SYSTEMS FOR PROTECTION OF THE SHOP BUILDING SHALL BE HYDRAULICALLY DESIGNED □ ET PIPE SPRIN□LER SYSTEMS AS SPECIFIED IN THE FOLLO□ ING
   A. OFFICES, INCLUDING CORRIDORS, LOUNGES, AND SIMILAR SPACES SHALL BE DESIGNED FOR A LIGHT HA□ARD OCCUPANCY TO PRO□IDE A MINIMUM DESIGN DISCHARGE DENSITY OF 0.10 GPM PER S□ FT O□ER THE HYDRAULIC CALCULATION AREA OR ROOM.
   B. SHOP AREA, MECHANICAL, MINOR STORAGE, AND SIMILAR AREAS OF THE BUILDINGS SHALL BE DESIGNED FOR AN ORDINARY HA□ARD GROUP 1 OCCUPANCY. MA□IMUM SPRIN□LER SPACING SHALL BE 130 S□ FT.
   C. ALL SPRIN□LERS □ ITHIN THE PRO□ECT AREA SHALL BE NE□ , □UIC□ RESPONSE, ORDINARY TEMPERATURE RATING □E□CEPT AS RE□UIRED BY NFPA 13 - 2010 SECTION 8.3.2.□
   D. CALCULATIONS SHALL INCLUDE AN INSIDE HOSE STREAM ALLO□ ANCE OF 100 GPM.

5. PIPE SI□ES INDICATED ON THE CONTRACT DRA□INGS SHALL NOT BE REDUCED.

6. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ESTABLISHING AND IMPLEMENTING ALL SAFETY PROGRAMS AND PROCEDURES FOR THIS PRO□ECT AND SHALL COMPLY □ ITH ALL FEDERAL, STATE AND LOCAL SAFETY AND HEALTH REGULATIONS.

7. THE CONTRACT DRA□ INGS ARE DIAGRAMMATIC ONLY. PIPE LENGTHS □IF SHO□ N□ ARE APPRO□IMATE CENTER TO CENTER LENGTHS BET□EEN FITTINGS. THE CONTRACTOR SHALL DETERMINE THE ACTUAL MEASUREMENTS AND MA□E ANY AND ALL SUCH LENGTH AND OFFSET AD□USTEMENTS AS MAY BE NECESSARY TO COMPLETE THE INSTALLATION AT NO CHANGE IN THE CONTRACT PRICE. THE CONTRACT DRA□ INGS ARE NOT INTENDED TO RELIE□E THE CONTRACTOR OF ANY RESPONSIBILITY FOR A□OIDING CONFLICTS OR OBSTRUCTIONS, OR FOR INSTALLING THE NUMBER OF SPRIN□LERS AND SUPPLY PIPING AS RE□UIRED TO PRO□IDE COMPLETE PROTECTION OF THE DESIGNATED AREAS IN ACCORDANCE □ ITH THE RE□UIREMENTS OF THE REFERENCED STANDARDS AND THESE SPECIFICATIONS. □ RITTEN APPRO□AL SHALL BE OBTAINED FROM THE PROFESSIONAL PRIOR TO MA□ING ANY MA□OR DE□IATIONS FROM THE ARRANGEMENT AND LAYOUT SHO□ N ON THE CONTRACT DRA□INGS.

8. ALL E□UIPMENT SHALL BE LISTED BY UNDER□ RITER'S LABORATORIES AND□OR FACTORY MUTAL APPRO□ED.

9. SYSTEM, E□UIPMENT, INSTALLATION AND MATERIALS AND METHODS USED SHALL COMPLY □ ITH THE FOLLO□ ING:
   A. NATIONAL FIRE PROTECTION ASSOCIATION □NFPA□1 FIRE CODE 2012 EDITION.
   B. NFPA 13 STANDARD FOR THE INSTALLATION OF SPRIN□LER SYSTEMS 2010 EDITION.
   C. INTERNATIONAL BUILDING CODE - 2012
   D. MANUFACTURER'S RECOMMENDATIONS AND GUIDELINES.

10. ALL MATERIALS AND E□UIPMENT FURNISHED BY THE CONTRACTOR SHALL BE NE□ , FIRST GRADE STANDARD, CURRENT PRODUCTS OF A MANUFACTURER REGULARLY ENGAGED IN THE PRODUCTION OF SUCH MATERIALS AND E□UIPMENT. □ HERE T□O OR MORE PIECES OF E□UIPMENT PERFORMING THE SAME FUNCTION ARE RE□UIRED, THEY SHALL BE THE PRODUCT OF ONE MANUFACTURER AND E□ACT DUPLICATES.

11. PIPING SHALL BE NE□ , DESIGNED FOR 300 PSI □ OR□ING PRESSURE, CONFORMING TO ASTM SPECIFICATIONS, AND HA□E THE MANUFACTURER'S NAME OR BRAND ALONG □ ITH THE PIPE APPLICABLE ASTM STANDARD MAR□ED ON EACH LENGTH OF PIPE.

12. PIPING 2" DIAMETER AND SMALLER SHALL BE SCHEDULE 40 BLACK STEEL PIPE. PIPE SHALL BE MANUFACTUERED IN ACCORDANCE □ ITH SPECIFICATIONS ASTM A53 AND A135.

13. PIPING 2-1/2" DIAMETER AND LARGER SHALL BE SCHEDULE 10 BLACK STEEL PIPE MANUFACTURED IN ACCORDANCE WITH SPECIFICATION ASTM A135.

14. OTHER THIN-□ ALLED PIPING MATERIALS □SUCH AS SCHEDULE, 5, □L AND BLT THREADABLE THIN□ ALLS, ETC.□□ ILL NOT BE PERMITTED.

15. ALL FIRE PROTECTION SYSTEM PIPING SHALL BE PRO□IDED □ ITH FACTORY APPLIED ANTIMICROBIAL COATINGS TOINHIBIT MICROBIOLOGICALLY INFLUENCED CORROSION (MIC). ALLIED TUBE AND CONDUIT "ABF II", WHEATLAND TUBE COMPANY "MIC SHIELD" OR EQUAL.

16. THREADED FITTINGS SHALL BE CLASS 125 CAST IRON, BLAC□, AND IN ACCORDANCE □ ITH ANSI B16.□ OR DUCTILE OR MALLEABLE IRON, 150 LB CLASS, BLAC□, AND IN ACCORDANCE □ ITH ANSI B16.3. SCRE□ ED □OINTS SHALL BE MADE UP □ ITH APPRO□ED TEFLON □OINT COMPOUND OR TAPE.

17. BOLT ON OR STRAP ON BRANCH AND OUTLET FITTINGS □ ILL NOT BE PERMITTED. SIMILARLY, HOLE CUT PIPING SYSTEM OR STRAPLESS OUTLETS □ ILL NOT BE PERMITTED.

18. GROO□ED COUPLINGS SHALL BE UL LISTED AND□OR FM APPRO□ED FOR FIRE PROTECTION SER□ICE. PLAIN-END TYPE PIPE FITTINGS AND COUPLINGS SHALL NOT BE USED.

19. ALL PENDENT AND SIDE□ ALL SPRIN□LERS LOCATED □ ITHIN 7 FT OF THE FLOOR OR SUB□ECT TO MECHANICAL DAMAGE SHALL BE PRO□IDED □ ITH LISTED SPRIN□LER GUARDS COMPATIBLE □ ITH THE SPRIN□LER MODELS AND TYPES ON □ HICH THEY ARE INSTALLED.

20. E□TRA SPRIN□LERS IN THE □UANTIES RE□UIRED BY NFPA 13, CABINETS, AND □ RENCHES SHALL BE SUPPLIED AND DELI□ERED TO THE PROFESSIONAL.

21. INSTALL HANGERS, FLE□IBLE CONNECTIONS, S□ ING □OINTS AND BRACING IN ACCORDANCE □ ITH NFPA 13.

22. SYSTEM PIPING SHALL BE INSTALLED SUCH THAT NO □OINTS, FITTINGS OR DE□ICES OCCUR DIRECTLY O□ER ELECTRICAL E□UIPMENT OR □ ITHIN THE CLEARANCE SPACE AS RE□UIRED BY THE NATIONAL ELECTRIC CODE □NEC□.

23. IMPAIRMENTS OF E□ISTING FIRE PROTECTION SYSTEMS SHALL BE MINIMI□ED, COORDINATED □ ITH THE PROFESSIONAL AND PERFORMED IN ACCORDANCE □ ITH NFPA 25. ALL E□ISTING FIRE PROTECTION SYSTEMS SHALL BE RESTORED TO SER□ICE AT THE END OF EACH □ OR□ING DAY.

24. THE □ OR□ PERFORMED ON THIS PRO□ECT OCCURS □ ITHIN AN E□ISTING BUILDING. ALL E□UIPMENT AND MATERIAL TO BE FURNISHED AND INSTALLED ON THE PRO□ECT SHALL BE COORDINATED □ ITH THE SPACE CONSTRAINTS. ALL E□UIPMENT AND MATERIAL SHALL BE FABRICATED SUCH THAT COMPLETE SYSTEMS MAY BE BRO□EN DO□ NI INTO SECTION SUITABLE FOR LIFTING AND FITTING THROUGH PASSAGE□ AYS □ITHOUT MODIFCATION TO THE BUILDING UNLESS OTHER□ ISE NOTED, OR OTHER ARRANGEMENTS ARE MADE □ ITH THE PROFESSIONAL.

25. THE CONTACTOR SHALL BE RESPONSIBLE FOR ALL OPENINGS AND PENETRATIONS RE□UIRED FOR THE FIRE PROTECTION PIPING.

26. CUTTING STRUCTURAL MEMBERS FOR THE PASSING OF FIRE PROTECTION PIPING OR PIPE HANGER FASTENING □ ILL NOT BE PERMITTED E□CEPT □ ITH APPRO□AL OF THE PROFESSIONAL.

27. SUITABLE MEANS SHALL BE PRO□IDED AT EACH HOLE OR PENETRATION TO MAINTAIN THE DESIGNED FIRE RESISTANCE RATING OF THE □ ALL, CEILING, OR FLOOR ASSEMBLY.

28. INSTALL SPLIT □ ALL PLATES OR ESCUTCHEONS □ HERE E□POSED PIPING PASSES THROUGH A FINISHED FLOOR, □ ALL OR CEILING. THEY SHALL FIT SNUGLY AROUND PIPING. THE FINISH OF ESCUTCHEONS OR □ ALL PLATES SHALL MATCH THE COLOR OF AD□ACENT □ ALLS, CEILINGS, OR FLOORS.

29. UPON COMPLETION OF INSTALLATION AND □ HILE PIPING IS STILL E□POSED, HYDROSTATICALLY TEST THE SYSTEMS AT 200 PSI □OR 50 PSI IN E□CES OF THE SYSTEM □ OR□ING PRESSURE, □ HICHE□ ER IS GREATER□ FOR A PERIOD OF 2 HOURS. PORTIONS OF THE SYSTEM MAY BE TESTED AS THEY ARE COMPLETED. SE□ENTY-T□ O HOUR NOTICE SHALL BE GI□EN TO THE PROFESSIONAL AND THE AUTHORITY HA□ING □URISDICTION PRIOR TO ANY TEST. A PRE-INSTALLATION INSPECTION OF PIPE, FITTINGS, AND DE□ICES IS RE□UIRED.

30. SPRIN□LER HEADS INSTALLED IN TILE CEILINGS SHALL BE INSTALLED IN THE CENTER OF THE TILES.

31. SPRIN□LER SYSTEM DRAIN LINES SHALL BE ROUTED AS INDICATED ON FLOOR PLANS AND FULLY COORDINATED □ ITH ALL TRADES SUCH THAT IT A□OIDS THE TRA□EL PATH OF THE O□ERHEAD CRANE . REFER TO SECTION 2 ON SHEET A30□.

32. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL LEA□S.

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ELECTRICAL LEGEND

GENERAL NOTES

1. ALL EQUIPMENT AND DEVICES ARE TO BE FLUSH MOUNTED UNLESS OTHERWISE NOTED.
2. DEVICES NOTED AS "GFI" SHALL BE GROUND FAULT CIRCUIT INTERRUPTING DEVICES.
3. DEVICES NOTED AS "WP" SHALL BE WEATHERPROOF WHILE-IN-USE.
4. PROVIDE UNSWITCHED POWER TO EMERGENCY BATTERY PACKS.

LUMINAIRES (See Light Fixture Schedule)

NOTE: THE NUMBER INSIDE THE CIRCLE IS THE CIRCUIT NUMBER. THE LETTER BESIDE THE SYMBOL IS THE FIXTURE TYPE DESCRIBED IN THE LIGHT FIXTURE SCHEDULE.

- 2'X4' RECESSED FIXTURE.
- 2'X4' RECESSED EMERGENCY FIXTURE.
- SURFACE MOUNTED OR SUSPENDED FIXTURE.
- SURFACE MOUNTED OR SUSPENDED EMERGENCY FIXTURE.
- LINEAR RECESSED FIXTURE.
- LINEAR RECESSED EMERGENCY FIXTURE.
- RECESSED CEILING FIXTURE.
- RECESSED EMERGENCY CEILING FIXTURE.
- PENDANT MOUNT FIXTURE.
- CEILING MOUNTED EXIT SIGN. PROVIDE CHEVRONS AS INDICATED BY ARROWS.
- EXIT SIGN WITH EMERGENCY LIGHTING.
- WALL MOUNTED EXIT SIGN. PROVIDE CHEVRONS AS INDICATED BY ARROWS.
- WALL MOUNTED LINEAR FIXTURE.
- WALL MOUNTED EMERGENCY LINEAR FIXTURE.

MISCELLANEOUS

- CEILING MOUNTED JUNCTION BOX.
- WALL MOUNTED JUNCTION BOX.
- FLEXIBLE CONNECTION TO EQUIPMENT.

FIRE ALARM SYSTEM

- MANUAL PULL STATION. MOUNT 48"A.F.F. TO CENTERLINE OF BOX.
- STROBE. MOUNT 80"A.F.F. TO BOTTOM OF BOX.
- COMBINATION HORN AND STROBE. MOUNT 80"A.F.F. TO BOTTOM OF BOX.
- SMOKE DETECTOR.
- THERMAL DETECTOR.
- DUCT SMOKE DETECTOR IN RETURN DUCT.
- DUCT SMOKE DETECTOR IN SUPPLY DUCT.
- ELEVATOR RECALL SMOKE DETECTOR.
- SOUNDER BASE SMOKE DETECTOR.
- SMOKE DETECTOR WITH DETENTION GRADE COVER.
- FACP: FIRE ALARM CONTROL PANEL.
- FAAP: FIRE ALARM ANNUNCIATOR PANEL.
- FS: FLOW SWITCH. COORDINATE EXACT LOCATION WITH SPRINKLER CONTRACTOR.
- TS: TAMPER SWITCH. COORDINATE EXACT LOCATION WITH SPRINKLER CONTRACTOR.
- CONNECTION TO SPRINKLER GONG. COORDINATE EXACT REQUIREMENTS WITH SPRINKLER CONTRACTOR.
- PIV: TAMPER SWITCH. COORDINATE EXACT LOCATION WITH SPRINKLER CONTRACTOR.

SWITCHES

- $: SINGLE-POLE, SINGLE-THROW SWITCH. MOUNT CENTERLINE OF BOX AT 45"A.F.F. UNLESS NOTED OTHERWISE.
- 2P $: DOUBLE-POLE, SINGLE-THROW, 30 AMP SWITCH. MOUNT CENTERLINE OF BOX AT 45"A.F.F. UNLESS NOTED OTHERWISE.
- M $: AUTOMATIC WALL SWITCH. SENSORSWITCH #WSD-PDT OR APPROVED EQUAL. MOUNT CENTERLINE OF BOX AT 45" A.F.F. UNLESS NOTED OTHERWISE.
- $TS: DIGITAL TIME SWITCH WITH ADJUSTABLE RANGE FROM 5 MINUTES TO 12 HOURS. FURNISH WITH AUDIBLE WARNING. SENSORSWITCH #PTS-60 OR APPROVED EQUAL. MOUNT CENTERLINE OF BOX AT 45" A.F.F. UNLESS NOTED OTHERWISE.
- $T: HORSEPOWER RATED SWITCH WITH THERMAL OVERLOADS (MANUAL MOTOR STARTER).
- MD1: PASSIVE INFRARED AND ULTRASONIC DUAL TECHNOLOGY OCCUPANCY SENSOR WITH A 12' RADIAL COVERAGE. CEILING MOUNTED. SENSORSWITCH #CM-PDT-9 OR APPROVED EQUAL.
- MD2: PASSIVE INFRARED AND ULTRASONIC DUAL TECHNOLOGY OCCUPANCY SENSOR WITH A 28' RADIAL COVERAGE. CEILING MOUNTED. SENSORSWITCH #CM-PDT-10 OR APPROVED EQUAL.
- MDC: PASSIVE INFRARED AND ULTRASONIC DUAL TECHNOLOGY OCCUPANCY SENSOR WITH A 2000 SQ. FT. COVERAGE. MOUNT IMMEDIATELY BELOW CEILING. SENSORSWITCH #WV-PDT-16 OR APPROVED EQUAL.
- PP: POWER PACK MOUNTED ABOVE CEILING. SENSORSWITCH #PP20 OR APPROVED EQUAL.
- PP2: DUAL RELAY PACK MOUNTED ABOVE CEILING. SENSORSWITCH #PP20-2P OR APPROVED EQUAL.
- EPP: EMERGENCY LIGHTING BYPASS SHUNT RELAY. SENSORSWITCH #PP16-SHUNT OR APPROVED EQUAL.
- DS: DAYLIGHT SENSOR.
- ELCU: EMERGENCY LIGHTING CONTROL UNIT. EQUAL TO WATTSTOPPER #ELCU-100 OR APPROVED EQUAL.
- PD: POWER PACK WITH WIRELESS AND DIMMING MODULE WITH 0-10V CONTROL MOUNTED ABOVE CEILING. LUTRON #RMJ-5T-DV-B OR APPROVED EQUAL.
- P: POWER PACK WITH WIRELESS MOUNTED ABOVE CEILING. LUTRON #RMJ-16R-DV-B OR APPROVED EQUAL.
- WD: WIRELESS PASSIVE INFRARED OCCUPANCY SENSOR. CEILING MOUNTED. LUTRON #LRF2-OCR2B-P-WH OR APPROVED EQUAL.
- EPD: EMERGENCY LIGHTING CONTROL UNIT WITH DIMMING BYPASS. EQUAL TO LVS CONTROLS #EPC-1-D OR APPROVED EQUAL.
- EPP: EMERGENCY LIGHTING BYPASS SHUNT RELAY. SENSORSWITCH #PP16-SHUNT OR APPROVED EQUAL.
- WDS: WIRELESS DAYLIGHT SENSOR.
- $3RL: WIRELESS THREE BUTTON WITH RAISE-LOWER WALL SWITCH. LUTRON #PJ2-3BRL-GWH-L01

ACCESS CONTROL

- CR: CARD READER.
- ES: ELECTRIC DOOR STRIKE.
- ACP: ACCESS CONTROL PANEL.

INTRUSION DETECTION SYSTEM

- MOTION DETECTOR.
- GB: GLASS BREAK DETECTOR.
- DC: DOOR CONTACT.
- ALARM HORN.
- IDCP: INTRUSION DETECTION CONTROL PANEL.

PAGING SYSTEM

- CEILING SPEAKER.
- SURFACE MOUNT SPEAKER.
- VOLUME CONTROL IN FLUSH MOUNTED BOX ON WALL AT 48"A.F.F.

CONDUIT AND WIRING

- CONDUCTORS IN CONDUIT CONCEALED WITHIN WALL OR CEILING. TIC MARKS INDICATE NUMBER OF CONDUCTORS. THE EQUIPMENT GROUNDING CONDUCTOR IS NOT SHOWN, BUT SHALL BE PROVIDED. SIZE THE EQUIPMENT GROUNDING CONDUCTOR AND THE CONDUIT PER THE NEC. THE ABSENCE OF TIC MARKS SIGNIFIES THAT TWO CONDUCTORS PLUS AN EQUIPMENT GROUNDING CONDUCTOR SHOULD BE PROVIDED. FOR EXAMPLE, THE MARKINGS TO THE LEFT SIGNIFY THAT THREE CONDUCTORS PLUS AN EQUIPMENT GROUNDING CONDUCTOR SHOULD BE PROVIDED.
- #10: THE TEXT INSIDE THE ARC INDICATES THE AWG SIZE OF THE CONDUCTORS THAT SHALL BE RUN IN THE CONDUIT. THE ABSENCE OF TEXT SIGNIFIES THAT THE CONDUCTORS SHOULD BE #12 AWG.
- CIRCUITRY RUN IN STRAIGHT LINE SEGMENTS SIGNIFIES EXPOSED SURFACE-MOUNTED RACEWAY (SEE SPECIFICATIONS).
- CONDUCTORS IN CONDUIT CONCEALED BELOW GRADE OR FLOOR. TIC MARKS INDICATE NUMBER OF CONDUCTORS. THE EQUIPMENT GROUNDING CONDUCTOR IS NOT SHOWN, BUT SHALL BE PROVIDED. SIZE THE EQUIPMENT GROUNDING CONDUCTOR AND THE CONDUIT PER THE NEC. THE ABSENCE OF TIC MARKS SIGNIFIES THAT TWO CONDUCTORS PLUS AN EQUIPMENT GROUNDING CONDUCTOR SHOULD BE PROVIDED. THE MARKINGS TO THE LEFT SIGNIFY THAT THREE CONDUCTORS PLUS AN EQUIPMENT GROUNDING CONDUCTOR SHOULD BE PROVIDED.
- LA-1: HOMERUN TO PANELBOARD. ARC DENOTES CONCEALED CIRCUITRY. TEXT DENOTES PANELBOARD NAME WITH CIRCUIT NUMBER. DEVICES HAVING CIRCUIT NUMBERS LOCATED BESIDE THEM MAY NOT SHOW THE CIRCUIT NUMBERS AT THE HOMERUN ARROWS.
- LA-1: PARTIAL HOMERUN TO PANELBOARD. COMBINE ALL PARTIAL HOMERUNS THAT ARE ON THE SAME CIRCUIT IN A JUNCTION BOX PRIOR TO ENTERING THE PANELBOARD.
- LOW VOLTAGE CONDUCTORS USED FOR MOTION DETECTOR CIRCUITRY. SEE MANUFACTURER'S RECOMMENDATIONS FOR CONDUCTOR REQUIREMENTS.
- 6: CABLE TRAY. NUMBER INDICATES WIDTH OF CABLE TRAY. NO NUMBER INDICATES A DEFAULT WIDTH OF 12"
- CRITICAL BRANCH CONDUCTORS IN CONDUIT CONCEALED WITHIN WALL OR CEILING. TIC MARKS INDICATE NUMBER OF CONDUCTORS. THE EQUIPMENT GROUNDING CONDUCTOR IS NOT SHOWN, BUT SHALL BE PROVIDED. SIZE THE EQUIPMENT GROUNDING CONDUCTOR AND THE CONDUIT PER THE NEC. THE ABSENCE OF TIC MARKS SIGNIFIES THAT TWO CONDUCTORS PLUS AN EQUIPMENT GROUNDING CONDUCTOR SHOULD BE PROVIDED. FOR EXAMPLE, THE MARKINGS TO THE LEFT SIGNIFY THAT TWO #12 AWG CONDUCTORS PLUS AN EQUIPMENT GROUNDING CONDUCTOR SHOULD BE PROVIDED.

VOLTAGE DROP CHART FOR 20A, 1Ø CIRCUITS

Voltage	Circuit Length	Conductor Size (AWG)
120	< 90'	#12
120	> 90'	#10
120	> 145'	#8
120	> 230'	#6
277	< 200'	#12
277	> 200'	#10
277	> 325'	#8
277	> 525'	#6

VOLTAGE DROP CHART NOTES:

1) CIRCUIT SIZES INDICATED ON THE DRAWINGS ARE MINIMUM REQUIREMENTS. REFER TO THIS CHART FOR UPSIZING CONDUCTORS AS NEEDED.

2) DO NOT CONNECT CONDUCTORS LARGER THAN #10 DIRECTLY TO A RECEPTACLE OR A SWITCH. PROVIDE A JUNCTION BOX TO DOWNSIZE THE CONDUCTOR TO #12 AT THE DEVICE.

3) FOR CIRCUITS LONGER THAN THOSE LISTED ABOVE, CONSULT WITH THE ENGINEER FOR CONDUCTOR SIZES.

RECEPTACLES

- DUPLEX RECEPTACLE, NEMA 5-20R, MOUNTED 18" A.F.F. TO CENTERLINE OF BOX UNLESS NOTED OTHERWISE.
- SWITCHED DUPLEX RECEPTACLE, NEMA 5-20R, MOUNTED 18" A.F.F. TO CENTERLINE OF BOX UNLESS NOTED OTHERWISE.
- DUPLEX RECEPTACLE, NEMA 5-20R, MOUNTED WITH BOTTOM OF BOX 2" ABOVE COUNTER WITH BACKSPLASH AND 6" ABOVE COUNTER WITHOUT BACKSPLASH. WHERE RECEPTACLE IS SHOWN IN AN AREA WITH NO COUNTER, MOUNT 45"A.F.F. TO CENTERLINE OF BOX.
- SWITCHED DUPLEX RECEPTACLE, NEMA 5-20R, MOUNTED WITH BOTTOM OF BOX 2" ABOVE COUNTER WITH BACKSPLASH AND 6" ABOVE COUNTER WITHOUT BACKSPLASH. WHERE RECEPTACLE IS SHOWN IN AN AREA WITH NO COUNTER, MOUNT 45"A.F.F. TO CENTERLINE OF BOX.
- DOUBLE DUPLEX RECEPTACLE, NEMA 5-20R, ONE COVER PLATE, MOUNTED 18" A.F.F. TO CENTERLINE OF BOX UNLESS NOTED OTHERWISE.
- DOUBLE DUPLEX RECEPTACLE, NEMA 5-20R, ONE COVER PLATE, MOUNTED WITH BOTTOM OF BOX 2" ABOVE COUNTER WITH BACKSPLASH, AND 6" ABOVE COUNTER WITHOUT BACKSPLASH. WHERE RECEPTACLE IS SHOWN IN AN AREA WITH NO COUNTER, MOUNT 45"A.F.F. TO CENTERLINE OF BOX.
- DOUBLE DUPLEX RECEPTACLE, NEMA 5-20R, ONE COVER PLATE, MOUNTED WITH BOTTOM OF BOX 2" ABOVE COUNTER WITH BACKSPLASH, AND 6" ABOVE COUNTER WITHOUT BACKSPLASH. WHERE RECEPTACLE IS SHOWN IN AN AREA WITH NO COUNTER, MOUNT 45"A.F.F. TO CENTERLINE OF BOX. ONE DUPLEX RECEPTACLE WILL BE SWITCH AND ONE DUPLEX RECEPTACLE WILL BE UNSWITCHED.
- DOUBLE DUPLEX RECEPTACLE, NEMA 5-20R, ONE COVER PLATE, MOUNTED 18" A.F.F. TO CENTERLINE OF BOX UNLESS NOTED OTHERWISE. ONE DUPLEX RECEPTACLE WILL BE SWITCH AND ONE DUPLEX RECEPTACLE WILL BE UNSWITCHED.
- DF: DUPLEX RECEPTACLE, NEMA 5-20R, FOR DRINKING FOUNTAIN FED FROM GFCI BREAKER. MOUNTED IN ACCORDANCE WITH MANUFACTURER'S ROUGH-IN REQUIREMENTS. VERIFY CONNECTION TYPE PRIOR TO BID. PROVIDE PROPER EQUIPMENT FOR CONNECTION TYPE REQUIRED.
- 20A WIRELESS RELAY POWER PACK MOUNTED ABOVE CEILING. LUTRON RMJ-H20R-DV-B OR APPROVED EQUAL.

COMMUNICATIONS (Cable Pulled in Contract)

- DOUBLE DUPLEX RECEPTACLE, NEMA 5-20R AND A COMBINATION TELEPHONE/DATA OUTLET MOUNTED IN A FLOOR BOX. COMMUNICATION OUTLET SHALL HAVE ONE TELEPHONE JACK AND ONE DATA JACK UNLESS NOTED OTHERWISE.
- V/D: DOUBLE DUPLEX RECEPTACLE, NEMA 5-20R, A COMBINATION TELEPHONE/DATA OUTLET, AND HDMI AND VGA OUTLET MOUNTED IN A FLOOR BOX.

CCTV SYSTEM

- CEILING MOUNTED CAMERA.
- WALL MOUNTED CAMERA.
- DGH: INSIDE CORNER MOUNTED CAMERA IN DETENTION GRADE HOUSING.
- OUTSIDE CORNER MOUNTED CAMERA.
- TELEVISION CABLE OUTLET MOUNTED 18" A.F.F. TO CENTERLINE OF BOX UNLESS NOTED OTHERWISE.

GEAR

- NON-FUSED DISCONNECT SWITCH. TEXT INDICATES AMPACITY/NUMBER OF POLES/ENCLOSURE TYPE.
- MAGNETIC MOTOR STARTER.
- PANELBOARD.
- MOTOR.

COMMUNICATIONS

- COMBINATION TELEPHONE/DATA OUTLET MOUNTED 18" A.F.F. TO CENTERLINE OF BOX UNLESS NOTED OTHERWISE.
- COMBINATION TELEPHONE/DATA OUTLET MOUNTED WITH BOTTOM OF BOX 2" ABOVE COUNTER WITH BACKSPLASH, AND 6" ABOVE COUNTER WITHOUT BACKSPLASH.
- TELEPHONE OUTLET MOUNTED 18" A.F.F. TO CENTERLINE OF BOX UNLESS NOTED OTHERWISE.
- TELEPHONE OUTLET MOUNTED WITH BOTTOM OF BOX 2" ABOVE COUNTER WITH BACKSPLASH, AND 6" ABOVE COUNTER WITHOUT BACKSPLASH.
- DATA OUTLET MOUNTED 18" A.F.F. TO CENTERLINE OF BOX UNLESS NOTED OTHERWISE.
- DATA OUTLET MOUNTED WITH BOTTOM OF BOX 2" ABOVE COUNTER WITH BACKSPLASH, AND 6" ABOVE COUNTER WITHOUT BACKSPLASH.
- DOUBLE DUPLEX RECEPTACLE, NEMA 5-20R AND A COMBINATION TELEPHONE/DATA OUTLET MOUNTED IN A FLOOR BOX.
- V/D: DOUBLE DUPLEX RECEPTACLE, NEMA 5-20R, A COMBINATION TELEPHONE/DATA OUTLET, AND A MICROPHONE OUTLET MOUNTED IN A FLOOR BOX.
- TELEVISION CABLE OUTLET MOUNTED 18" A.F.F. TO CENTERLINE OF BOX UNLESS NOTED OTHERWISE.
- FLUSH WALL MOUNTED JUNCTION BOX WITH FLUSH COVER. VERIFY FINISH COLOR WITH ARCHITECT. VERIFY LOCATION WITH OWNER AND FURNITURE PLAN.

SHEET INDEX

Mark	Description
E0.0	ELECTRICAL LEGEND
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E0.2	ELECTRICAL DETAILS
E0.3	ELECTRICAL DETAILS
E0.□	PANEL SCHEDULES
E0.5	PANEL SCHEDULES
E0.6	TELECOMMUNICATION RISER DIAGRAM
E1.0	LIGHTING PLAN - FIRST AND SECOND FLOOR
E1.1	LIGHTING PLAN - THIRD FLOOR AND ROOF
E2.0	PO□ER PLAN - FIRST AND SECOND FLOOR
E2.1	PO□ER PLAN - THIRD FLOOR AND ROOF
E3.0	AU□ILIARY PLAN - FIRST AND SECOND FLOOR
E3.1	AU□ILIARY PLAN - THIRD FLOOR AND ROOF
E□.0	MECHANICAL PLAN - FIRST AND SECOND FLOOR
E□.1	MECHANICAL PLAN - THIRD FLOOR AND ROOF
SEC1.0	SECURITY PLAN - FIRST AND SECOND FLOOR
SEC1.1	SECURITY PLAN - THIRD FLOOR AND ROOF

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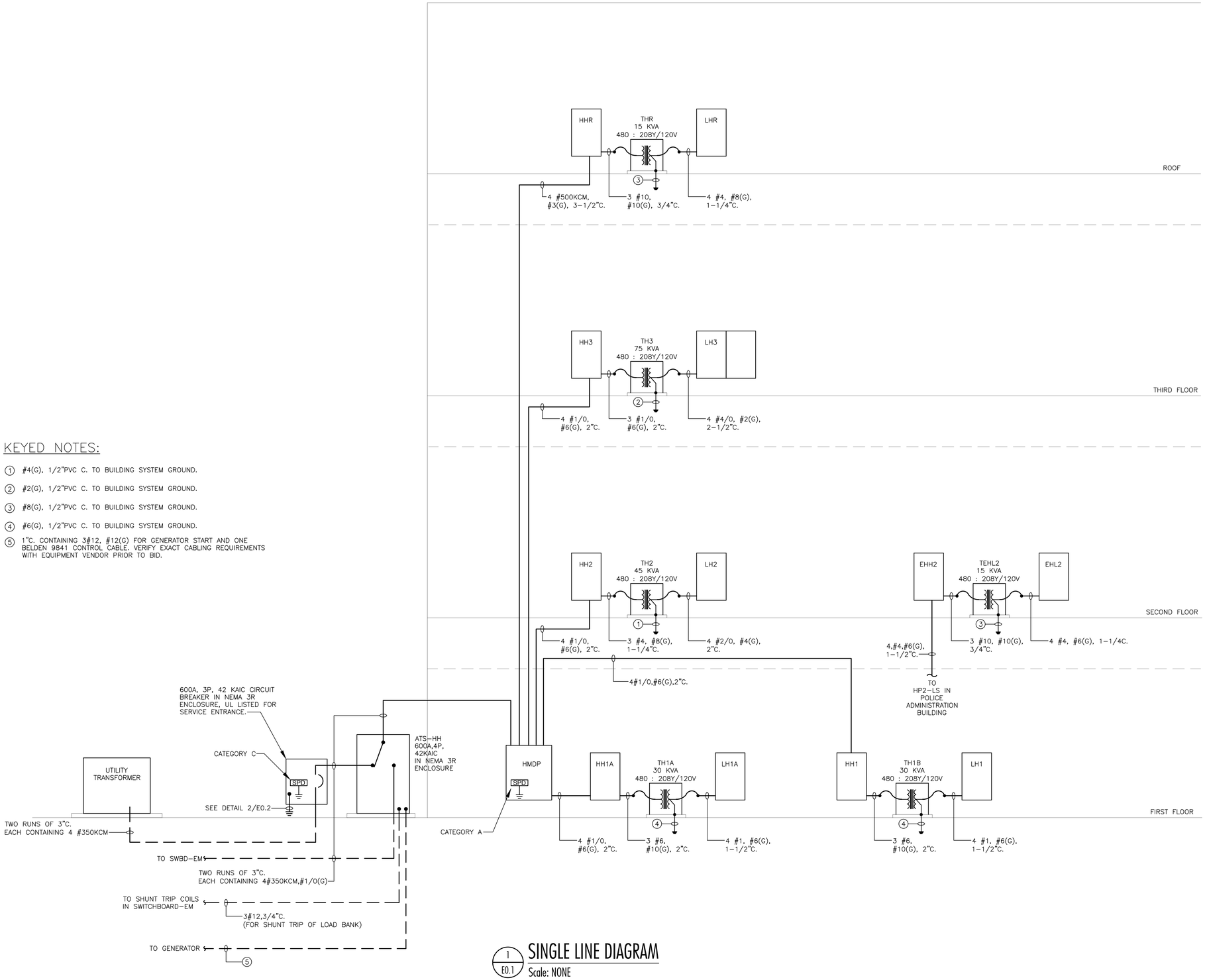
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E0.0

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KEYED NOTES:

1. #4(G), 1/2"PVC C. TO BUILDING SYSTEM GROUND.
2. #2(G), 1/2"PVC C. TO BUILDING SYSTEM GROUND.
3. #8(G), 1/2"PVC C. TO BUILDING SYSTEM GROUND.
4. #6(G), 1/2"PVC C. TO BUILDING SYSTEM GROUND.
5. 1"C. CONTAINING 3#12, #12(G) FOR GENERATOR START AND ONE BELDEN 9841 CONTROL CABLE. VERIFY EXACT CABLING REQUIREMENTS WITH EQUIPMENT VENDOR PRIOR TO BID.



1 / E0.1 SINGLE LINE DIAGRAM
Scale: NONE

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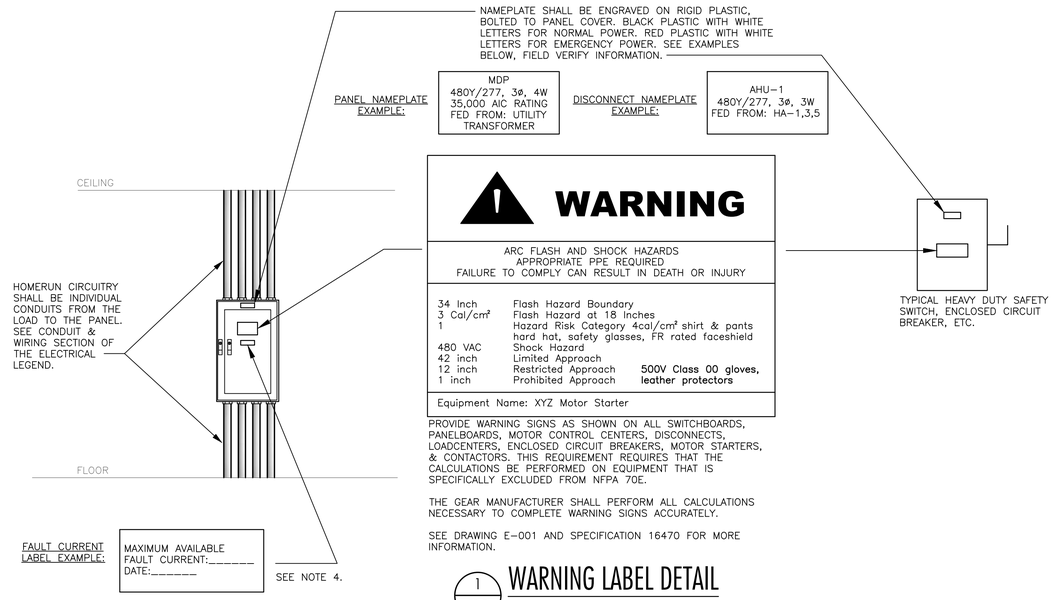
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3/10/2017

E0.1

LIGHTING FIXTURE SCHEDULE

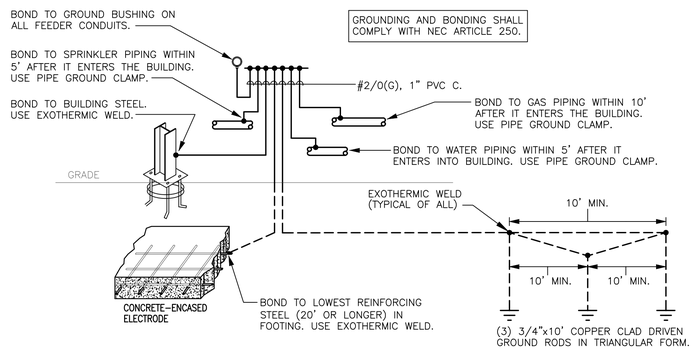
TYPE	MANUFACTURER	PART NUMBER	LAMPS	MOUNTING	REMARKS
AA	PEERLESS	BRM9L-LSL-4FT-MSL4-80CRI-35K-ID800LMF-0/100-DARK-Z1-277-SCT-F2/36A-C110	LED - 43.8W 3,604 LUMENS	SUSPENED	MOUNTED 7.5' A.F.F.
BB	LITHONIA	ZL2X-L24-2000LM-MDD-MVOLT-35K-80CRI-WH	LED - 32W 2,249 LUMENS	RECESSED	
BB1	LITHONIA	ZL2N-L48-2000LM-MDD-MVOLT-35K-80CRI-WH	LED - 31W 1,905 LUMENS	RECESSED	
BB2	LITHONIA	ZL2N-L48-3000LM-MDD-MVOLT-35K-80CRI-WH	LED - 41W 2952 LUMENS	RECESSED	
BB3	LITHONIA	ZL2N-L48-5000LM-MDD-MVOLT-35K-80CRI-WH	LED - 70W 4,450 LUMENS	RECESSED	
CC1	GOTHAM	EVO-35/10-6AR-WD-LS-MVOLT-EZ1	LED - 18.4W 1,059 LUMENS	RECESSED	
CC2	GOTHAM	EVO-35/15-6AR-WD-LS-MVOLT-EZ1	LED - 24.6W 1,572 LUMENS	RECESSED	
DD	NOT USED				
FF	LITHONIA	WL2-12L-EZ1-LP835	LED - 12.2W 1,249 LUMENS	SURFACE	
GG	LITHONIA	WL4-40L-EZ1-LP835-MSD7-DIM10	LED - 39.5W 4,124 LUMENS	SURFACE	
HH	BEGA-US	L2571.3	LED - 16.5W 1,000 LUMENS	SURFACE	
KK1	FINELITE	HP-4-R-HO-3500K-SC-**	LED - 37.2W 2,622 LUMENS	RECESSED	** VERIFY MOUNTING WITH ARCHITECT
KK2	FINELITE	HP-4-R-SO-3500K-SC-**	LED - 18.2W 1,348 LUMENS	RECESSED	** VERIFY MOUNTING WITH ARCHITECT
KKP	FINELITE	HP-4-ID-XX-SO-SO-3500K-TG-277-FA-SC-C4	LED	PENDANT	XX-PROVIDE FIXTURE IN LENGTHS AS SHOWN. PROVIDE FACTORY AIRCRAFT CABLE IN LENGTH REQUIRED.
KKW	SELUX	L125-1L35-40-PC-W-004-WH-277	LED - 38W	WALL	** VERIFY MOUNTING WITH ARCHITECT
PP	OCL	STI-P1AA-18-MW-XX-LED-35K-24	LED	PENDANT	XX - VERIFY COLOR WITH ARCHITECT
SS	CREE LIGHTING	ZR24-40L-35K-10V	LED - 44W 4,000 LUMENS	RECESSED	
TT	KENALL	RMCD-4-FL/CC-2/2-245L40K-IS-1-277-J+-1	LED - 50W 4,210 LUMENS	RECESSED	
X1	LITHONIA	EDG-W-1-6MR	LED	UNIVERSAL	
X2	LITHONIA	EDG-W-2-6MR	LED	UNIVERSAL	
X3	KENALL	MMEX-1-0-G-DT-XAC	LED	UNIVERSAL	



1 E0.2 WARNING LABEL DETAIL
Scale: NONE

NOTES:

1. HOMERUN CONDUITS SHALL BE SIZE 3/4" OR LARGER.
2. CONDUITS SHALL BE LIMITED TO THREE CURRENT CARRYING CONDUCTORS.
3. PROVIDE TYPEWRITTEN CIRCUIT DIRECTORIES INSIDE DOOR OF EACH PANELBOARD. EACH CIRCUIT SHALL BE DISTINGUISHED FROM ALL OTHERS.
4. PROVIDE A LABEL FOR ALL SWITCHGEAR, SWITCHBOARDS, MOTOR CONTROL CENTERS, PANELBOARDS, AND OTHER SERVICE EQUIPMENT THAT LEGIBLY DISPLAYS THE MAXIMUM AVAILABLE FAULT CURRENT. THE MAXIMUM FAULT CURRENT INFORMATION SHALL BE TAKEN FROM THE ARC FLASH/PROTECTIVE DEVICE COORDINATION STUDY PERFORMED BY THE GEAR MANUFACTURER. THE LABEL SHALL INCLUDE THE DATE THAT THE FAULT CURRENT CALCULATION WAS PERFORMED AND BE OF SUFFICIENT DURABILITY TO WITHSTAND THE ENVIRONMENT OF THE EQUIPMENT.



2 E0.2 GROUNDING DETAIL
Scale: NONE

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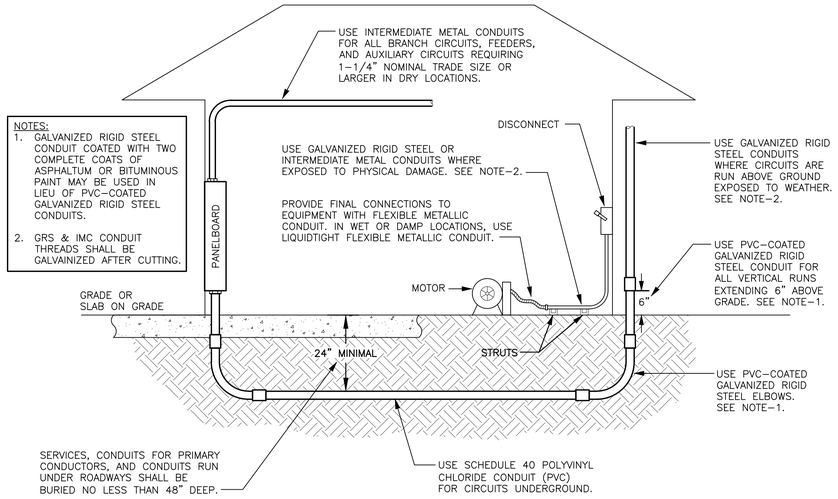
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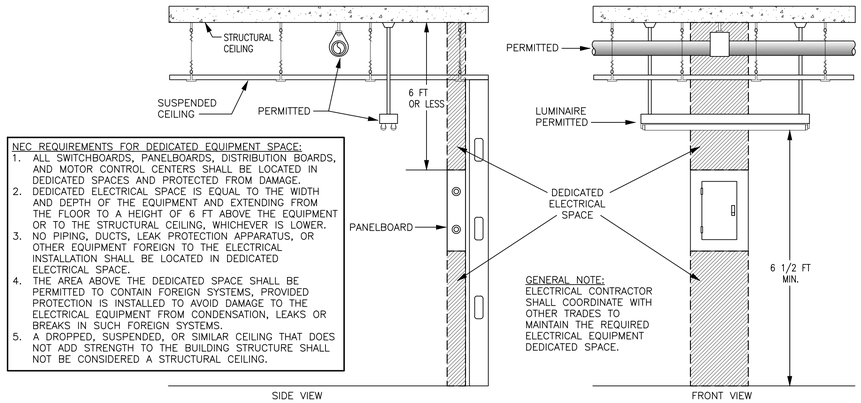
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E0.2



1 / E0.3 **CONDUIT DETAIL**
Scale: NONE



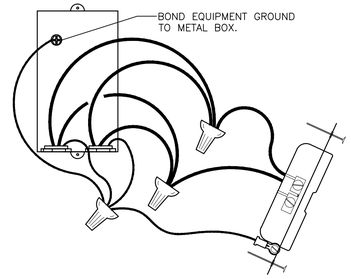
3 / E0.3 **DEDICATED SPACE DETAIL**
Scale: NONE

RECEPTACLE DETAIL NOTES:

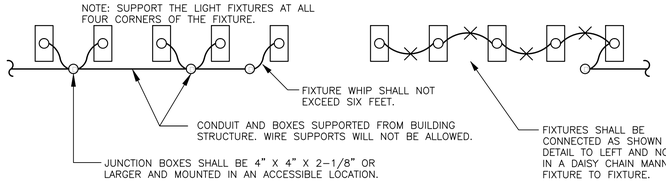
A. THESE DRAWINGS ARE BASED ON THE BEST INFORMATION AVAILABLE AT THE TIME OF DESIGN. COORDINATE WITH THE MILLWORK CONTRACTOR TO DETERMINE THE EXACT LOCATION OF OUTLETS BEING PLACED IN AND AROUND MILLWORK.

B. RECEPTACLES SHOWN AS GFI MAY BE NON GFI TYPE RECEPTACLES IF FED FROM A 20/1 GFI BREAKER OR THE LOAD SIDE OF A GFI RECEPTACLE IN THE SAME ROOM, ON THE SAME CIRCUIT AND RATED 20 AMP FEED-THRU CAPACITY. COVER PLATES SHALL BE CLEARLY MARKED GFI.

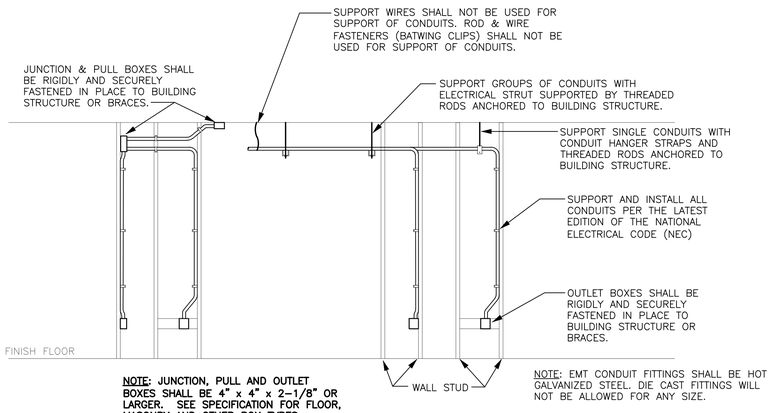
C. NON GFI RECEPTACLES SHALL NOT BE CONNECTED IN A FEED-THRU MANNER. WIRE CONNECTIONS IN RECEPTACLE BOXES SHALL BE MADE IN A PIGTAIL MANNER AS SHOWN IN RECEPTACLE DETAIL.



2 / E0.3 **RECEPTACLE DETAIL**
Scale: NONE



5 / E0.3 **FIXTURE CONNECTION DETAIL**
Scale: NONE



4 / E0.3 **JUNCTION & OUTLET BOX DETAIL**
Scale: NONE

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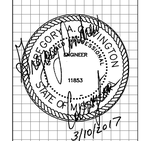
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E0.3

PANEL HMDP

LOCATION: **ELECTRICAL ROOM** | LUG LOCATION: **BOTTOM FEED**
VOLT: **480Y/277V, 3Ø, 4W** | MAIN BUS: **MAIN LUGS ONLY**
BUS: **600A** | MOUNTING: **SURFACE** | PANELBOARD AIC RATING (A): **42,000**

CIRCUIT NO.	BREAKER AMPS	BREAKER POLES	DESCRIPTION	PHASE LOAD (KVA) A		PHASE LOAD (KVA) B		PHASE LOAD (KVA) C		DESCRIPTION	BREAKER AMPS	BREAKER POLES	CIRCUIT NO.
1	125	3	HH1A	4.8	12.9					HH2	125	3	2
3	-	-	-			5.3	12.2			-	-	-	4
5	-	-	-					6.0	10.7	-	-	-	6
7	125	3	HH1	7.5	17.0					HH3	125	3	8
9	-	-	-			4.8	18.3			-	-	-	10
11	-	-	-					4.5	15.7	-	-	-	12
13	400	1	HHR	53.0	0.0					SPARE	225	3	14
15	-	-	-			52.4	0.0			-	-	-	16
17	-	-	-					52.6	0.0	-	-	-	18
19	125	1	SPARE	0.0	0.0					SPARE	100	3	20
21	-	-	-			0.0	0.0			-	-	-	22
23	-	-	-					0.0	0.0	-	-	-	24
TOTAL				98.6		98.3		95.6					

PANEL HH1A

LOCATION: **ELECTRICAL ROOM** | LUG LOCATION: **BOTTOM FEED**
VOLT: **480Y/277V, 3Ø, 4W** | MAIN BUS: **MAIN LUGS ONLY**
BUS: **125A** | MOUNTING: **SURFACE** | PANELBOARD AIC RATING (A): **42,000** | Series Rated

CIRCUIT NO.	BREAKER AMPS	BREAKER POLES	DESCRIPTION	PHASE LOAD (KVA) A		PHASE LOAD (KVA) B		PHASE LOAD (KVA) C		DESCRIPTION	BREAKER AMPS	BREAKER POLES	CIRCUIT NO.
1	20	1	LTS. - (CORR., FIRE RISER, PURCHASING STO.)	1.4	0.0					SPARE	20	1	2
3	20	1	SPARE			0.0	0.0			SPARE	20	1	4
5	20	1	SPARE					0.0	0.0	SPARE	20	1	6
7	20	1	SPARE	0.0	0.0					SPARE	20	1	8
9	20	1	SPARE			0.0	0.0			SPARE	20	1	10
11	20	1	SPARE					0.0	0.0	SPARE	20	1	12
13	20	1	SPARE	0.0	0.0					SPARE	20	1	14
15	20	1	SPARE			0.0	0.0			SPARE	20	1	16
17	20	1	SPARE					0.0	0.0	SPARE	20	1	18
19	20	1	SPARE	0.0	3.4					TRANSFORMER "T1A"	50	3	20
21	20	1	SPARE			0.0	5.3			-	-	-	22
23	20	1	SPARE					0.0	6.0	-	-	-	24
TOTAL				4.8		5.3		6.0					

PANEL LH1A - SEC. 1

LOCATION: **ELECTRICAL ROOM** | LUG LOCATION: **BOTTOM FEED**
VOLT: **208Y/120V, 3Ø, 4W** | MAIN BUS: **100A MAIN BREAKER W/FEED THRU LUGS**
BUS: **100A** | MOUNTING: **SURFACE** | PANELBOARD AIC RATING (A): **10,000**

CIRCUIT NO.	BREAKER AMPS	BREAKER POLES	DESCRIPTION	PHASE LOAD (KVA) A		PHASE LOAD (KVA) B		PHASE LOAD (KVA) C		DESCRIPTION	BREAKER AMPS	BREAKER POLES	CIRCUIT NO.
1	20	1	REC. - (ELEC.)	0.2	0.1					IU-4.1,2,3,4,5A,5B	15	2	2
3	20	1	REC. - (MAINTENANCE AREA, EXT.)			0.7	0.1			-	-	-	4
5	20	1	REC. - (PURCH. STO., COR., JAN., EXT., RISER)					1.4	0.1	IU-3.3,4,5	15	2	6
7	20	1	SPARE	0.0	0.1					-	-	-	8
9	20	1	REC. - (PURCHASEING RECEIVING OFFICE)			1.1	0.1			IU-3.1,2,6A,6B	15	2	10
11	20	1	REC. - (WOMEN, MEN, CORR., EXT.)					1.3	0.1	-	-	-	12
13	20	1	REC. - (CORR. - DRINKING FOUNTAIN)	0.5	0.2					REC - RM 138	20	1	14
15	20	1	REC. - (BRIEFING/MUSTER)			0.9	0.0			SPARE	15	2	16
17	20	1	REC. - (BRIEFING/MUSTER)					1.3	0.0	SPARE	-	-	18
19	20	1	REC. - (WRITING REPORT)	0.4	0.0					SPARE	15	1	20
21	20	1	REC. - (WRITING REPORT)			0.4	0.0			SPARE	15	1	22
23	20	1	REC. - (WRITING REPORT)					0.4	0.0	SPARE	15	1	24
25	20	1	REC. - (MAILROOM)	0.4	0.0					SPARE	20	1	26
27	20	1	REC. - (MAILROOM)			0.4	0.0			SPARE	20	1	28
29	20	1	REC. - (MAILROOM, REPORT WRITING)					0.4	0.0	SPARE	20	1	30
31	20	1	REC. - (PATROL BREAK ROOM)	0.2	0.0					SPARE	20	1	32
33	20	1	REC. - (PATROL BREAK ROOM)			0.2	0.0			SPARE	20	1	34
35	20	1	REC. - (PATROL BREAK ROOM)					0.8	0.0	SPARE	20	1	36
37	20	1	REC. - (PATROL BREAK ROOM - VENDING MACH	1.4	0.0					SPARE	30	1	38
39	20	1	REC. - (PATROL BREAK ROOM - VENDING MACH			1.4	0.0			SPARE	30	1	40
41	20	1	REC. - (PATROL BREAK ROOM)					0.4	0.0	SPARE	30	1	42
TOTAL				3.4		5.3		6.0					

PANEL HH1

LOCATION: **ELECTRICAL ROOM** | LUG LOCATION: **BOTTOM FEED**
VOLT: **480Y/277V, 3Ø, 4W** | MAIN BUS: **MAIN LUGS ONLY**
BUS: **125A** | MOUNTING: **SURFACE** | PANELBOARD AIC RATING (A): **42,000** | Series Rated

CIRCUIT NO.	BREAKER AMPS	BREAKER POLES	DESCRIPTION	PHASE LOAD (KVA) A		PHASE LOAD (KVA) B		PHASE LOAD (KVA) C		DESCRIPTION	BREAKER AMPS	BREAKER POLES	CIRCUIT NO.
1	20	1	LTS. - (INMATE STO., OFFICES, CORR., ETC.)	2.0	0.0					SPARE	20	1	2
3	20	1	SPARE			0.0	0.0			SPARE	20	1	4
5	20	1	SPARE					0.0	0.0	SPARE	20	1	6
7	20	1	SPARE	0.0	0.0					SPARE	20	1	8
9	20	1	SPARE			0.0	0.0			SPARE	20	1	10
11	20	1	SPARE					0.0	0.0	SPARE	20	1	12
13	20	1	SPARE	0.0	0.0					SPARE	20	1	14
15	20	1	SPARE			0.0	0.0			SPARE	20	1	16
17	20	1	SPARE					0.0	0.0	SPARE	20	1	18
19	20	1	SPARE	0.0	5.4					TRANSFORMER "T1" (PANEL LH1)	50	3	20
21	20	1	SPARE			0.0	4.8			-	-	-	22
23	20	1	SPARE					0.0	4.5	-	-	-	24
TOTAL				7.5		4.8		4.5					

PANEL LH1

LOCATION: **ELECTRICAL ROOM** | LUG LOCATION: **BOTTOM FEED**
VOLT: **208Y/120V, 3Ø, 4W** | MAIN BUS: **100A MAIN BREAKER**
BUS: **100A** | MOUNTING: **SURFACE** | PANELBOARD AIC RATING (A): **10,000**

CIRCUIT NO.	BREAKER AMPS	BREAKER POLES	DESCRIPTION	PHASE LOAD (KVA) A		PHASE LOAD (KVA) B		PHASE LOAD (KVA) C		DESCRIPTION	BREAKER AMPS	BREAKER POLES	CIRCUIT NO.
1	20	1	REC. - (ELEC., EXT.)	1.4	0.0					SPARE	20	1	2
3	20	1	REC. - (LT OFFICE)			1.1	0.0			SPARE	20	1	4
5	20	1	REC. - (SGT OFFICE)					1.1	0.0	SPARE	20	1	6
7	20	1	REC. - (INMATE PROP. STO., CORR., TOI., EXT.)	1.4	0.0					SPARE	20	1	8
9	20	1	REC. - (BREATHALYZER)			1.1	0.0			SPARE	20	1	10
11	20	1	REC. - (FINGERPRINTING)					1.1	0.0	SPARE	20	1	12
13	20	1	REC. - (CPT OFFICE)	1.1	0.0					SPARE	20	1	14
15	20	1	REC. - (CPT OFFICE)			1.1	0.0			SPARE	20	1	16
17	20	1	REC. - (CPT OFFICE)					1.1	0.0	SPARE	20	1	18
19	20	1	REC. - (CPT OFFICE)	1.1	0.0					SPARE	20	1	20
21	20	1	REC. - (SECRETARY)			1.1	0.0			SPARE	20	1	22
23	20	1	REC. - (CHAPLIN)					1.1	0.0	SPARE	20	1	24
25	15	2	IU-1.1,2,3,4,5	0.3	0.0					SPARE	20	1	26
27	-	-	-			0.3	0.0			SPARE	20	1	28
29	15	2	IU-1.6,7,8,9					0.1	0.0	SPARE	20	1	30
31	-	-	-	0.1	0.0					SPARE	30	1	32
33	15	2	IU-2.1,2,3,4			0.1	0.0			SPARE	30	1	34
35	-	-	-					0.1	0.0	SPARE	30	1	36
37	15	2	IU-2.5,6,7A,7B	0.1	0.0					SPARE	15	1	38
39	-	-	-			0.1	0.0			SPARE	15	1	40
41	20	1	SPARE					0.0	0.0	SPARE	15	1	42
TOTAL				5.4		4.8		4.5					

PANEL HH2

LOCATION: **ELECTRICAL ROOM** | LUG LOCATION: **BOTTOM FEED**
VOLT: **480Y/277V, 3Ø, 4W** | MAIN BUS: **MAIN LUGS ONLY**
BUS: **125A** | MOUNTING: **SURFACE** | PANELBOARD AIC RATING (A): **42,000** | Series Rated

CIRCUIT NO.	BREAKER AMPS	BREAKER POLES	DESCRIPTION	PHASE LOAD (KVA) A		PHASE LOAD (KVA) B		PHASE LOAD (KVA) C		DESCRIPTION	BREAKER AMPS	BREAKER POLES	CIRCUIT NO.
1	20	1	LTS. - (CORR., OFFICES,, INTERROGATION, ETC.	2.2	0.0					SPARE	20	1	2
3	20	1	LTS. - (CORR., OFFICES,, INTERROGATION, ETC.			1.4	0.0			SPARE	20	1	4
5	20	1	SPARE					0.0	0.0	SPARE	20	1	6
7	20	1	SPARE	0.0	0.0					SPARE	20	1	8
9	20	1	SPARE			0.0	0.0			SPARE	30	1	10
11	20	1	SPARE					0.0	0.0	SPARE	30	1	12
13	20	1	SPARE	0.0	0.0					SPARE	15	1	14
15	20	1	SPARE			0.0	0.0			SPARE	15	1	16
17	20	1	SPARE					0.0	0.0	SPARE	15	1	18
19	20	1	SPARE	0.0	10.7					TRANSFORMER "T2"	70	3	20
21	20	1	SPARE			0.0	10.8			-	-	-	22
23	20	1	SPARE					0.0	10.7	-	-	-	24
TOTAL				12.9		12.2		10.7					

PANEL LH2

LOCATION: **ELECTRICAL ROOM** | LUG LOCATION: **BOTTOM FEED**
VOLT: **208Y/120V, 3Ø, 4W** | MAIN BUS: **175A MAIN BREAKER**
BUS: **200A** | MOUNTING: **SURFACE** | PANELBOARD AIC RATING (A): **10,000**

CIRCUIT NO.	BREAKER AMPS	BREAKER POLES	DESCRIPTION	PHASE LOAD (KVA) A		PHASE LOAD (KVA) B		PHASE LOAD (KVA) C		DESCRIPTION	BREAKER AMPS	BREAKER POLES	CIRCUIT NO.
1	20	1	REC. - (ELEC.)	0.2	1.1					REC. - (LT TRAFFIC OFFICE)	20	1	2
3	20	1	REC. - (CORR., MEN, WOMEN, BREAK ROOM)			1.4	1.1			REC. - (SGT TRAFFIC OFFICE)	20	1	4
5	20	1	REC. - (BREAKROOM - REF.)					0.8	1.1	REC. - (DUI COORDINATION OFFICE)	20	1	6
7	20	1	REC. - (BREAKROOM)	0.2	0.9					REC. - (FUTURE)	20	1	8
9	20	1	REC. - (BREAKROOM)			0.4	0.7			REC. - (FUTURE)	20	1	10
11	30	1	REC. - (STAR DRESS OUT ROOM)					1.1	0.7	REC. - (POLYGRAPH)	20	1	12
13	20**	1	REC. - (SPECIAL OPS)	1.1	0.9					REC. - (TLT., CORR., COM.)	20	1	14
15	20**	1	REC. - (SPECIAL OPS)			1.1	1.4			REC. - (INTERROGATION)	20	1	16
17	20**	1	REC. - (SPECIAL OPS)					1.1	1.4	REC. - (INTERROGATION)	20	1	18
19	20	1	REC. - (SPECIAL OPS)	1.1	1.4					REC. - (INTERROGATION)	20	1	20
21	15*	1	REC. - (SPECIAL OPS)			1.1	1.4			REC. - (INTERROGATION)	20	1	22
23	15*	1	REC. - (STRIKE UNIT)					1.1	1.3	REC. - (INTERROG CONTROL ROOM, CORR.)	20	1	24
25	50*	2	REC. - (NET)	1.1	0.9					REC. - (CONFERENCE ROOM)	20	1	26
27	-	-	REC. - (HIT OFFICE)			1.1	0.1			IU-1.11,10,12,13	15	2	28
29	50**	2	REC. - (HIT OFFICE)					1.1	0.1	-	-	-	30
31	-	-	REC. - (WORK AREA - COPIER)	1.0	0.1					IU-1.14,15,16,17	15	2	32
33	20*	2	REC. - (WORK AREA)			0.4	0.1			-	-	-	34
35	-	-	REC. - (WORK AREA)					0.4	0.1	IU-2.8,9,10,11,12,15,16	15	2	36
37	20	1	REC. - (WORK AREA)	0.2	0.1					-	-	-	38
39	15*	1	REC. - (TRAFFIC REPORT WRITING)			0.4	0.0			IU-2.13,14A,14B,17,18,19	15	2	40
41	20*	1	REC. - (TRAFFIC REPORT WRITING)					0.4	0.0	-	-	-	42
43	15	2	IU-3.7,8,9,10,11	0.1	0.4					REC. - (INTERROG. CONTROL ROOM)	20	1	44
45	-	-	-			0.1	0.0			SPARE	20	1	46
47	15	2	IU-3.12,13,14,15					0.1	0.0	SPARE	20	1	48
49	-	-	-	0.1	0.0					SPARE	20	1	50
51	15	2	IU-4.6,7A,7B			0.1	0.0			SPARE	20	1	52
53	-	-	-					0.1	0.0	SPARE	20	1	54
TOTAL				10.7		10.8		10.7					

PANEL HH3

LOCATION: **ELECTRICAL ROOM** | LUG LOCATION: **BOTTOM FEED**
VOLT: **480Y/277V, 3Ø, 4W** | MAIN BUS: **MAIN LUGS ONLY**
BUS: **125A** | MOUNTING: **SURFACE** | PANELBOARD AIC RATING (A): **42,000** | Series Rated

CIRCUIT NO.	BREAKER AMPS	BREAKER POLES	DESCRIPTION	PHASE LOAD (KVA) A		PHASE LOAD (KVA) B		PHASE LOAD (KVA) C		DESCRIPTION	BREAKER AMPS	BREAKER POLES	CIRCUIT NO.
1	20	1	LTS. - (CORR., PURCHASING, KIT., PANTRY,ETC	1.3	0.0					SPARE	20	1	2
3	20	1	TS. - (CLASSROOM, OFFICES, CORR., PUR., ETC			2.3	0.0			SPARE	20	1	4
5	20	1	SPARE					0.0	0.0	SPARE	20	1	6
7	20	1	SPARE	0.0	0.0					SPARE	20	1	8
9	20	1	SPARE			0.0	0.0			SPARE	30	1	10
11	20	1	SPARE					0.0	0.0	SPARE	30	1	12
13	20	1	SPARE	0.0	0.0					SPARE	15	1	14
15	20	1	SPARE			0.0	0.0			SPARE	15	1	16
17	20	1	SPARE					0.0	0.0	SPARE	15	1	18
19	20	1	SPARE	0.0	15.7					TRANSFORMER "T3"	125	1	20
21	20	1	SPARE			0.0	16.0			-	-	-	22
23	20	1	SPARE					0.0	15.7	-	-	-	24
TOTAL				17.0		18.3		15.7					

PANEL LH3 - SEC. 1

LOCATION: **ELECTRICAL ROOM** | LUG LOCATION: **BOTTOM FEED**
VOLT: **208Y/120V, 3Ø, 4W** | MAIN BUS: **225A MAIN BREAKER W/FEED THRU LUGS**
BUS: **225A** | MOUNTING: **SURFACE** | PANELBOARD AIC RATING (A): **10,000**

CIRCUIT NO.	BREAKER AMPS	BREAKER POLES	DESCRIPTION	PHASE LOAD (KVA) A		PHASE LOAD (KVA) B		PHASE LOAD (KVA) C		DESCRIPTION	BREAKER AMPS	BREAKER POLES	CIRCUIT NO.
1	20	1	REC. - (ELEC.)	0.2	0.4					REC. - (KITCHEN)	20	1	2
3	20	1	REC. - (PURCHASING)			0.9	0.7			REC. - (GAS RANGE)	20	1	4
5	20	1	REC. - (PURCHASING, CORR., TLT.)					0.7	0.0	SHUNT TRIP COIL	-	-	6
7	20	1	SPARE	0.0	0.6					REC. - (DOUBLE FRYER)	15	1	8
9	20	1	SPARE			0.0	0.0			SHUNT TRIP COIL	-	-	10
11	30	1	REC. - (STAGING)					0.7	0.9	REC. - (CONVECTION OVEN)	20	1	12
13	20**	1	REC. - (DORM)	0.9	0.0					SHUNT TRIP COIL	-	-	14
15	20**	1	REC. - (DORM)			0.9	1.1			REC. - (CLASSROOM)	20	1	16
17	20**	1	REC. - (DORM)					0.9	1.3	REC. - (CLASSROOM)	20	1	18
19	20	1	REC. - (CORR., STAGING, PANTRY)	1.4	1.1					REC. - (DEA)	20	1	20
21	15*	1	REC. - (PANTRY - REF.)			0.7	1.1			REC. - (US MARSHALL)	20	1	22
23	15*	1	REC. - (PANTRY - FREEZER)					1.3	1.1	REC. - (FBI)	20	1	24
25	50*	2	KITCHEN - DISHWASHER	3.9	0.0					REC. - (ATF)	20	1	26
27	-	-	-			3.9	1.1			REC. - (FUTURE GOVERNMENT)	20	1	28
29	50**	2	KITCHEN - DISHWASHER					3.9	1.1	REC. - (FUTURE GOVERNMENT)	20	1	30
31	-	-	-	3.9	1.3					REC. - (CONF. ROOM)	20	1	32
33	20*	2	KITCHEN - TRASH DISPOSAL			1.4	0.4			REC. - (ALCOVE)	20	1	34
35	-	-	-					1.4	0.4	REC. - (PURCHASING)	20	1	36
37	20	1	REC. - (KITCHEN)	0.4	0.4					REC. - (PURCHASING)	20	1	38
39	15*	1	KITCHEN - ICE MACHINE			1.3	1.3			REC. - (PENTHOUSE ACCESS, CORR., TOI.)	20	1	40
41	20*	1	REC. - (KITCHEN)					0.4	0.4	REC. - (PURCHASING)	20	1	42
TOTAL				14.4		14.7		14.5		*** = GFCI BREAKER, ** = ARC FAULT BREAKER**			

THE POWER SOURCE
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HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT
HATTIESBURG MUNICIPAL COURT ■

HPSC Historic Hospital Builidng

Drawing Issued:

Date	Rev.	Description
08-31-2015	-	DD Check Set
10-20-2015	-	75% Progress Set
11-02-2015	-	90% Pricing Set
11-19-2018	-	100% Bid Docs

Drawn By: FB
Checked By: CG, AC
Client No: --------
Albert & Associates: 12575

GREGORY A. WASHINGTON — REGISTERED ENGINEER — 11853 — STATE OF MISSISSIPPI — 3/10/2017

E0.□

PANEL	LOCATION:	ELECTRICAL ROOM	LUG LOCATION:	TOP FEED
LH3 - SEC. 2	VOLT:	208Y/120V, 3Ø, 4W	MAIN:	MAIN LUGS ONLY
	BUS:	225A	MOUNTING:	SURFACE

PANELBOARD AIC RATING (A): 10,000

CIRCUIT NO.	BREAKER AMPS	BREAKER POLES	DESCRIPTION	PHASE LOAD (KVA) A	A	B	B	C	C	DESCRIPTION	BREAKER AMPS	BREAKER POLES	CIRCUIT NO.
43	15	2	BC-1	0.1	0.5					REC. - (PURCHASING)	20	1	44
45	-	-	-			0.1	0.5			REC. - (CLASSROOM)	20	1	46
47	15	2	BC-2					0.1	0.5	REC. - (CLASSROOM)	20	1	48
49	-	-	-	0.1	0.0					SPARE	15	1	50
51	15	2	BC-3			0.1	0.0			SPARE	15	1	52
53	-	-	-					0.1	0.0	SPARE	15	1	54
55	15	2	BC-4	0.1	0.0					SPARE	50	2	56
57	-	-	-			0.1	0.0			SPARE	-	-	58
59	15	2	IU-1.18, IU-1.24, IU-1.19A, IU-1.19B					0.1	0.0	SPARE	20	1	60
61	-	-	-	0.1	0.0					SPARE	20	1	62
63	15	2	IU-1.20, IU-1.21, IU-1.22, IU-1.23			0.1	0.0			SPARE	20	1	64
65	-	-	-					0.1	0.0	SPARE	20	1	66
67	15	2	IU-2.20A,2.20B,2.21,2.22A,2.22B,2.22C	0.2	0.0					SPARE	20	1	68
69	-	-	-			0.2	0.0			SPARE	20	1	70
71	15	2	IU-3.16A,16B,17A,17B,18					0.1	0.0	SPARE	20	1	72
73	-	-	-	0.1	0.0					SPARE	20	1	74
75	15	2	IU-4.8,9,10,11,12			0.2	0.0			SPARE	20	1	76
77	-	-	-					0.2	0.0	SPARE	20	1	78
79	20	1	SPARE	0.0	0.0					SPARE	20	1	80
81	20	1	SPARE			0.0	0.0			SPARE	20	1	82
83	20	1	SPARE					0.0	0.0	SPARE	20	1	84
TOTAL				1.3		1.3		1.3		* = GFCI BREAKER, ** = ARC FAULT BREAKER			

PANEL	LOCATION:	ELECTRICAL ROOM	LUG LOCATION:	BOTTOM FEED
HHR	VOLT:	480Y/277V, 3Ø, 4W	MAIN BUS:	MAIN LUGS ONLY
	BUS:	400A	MOUNTING:	SURFACE

PANELBOARD AIC RATING (A): 42,000 Series Rated

CIRCUIT NO.	BREAKER AMPS	BREAKER POLES	DESCRIPTION	PHASE LOAD (KVA) A	A	B	B	C	C	DESCRIPTION	BREAKER AMPS	BREAKER POLES	CIRCUIT NO.
1	20	1	LTS. - (PENTHOUSE)	0.2	0.4					MUA-1	15	3	2
3	30	3	SPARE			0.0	0.4			-	-	-	4
5	-	-	-					0.0	0.4	-	-	-	6
7	-	-	-	0.0	0.0					SHUNT TRIP COIL	-	-	8
9	50	3	OU-1			8.6	7.8			OUA-1	40	3	10
11	-	-	-					8.6	7.8	-	-	-	12
13	-	-	-	8.6	7.8					-	-	-	14
15	35	3	OU-2 - (MODULE 1)			6.6	7.7			OAU-2	40	3	16
17	-	-	-					6.6	7.7	-	-	-	18
19	-	-	-	6.6	7.7					-	-	-	20
21	30	3	OU-2 - (MODULE 2)			5.3	0.0			SPARE	40	3	22
23	-	-	-					5.3	0.0	-	-	-	24
25	-	-	-	5.3	0.0					-	-	-	26
27	50	3	OU-3			8.6	0.0			SPARE	15	3	28
29	-	-	-					8.6	0.0	-	-	-	30
31	-	-	-	8.6	0.0					-	-	-	32
33	25	3	OU-4			5.8	0.0			SPARE	20	1	34
35	-	-	-					5.8	0.0	SPARE	20	1	36
37	-	-	-	5.8	1.9					TRANSFORMER "T2"	25	3	38
39	15	1	SPARE			0.0	1.5			-	-	-	40
41	15	1	SPARE					0.0	1.7	-	-	-	42
TOTAL				53.0		52.4		52.6					

PANEL	LOCATION:	ELECTRICAL ROOM	LUG LOCATION:	BOTTOM FEED
LHR	VOLT:	208Y/120V, 3Ø, 4W	MAIN BUS:	60A MAIN BREAKER
	BUS:	100A	MOUNTING:	SURFACE

PANELBOARD AIC RATING (A): 10,000

CIRCUIT NO.	BREAKER AMPS	BREAKER POLES	DESCRIPTION	PHASE LOAD (KVA) A	A	B	B	C	C	DESCRIPTION	BREAKER AMPS	BREAKER POLES	CIRCUIT NO.
1	20	1	REC. - (PENTHOUSE)	0.4	0.5					EF-1	15	2	2
3	20	1	REC. - (PENTHOUSE)			0.4	0.5			-	-	-	4
5	20	1	SPARE					0.0	0.0	SHUNT TRIP COIL	-	-	6
7	20	1	SPARE	0.0	0.3					SHUNT TRIP FOR HOOD	15	1	8
9	20	1	SPARE			0.0	0.3			VENT HOOD LIGHTS	20	1	10
11	20	1	SPARE					0.0	0.0	SHUNT TRIP COIL	-	-	12
13	30	1	SPARE	0.0	0.3					GWH-1	20	1	14
15	20	1	SPARE			0.0	0.3			GWH-1	20	1	16
17	20	1	SPARE					0.0	1.7	RH-1	25	1	18
19	15	1	SPARE	0.0	0.4					GUH-1	20	1	20
21	15	1	SPARE			0.0	0.0			SPARE	15	2	22
23	20	1	SPARE					0.0	0.0	-	-	-	24
25	15	1	SPARE	0.0	0.0					SPARE	15	1	26
27	15	1	SPARE			0.0	0.0			SPARE	15	1	28
29	15	1	SPARE					0.0	0.0	SPARE	15	1	30
TOTAL				1.9		1.5		1.7					

PANEL	LOCATION:	ELECTRICAL ROOM	LUG LOCATION:	BOTTOM FEED
EHH2	VOLT:	480Y/277V, 3Ø, 4W	MAIN BUS:	60A MAIN BREAKER
	BUS:	100A	MOUNTING:	SURFACE

PANELBOARD AIC RATING (A): 18,000

CIRCUIT NO.	BREAKER AMPS	BREAKER POLES	DESCRIPTION	PHASE LOAD (KVA) A	A	B	B	C	C	DESCRIPTION	BREAKER AMPS	BREAKER POLES	CIRCUIT NO.
1	20	1	LTS. - (EMERGENCY FIRST FLOOR AND STAIRS	1.5	0.0					SPARE	20	1	2
3	20	1	LTS. - (EMERGENCY SECOND FLOOR)			0.8	0.0			SPARE	20	1	4
5	20	1	LTS. - (EMERGENCY THIRD FLOOR)					0.9	0.0	SPARE	20	1	6
7	20	1	LTS. - (EMERGENCY PENTHOUSE)	0.1	0.0					SPARE	20	1	8
9	25	3	TRANSFORMER "TEHL2"			0.0	0.0			SPARE	20	1	10
11	-	-	-					0.0	0.0	SPARE	20	1	12
13	-	-	-	0.0	0.0					SPARE	20	1	14
15	20	1	SPARE			0.0	0.0			SPARE	20	1	16
17	20	1	SPARE					0.0	0.0	SPARE	20	1	18
TOTAL				1.6		0.8		0.9					

PANEL	LOCATION:	ELECTRICAL ROOM	LUG LOCATION:	BOTTOM FEED
EHL2	VOLT:	208Y/120V, 3Ø, 4W	MAIN BUS:	60A MAIN BREAKER
	BUS:	100A	MOUNTING:	SURFACE

PANELBOARD AIC RATING (A): 10,000

CIRCUIT NO.	BREAKER AMPS	BREAKER POLES	DESCRIPTION	PHASE LOAD (KVA) A	A	B	B	C	C	DESCRIPTION	BREAKER AMPS	BREAKER POLES	CIRCUIT NO.
1	20	1	FACP	0.5	0.5					CONNECTION TO SPRINKLER GONG	15	1	2
3	20	1	INTRUSTION DETECTION CONTROL PANEL			0.5	0.4			COMM ROOM 1ST FLOOR QUAD	20	1	4
5	20	1	COMM ROOM 1ST FLOOR QUAD					0.4	0.0	SPARE	20	1	6
7	20	1	COMM ROOM 2ND FLOOR QUAD	0.4	0.0					SPARE	20	1	8
9	20	1	COMM ROOM 3RD FLOOR QUAD			0.4	0.0			SPARE	20	1	10
11	20	1	SPARE					0.0	0.0	SPARE	20	1	12
TOTAL				1.4		1.3		0.4					

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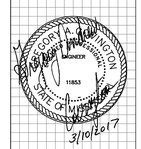
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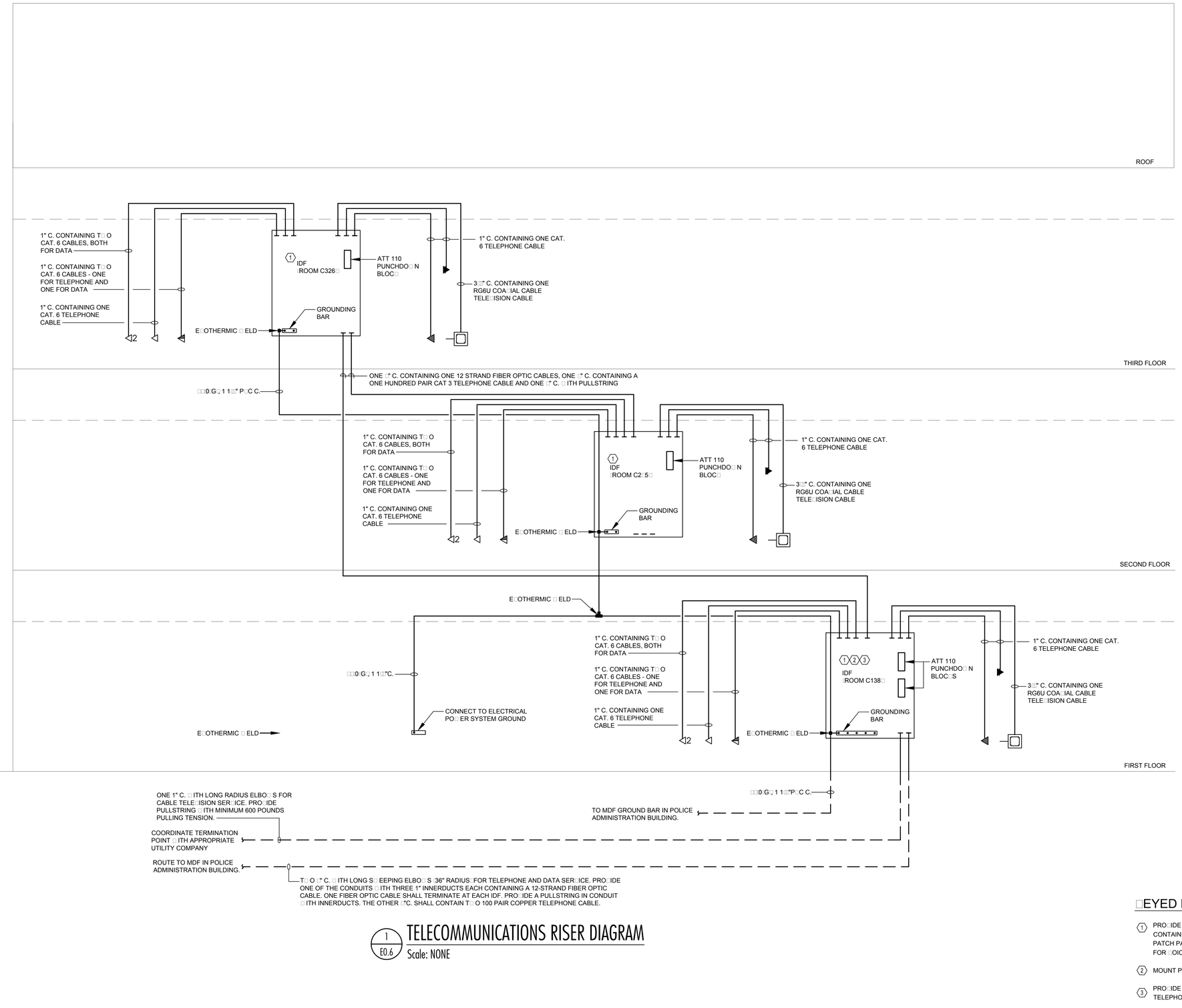
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Checked By: CG, AC
Client No: ------
Albert & Associates: 12575



E0.5



1 / E0.6 TELECOMMUNICATIONS RISER DIAGRAM

Scale: NONE

□EYED NOTES:

1. PRO□IDE 72" TALL FLOOR MOUNTED E□UIPMENT RAC□ CONTAINING FIBER OPTIC PATCH PANELS, T□O □8 PORT PATCH PANELS FOR DATA, T□O □8 PORT PATCH PANELS FOR □OICE.
2. MOUNT PAGING AMPLIFIER IN THE E□UIPMENT RAC□.
3. PRO□IDE SPLICE CASE AND SURGE PROTECTORS FOR TELEPHONE CABLES.

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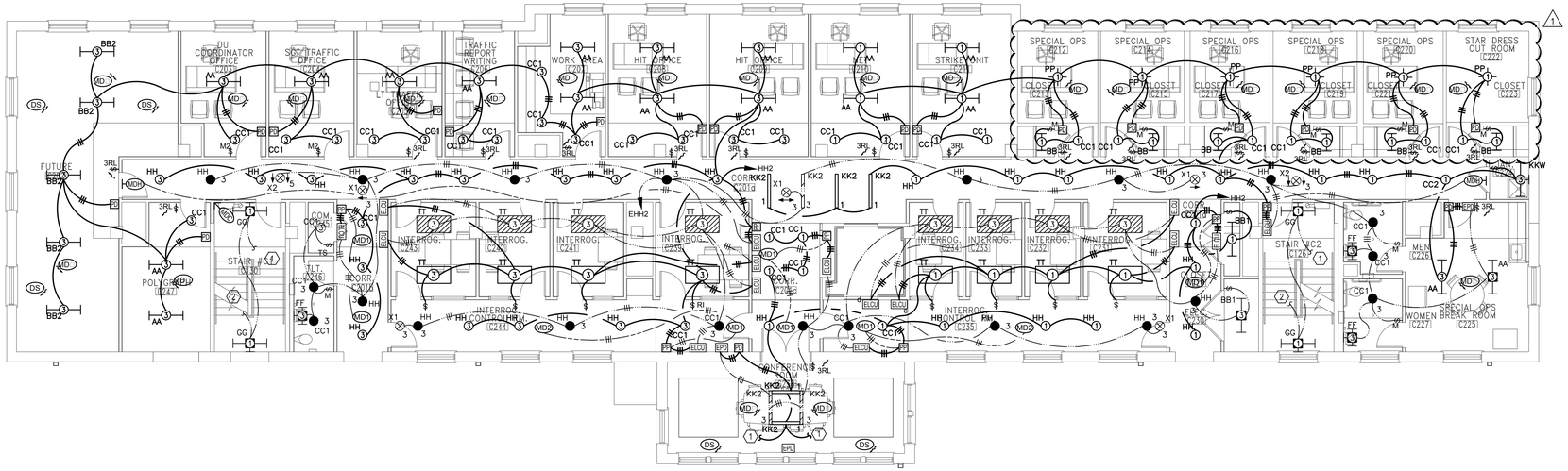
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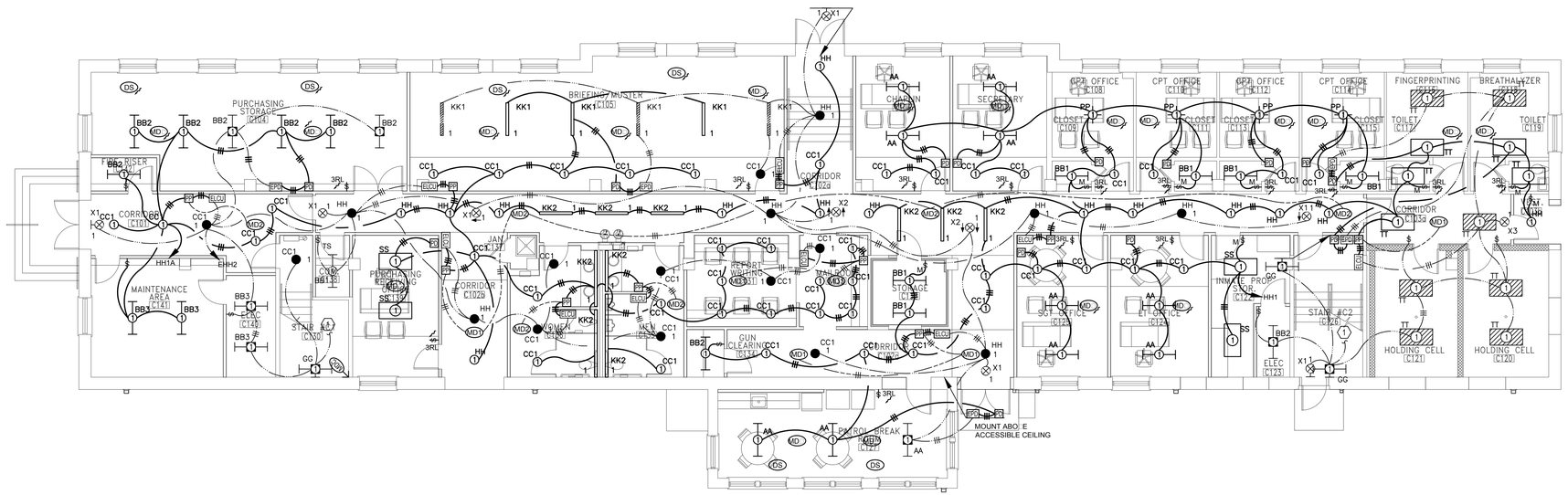
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E0.6



2 / E1.0 LIGHTING PLAN - SECOND FLOOR

Scale: 1/8" = 1'-0"



1 / E1.0 LIGHTING PLAN - FIRST FLOOR

Scale: 1/8" = 1'-0"

GENERAL NOTES

#	Description
1.	LIGHTING CONTROLS THAT ARE SHO□N IN CEILING TYPES OTHER THAN LAY-IN CEILING GRID SHALL BE MOUNTED TO THE CEILING, AND PAINTED TO MATCH THE CEILING COLOR. SEE ARCHITECTS REFLECTI□E CEILING PLAN TO □ERIFY CEILING TYPES.

KEYED NOTES

Mark	Description
1	CONNECT TO FI□TURES ABO□E.
2	CONNECT TO FI□TURES BELO□.

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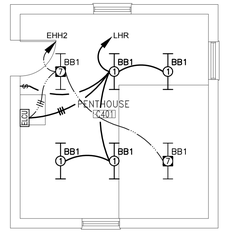
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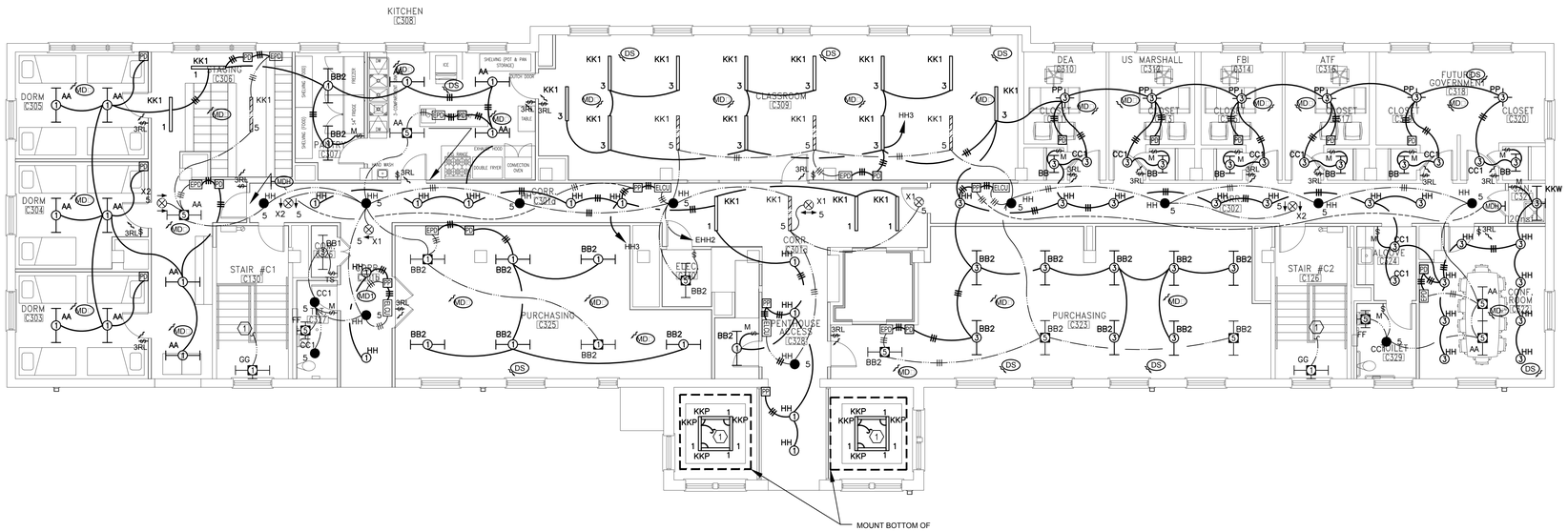
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E1.0

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3 / E1.1 LIGHTING PLAN - PENTHOUSE
Scale: 1/8" = 1'- 0"



1 / E1.1 LIGHTING PLAN - THIRD FLOOR
Scale: 1/8" = 1'- 0"

GENERAL NOTES

#	Description
1.	LIGHTING CONTROLS THAT ARE SHOWN IN CEILING TYPES OTHER THAN LAY-IN CEILING GRID SHALL BE MOUNTED TO THE CEILING, AND PAINTED TO MATCH THE CEILING COLOR. SEE ARCHITECTS REFLECTIVE CEILING PLAN TO VERIFY CEILING TYPES.

KEYED NOTES

Mark	Description
1	CONNECT TO FIXTURES BELOW.

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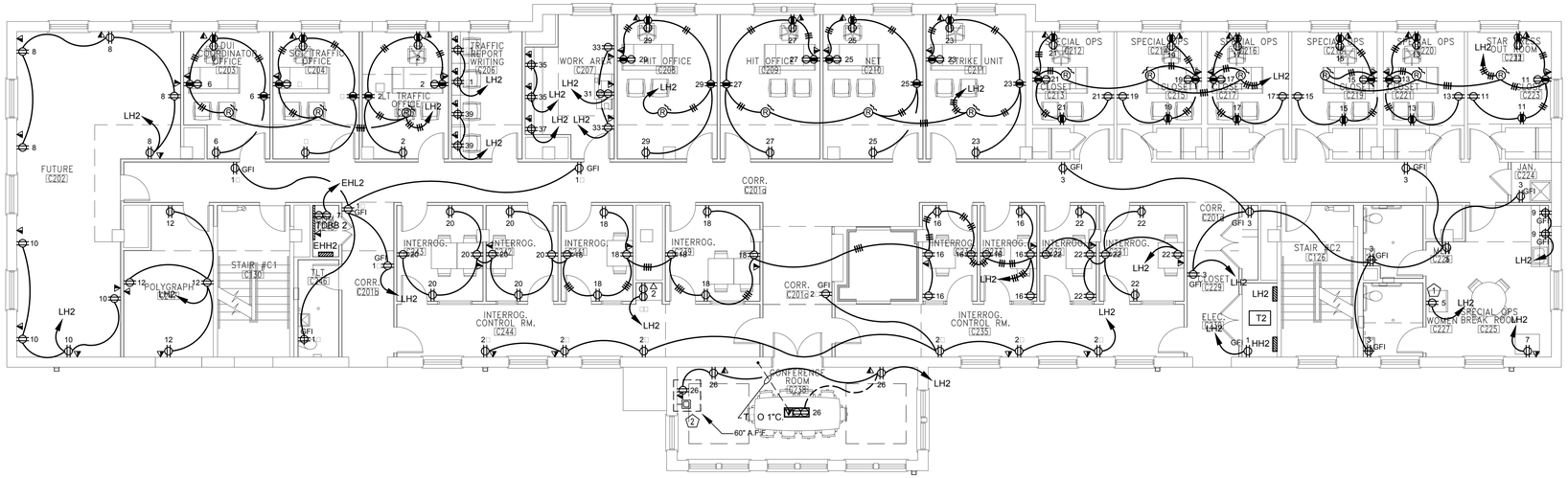
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E1.1

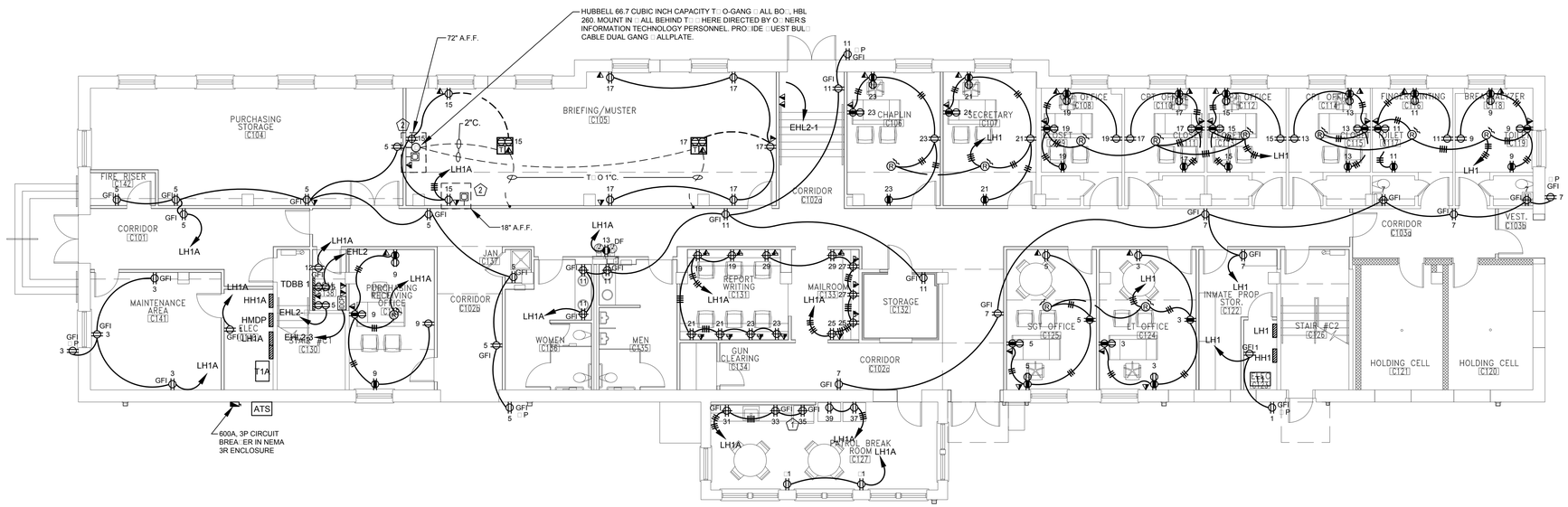
□EYED NOTES:

1. MOUNT RECEPTACLE FOR REFRIGERATOR AT 60" A.F.F.
2. COORDINATE E□ACT RE□UIREMENTS □ ITH AUDIO□ISUAL DRA□ INGS.



2 / E2.0 POWER PLAN - SECOND FLOOR

Scale: 1/8" = 1'- 0"



1 / E2.0 POWER PLAN - FIRST FLOOR

Scale: 1/8" = 1'- 0"

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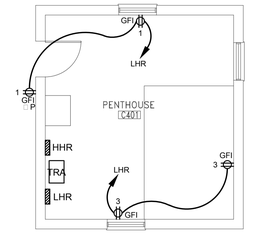
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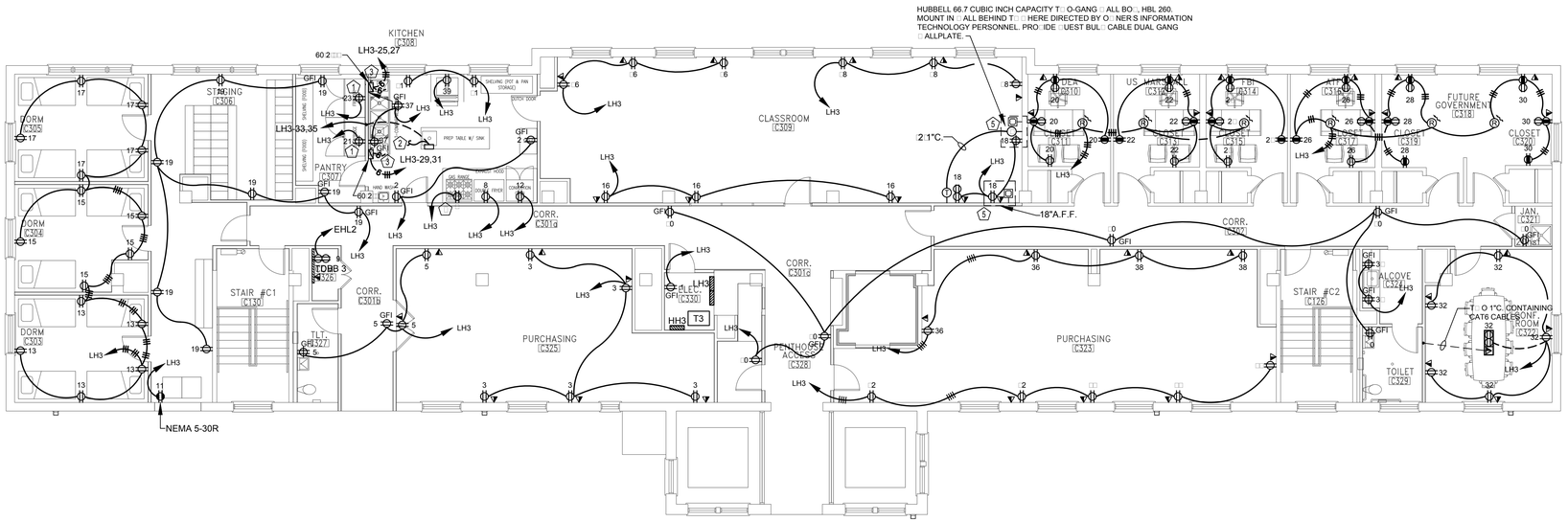
E2.0

□EYED NOTES:

1. MOUNT RECEPTACLE FOR REFRIGERATOR□FREE□ER AT 60" A.F.F.
2. FOOD □ ASTE DISPOSER CONTROL PANEL. DISCONNECT PRO□IDED □ ITH E□UIPMENT.
3. MOUNT RECEPTACLE FOR DISH□ ASHER IN ACCORDANCE □ ITH NEC □22.16□B□2□
5. MOUNT RECEPTACLE FOR RANGE IN ACCORDANCE □ ITH NEC □22.33□B□
6. COORDINATE E□ACT RE□UIREMENTS □ ITH AUDIO□□ISUAL DRA□ INGS.



3 / E2.1 POWER PLAN - PENTHOUSE
Scale: 1/8" = 1'- 0"



1 / E2.1 POWER PLAN - THIRD FLOOR
Scale: 1/8" = 1'- 0"

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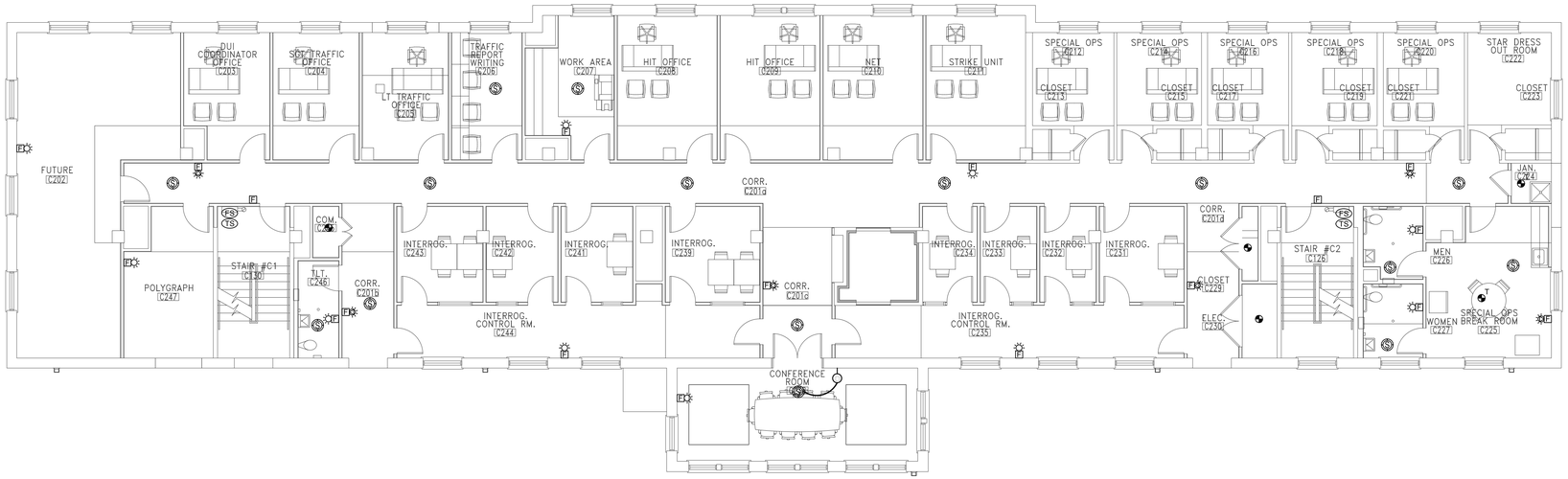
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E2.1

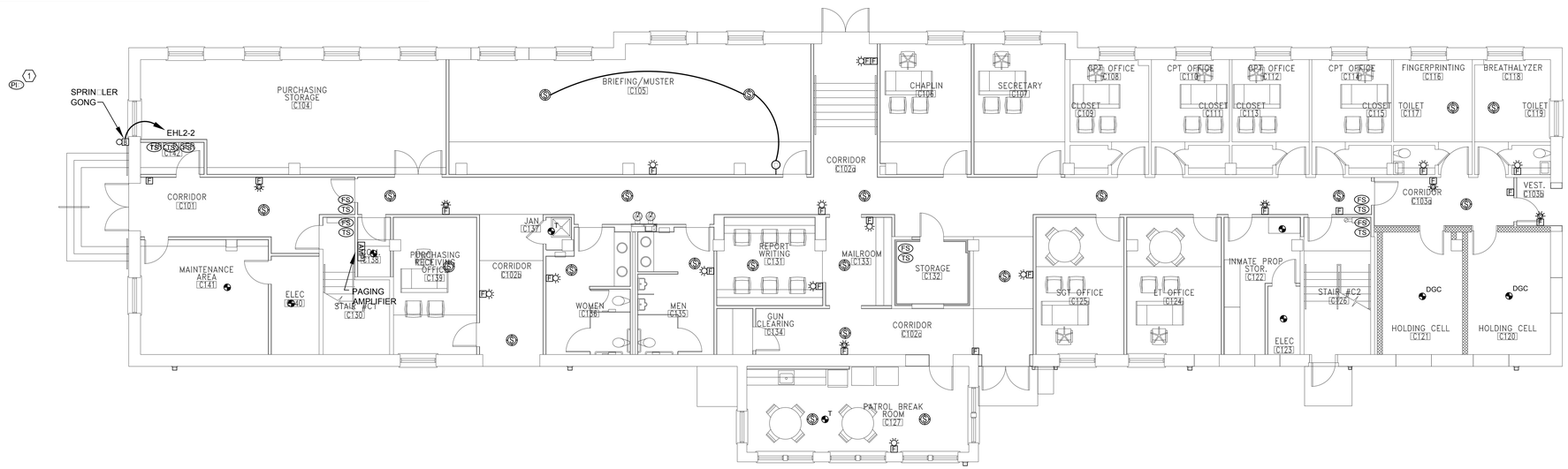


2 E3.0 **AUXILIARY PLAN - SECOND FLOOR**

Scale: 1/8" = 1'-0"

KEYED NOTES

Mark	Description
1	COORDINATE LOCATION WITH SPRINKLER CONTRACTOR.



1 E3.0 **AUXILIARY PLAN - FIRST FLOOR**

Scale: 1/8" = 1'-0"

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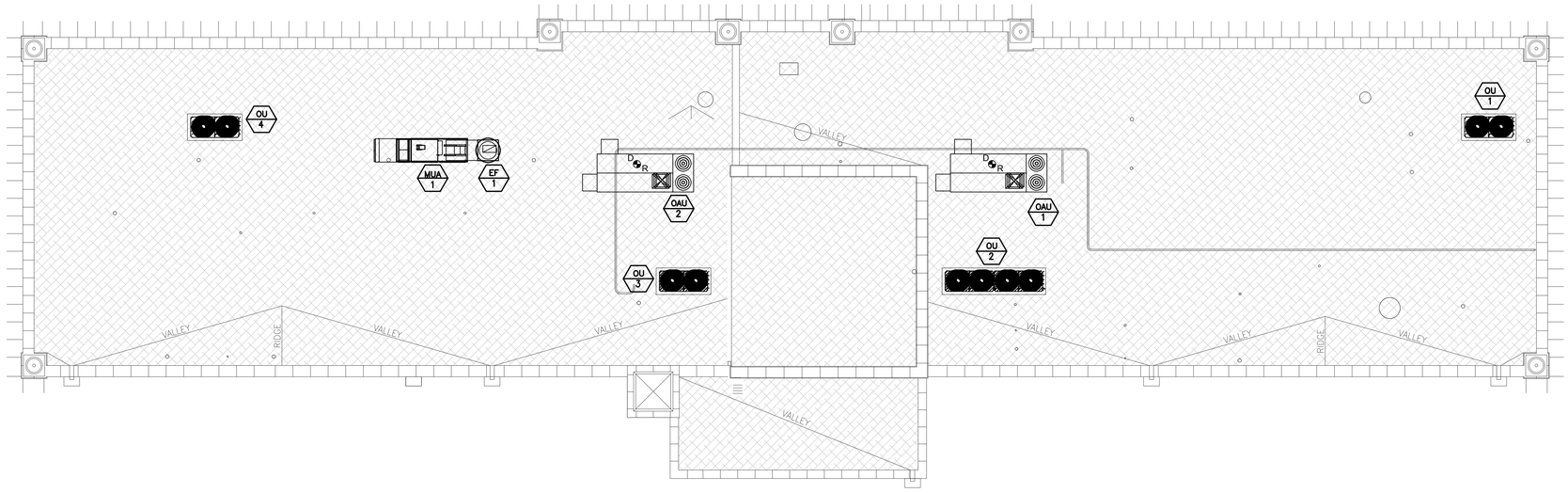
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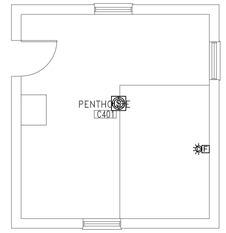
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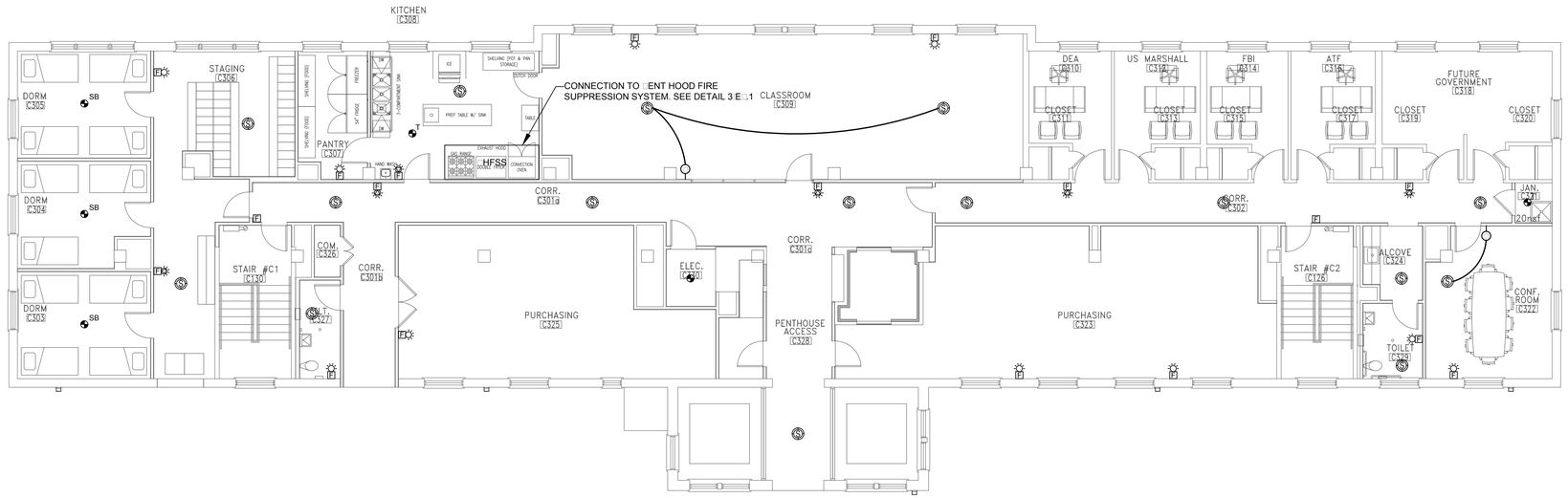
E3.0



2 / E3.1 AUXILIARY PLAN - ROOF
Scale: 1/8" = 1'-0"



3 / E3.1 AUXILIARY PLAN - PENTHOUSE
Scale: 1/8" = 1'-0"



1 / E3.1 AUXILIARY PLAN - THIRD FLOOR
Scale: 1/8" = 1'-0"

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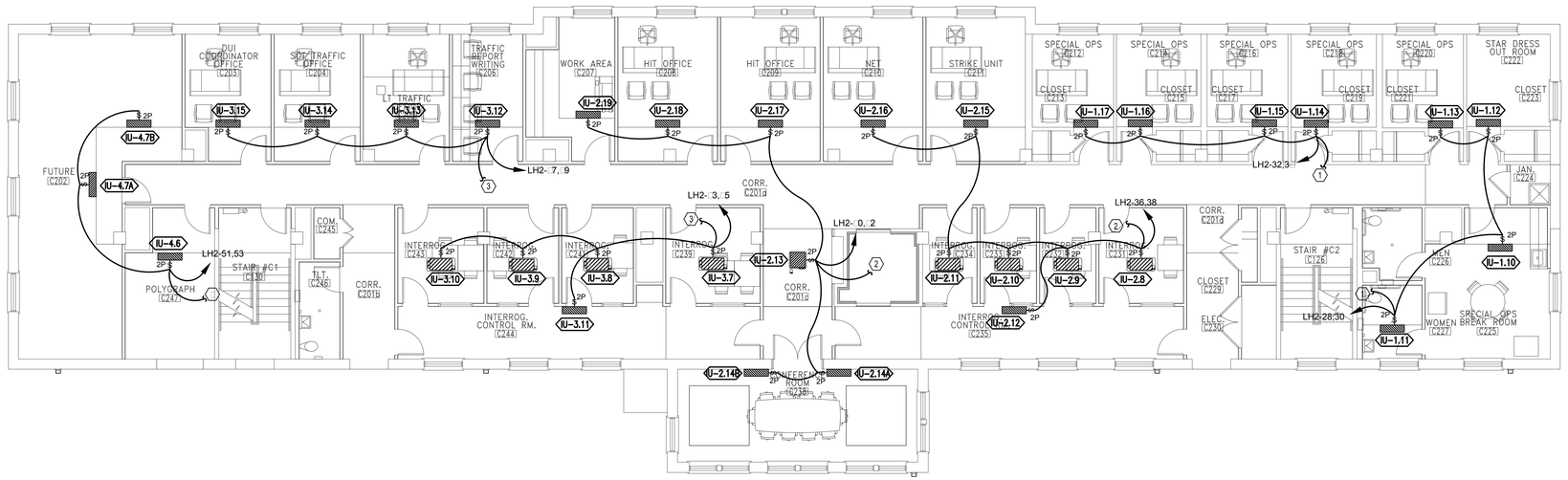
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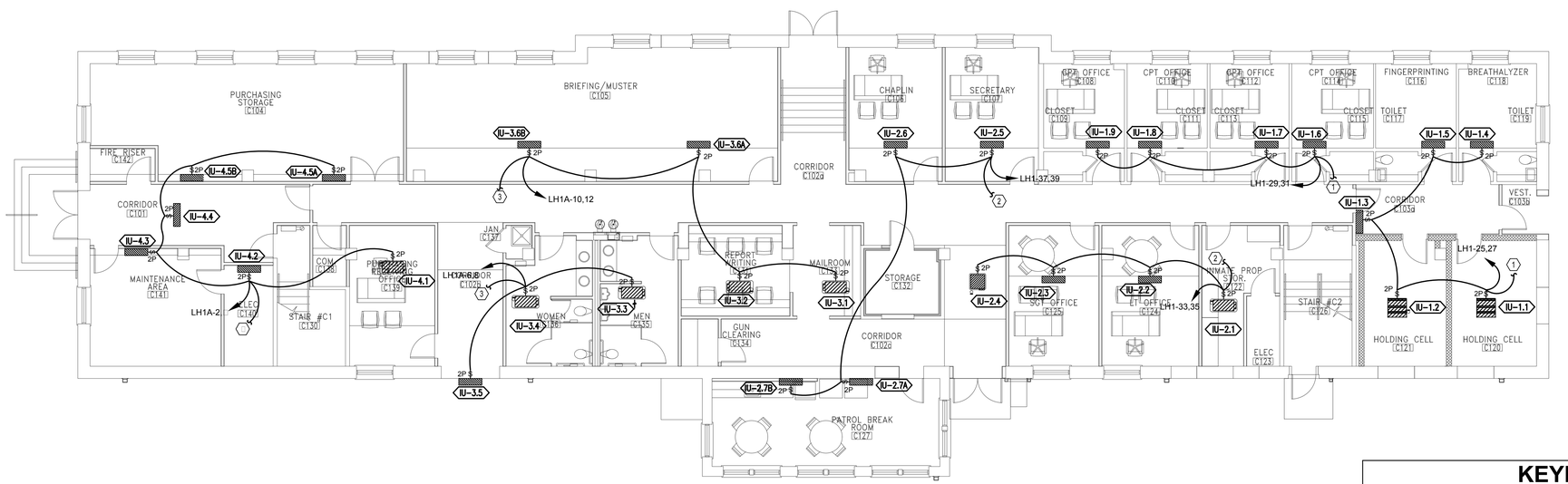
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E3.1



2 / E4.0 MECHANICAL CONNECTION PLAN - SECOND FLOOR

Scale: 1/8" = 1'- 0"



1 / E4.0 MECHANICAL CONNECTION PLAN - FIRST FLOOR

Scale: 1/8" = 1'- 0"

KEYED NOTES

Mark	Description
1	CONNECT TO BC-1.
2	CONNECT TO BC-2.
3	CONNECT TO BC-3.
4	CONNECT TO BC-4.

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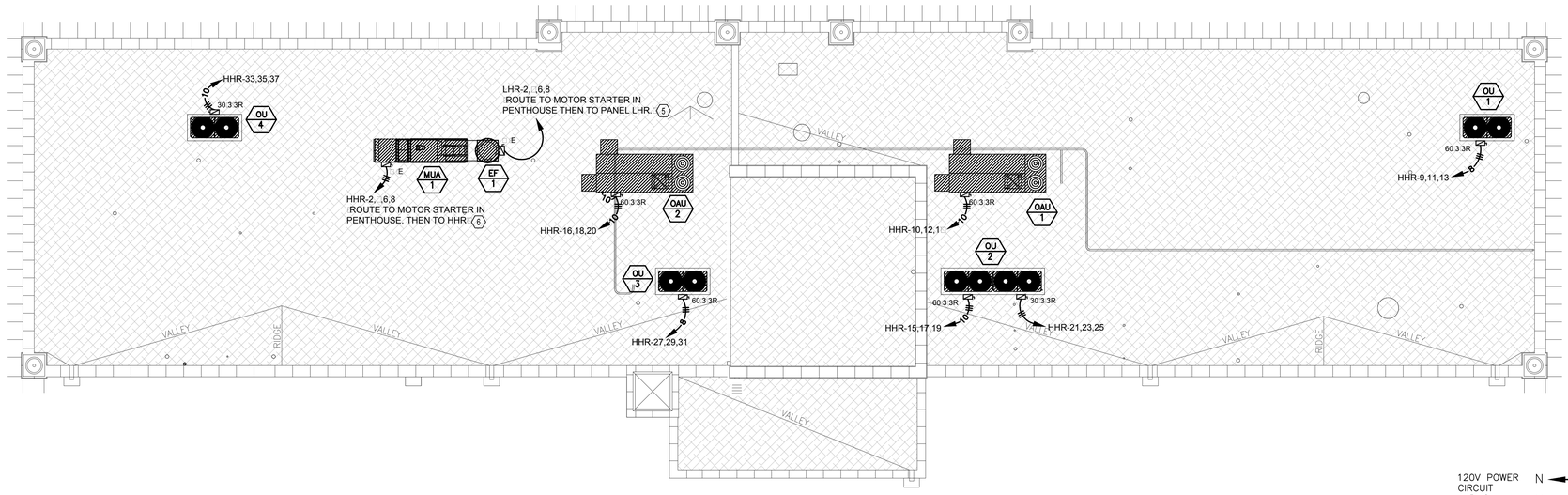
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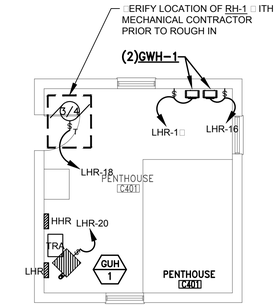
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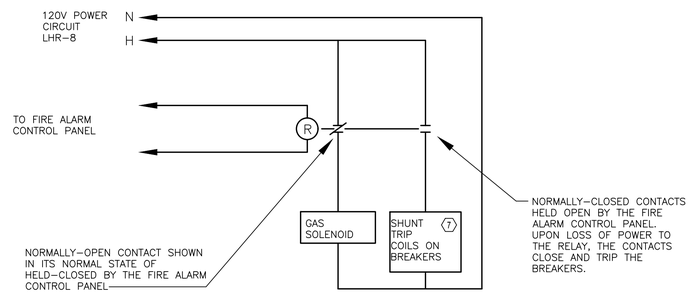
2 E4.1 MECHANICAL CONNECTION PLAN - ROOF

Scale: 1/8" = 1'- 0"



3 E4.1 MECHANICAL PLAN - PENTHOUSE

Scale: 1/8" = 1'- 0"

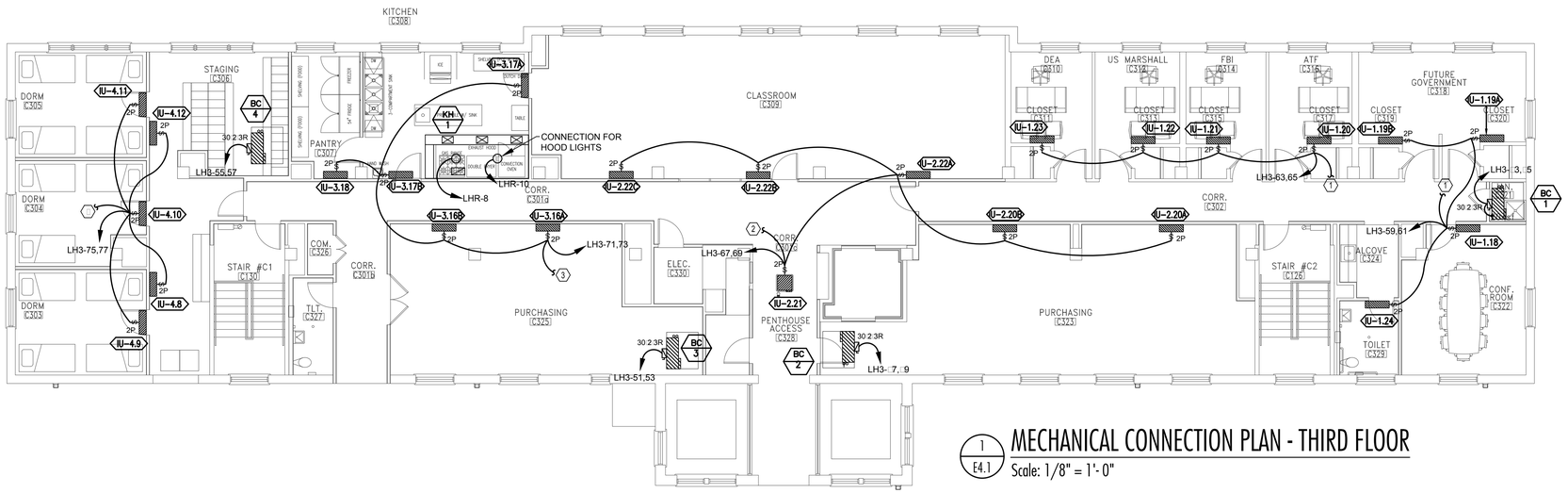


4 E4.1 EQUIPMENT SHUTDOWN DETAIL FOR FIRE SUPPRESSION SYSTEM

Scale: 1/8" = 1'- 0"

NOTE:

PROVIDE A SUPERVISED CIRCUIT FROM THE FIRE ALARM PANEL TO MONITOR THE VENT HOOD FIRE SUPPRESSION SYSTEM. UPON AN ALARM CONDITION OF THE FIRE ALARM SYSTEM, THE FIRE ALARM SYSTEM SHALL CAUSE THE SHUNT TRIP BREAKERS TO TRIP ALL ELECTRICAL APPLIANCES UNDER THE HOOD, AND ON THE SUPPLY AND EXHAUST FANS IN THE HOOD. SOME HOODS ARE UL LISTED TO OPERATE WITH THE EXHAUST FAN RUNNING IN THE ALARM CONDITION. VERIFY THAT THIS IS NOT THE CASE BEFORE CIRCUITING THIS UNIT TO SHUNT TRIP THE EXHAUST FAN BREAKER. THE FIRE ALARM PANEL SHALL ALSO PROVIDE POWER TO A RELAY THAT IN TURN HOLDS THE GAS SOLENOID VALVE, FURNISHED BY THE MECHANICAL CONTRACTOR, OPEN UNDER NORMAL CONDITIONS. AN ALARM CONDITION OF THE FIRE ALARM SYSTEM SHALL RELEASE THE POWER TO THIS SOLENOID CAUSING THE GAS TO THE EQUIPMENT UNDER THE VENT HOOD TO SHUT OFF. SEE DETAIL ON THIS SHEET.



1 E4.1 MECHANICAL CONNECTION PLAN - THIRD FLOOR

Scale: 1/8" = 1'- 0"

KEYED NOTES

Mark	Description
1	CONNECT TO BC-1.
2	CONNECT TO BC-2.
3	CONNECT TO BC-3.
⬡	CONNECT TO BC-□.
5	PRO□IDE A NEMA SI□E 00, 208□, 3-POLE MOTOR STARTER IN PENTHOUSE AD□ACENT TO PANEL LHR. PRO□IDE MOTOR STARTER □ ITH INTEGRAL 208□120□ CONTROL TRANSFORMER SI□ED AS RE□UIRED BY STARTER COIL. PRO□IDE STARTER NEMA 1 ENCLOSURE □ ITH HAND-OFF-AUTO S□ITCH. PRO□IDE 2□12,□12□G,3□□°C. TO S□ITCH IN HOOD FOR CONTROL OF FAN.
6	PRO□IDE A NEMA SI□E 00,□80□, 3-POLE STARTER □ ITH ONE SET OF AU□ILIARY CONTACTS. MOUNT AD□ACENT PANEL HHR IN PENTHOUSE. PRO□IDE MOTOR STARTER □ ITH INTERGRAL 80□□120□CONTROL TRANSFORMER SI□ED AS RE□UIRED BY STARTER COIL. PRO□IDE STARTER IN NEMA 1 ENCLOSURE □ ITH HAND-OFF-AUTO S□ITCH. PRO□IDE 2□12,□12□G,3□□°C. TO S□ITCH IN HOOD FOR CONTROL OF MAU-1.
7	CIRCUITS HHR-2,□,6,8□LHR-2,□,6□LHR-10,12□LH3-□,6□LH3-8,10□LH3-12,1□ ARE CIRCUITS THAT MUST BE TRIPPED.

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CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Historic Hospital Buildng

Drawing Issued:

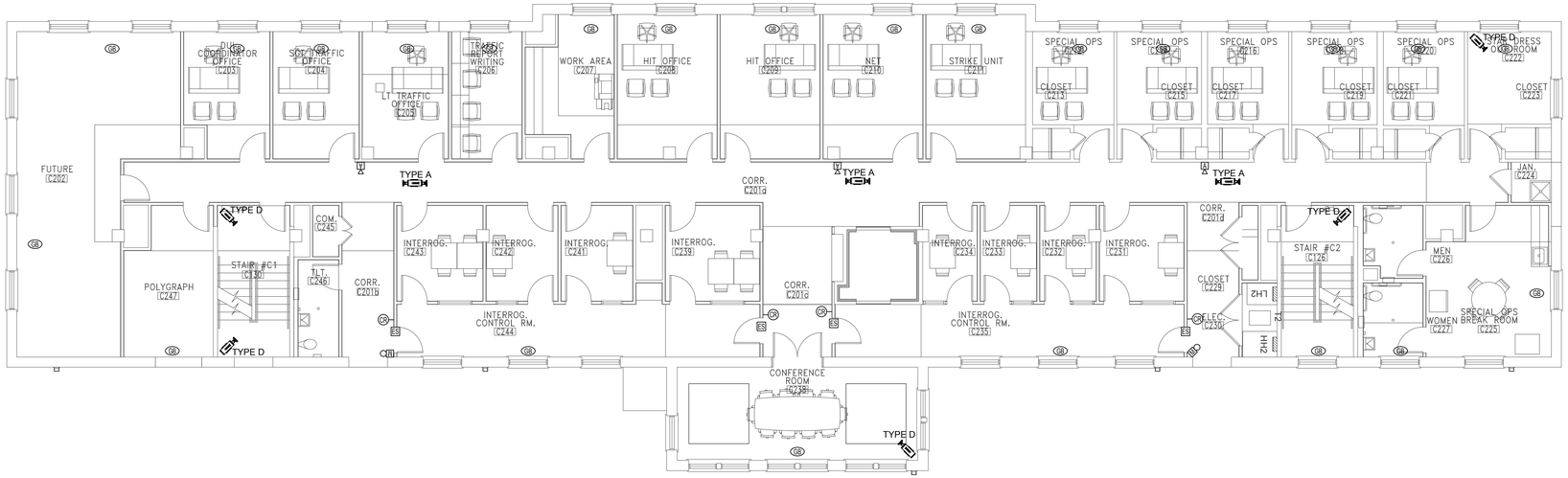
Date	Rev.	Description
08-31-2015		DD Check Set
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11-02-2015		90% Pricing Set
11-19-2018		100% Bid Docs

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Client No: ------
Albert & Associates: 12575

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Albert & McCleskey Associates Architects

MECHANICAL PLAN - THIRD FLOOR AND ROOF

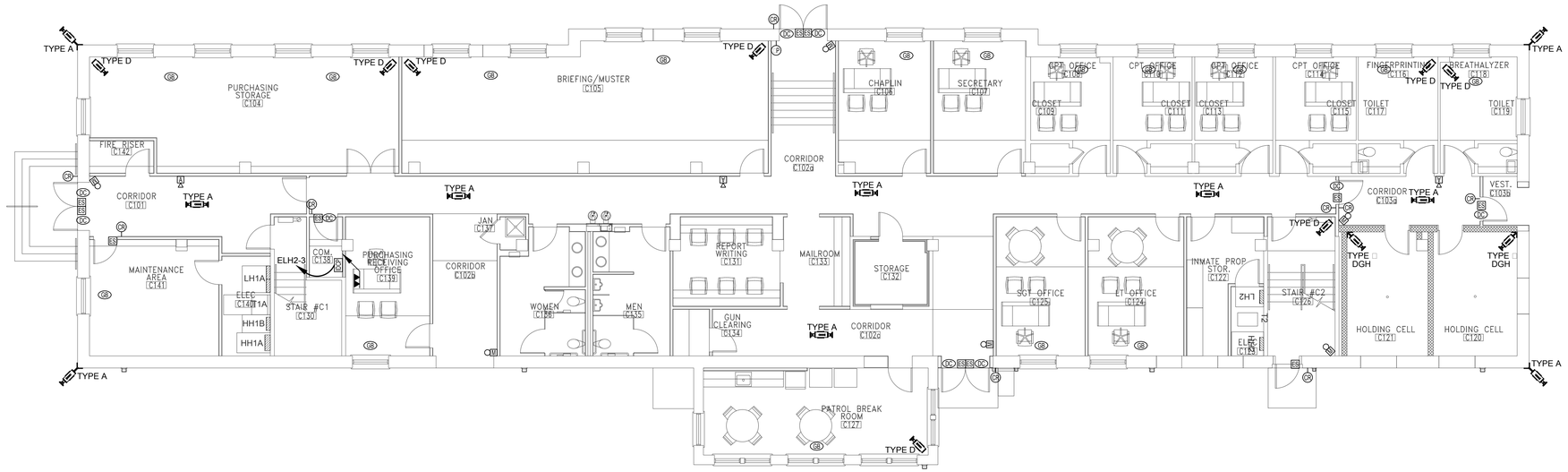
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2 SEC1.0

SECURITY PLAN - SECOND FLOOR

Scale: 1/8" = 1'-0"



1 SEC1.0

SECURITY PLAN - FIRST FLOOR

Scale: 1/8" = 1'-0"

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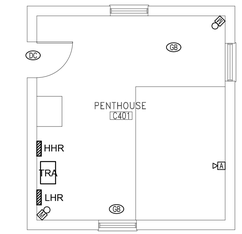
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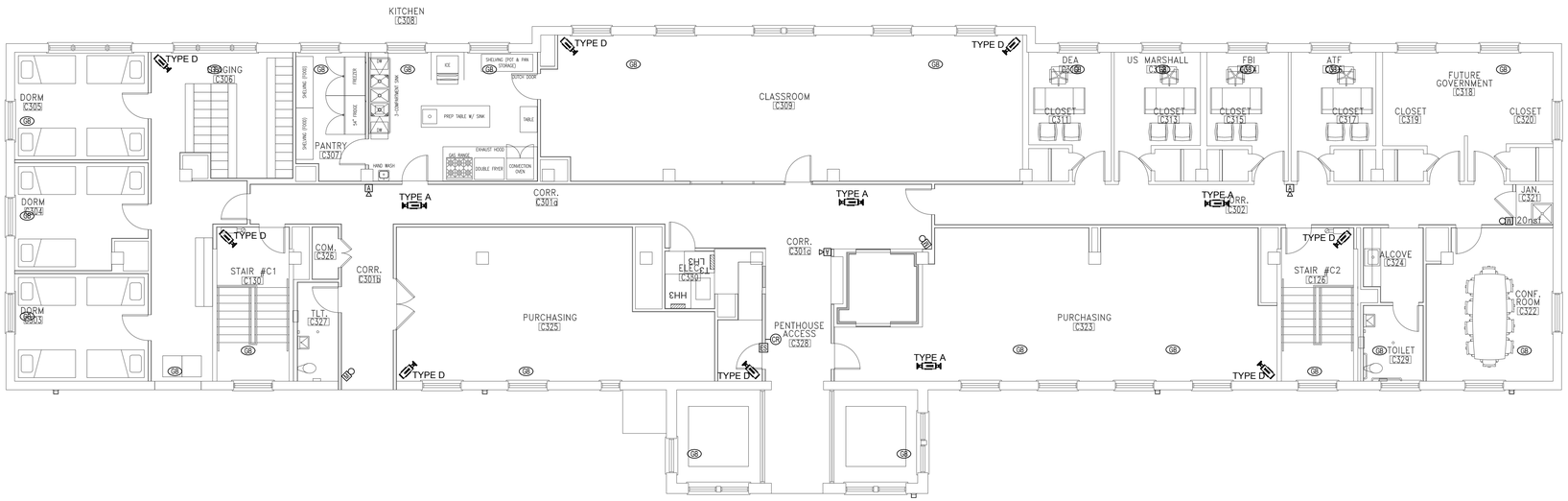
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3/10/2017

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3 SEC1.1 SECURITY PLAN - PENTHOUSE
Scale: 1/8" = 1'- 0"



1 SEC1.1 SECURITY PLAN - THIRD FLOOR
Scale: 1/8" = 1'- 0"

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HATTIESBURG PUBLIC SAFETY COMPLEX

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H A T T I E S B U R G M I S S I S S I P P I

ARCHITECTURAL SYMBOLS

WINDOW TAG

DOOR TAG

GLAZING TAG

ARCHITECTURAL NOTES

FABRICATED RAILING DESIGNATION

MODIFICATION DESIGNATION

ROOM NAME AND NUMBER

ADDENDA MODIFICATIONS

NOTATION LINES

COLUMN LINES

WALL/PARTITION TYPES

VERTICAL ELEVATION

CENTER LINE

BUILDING SECTION

INTERIOR ELEVATION

INTERIOR ELEVATION

WALL SECTION

EXTERIOR ELEVATION

MISCELLANEOUS SECTION

AREA TO BE ENLARGED ON DRAWINGS

ABBREVIATIONS

A/C	AIR CONDITIONING
ADD'M	ADDENDUM
ADJ	ADJUSTABLE
AFF	ABOVE FIRST FLOOR
BD	BOARD
BLKG	BLOCKING
CJ	CONTROL JOINT
CLG.	CEILING
CMU	CONCRETE MASONRY UNIT
CONC	CONCRETE
CONT	CONTROL OR CONTINUOUS
CPT	CARPET
CTR	CENTER
DIM	DIMENSION
DN	DOWN
DS	DOWN SPOUT
DWGS	DRAWINGS
EA	EACH
EDF	ELECTRIC DRINKING FOUNTAIN
ELEC	ELECTRICAL
EQ	EQUAL
EXP	EXPOSED
FD	FLOOR DRAIN
FE	FIRE EXTINGUISHER
FFE	FINISHED FLOOR ELEVATION
GB	GRAB BAR
GYP	GYPSUM
HM	HOLLOW METAL
HORIZ	HORIZONTAL
HGHT	HEIGHT
INSUL	INSULATION
JAN	JANITOR
JT	JOINT
LAM	PLASTIC LAMINATE
L.A.T.	LAY-IN ACOUSTIC TILE
MAX	MAXIMUM
MECH	MECHANICAL
MIN	MINIMUM
MISC	MISCELLANEOUS
MO	MASONRY OPENING
MRGB	MOISTURE RESISTANT GYP. BOARD
MTD	MOUNTED OR MOUNTING
MTL	METAL
N	NORTH
NIC	NOT IN CONTRACT
NTS	NOT TO SCALE
OC	ON CENTER
O.H.	OPPOSITE HAND
OPNG	OPENING
PL	PLATE OR PLATED
PLYWD	PLYWOOD
PNTD	PAINTED
POR	PORCELAIN TILE
PT	PAINT
PTD	PAPER TOWEL DISPENSER/DISPOSAL
PVR	PORCELAIN PAVER
QT	QUARRY TILE
RB	RUBBER BASE
RD	ROOF DRAIN
RE	REFERENCE
REQ'D	REQUIRED
RM	ROOM
SCH	SCHEDULE
SHT	SHEET
SIM	SIMILAR
S/M	SHEET METAL
SMACNA	S/M AND A/C CONTRACTORS NATIONAL ASSOCIATION, INC.
SND	SANITARY NAPKIN DISPOSAL
SPECS	SPECIFICATIONS
SS	STAINLESS STEEL
STRUCT.	STRUCTURAL
STN	STAINED WOOD
TPD	TOILET PAPER DISPENSER
TYP	TYPICAL
VCT	VINYL COMPOSITION TILE
VERT	VERTICAL
VWC	VINYL WALL COVERING
WB	WOOD BASE
WD	WOOD

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EAV–101 DETAILS AND VIDEO WALL
EAV–102 CONDUIT RISER DIAGRAMS
EAV–201 FIRST FLOOR AUDIOVISUAL INFRASTRUCTURE
EAV–202 SECOND FLOOR AUDIOVISUAL INFRASTRUCTURE
EAV–203 THIRD FLOOR AUDIOVISUAL INFRASTRUCTURE
EAV–205 FIRST & SECOND FLOOR AUDIOVISUAL INFRASTRUCTURE – BUILDING C
EAV–301 FIRST FLOOR RCP AUDIOVISUAL INFRASTRUCTURE

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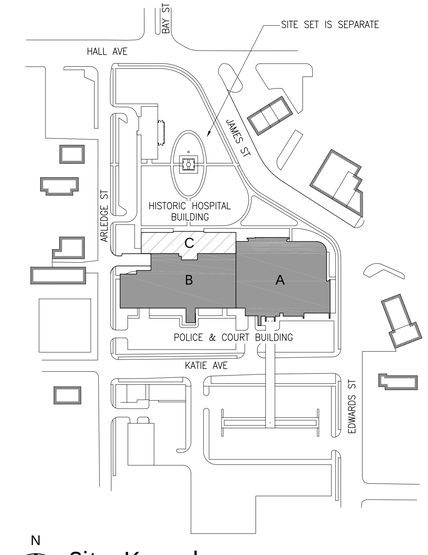
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PROJECT LOCATION

PROJECT SITE: 701 JAMES ST., HATTIESBURG, MS 39401



N

Site Keyplan

SCALE: N.T.S.

HATTIESBURG PUBLIC SAFETY COMPLEX
HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

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Checked By: CR,LA,CP
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REGISTERED ARCHITECT Larry S. Albert Hattiesburg, MS STATE OF MISSISSIPPI

T1.0

GENERAL NOTES

00 - PROCUREMENT AND CONTRACTING

0.1 REVIEW BY ALL PARTIES: CONTRACTOR SHALL ENSURE THAT ALL SUBCONTRACTORS AND SUPPLIERS REVIEW AND ABIDE BY THE TERMS OF THESE GENERAL NOTES FOR CONTRACT COMPLIANCE.

0.2 RELATIONSHIP TO CONSTRUCTION DOCUMENTS: GENERAL NOTES ARE MEANT TO COMPLIMENT AND/OR EMPHASIZE INFORMATION PRESENTED IN THE CONTRACT DOCUMENTS. THE CONTRACTOR SHALL NOTIFY THE ARCHITECT WHERE A CONFLICT ARISES BETWEEN THE FOLLOWING GENERAL NOTES AND REMAINING CONTRACT DOCUMENTS DURING BIDDING AND FOR THE DURATION OF THE PROJECT. IF A CONFLICT ARISES DURING BIDDING THAT CANNOT BE LEGALLY CLARIFIED BY THE ARCHITECT, THE CONTRACTOR SHALL BASE THE BID ON THE MOST EXPENSIVE COMBINATION OF QUALITY AND QUANTITY OF WORK INDICATED.

0.3 KEYED NOTES: WHERE PROVIDED, NUMBERED NOTES ARE KEYED ON THE DRAWINGS TO DEMONSTRATE AN EXAMPLE OF A PARTICULAR CONDITION AT THE TIME OF DRAWING PREPARATION AND ARE NOT INCLUSIVE OF ALL INSTANCES OF THAT CONDITION, AND THUS MAY ALSO APPLY AS GENERAL NOTES FOR SITUATIONS OF THE SAME CONDITION.

01 - GENERAL REQUIREMENTS

1.1. FIELD CONDITIONS DURING BIDDING: CONTRACTOR SHALL PAY VERY CLOSE ATTENTION TO FIELD CONDITIONS DURING BIDDING TO ENSURE THAT ALL CONDITIONS ARE ACCOUNTED FOR AT THAT TIME. KNOWN OMISSIONS AND ERRORS BY THE A CONTRACTOR OR A SUBCONTRACTOR SHALL BE BROUGHT TO THE ARCHITECT'S ATTENTION FOR CLARIFICATION PRIOR TO BIDDING.

1.2. PUBLIC SAFETY: THE CONTRACTOR SHALL COORDINATE WITH THE JURISDICTION HAVING AUTHORITY TO ENSURE PUBLIC SAFETY AROUND THE CONSTRUCTION LIMITS AT ALL TIMES.

1.3. CONTRACTOR/SUBCONTRACTOR COORDINATION: ALL SUBCONTRACTORS (INCLUDING BUT NOT LIMITED TO HVAC, PLUMBING, FIRE SPRINKLER, AND ELECTRICAL) SHALL BE BOUND TO THE DESIGN AS INDICATED ON ARCHITECTURAL DRAWINGS, ENGINEERING DRAWINGS, SUPPLEMENTAL INSTRUCTIONS AND SHOP DRAWINGS. WHERE A CONFLICT ARISES BETWEEN THE THOSE DOCUMENTS, THE SUBCONTRACTOR SHALL COORDINATE WITH THE GENERAL CONTRACTOR PRIOR TO EXECUTION OF WORK TO DETERMINE A SOLUTION AND THE GENERAL CONTRACTOR SHALL INVOLVE THE ARCHITECT AS NECESSARY.

1.4. COORDINATION W/ OWNER'S CONTRACTORS: CONTRACTOR IS RESPONSIBLE FOR COORDINATING OWNER SUPPLIED CONTRACTORS (SECURITY EQUIPMENT, TELEPHONE EQUIP., FURNITURE, ETC.) SO THAT CONFLICTS DO NOT OCCUR BETWEEN TRADES AND SCHEDULING.

1.5. ADA: ALL PHYSICAL PROPERTIES OF THE BUILDING WITHIN THE CONTRACT LIMITS MUST COMPLY WITH THE AMERICANS WITH DISABILITIES ACT - ACCESSIBILITY GUIDELINES (ADA-AG).

1.6. MOCK-UPS FOR APPROVAL: THE CONTRACTOR SHALL PROVIDE MOCK-UPS AS DIRECTED IN THE DRAWINGS AND SPECIFICATIONS FOR REVIEW BY THE OWNER, ARCHITECT, AND APPLICABLE ENGINEERS AND CONSULTANTS, IN A SINGLE PRESENTATION. WHEN POSSIBLE, MEASURES TO CORRECT UNAPPROVED SAMPLES SHALL BE COMPLETED IMMEDIATELY TO AVOID AN ADDITIONAL ON-SITE INSPECTION BY THE GROUP. THE CONTRACTOR SHALL INCUR ANY ADDITIONAL COSTS ARISING OUT OF THE NECESSITY OF RESCHEDULING AN ADDITIONAL REVIEW BY SAID GROUP AS A RESULT OF THE CONTRACTOR'S FAILURE TO PROVIDE THE REQUESTED SAMPLES AS DIRECTED. AMPLE NOTICE (NO LESS THAN 5 CALENDAR DAYS) SHALL BE GIVEN TO THE ARCHITECT THAT THE SAMPLES ARE READY TO BE REVIEWED. IN SOME CASE, APPROVED MOCK-UPS CAN REMAIN PART OF THE WORK. SEE SPECIFICATIONS FOR ADDITIONAL SAMPLE AND MOCK-UP REQUIREMENTS.

1.7. DIMENSIONS: CONTRACTOR TO VERIFY ALL DIMENSIONS.

1.8. ANGLES: ALL ANGLES ARE 45 AND 90 DEGREES, UNLESS NOTED OTHERWISE.

1.9. CONSTRUCTION LIMITS: THE CONTRACTORS MUST KEEP THEIR EMPLOYEES WITHIN THE DEFINED, CONTROLLED CONSTRUCTION LIMITS AT ALL TIMES OR AS DIRECTED BY THE GENERAL CONTRACTOR. THE GENERAL CONTRACTOR WILL BE RESPONSIBLE TO KEEP THE OWNER AND ARCHITECT INFORMED OF ANY OCCASIONS WHEN WORKERS NEED TO BE OUTSIDE THE CONSTRUCTION LIMITS. A SIX-FOOT HIGH CHAIN LINK CONSTRUCTION FENCE IS REQUIRED AROUND THE PERIMETER OF THE CONSTRUCTION LIMITS. TWELVE-FOOT WIDE, IN-SWINGING, LOCKABLE GATES ARE REQUIRED AT CONSTRUCTION LIMIT ACCESS POINTS.

1.10. BUILDING LAYOUT: CONTRACTOR SHALL STAKEOUT ENTIRE BUILDING LAYOUT AND ALL IMPROVEMENTS FOR APPROVAL BY THE ARCHITECT AND OWNER BEFORE BEGINNING WORK. ALL DISCREPANCIES TO BE DISCUSSED AND ADJUSTED AT THAT MEETING.

1.11. FINISH FLOOR ELEVATIONS: ARCHITECT AND CIVIL ENGINEER MUST APPROVE FINISH FLOOR ELEVATION/BUILDING LOCATION PRIOR TO SETTING FORM WORK.

02 - EXISTING CONDITIONS

2.1. VERIFY EXISTING CONDITIONS: THE CONTRACTOR SHALL VERIFY EXISTING BUILDING AND SITE CONDITIONS AS THEY RELATE TO THE CONSTRUCTION DOCUMENTS AND REPORT ANY AND ALL DISCREPANCIES TO THE ARCHITECT IN WRITING AND IN A TIMELY MANNER.

2.2. SITE DEMOLITION: CONTRACTOR SHALL BE RESPONSIBLE FOR THE REMOVAL OR MODIFICATION OF ANY AND ALL EXISTING CONDITIONS REQUIRED TO ACCOMPLISH WORK.

2.3. EXISTING TREE PROTECTION: ALL EXISTING TREES NOTED TO REMAIN ARE TO BE PROTECTED. CONTRACTOR SHALL PROVIDE CHAIN LINK FENCE AT A 15' RADIUS AROUND THE TREE TRUNK AND PAINT ON THE GROUND, WITH GREEN SURVEYING PAINT, AN OUTLINE OF THE TREE CANOPY ABOVE. SHOULD IT EXCEED 15'. AREAS INSIDE OF THE FENCING AND WITHIN THE GREEN PAINT ARE NOT TO BE USED FOR PERMANENT STORAGE OF MATERIAL OR EQUIPMENT OR VEHICLE PARKING. SHOULD DAMAGE OCCUR TO TREES SCHEDULED TO BE PROTECTED DUE TO INADEQUATE TREE PROTECTION, THE CONTRACTOR SHALL CONSULT WITH A PROFESSIONAL ARBORIST TO REMEDY THE SITUATION AND/OR REPLACE THE TREE WITH A NEW SPECIMEN EQUAL IN SPECIES AND SIZE. IN THE EVENT OF REPLACEMENT, THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE FULL ESTABLISHMENT OF THE TREE.

2.4. TREE AND STUMP REMOVAL: REMOVE ALL TREES AND STUMPS WITHIN 10' OF BUILDING UNLESS MARKED FOR PROTECTION. REVIEW ALL TRESS MARKED FOR REMOVAL WITH ARCHITECT PRIOR TO CUTTING (SEE SITE PLAN).

03 - CONCRETE

3.1. EXPOSED CONCRETE: ALL EXPOSED CONCRETE SURFACES SHALL RECEIVE A RUBBED FINISH TO CREATE A SMOOTH, UNIFORM APPEARANCE AND SHALL HAVE A MIN. 1/2" RADIUS ON ALL EXPOSED CORNER CONDITIONS.

3.2. CONCRETE BLOCK-OUTS: CONTRACTOR TO VERIFY ALL REQUIRED BLOCK-OUTS IN CONCRETE CONSTRUCTION DURING THE SHOP DRAWINGS PHASE AND/OR BEFORE CONCRETE POURS ARE ORDERED. CONTRACTOR SHALL PROVIDE BLOCK-OUTS IN ALL CONCRETE CONSTRUCTION FOR ALL ITEMS SHOWN ON ARCHITECTURAL, STRUCTURAL, AND MEP DRAWINGS AS BEING "RECESSED" OR FOR ITEMS SHOWN PENETRATING CONCRETE.

3.3. CONCRETE WORK: VIBRATE ALL CONCRETE IN BEAMS, PARTICULARLY AT THE RECESSES AROUND PERIMETER, TO ELIMINATE HONEYCOMBS.

04 - MASONRY

4.1. MASONRY EXPANSION JOINTS: WHERE NOT SHOWN OF DRAWINGS, MASONRY EXPANSION JOINTS ARE TO BE LOCATED 50'-0" APART MAXIMUM AND NO MORE THAN 25'-0" FROM BUILDING CORNERS. PLACE REQUIRED EXPANSION JOINTS AT INSIDE CORNERS WHERE POSSIBLE. HORIZONTAL EXPANSION JOINTS ARE REQUIRED AT ALL FLOORS WHERE STRUCTURAL RELIEF ANGLES ARE USED. MASONRY EXPANSION JOINTS ARE TO BE LOCATED TO LIMIT MASONRY AREA TO A MAXIMUM OF 500 SQ. FT. UNLESS OTHERWISE DIRECTED. THE CONTRACTOR SHALL COORDINATE ALL OF THE EXPANSION JOINT LOCATIONS WITH THE ARCHITECT AND STRUCTURAL ENGINEER BEFORE STARTING MASONRY WORK.

4.2. WEEPS: ALL MASONRY WEEPS ARE TO BE FULL OPEN HEAD JOINTS WITH PLASTIC INSERTS AT A MAXIMUM OF 24 INCHES ON CENTER. COORDINATE MASONRY CONSTRUCTION WITH "MORTAR NET" APPLICATION IN CAVITY WALLS AT ALL WALL FLASHING LOCATIONS.

4.3. MASONRY REINFORCING: ALL MASONRY WALL TIES SHALL BE SPACED A MAXIMUM OF 16" OC VERTICAL AND 16" OC HORIZONTAL. WALL TIE LOCATIONS THAT FALL NEXT TO CONCRETE COLUMNS REQUIRE THE USE OF DOVETAIL EMBED ANCHORS AND WALL TIES THAT FALL NEXT TO STEEL BEAMS REQUIRE THE USE OF SCREW APPLIED WALL ANCHORS. SEE STRUCTURAL DRAWINGS FOR ADDITIONAL REINFORCING REQUIREMENTS AND SPECIFICATIONS.

4.4. MASONRY LINTELS: PROVIDE LINTELS AT ALL MASONRY OPENINGS AS SHOWN IN STRUCTURAL DRAWINGS.

4.5. BOND COURSES: PROVIDE CONTINUOUS BOND COURSES AS SHOWN IN STRUCTURAL DRAWINGS.

4.6. DEFECTIVE MASONRY: BROKEN, CHIPPED, OR CRACKED CONCRETE MASONRY UNITS SHALL NOT BE USED IN THIS PROJECT.

05 - METALS

5.1. STEEL FINISH: ALL EXPOSED STEEL IS TO BE HOT DIPPED GALVANIZED OR SS.

5.2. EXTERIOR FASTENERS: USE HOT DIP GALVANIZED OR SS FASTENERS AT ALL EXTERIOR CONDITIONS. CONTRACTOR SHALL CONFIRM THAT ALL FASTENERS SUIT LOAD AND CONDITIONS.

5.3. MISCELLANEOUS STEEL: CONTRACTOR SHALL PROVIDE FOR ALL MISCELLANEOUS STEEL IN CONTRACT. NOT ALL STRUCTURAL AND MISCELLANEOUS STEEL IS SHOWN IN ARCHITECTURAL DRAWINGS AND NOT ALL MISCELLANEOUS STEEL IS SHOWN IN STRUCTURAL DRAWINGS. SOME BUILDING COMPONENTS AND SYSTEMS INCLUDING BUT NOT LIMITED TO PLUMBING FIXTURES, MECHANICAL UNITS, LIGHT FIXTURES, GUARDRAILS, WINDOWS, SIGNAGE, TOILET PARTITIONS, SPECIAL WALL CONDITIONS, EAVE, RAKE, WINDOW & DOOR FRAMING, ETC. MAY REQUIRE MISCELLANEOUS STEEL NOT SHOWN IN THE DRAWINGS.

5.4. STEEL DETAILING: CONTRACTOR TO VERIFY LOCATIONS AND SIZES OF ALL ROOF PENETRATIONS WITH MECHANICAL, STRUCTURAL, AND ARCHITECTURAL DRAWINGS AND VERIFY THAT STRUCTURAL STEEL MEETS THE UL ASSEMBLY SPECIFIED BEFORE DETAILING STEEL.

5.5. GUARDRAIL LOAD DESIGN: ALL GUARDRAILS ARE TO BE DESIGNED TO WITHSTAND THE REQUIREMENTS STATED IN THE MOST RECENT AND APPLICABLE BUILDING CODE. SEE LIFE SAFETY REVIEW IN DRAWINGS.

5.6. HANDRAILS: UNLESS NOTED OTHERWISE, ALL HANDRAILS ARE TO BE 1-1/4" OD (WOOD AND STEEL).

5.7. METAL STUDS: ALL METAL STUDS ARE 16" O.C. UNLESS NOTED OTHERWISE, SIZES AND GAUGES ARE SHOWN ON DRAWINGS OR IN SPECIFICATIONS.

06 - WOOD & PLASTICS

6.1. WOOD STUDS: WOOD WALL STUDS SHALL BE 16" OC UNLESS NOTED OTHERWISE.

6.2. WOOD BLOCKING: PROVIDE BLOCKING AND SOLID GROUNDS FOR ALL EQUIPMENT, ACCESSORIES SUCH AS: FIXTURES, TOILET PARTITIONS, WALL MOUNTED DOOR STOPS, HARDWARE, SHELVING, CABINETS, APPLIANCES, PLUMBING FIXTURES, ETC.

6.3. BLOCK-OUTS IN STUD WALLS: COORDINATE WITH ARCHITECTURAL, MECHANICAL, ELECTRICAL, AND STRUCTURAL FOR REQUIRED ROUGH-IN DIMENSIONS. PROVIDE STUD SPACING, BLOCKS, ETC. TO SUIT VARIOUS EQUIPMENT, REGISTERS, GRILLES, ETC. TO BE BUILT-IN. FORM HEADERS TO ADEQUATELY SUIT SPANS WHERE REQUIRED.

6.4. TREATED WOOD: ALL WOOD IN CONTACT WITH EARTH, MASONRY, CONCRETE OR STEEL SHALL BE PRESSURE PRESERVATIVE TREATED (PT), SEE SPECS AND DRAWINGS.

07 - THERMAL PROTECTION

7.1. MOLD AND MILDEW PLAN: THE CONTRACTOR WILL PROVIDE A COMPLETE PHOTOGRAPHIC RECORD OF THE ENTIRE INSTALLATION PROCESS AND COMPLETED INSTALLATION OF ALL BELOW AND ABOVE GRADE WATERPROOFING SYSTEM INSTALLATION, INCLUDING BUT NOT LIMITED TO, UNDER SLAB, SUB GRADE WALLS, ABOVE GRADE WALLS, WINDOWS, DOORS, PARAPETS, ROOF, ETC. BEFORE COVERING UP WITH FINISH MATERIAL. ALL PHOTOGRAPHS SHALL BE DATE-STAMPED WITH LOCATIONS NOTED ON THE AS-BUILT SET OF DRAWINGS. PHOTOGRAPHIC COVERAGE SHALL AT LEAST INCLUDE 50% OF EACH INSTALLED WATERPROOFING SYSTEM.

7.2. WATER TESTING AND RECORDS: THE CONTRACTOR SHALL PROVIDE WATER TESTING OF THE ENTIRE BUILDING ENVELOPE WATER PROTECTION SYSTEM WHICH INCLUDES BUT IS NOT LIMITED TO UNDER SLAB, SUB GRADE WALLS, ABOVE GRADE WALLS AND WINDOWS, FLASHING, AND ROOF CONSTRUCTION, IN A TIMELY MANNER AND AS DIRECTED BY THE ARCHITECT AND CXA (WHEN APPLICABLE). ANY DEFICIENCIES DISCOVERED WILL BE CORRECGRAPHS SHALL BE DATE-STAMPED WITH LOCATIONS NOTED ON THE AS-BUILT SET OF DRAWINGS. PHOTOGRAPHIC COVERAGE SHALL AT LEAST INCLUDE 50% OF EACH INSTALLED WATERPROOFING SYSTEM. (INCLUDING REPLACING ANY DAMAGED MATERIALS) AND RETESTED PRIOR TO BEGINNING MASONRY INSTALLATION.

7.3. INSULATION AND VAPOR BARRIERS: THE CONTRACTOR IS RESPONSIBLE FOR MAINTAINING THE CONTINUITY OF THE BUILDING INSULATION AND VAPOR BARRIERS WHEN SEPARATING CONDITIONED, UNCONDITIONED, AND SEMI-CONDITIONED SPACES. UNLESS NOTED OTHERWISE CONTRACTOR SHALL PROVIDE:

- ON EXTERIOR CMU: 2" R10 RIGID INSULATION ON EXTERIOR SIDE
- ON EXTERIOR METAL OR WOOD STUDS: 6" R19 BLANKET INSULATION WITHIN STUD SPACING
- IN ATTIC: 9-1/2" R30 BLANKET INSULATION THROUGHOUT ATTIC (AT CEILING AND ROOF DECK)

7.1. ROOF PENETRATIONS: WHERE PLUMBING, MECHANICAL, ELECTRICAL DEVICES AND EQUIPMENT PENETRATE ROOF, PROVIDE FLASHING CAPS, ROOFING MASTIC AND MEMBRANES AS REQUIRED TO MAKE PENETRATIONS THOROUGHLY WATERTIGHT. USE MATERIALS COMPATIBLE WITH ROOF MATERIAL. PROTECT VENTS FROM ULTRAVIOLET LIGHT AS RECOMMENDED BY MANUFACTURER. ALL PENETRATIONS IN ROOF CONSTRUCTION TO BE PERFORMED BY A QUALIFIED ROOFING CONTRACTOR AND AS PART OF THE ROOF WARRANTY. NO PENETRATIONS ARE TO BE PERFORMED BY PLUMBERS OR OTHER NON-ROOFING SUBCONTRACTORS.

7.2. SHEET METAL WORK: ALL SHEET METAL WORK INCLUDING METAL GAUGE THICKNESS, WALL FLASHING, GUTTERS, DOWN SPOUTS, EXPANSION JOINTS, FASCIA METAL, ETC. SHALL COMPLY WITH THE STANDARDS AND RECOMMENDED PRACTICES OF THE SHEET METAL AND AIR-CONDITIONING CONTRACTORS NATIONAL ASSOCIATION. (SMACNA)

7.3. GUTTER EXPANSION JOINTS: GUTTER EXPANSION JOINTS ARE REQUIRED AT A MAXIMUM OF 50'-0."

7.4. METAL FLASHING FINISH: ALL METAL ROOF AND WALL FLASHING, EDGE STRIPS, EXTERIOR TRIM, DOWN SPOUTS, GUTTERS SHALL BE FACTORY FINISHED AND COMPATIBLE WITH SPECIFIED ROOFING SYSTEM (WHERE APPLICABLE). CONTRACTOR SHALL PROVIDE ARCHITECT WITH MANUFACTURER'S COLOR SAMPLES FOR APPROVAL.

7.5. WALL OPENING FLASHING: PROVIDE FLASHINGS ON ALL SIDES OF ALL WINDOW, DOOR AND LOUVER PENETRATIONS INCLUDING HEAD FLASHINGS AND WEEPS, JAMB FLASHINGS TO ALLOW MOISTURE TO FALL VERTICALLY TO SILL FLASHING, AND SILL FLASHINGS WITH END DAMS AND WEEPS.

7.6. CAVITY WALL FLASHING: THRU-WALL MEMBRANE FLASHING IS REQUIRED IN ALL MASONRY CAVITY WALL CONDITIONS WHERE THE WATER MUST BE DIRECTED OUT OF THE CAVITY WALL SPACE. IT IS CRITICAL THAT THE CONTRACTOR VERIFY THAT THE THRU-WALL FLASHING IS COORDINATED WITH THE OTHER TRADES SO THAT THE INTEGRITY OF THE TOTAL FLASHING SYSTEM WORKS AS DESIGNED AND THAT ALL FLASHING PIECES ARE IN THE RIGHT LOCATION TO DIRECT WATER OUT OF THE BUILDING.

7.7. UL APPROVED STANDARDS: THE CONTRACTOR AND SUBCONTRACTOR ARE TO PROVIDE THE ARCHITECT WITH A WRITTEN GUARANTEE THAT THE SPECIFIED AMOUNTS OF FIREPROOFING AND FIRESTOPPING ARE INSTALLED PROPERLY TO MEET APPLICABLE CODES AND UL APPROVED CONSTRUCTION STANDARDS.

7.8. JOINT SEALANTS: PROVIDE CAULKING AND/OR SEALANT AT ALL CRACKS AND INTERSECTIONS OF MATERIALS WHERE WEATHER-TIGHTNESS OR INSECT CONTROL IS NEEDED OR WHERE APPEARANCE IS IMPORTANT. INTENT IS A NEAT, WEATHER TIGHT, FINISHED PROJECT AT ALL LOCATIONS.

7.9. SEALANT COLORS: ALL EXTERIOR SEALANT COLOR IS TO MATCH THE MORTAR COLOR OF MASONRY CONSTRUCTION. INCLUDE A SAMPLE WITH MASONRY MOCK-UP FOR APPROVAL. ALL INTERIOR CAULK COLORS ARE TO MATCH ADJACENT PAINT OR MATERIAL COLORS OR BE PAINTABLE.

7.10. EXPANSION JOINTS: PROVIDE FOR EXPANSION JOINTS AND COVERS WHERE NEEDED IN ALL MATERIALS.

08 - DOORS & WINDOWS

8.1. THRESHOLDS: CONTRACTOR TO SET DOOR THRESHOLDS IN A FULL BED OF SEALANT.

8.2. DOOR LOCATION DIMENSIONS: ALL DOORS SHALL BE LOCATED 6" FROM THE FACE OF THE WALL IN METAL STUD/GYPSUM BOARD WALLS, 8" FROM THE FACE OF THE WALL IN CMU CONSTRUCTION, OR CENTERED ON THE WALL, UNLESS NOTED OTHERWISE ON THE DRAWINGS.

8.3. EXTERIOR LOUVERS: THE EXTERIOR LOUVERS WILL BE FACTORY PRE-FINISHED TO EXACTLY MATCH THE COLOR OF THE ADJACENT SURFACES. CONTRACTOR SHALL VERIFY THAT ALL LOUVERS PREVENT WATER FROM ENTERING THE BUILDING. A SAMPLE LOUVER COLOR WILL BE APPROVED BEFORE MANUFACTURING.

09 - FINISHES

9.1. PARTITION TYPES: WHERE CHANGES IN PARTITION TYPES COME TOGETHER ALONG A CONTINUOUS WALL, ADJUST THE STUDS TO ALLOW THE OUTERMOST FACES OF FINISH TO BE FLUSH. PARTITION TYPE TRANSITIONS SHALL BE IMPERCEPTIBLE.

9.2. CEMENTITIOUS BACKER BOARD: CEMENTITIOUS BACKER BOARD IS REQUIRED BEHIND ALL CERAMIC WALL TILE LOCATIONS.

9.3. FLOOR TRANSITIONS: AT ALL FLOORING PRODUCT TRANSITIONS, PROVIDE NECESSARY ADA COMPLIANT TRANSITION MATERIALS.

9.4. FLOOR PREP: ALL FLOORS TO BE PROPERLY PREPPED AND FLOATED AS REQUIRED AND BASED ON EXISTING OR NEW SLAB CONIDTIONS.

9.5. FLOOR PATTERNS: CONTRACTOR TO LAYOUT ALL PATTERN FLOOR AREAS AND DRY INSTALL A PORTION OF DESIGN FOR ARCHITECT'S APPROVAL BEFORE INSTALLING FLOOR.

9.6. TILE WORK: ALL FLOOR AND WALL TILE INSTALLATIONS SHALL COMPLY WITH THE STANDARDS AND RECOMMENDED PRACTICES OF THE TCA HANDBOOK FOR CERAMIC TILE INSTALLATION BY THE TILE COUNCIL OF NORTH AMERICA, INC.

9.7. STAIR FINISHES: CONTRACTOR TO VERIFY STAIR FINISH ON FINISH FLOOR PLANS, STAIR PLANS AND DETAILS, AND FINISH SCHEDULE OF ROOM THAT STAIR IS LOCATED BEFORE POURING CONCRETE TREAD. IF NO FINISH IS SHOWN OR CALLED FOR ON STAIR, THEN CONTRACTOR TO PROVIDE FINISH FOR TREADS AND LANDINGS THE SAME AS FINISH SPECIFIED IN ROOM STAIR IS LOCATED ON THE FINISH SCHEDULE. ALL EXPOSED PORTIONS OF STEEL PAN STAIRS SHALL BE PAINTED WHERE NO OTHER FINISH IS SHOWN.

9.8. CEILING GRIDS: ALL SUSPENDED CEILING GRIDS SHALL BE APPROVED BY THE ARCHITECT FOR EXACT LAYOUT BEFORE INSTALLATION. IF THE GRID IS INSTALLED WITHOUT APPROVAL, THEN THE GRID SHALL BE REMOVED AND REINSTALLED BY THE CONTRACTOR AT NO ADDITIONAL COST TO THE OWNER.

9.9. PAINT: ALL SURFACES IN THE PROJECT THAT ARE NOT PRE-FINISHED PAINTABLE IN NATURE ARE TO BE PAINTED. NOTHING SHALL BE LEFT UNPAINTED. SEE SPECIFICATIONS FOR TYPES OF PAINT TO BE USED. CONTRACTOR SHALL PUT UP AN 8'X8' SAMPLE AREA OF ALL PAINT COLORS FOR APPROVAL BEFORE ORDERING PAINT.

9.10. GRILLES: ALL GRILLES THAT ARE EXPOSED ARE TO BE THE MATCHING COLOR OF ADJACENT SURFACES UNLESS OTHERWISE NOTED. EXACT PLACEMENT OF GRILLE LOCATIONS IN THE WALLS ARE TO BE APPROVED BY THE ARCHITECT BEFORE INSTALLATION. IF GRILLES ARE INSTALLED WITHOUT APPROVAL, THEY WILL BE RELOCATED AND THE WALL PATCHED BY THE CONTRACTOR AT NO ADDITIONAL COST TO THE OWNER.

9.11. FURR-DOWN PAINT: UNLESS NOTED OR SPECIFIED OTHERWISE, ALL WALL SURFACES AT FURR DOWNS SHALL RECEIVE PAINTED FINISH TO MATCH ADJACENT WALL COLORS. VERIFY ALL FURR DOWNS WITH ARCHITECT BEFORE PROCEEDING.

9.12. CMU FINISH: ALL CMU BLOCK TO RECEIVE DRYLOK COATING AS SPECIFIED.

9.13. ACOUSTICAL BATT: INSULATE ALL INTERIOR WALLS WITH A MINIMUM OF 3-1/2" UN-FACED FIBERGLASS ACOUSTICAL BATT INSULATION FOR ACOUSTIC CONTROL.

10 - SPECIALTIES

10.1. RECESSED EQUIPMENT: VERIFY THAT ALL RECESSED EQUIPMENT SPECIFIED INCLUDING BUT NOT LIMITED TO FIRE EXTINGUISHER CABINETS, PAPER TOWEL DISPENSERS, ETC., WILL BE CONCEALED IN WALLS. ADJUST WALL THICKNESS AS REQUIRED FOR RECESSED EQUIPMENT.

10.2. BLOCKING FOR EQUIPMENT: PROVIDE BLOCKING AND SOLID GROUNDS FOR ALL EQUIPMENT AND ACCESSORIES INCLUDING BUT NOT LIMITED TO PLUMBING AND LIGHTING FIXTURES, TOILET PARTITIONS, BATHROOM ACCESSORIES, WALL-MOUNTED DOOR STOPS, HARDWARE, SHELVING, CABINETS, APPLIANCES, ETC. ALL WOOD BLOCKING IN METAL STUD PARTITIONS SHALL BE FIRE RETARDANT TREATED.

10.3. EQUIPMENT INSTALLATION: VERIFY ALL EQUIPMENT INSTALLATION CLEARANCES WITH MANUFACTURER, INCLUDING BUT NOT LIMITED TO APPLIANCES AND EQUIPMENT NOT-IN-CONTRACT BUT SHOWN IN DRAWINGS.

13 - SPECIAL CONSTRUCTION

13.1. METAL BUILDING REQUIREMENTS: ALL ROOF AND WALL EXPOSED FASTENERS TO HAVE WATERPROOF WASHERS SUPPLIED AND APPROVED BY THE METAL BUILDING MANUFACTURER.

GENERAL MEP

MEP.1 EQUIPMENT INSTALLATION: CONTRACTOR SHALL VERIFY ALL EQUIPMENT INSTALLATION CLEARANCES AND POWER REQUIREMENTS WITH MANUFACTURER AND COORDINATE ALL SUBCONTRACTORS TO KEEP THE SYSTEMS AS CLOSE TO THE UNDERSIDE OF FLOOR DECK AS POSSIBLE.

MEP.2 FURR-DOWNS / FURR-OUTS: UNLESS OTHERWISE NOTED, THE CONTRACTOR SHALL NOT FURR-OUT OR FURR-DOWN FOR ANY REASON. THE CONTRACTOR SHALL NOTIFY THE ARCHITECT IMMEDIATELY IF IS SUSPECTED THAT A PIPE, DUCT, CONDUIT, OR ANY OTHER MECHANICAL, ELECTRICAL OR PLUMBING DEVICE WILL NOT REMAIN CONCEALED UNDER A FLUSH CONDITION. RE; REFLECTED CEILING PLANS FOR THE LAYOUT OF APPROVED FURR-DOWNS.

MEP.3 DEVICE CONTROLLER LOCATIONS: THE COLORS AND PLACEMENT OF ALL VISIBLE DEVICE CONTROLLERS FOR MECHANICAL, ELECTRICAL, A/V, COMMUNICATIONS, AND OTHER RELATED EQUIPMENT SHALL BE COORDINATED AND APPROVED BY THE ARCHITECT PRIOR TO INSTALLATION TO ENSURE A COHESIVE AND ORGANIZED RESULT. ALL DEVICE CONTROLLERS SHALL MATCH IN MOUNTING HEIGHT ABOVE FINISHED FLOOR AND IN COLOR.

MEP.4 EXPOSED MECHANICAL/ELECTRICAL FIXTURE MOUNTING HEIGHTS: REFER TO ARCHITECTURAL REFLECTED CEILING PLANS AND INTERIOR ELEVATIONS FOR MOUNTING LOCATIONS AND HEIGHTS OF ALL LIGHT FIXTURES AND CEILING FANS AND MECHANICAL DUCTS, DIFFUSERS, ETC. IF MOUNTING HEIGHTS ARE NOT SHOWN, OR DIFFER FROM THE ENGINEERING DRAWINGS, CONSULT THE ARCHITECT.

MEP.5 SPRINKLER SYSTEM SHOP DRAWINGS: THE CONTRACTOR MUST SUBMIT A SPRINKLER SYSTEM LAYOUT WITH THE SPRINKLER SYSTEM SUBMITTAL FOR REVIEW BY THE ARCHITECT. THIS LAYOUT DRAWING MUST BE TO A MIN. OF 1/8=1' SCALE. THE DRAWING MUST INCLUDE CEILING MATERIALS, LIGHT FIXTURES, HVAC DIFFUSERS AND RETURNS, SMOKE DETECTORS, ETC.

MEP.6 SPRINKLER SYSTEM: THE BUILDING FIRE PROTECTION SPRINKLER SYSTEM IS TO BE INSTALLED ABOVE CEILINGS UNLESS NOTED OTHERWISE ON RCP'S. SPRINKLER HEADS SHALL BE CENTERED IN CEILING TILES OR GYPSUM BOARD CEILINGS. WHERE HEADS ARE NOT CENTERED OR OUT OF ALIGNMENT, THEY SHALL BE REINSTALLED AND ALL SURROUNDING FINISHES REPAIRED WHERE FORMER HOLE WAS LOCATED. FIRE SPRINKLER SUBCONTRACTOR SHALL BE PREPARED TO MODIFICATIONS TO THREADED PIPE IN THE FIELD AS REQUIRED TO ENSURE PROPER LOCATION OF HEADS. (WHERE CEILINGS ARE NOT IN CONTRACT (IE, SHELLED SPACES), THE FUTURE CEILING HEIGHTS ARE SHOWN ON THE RCP'S. NOTE THAT IN SUCH CASE, CONTRACTOR MUST TAKE INTO ACCOUNT OTHER SYSTEMS TO BE INSTALLED IN FUTURE SPACE AND COORDINATE PLACEMENT OF FIRE SPRINKLER ACCORDINGLY).

MEP.7 FLOOR DRAINS: WHERE FLOOR DRAINS ARE PRESENT, FLOORS SHALL SLOPE AT A MINIMUM OF 1/8" PER FOOT TO THE DRAIN AND DRAINS SHALL BE LOCATED AT THE LOWEST POINT OF THE AREA WHICH THE DRAIN SERVES.

MEP.8 LIGHT FIXTURES: STEM LENGTH OF ALL PENDANT LIGHT FIXTURES SHALL BE APPROVED BY THE ARCHITECT. CONTRACTOR SHALL INSTALL A SAMPLE FIXTURE FOR APPROVAL, MAKING ADJUSTMENTS TO THE LENGTH AS REQUIRED.

31 - EARTHWORK

31.1. SITE TRENCHING: FOR ALL TRENCHING WORK, CONTRACTOR SHALL REPLACE ALL DISTRIBUTED GROUND WITH NEW FILL AND SOD; REPLACE ALL CUT, BROKEN, REMOVED, DISTURBED ASPHALT PAVING, CONCRETE CURBS AND CONCRETE SIDEWALKS WITH NEW IN-KIND MATERIALS TO MATCH ORIGINAL DESIGN. USE APPROVED BACKFILL UNDER ALL ITEMS AS SPECIFIED. CUT ALL SIDEWALKS AT EXISTING CONTROL JOINTS ONLY. IF EXISTING UTILITIES, ARE ENCOUNTERED, PATCH ANY DISTURBED LINES.

31.2. TEMPORARY SHORING. PROVIDE SHORING AS NEEDED FOR EXCAVATION FOOTINGS, MECHANICAL & ELECTRICAL WORK AS DIRECTED BY THE CIVIL, STRUCTURAL DRAWINGS, AND REQUIRED BY CODE AND OSHA REQUIREMENTS.

31.3. SILT AND SOIL EROSION CONTROL: THE CONTRACTOR MUST CONTROL EROSION FROM SITE DURING CONSTRUCTION OF THE PROJECT AS REQUIRED IN THE SPECIFICATIONS.

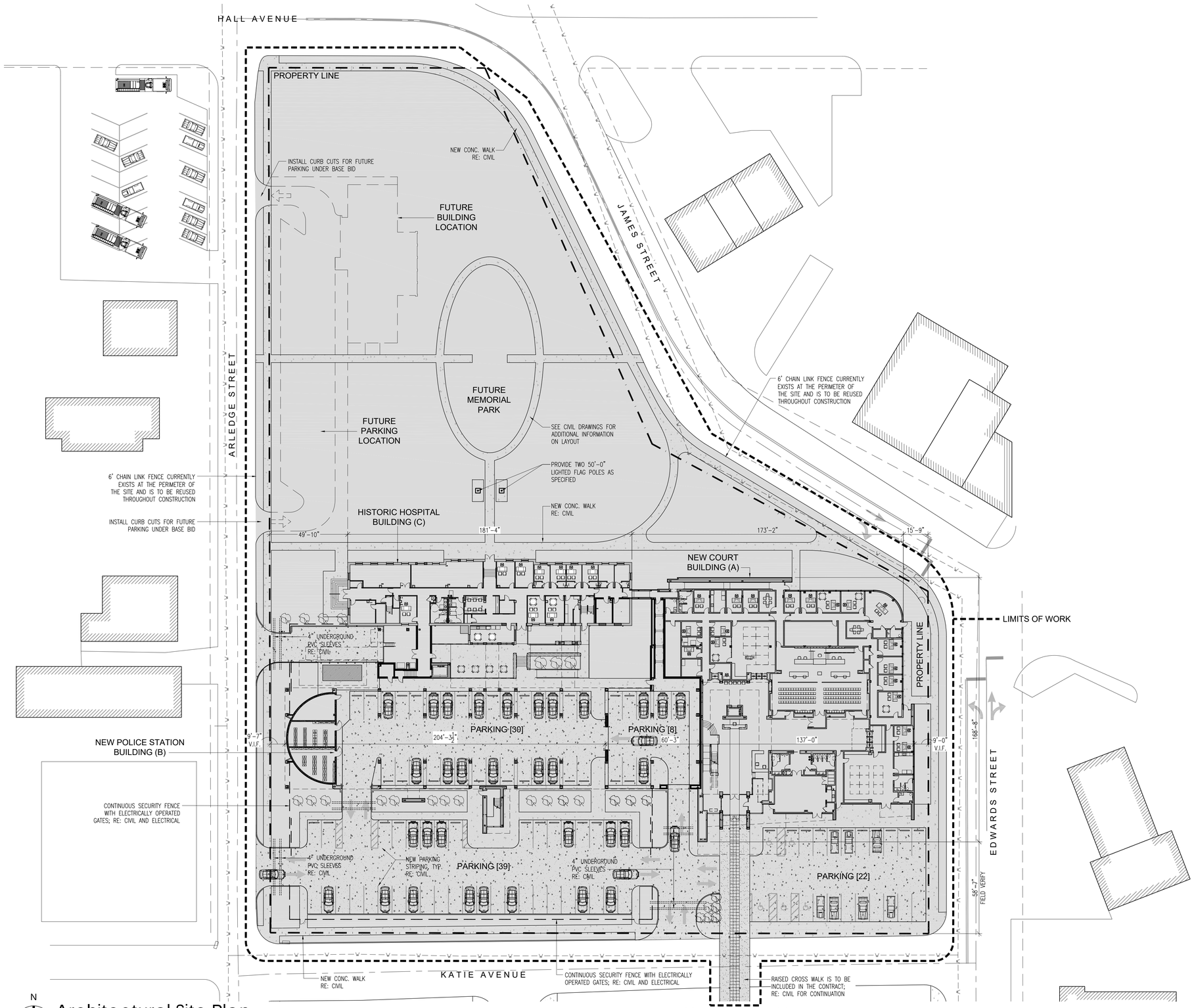
32 - EXTERIOR IMPROVEMENTS

32.1. CONCRETE PAVEMENT SLOPES: SLOPE ALL CONCRETE PARKING LOT PAVEMENT A MIN. OF 1% IN DIRECTION OF WATER RUN-OFF AND SLOPE ALL CONCRETE PORCHES, SLABS, & SIDEWALKS AWAY FROM BUILDING 1/4" PER FOOT TO INSURE POSITIVE DRAINAGE. CONTRACTOR IS RESPONSIBLE FOR MAINTAINING POSITIVE RUN-OFF AWAY FROM THE BUILDING AND THE ELIMINATION OF STANDING WATER ON THE PARKING LOT AND SITE. ANY CONCRETE, PAVED, OR FINISHED PAVER SURFACES THAT POND WATER SHALL BE REMOVED AND TOTALLY REWORKED TO PROVIDE A NON-PONDING FINISHED RESULT.

32.2. FINISH GRADING: SEE CIVIL DRAWINGS FOR ALL FINISH GRADES AROUND THE BUILDING. FINISH GRADES SHALL NEVER BE ABOVE THE FINISH FLOOR ELEVATION (FFE) AND SHALL SLOPE AWAY FROM BUILDING ON ALL SIDES. THE FINISH GRADE SHALL BE A MINIMUM OF 1/2" BELOW THE FFE AT ALL DOORS. ALL DOOR THRESHOLDS SHALL MEET THE ADA.

32.3. TERMITE PROTECTION: PROVIDE TERMITE TREATMENT, WITH CERTIFICATE TO OWNER; SEE SPECS. PROVIDE A FIVE-YEAR WARRANTY.

32.4. SLEEVES FOR FUTURE. THE GENERAL CONTRACTOR SHALL PRO



Architectural Site Plan

SCALE: 1" = 30'-0"

PARKING SUMMARY:

94 PARKING SPACES
5 HC PARKING SPACES
99 TOTAL PARKING SPACES

LEGEND:

- NEW FINISHED CONCRETE PAVING RE: CIVIL
- NEW CONCRETE PAVING RE: CIVIL
- NEW STAMPED CONCRETE PAVING RE: CIVIL
- NEW SOLID SOD RE: CIVIL
- PROPERTY LINE RE: CIVIL
- CONSTRUCTION LIMITS OF WORK

SITE PLAN NOTES:

1. SEE CIVIL DRAWINGS FOR LOCATIONS OF CURB AND GUTTERS.
2. SEE CIVIL DRAWINGS FOR NEW GRADING AND SITE UTILITIES.
3. SEE CIVIL DRAWINGS FOR SIDEWALK AND ASPHALT ROADWAY LAYOUTS AND DETAILS.
4. NOTE: ALL DOWNSPOUTS ARE TO BE TIED UNDERGROUND TO STORM SEWER LOCATIONS SHOWN ON THE CIVIL PLANS; SEE CIVIL DRAWINGS.
5. ALL LANDSCAPING WILL BE PROVIDED BY THE OWNER AND IS NOT INCLUDED IN CONTRACT (EXCEPT SODDING ON DISTURBED AREAS AS REQUIRED BY GENERAL NOTES); ALL LANDSCAPING INSTALLED BY OWNER WILL FOLLOW CITY OF HATTIESBURG REQUIREMENTS AT SITE PLAN REVIEW.
6. SEE CIVIL DRAWINGS FOR LAYOUT OF MEMORIAL PARK.

CITY OF HATTIESBURG MISSISSIPPI 1884

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

Drawing Issued:

Date	Rev.	Description
08-31-2015		DD Check Set
10-20-2015		75% Progress Set
11-02-2015		90% Pricing Set
11-19-2018		100% Bid Docs

Drawn By: CR,CP,AS,RB
Checked By: CR,LA,CP
Client No: -------
Albert & Associates: 12575

REGISTERED ARCHITECT Larry A. Albert Hattiesburg, MS STATE OF MISSISSIPPI

A0.1

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ARCHITECTURAL SITE PLAN

SHADED AREA IS INCLUDED IN THE BASE BID

KATIE AVENUE

ARLEDGE STREET

EDWARDS STREET

EXISTING BUILDING TO REMAIN

FUTURE CSI BUILDING NOT INCLUDED IN ADDITIVE ALTERNATE #2

FUTURE FLEET MAINTENANCE BUILDING NOT INCLUDED IN ADDITIVE ALTERNATE #2

SECURITY FENCING; RE: CIVIL

SECURITY FENCING SHALL BE PART OF ADDITIVE ALTERNATE #2

RAISED CROSS WALK IS TO BE INCLUDED IN THE CONTRACT

ADDITIVE ALTERNATE #1

ADDITIVE ALTERNATE #2

ADDITIVE ALTERNATE #2

ADDITIVE ALTERNATE #2

ADDITIVE ALTERNATE #2 ADDS ALL LABOR AND MATERIALS REQUIRED FOR CONSTRUCTION OF VEHICULAR MAINTENANCE AREA ON THE SOUTH SIDE OF KATIE AVENUE. THIS INCLUDES BUT IS NOT LIMITED TO PAVING, CURBS, WALKWAYS, STRIPING, AND SECURITY FENCING. THIS DOES NOT INCLUDE CONSTRUCTION OF THE CSI BUILDING NOR THE FLEET MAINTENANCE BUILDING. SEE CIVIL DRAWINGS FOR ADDITIONAL INFORMATION REGARDING LAYOUT.

THE SECTION OF SECURITY FENCING SHOWN WITHIN THE BOUNDARY OF ADDITIVE ALTERNATE #1 SHALL BE PART OF ADDITIVE ALTERNATE #2.

Additive Alternate #1

ADDITIVE ALTERNATE #1 ADDS ALL LABOR AND MATERIALS REQUIRED FOR CONSTRUCTION OF THE ENTIRE SCOPE OF WORK FOR THE PUBLIC PARKING LOT ON THE SOUTH SIDE OF KATIE AVENUE. THIS INCLUDES BUT IS NOT LIMITED TO PAVING, CURBS, WALKWAYS, AND STRIPING. SEE CIVIL DRAWINGS FOR ADDITIONAL INFORMATION REGARDING LAYOUT.

THE SECTION OF SECURITY FENCING SHOWN WITHIN THE BOUNDARY OF ADDITIVE ALTERNATE #1 SHALL BE PART OF ADDITIVE ALTERNATE #2.

N

Architectural Site Plan

SCALE: 1" = 30'-0"

LEGEND:

- NEW FINISHED CONCRETE PAVING RE: CIVIL
- NEW CONCRETE PAVING RE: CIVIL
- NEW STAMPED CONCRETE PAVING RE: CIVIL
- NEW SOLID SOD RE: CIVIL
- PROPERTY LINE RE: CIVIL
- CONSTRUCTION LIMITS OF WORK

SITE PLAN NOTES:

1. SEE CIVIL DRAWINGS FOR LOCATIONS OF CURB AND GUTTERS.

2. SEE CIVIL DRAWINGS FOR NEW GRADING AND SITE UTILITIES.

3. SEE CIVIL DRAWINGS FOR SIDEWALK AND ASPHALT ROADWAY LAYOUTS AND DETAILS.

4. NOTE: ALL DOWNSPOUTS ARE TO BE TIED UNDERGROUND TO STORM SEWER LOCATIONS SHOWN ON THE CIVIL PLANS; SEE CIVIL DRAWINGS.

5. ALL LANDSCAPING WILL BE PROVIDED BY THE OWNER AND IS NOT INCLUDED IN CONTRACT (EXCEPT SODDING ON DISTURBED AREAS AS REQUIRED BY GENERAL NOTES); ALL LANDSCAPING INSTALLED BY OWNER WILL FOLLOW CITY OF HATTIESBURG REQUIREMENTS AT SITE PLAN REVIEW.

6. SEE CIVIL DRAWINGS FOR LAYOUT OF MEMORIAL PARK.

CITY OF HATTIESBURG MISSISSIPPI 1884

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

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Checked By: CR,LA,CP

Client No: -------

Albert & Associates: 12575

REGISTERED ARCHITECT Larry M Albert Hattiesburg, MS STATE OF MISSISSIPPI

A0.2

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ARCHITECTURAL SITE PLAN

2012 INTERNATIONAL BUILDING CODE

OCCUPANCY: Mixed Occupancy - Assembly (A-3), Business (B), Institutional (I-3, CONDITION 5), Storage (S-1,S-2)

Construction type selected to meet the requirements of each of the included occupancies based on separated and non-separated occupancy requirements. Egress designed for most restrictive separated occupancy found within a given story. At first floor, A-3 and S-2 are greater than 10% of total floor area, and I-3 and S-1 are less than 10% of total floor area. At second floor, S-1 is greater than 10% of total floor area. At third floor, S-1 is less than 10% of total floor area.

PHYSICAL PROPERTIES

BUILDING (A) AND (B) (NEW CONSTRUCTION)
Area (Conditioned):
- First Floor: 22,000 SF
- Second Floor: 24,200 SF
- Third Floor: 21,000 SF
- Total: 67,200 SF (Conditioned)

Area (Unconditioned):
- Parking Garage: 18,000 SF
- Mech. Penthouse: 4,200 SF
- Total: 22,200 SF
- Total Building: 89,400 SF

Grade Elevation: 156'
Floor Elevation: 156.25'
Building Height: 59'
Building Stories: 3
Separation: >30 FT at all sides - unlimited openings
Type of Construction: Type II-B (T601) (Non-combustible Materials - Sprinkled).

BUILDING (C) (EXISTING CONSTRUCTION)
Area:
- First floor: 7,800 SF
- Second floor: 7,800 SF
- Third floor: 7,800 SF
- Elevator Penthouse: 580 SF
- Total area: 23,980 SF

Grade Elevation: 156'
Floor Elevation: 161.25'
Building Height: 49'
Building Stories: 3
Separation: >30 FT at all sides - unlimited openings
Type of Construction: Type II-B (T601) (Non-combustible Materials - Sprinkled).

TOTAL AREA OF COMBINED BUILDINGS:
- First Floor: 47,800 GSF
- Second Floor: 32,000 GSF
- Third Floor: 28,800 GSF
- Penthouses: 4,780 GSF
- Total Project: 113,380 GSF

AREA & HEIGHT LIMITATIONS:

BUSINESS (B)
Max Height - 55 FT / Max # of Stories - 3 / Max Building Area - 23,000 SF/FLOOR (T503)
BUILDING HEIGHT MODIFICATIONS (504.2)
With sprinkler, max building height increased by 20 FT and max number of stories increased by 1.
AREA MODIFICATIONS (506.1)
Frontage: Area increase due to frontage is 75% (506.2)
$I_f = [F/P - 0.25]W/30$
$I_f = [1,171/1,171 - 0.25]30/30$
$I_f = .75$
Sprinkler: Area increase due to sprinkler is 200% (506.3)
$I_s = 2$
Allowable Building Area Per Floor:
$A_a = \{A_t + [A_t \times I_f] + [A_t \times I_s]\}$
$A_a = \{23,000 + [23,000 \times .75] + [23,000 \times 2]$
$A_a = 86,250$
ADJUSTED MAX HEIGHT: 75 FT
ADJUSTED MAX # OF STORIES: 4 STORIES
ADJUSTED MAX BUILDING AREA: 86,250 SF/FLOOR

ASSEMBLY (A-3)
Max Height - 55 FT / Max # of Stories - 2 / Max Building Area - 9,500 SF/FLOOR (T503)
BUILDING HEIGHT MODIFICATIONS (504.2)
With sprinkler, max building height increased by 20 FT and max number of stories increased by 1.
AREA MODIFICATIONS (506.1)
Frontage: Area increase due to frontage is 75% (506.2)
$I_f = [F/P - 0.25]W/30$
$I_f = [1,171/1,171 - 0.25]30/30$
$I_f = .75$
Sprinkler: Area increase due to sprinkler is 200% (506.3)
$I_s = 2$
Allowable Building Area Per Floor:
$A_a = \{A_t + [A_t \times I_f] + [A_t \times I_s]\}$
$A_a = \{9,500 + [9,500 \times .75] + [9,500 \times 2]$
$A_a = 35,625$
ADJUSTED MAX HEIGHT: 75 FT
ADJUSTED MAX # OF STORIES: 3 STORIES
ADJUSTED MAX BUILDING AREA: 35,625 SF/FLOOR

STORAGE (S-1)
Max Height - 55 FT / Max # of Stories - 2 / Max Building Area - 17,500 SF/FLOOR (T503)
BUILDING HEIGHT MODIFICATIONS (504.2)
With sprinkler, max building height increased by 20 FT and max number of stories increased by 1.
AREA MODIFICATIONS (506.1)
Frontage: Area increase due to frontage is 75% (506.2)
$I_f = [F/P - 0.25]W/30$
$I_f = [1,171/1,171 - 0.25]30/30$
$I_f = .75$
Sprinkler: Area increase due to sprinkler is 200% (506.3)
$I_s = 2$
Allowable Building Area Per Floor:
$A_a = \{A_t + [A_t \times I_f] + [A_t \times I_s]\}$
$A_a = \{17,500 + [17,500 \times .75] + [17,500 \times 2]$
$A_a = 65,625$
ADJUSTED MAX HEIGHT: 75 FT
ADJUSTED MAX # OF STORIES: 3 STORIES
ADJUSTED MAX BUILDING AREA: 65,625 SF/FLOOR

STORAGE (S-2)
Max Height - 55 FT / Max # of Stories - 3 / Max Building Area - 26,000 SF/FLOOR (T503)
BUILDING HEIGHT MODIFICATIONS (504.2)
With sprinkler, max building height increased by 20 FT and max number of stories increased by 1.
AREA MODIFICATIONS (506.1)
Frontage: Area increase due to frontage is 75% (506.2)
$I_f = [F/P - 0.25]W/30$
$I_f = [1,171/1,171 - 0.25]30/30$
$I_f = .75$
Sprinkler: Area increase due to sprinkler is 200% (506.3)
$I_s = 2$
Allowable building area Per Floor:
$A_a = \{A_t + [A_t \times I_f] + [A_t \times I_s]\}$
$A_a = \{26,000 + [26,000 \times .75] + [26,000 \times 2]$
$A_a = 97,500$
ADJUSTED MAX HEIGHT: 75 FT
ADJUSTED MAX # OF STORIES: 4 STORIES
ADJUSTED MAX BUILDING AREA: 97,500 SF/FLOOR

ALLOWABLE BUILDING AREA FOR SEPARATED OCCUPANCIES (508.4.2):
First Story: 3,883/35,625 (A-3) + 16,202/86,250 (B) + 16,220/97,500 (S-2) = 0.48
I-3 and S-1 are each less than 10% of aggregate floor area of story and therefore are accessory occupancies.
Second Story: S-1 is greater than 10% of story. No separation required between Group B and Group S-1. Area and Height limitations are based on most restrictive group (S-1).
Third Story: S-1 is less than 10% of aggregate floor area of story and therefore is an accessory occupancy.

SPECIAL DETAILED REQUIREMENTS BASED ON USE AND OCCUPANCY

ATRIUMS: The atrium floor area is permitted to be used for any approved use with an automatic sprinkler system (404.2, Exception). Automatic sprinkler system required throughout the entire building (404.3). Fire alarm system required (404.4). Smoke control system required (404.5). 1-hour fire barrier is provided at atrium enclosures (404.6), or a glass wall forming a smoke partition is provided as follows: automatic sprinklers provided along both sides of the separation wall and doors, sprinkler heads are located between 4" and 12" away from the glass and at maximum intervals of 6 feet, the sprinkler system wets the entire surface of the glass upon activation, the framing system is gasketed to allow deflection of the glass without breaking before the sprinkler system activates, and doors close automatically (404.6, Exception). A fire barrier is not required between the atrium and the adjoining spaces of any three floors of the atrium provided such spaces are accounted for in the design of the smoke control system. The interior finish of walls and ceilings of the atrium shall be not less than Class B (404.8). Other than the lowest level of the atrium, where the required means of egress is through the atrium space, the portion of exit access travel distance within the atrium space shall be not greater than 200 feet (404.9).

STAGES: Permanent platforms shall be constructed of materials as required for the type of construction of the building in which the permanent platform is located (410.4).

GROUP I-3: Exits are permitted to discharge into a fenced or walled courtyard; enclosed yards or courts shall be of a size to accommodate all occupants, be located not less than 50 feet from the building and have an area of not less than 15 square feet per person (408.3.6). A sallyport shall be permitted in a means of egress where there are provisions for continuous and unobstructed passage through the sallyport during an emergency egress condition (408.3.7). Doors from a refuge area to the outside are permitted to be locked with a key; the keys to unlock the exterior doors shall be available at all times and the locks shall be operable from both sides of the door (408.4). Remote release of locks on doors in a means of egress shall be provided with reliable means of operation to release locks on all required doors (408.4.1). Power-operated doors or locks shall be operable by a manual release mechanism at the door, and either emergency power or a remote mechanical operating release shall be provided (408.4.2). Remote release doors or locks shall be provided with a mechanically operated release mechanism at each door, or shall be provided with a redundant remote release control (408.4.3). Doors remotely unlocked under emergency conditions shall not automatically relock when closed unless specific action is taken at the remote location to enable doors to relock (408.4.4). Security glazing permitted where the following conditions are met: Individual panels of glazing shall not exceed 1,296 square inches, the glazing shall be protected on both sides by an automatic sprinkler system, the framing system is gasketed to allow deflection of the glass without breaking before the sprinkler system activates, obstructions shall not be installed between the automatic sprinklers and the glazing (408.7). For the purposes of this section, a windowless building or portion of a building is one with non-openable windows, windows not readily breakable, or without windows; windowless buildings shall be provided with an engineered smoke control system to provide a tenable environment for exiting from the smoke compartment in the area of fire origin (408.9). A fire alarm system shall be provided (408.10). Group I-3 occupancies shall be equipped throughout with a sprinkler system (408.11).

GENERAL BUILDING HEIGHTS AND AREAS

BUILDINGS ON THE SAME LOT: Buildings are considered to be portions of one building as the building height of each building and the aggregate building area of the buildings are within the limitations (503.1.2).

MIXED USE AND OCCUPANCY: Each portion of a building shall be individually classified in accordance with Section 302.1. Where a building contains more than one occupancy group, the building or portion thereof shall comply with Section 508.2 (Accessory Occupancies), 508.3 (Nonseparated Occupancies), 508.4 (Separated Occupancies), or a combination of these sections (508.1).

ACCESSORY OCCUPANCIES: Accessory occupancies are ancillary to the main occupancy of the building or portion thereof (508.2). 10% of the building area of story max (508.2.1). Shall be individually classified in accordance with Section 302.1 (508.1.2). No separation is required between accessory occupancies and the main occupancy (508.2.4).

NONSEPARATED OCCUPANCIES: Nonseparated occupancies shall be individually classified in accordance with Section 302.1. The requirements of this code shall apply to each portion of the building based on the occupancy classification of that space. In addition, the most restrictive provisions of Chapter 9 which apply to the nonseparated occupancies shall apply to the total nonseparated occupancy area (508.3.1). The allowable building area and height of the building or portion thereof shall be based on the most restrictive allowances for the occupancy groups under consideration for the type of construction of the building in accordance with Section 503.1 (508.3.2). No separation is required between nonseparated occupancies (508.3.3).

SEPARATED OCCUPANCIES: Separated occupancies shall be individually classified in accordance with Section 302.1. Each separated space shall comply with this code based on the occupancy classification of that portion of the building (508.4.1). In each story, the building area shall be such that the sum of the ratios of the actual building area of each separated occupancy divided by the allowable building area of each separated occupancy shall not exceed 1 (508.4.2). Each separated occupancy shall comply with the building height limitations based on the type of construction of the building in accordance with Section 503.1 (508.4.3).

REQUIRED SEPARATION OF OCCUPANCIES (T508.4)
- Group A to Group B - 1 Hour with sprinkler
- Group A to Group S-2 - No separation required
- Group I-3 to Group B - 1 Hour with sprinkler
- Group S-1 to Group B - No separation required
- Group S-2 to Group B - 1 Hour with sprinkler
- Group S-2 to Group S-1 - 1 Hour with sprinkler

INCIDENTAL OCCUPANCIES: Incidental uses are ancillary functions associated with a given occupancy that generally pose a greater level of risk to that occupancy and are limited to those uses listed in Table 509 (509.1). Incidental uses shall not be individually classified in accordance with Section 302.1, and shall be included in the building occupancies within which they are located (509.2). Incidental uses shall not occupy more than 10 percent of the building area of the story in which they are located (509.3). The incidental uses listed in Table 509 shall be separated from the remainder of the building or equipped with an automatic sprinkler system, or both, in accordance with the provisions of that table (509.4).

OPEN PARKING GARAGE BENEATH GROUP B: Open parking garages constructed under Groups B shall not exceed the height and area limitations permitted under Section 406.5. The height and area of the portion of the building above the open parking garage shall not exceed the limitations in Section 503 for the upper occupancy. The height, in both feet and stories, of the portion of the building above the open parking garage shall be measured from grade plane and shall include both the open parking garage and the portion of the building above the parking garage (510.7). 1-hour fire barriers and horizontal assemblies required between the parking occupancy and adjacent/upper Group B and Group S-1 occupancies per Table 508.4. Means of egress for the upper occupancy shall conform to Chapter 10 and shall be separated from the parking occupancy by fire barriers or horizontal assemblies having not less than a 2-hour fire-resistance rating with self-closing doors (510.7.1).

OPEN PARKING GARAGES: Open parking garages shall be of Type I, II or IV construction. Open parking garages shall meet the design requirements of Chapter 16 (406.5.1). For natural ventilation purposes, the exterior side of the structure shall have uniformly distributed openings on two or more sides. The area of such openings in exterior walls on a tier shall be not less than 20 percent of the total perimeter wall area of each tier. The aggregate length of the openings considered to be providing natural ventilation shall be not less than 40 percent of the perimeter of the tier [Exception: Openings are not required to be distributed over 40 percent of the building perimeter where the required openings are uniformly distributed over two opposing sides of the building] (406.5.2). Area and height of open parking garages shall be limited as set forth in Chapter 5 for Group S-2 occupancies and as further provided for in Section 508.1 (406.5.4).

TYPE OF CONSTRUCTION

TYPE II. Type II construction is that type of construction in which the building elements listed in Table 601 are of noncombustible materials. (602.2)

FIRE RESISTANCE RATING REQUIREMENTS FOR TYPE II-B (T601)
- Primary Structural Frame: 0-hour
- Exterior Bearing Walls: 0-hour
- Interior Bearing Walls: 0-hour
- Non-bearing Exterior Partitions: 0-hour (T602 - separation greater than 30 ft)
- Non-bearing Interior Partitions: 0-hour (Not less than fire-resistance rating required by other sections of this code)
- Floor Construction: 0-hour
- Roof Construction: 0-hour

FIRE AND SMOKE PROTECTION FEATURES

SHAFT ENCLOSURES: 2-hour fire-resistance rating where connecting four stories or more; not less than 1-hour fire-resistance rating where less than four stories (713.4). Enclosed elevator lobbies are not required where the building is protected by an automatic sprinkler system (713.14.1, Exception 4).

OPENING PROTECTIVES: Fire Walls and Fire Barriers: 2-hour wall - 90 minute door; 1½-hour wall - 90 minute door; 1-hour wall - 45 minute door. Exit Passage or Exit Shaft: 2-hour wall - 90 minute door; 1-hour wall - 60 minute door (T716.5).

INTERIOR FINISHES

INTERIOR WALL/CEILING FINISHES: Selected for most restrictive group (A-3) - Vertical Exits - B Minimum.; Exit Access - B minimum; Rooms - C minimum (T803.9).

FIRE PROTECTION SYSTEMS

FIRE SPRINKLER SYSTEM: An automatic sprinkler system is required in this building for most restrictive group [A-3] (903.2.1.3). Automatic sprinkler system to be installed in accordance with NFPA 13 (903.3.1.1).

PORTABLE FIRE EXTINGUISHERS: Portable fire extinguishers are to be installed in Groups A, B, I, and S occupancies, within 30 feet of commercial cooking equipment, and in computer and generator rooms (906.1). Portable fire extinguishers selected and installed in accordance with NFPA 10 (906.2). Minimum rated single extinguisher - 2-A; maximum floor area per unit of A - 3,000 SF; maximum floor area for extinguisher - 11,250 SF; maximum travel distance to extinguisher - 75 feet (T906.3(1)).

FIRE ALARM SYSTEM: Fire alarm system is required in this building for most restrictive group [B] (907.2.1).

MEANS OF EGRESS

GENERAL MEANS OF EGRESS: Minimum ceiling height - 7'-6" (1003.2). Provide 27" maximum high barrier where vertical clearance is less than 80" (1003.3.1). Handrails may protrude 4½" into clearance (1003.3.3, Exception). Floor surface shall be slip resistant (1003.4). Any change in elevation less than 12" must be a sloped walking surface/ramp; 6" or less must have either contrasting floor finishes or handrails (1003.5). Path of egress travel must be continuous (1003.6).

OCCUPANT LOADS: Posting of occupant load required for every room that is an assembly occupancy (1004.3). Where multiple occupancies, egress components shall meet the more stringent requirements of all occupancies that are served (1004.6).

MAXIMUM FLOOR AREA ALLOWANCES PER OCCUPANT (T1004.1.2)
- Accessory Storage/Mechanical: 300 gross
- Assembly - Standing: 5 net
- Assembly - Chairs: 7 net
- Assembly - Chairs and Tables: 15 net
- Business: 100 gross
- Courtrooms: 40 net
- Dormitories: 50 gross
- Classroom Area: 20 net
- Exercise Room: 50 gross
- Commercial Kitchens: 200 gross
- Parking Garages: 200 gross
- Stages/Platforms: 15 net

MEANS OF EGRESS SIZING: .2"/person for stairs (1005.3.1, Exception). .15"/person for other egress components (1005.3.2, Exception). Door encroachment is to be max of 7" when fully opened (1005.7.1).

ACCESSIBLE MEANS OF EGRESS: Two accessible means of egress required (1007.1 & 1015). 48" clear between handrails at stairways not required with automatic sprinkler system (1007.3, Exception #1). Areas of refuge not required with automatic sprinkler system (1007.3, Exception #2). Elevators complying with Section 2.27 of ASME A17.1 and having standby power in accordance with Chapter 27 and Section 3003 allowed to be part of an accessible means of egress (1007.4).

DOORS: Means of egress doors must provide clear opening of 32" (1008.1.1). Doors swing in the direction of egress travel for rooms having 50 or more occupants (1008.1.2). In Group I-3, means of egress doors for spaces occupied by persons whose movements are controlled for security reasons shall be permitted to be locked when equipped with egress control devices which shall unlock manually and by either activation of an automatic sprinkler system, activation of an manual alarm box, or a signal from a constantly attended location (1008.1.9.10).

STAIRWAYS: Exit access stairways within an atrium are not required to be enclosed (1009.3, Exception #5). Minimum stairway width is 44" (1009.4). Minimum head room is 80" (1009.5). Maximum riser height is 7"; minimum tread depth is 11" (1009.7.2). Stair treads and risers shall be of uniform size and shape (1009.7.4). No water accumulation on outdoor egress stairways (1009.9.2). A flight of stairs shall not have a vertical rise greater than 12 feet between floors/landings (1009.10). Stairs shall have handrails on each side (1009.15). Stairway shall extend to the roof surface with four or more stories (1009.16).

RAMPS: Maximum vertical rise for any ramp is 30" (1010.5). Minimum width between handrails is 36" (1010.6.1). Minimum head room is 80" (1010.6.2). Landing width shall be equal to ramp width minimum (1010.7.2). Landing length is 5 feet minimum (1010.7.3). 60"x60" minimum at change in direction (1010.7.4). Handrails required on each side if rise is greater than 6" (1010.9). A curb, rail, wall, or barrier shall be provided as edge protection (1010.10.1). Guards provided by Section 1013 (1010.11).

HANDRAILS: Handrail height is 34-38 inches (1012.2). Handrail diameter is 1 ¼" minimum and 2" maximum (1012.3.1). Handrail gripping surface to be continuous (1012.4). Handrail to extend 12" beyond top riser and continue for one tread depth beyond bottom riser; handrails to extend minimum of 12" beyond top and bottom of ramp runs (1012.6).

GUARDS: Required at open-sided walking surfaces 30" or greater above the floor or grade below at any point within 36" of edge (1013.2). 42" minimum in height (1013.3). Openings shall not allow the passage of a 4" diameter sphere (1013.4); 4 ⅜" between 36" and 42" (1013.4, Exception #1); 6" at triangular openings between stair and guardrail (1013.4, Exception #2).

EXIT ACCESS: Egress not allowed through intervening rooms unless they are accessory to space (1014.2). Common path of travel is 75 feet for Group A; 100 feet for Group B (T1014.3).

EXIT ACCESS DOORWAYS: One exit allowed from rooms or 49 occupants or less (T1015.1). Diagonal rule for exit location is reduced to 1/3 from 1/2 because of sprinkler system where two exits are required (1015.2.1, Exception #2).

EXIT ACCESS TRAVEL: Maximum exit access travel distance is 250 feet for Group A with sprinkler; 300 feet for Group B (T1016.2).

CORRIDORS: 0-hour corridor fire rating required (T1018.1). Minimum corridor width is 44" (T1018.2). Max dead end corridor length is 20 feet in Group A; 50 feet in Group B with sprinkler; length shall not be limited where length is less than 2.5 times the width (1018.4). Foyers, lobbies, and reception rooms may intervene in corridor exit access (1018.6).

NUMBER OF EXITS AND EXIT CONFIGURATION: Minimum number of exits: 50-500 = 2; 501-1000 = 3; greater than 1000 = 4 (T1021.2 & 1021.2.4).

EGRESS BALCONIES: Egress balconies have same requirements as corridors for width, headroom, projections, dead ends, and min snow/ice coverage (1019). Exterior egress balconies shall be separated from interior with same requirements as corridors (0-hour) (1019.2). 50% openness required (1019.3). Exterior egress balconies shall have 10 feet minimum separation from lot line or adjacent unprotected buildings in accordance with Section 705 (1019.4).

INTERIOR EXIT STAIRWAYS AND RAMPS: Shall lead directly to the exterior of the building or extend to the exterior of the building with an exit passageway; shall not be used for any purpose other than a means of egress (1022.1). Shall be constructed as fire barriers or horizontal assemblies: 1-hour where connecting less than four stories; 2-hours where connecting four stories or more (1022.2). Shall terminate at an exit discharge or public way (1022.3). Penetrations prohibited except for required exit doors, equipment, and ductwork (1022.5). Where non-rated walls enclose the exterior of the stairway and the walls are exposed by other parts of the building at an angle of less than 180 degrees, the exterior walls within 10 feet of a non-rated wall shall have a fire-resistance rating of not less than one hour (1022.7).

EXIT PASSAGEWAYS: Width shall not be less than 44" (1023.2). Walls, floors, and ceilings shall not have less than 1-hour fire-resistance rating, and not less than that required for any connecting interior exit stairway or ramp (1023.3). Shall terminate at exit discharge on the level of exit discharge; shall terminate at an exit on other levels (1023.4).

REQUIREMENTS FOR EXTERIOR EXIT RAMPS AND STAIRS: Building must be less than 6 stories and not a high-rise (1026.2). Element must have an open side (1026.3). Open areas adjoining exterior exit stairways or ramps shall be yards, courts, or public ways (1026.4). 10 feet minimum separation from lot line or adjacent unprotected buildings (1026.5). Shall be separated from the interior of the building as required by Section 1022.2 (1026.6).

EXIT DISCHARGE: Exits shall discharge directly to the exterior of the building (1027.1). Egress courts are permitted as a portion of the exit discharge in the means of egress (1027.4). Egress court minimum width shall not be less than 44"; height shall unobstructed to a height of 7 feet (1027.4.1). Where width is less than 10 feet, egress court walls shall not have less than 1-hour fire-resistance rating for a distance of 10 feet above the floor of the court (1027.4.2). Exit discharge shall provide direct and unobstructed access to a public way; a safe dispersal area is allowed where the following conditions are met: the area shall be of a size to accommodate at least 5 square feet for each person, the area shall be located on the same lot at least 50 feet away from the building requiring egress, the area shall be permanently maintained and identified as a safe dispersal area, and the area shall be provided with a safe and unobstructed path of travel from the building (1027.5).

ASSEMBLY: 50% of Group A occupants are to exit through the main exit if over 300 occupants (1028.2). Exits and aisles shall be located so that the travel distance to an exit door shall not be greater than 250 feet with sprinkler (1028.7).

ACCESSIBILITY

ACCESSIBLE ROUTE: Accessible routes within the site shall be provided from public transportation stops, accessible parking, accessible passenger loading zones, and public streets or sidewalk to the accessible building entrance served (1104.1). At least one accessible route shall connect accessible buildings, accessible facilities, accessible elements, and accessible spaces that are on the same site (1104.2). At least one accessible route shall connect each accessible level (1104.4). Accessible routes shall coincide with or be located in the same area as a general circulation path (1104.5).

ACCESSIBLE ENTRANCES: Minimum of 60% of all public entrances shall be accessible (1105.1).

PARKING AND PASSENGER LOADING FACILITIES: Where parking is provided, accessible parking spaces shall be provided in compliance with Table 1106.1. Accessible parking spaces shall be located on the shortest accessible route of travel from adjacent parking to an accessible building entrance (1106.6). Passenger loading zones shall be accessible (1106.7).

SIGNAGE: Provide accessible signage in accordance with Section 1110.

INTERIOR ENVIRONMENT

INTERIOR SPACE DIMENSIONS: Habitable spaces shall not be less 7 feet in any dimension (1208.1). Minimum ceiling height shall be 7'-6" (1208.2). Minimum habitable space shall be 70 square feet (1208.3).

TOILET AND BATHROOM REQUIREMENTS: Floors shall have a smooth, hard, nonabsorbent surface with a 4" smooth, hard, nonabsorbent base (1210.2.1). 48" high minimum wainscot of smooth, hard, nonabsorbent surface required in rest rooms within 2 feet of service sinks, urinals, and water closets (1210.2.2). A separate compartment with walls or partitions and a door for each water closet shall be provided (1210.3.1). A separate area with walls or partitions shall be provided for each urinal and shall begin at a height not more than 12 inches from and extend not less than 60 inches above the finished floor surface; partitions shall extend not less than 18" from the wall surface at each side of the urinal (1210.3.2).

ROOFTOP STRUCTURES (PENTHOUSES): Penthouses in compliance with Sections 1509.2.1 through 1509.2.5 shall be considered a portion of the story directly below the roof deck on which such penthouses are located. All other penthouses shall be considered as an additional story of the building (1509.2). Penthouses constructed on buildings of other than Type I construction shall not exceed 18 feet in height above the roof deck as measured to the average height of the roof of the penthouse (1509.2.1). The aggregate area of penthouses and other enclosed rooftop structures shall not exceed one-third the area of the supporting roof deck. Such penthouses and other enclosed rooftop structures shall not be required to be included in determining the building area or number of stories as regulated by Section 503.1. The area of such penthouses shall not be included in determining the fire area specified in Section 901.7.1 (1509.2.2).

ELEVATORS AND CONVEYING SYSTEMS: Elevators connecting four or more stories shall be sized to accommodate a 24"x84" ambulance stretcher (3002.4). Emergency operations for elevators acting as part of an accessible means of egress by Section 3003. Machine room requirements by section 3006. Occupant evacuation elevator requirements by Section 3008.

SPECIAL CONSTRUCTION: Awnings and canopies requirements by Section 3105.

SAFEGUARDS DURING CONSTRUCTION: Provide in accordance with Chapter 33.

CONSTRUCTION TO BE COMPLETED IN ACCORDANCE WITH ALL OTHER STATE AND LOCAL CODES, LAWS, AND REGULATIONS

PLUMBING TOTALS PER 2902.1 IBC 2012 – BUILDING A

ZONE 1 – ASSEMBLY (PUBLIC)			ZONE 2 – COURT SUITE (COURT EMPLOYEES)			ZONE 3 – CLERK SUITE (COURT EMPLOYEES)		
CLASSIFICATION: ASSEMBLY (A–3)			CLASSIFICATION: BUSINESS (B)			CLASSIFICATION: BUSINESS (B)		
OCCUPANCY: 397			OCCUPANCY: 58			OCCUPANCY: 46		
SPLIT OCCUPANCY / SEX: 199M/198F			SPLIT OCCUPANCY / SEX: 29M/29F			SPLIT OCCUPANCY / SEX: 23M/23F		
WATER CLOSETS: 1/125 FOR MEN; 1/65 FOR WOMEN			WATER CLOSETS: 1/25 FOR THE FIRST 50; 1/50 FOR THE REMAINDER			WATER CLOSETS: 1/25 FOR THE FIRST 50; 1/50 FOR THE REMAINDER		
LAVATORIES: 1/200 FOR BOTH			LAVATORIES: 1/40 FOR THE FIRST 80; 1/80 FOR THE REMAINDER			LAVATORIES: 1/40 FOR THE FIRST 80; 1/80 FOR THE REMAINDER		
DRINKING FOUNTAINS: 1/500 COMBINED			DRINKING FOUNTAINS: 1/100 COMBINED			DRINKING FOUNTAINS: 1/100 COMBINED		
	REQUIRED	PROVIDED		REQUIRED	PROVIDED		REQUIRED	PROVIDED
MEN	2	3	MEN	2	2	MEN	1	1
WOMEN	3	3	WOMEN	2	2	WOMEN	1	2
LAVATORIES	M:1; W:1	M:2; W:2	LAVATORIES	M:1; W:1	M:1; W:1	LAVATORIES	M:1; W:1	M:1; W:2
DRINKING FOUNTAINS							2	2
SERVICE SINKS							1	1

PLUMBING TOTALS PER 2902.1 IBC 2012 – BUILDINGS B & C

ZONE 4 – POLICE SPACES (POLICE EMPLOYEES)												
CLASSIFICATION: ASSEMBLY (A–3)			CLASSIFICATION: BUSINESS (B)			CLASSIFICATION: STORAGE (S–1)			CLASSIFICATION: STORAGE (S–2)			CLASSIFICATION: INSTITUTIONAL (I–3)		
OCCUPANCY: 48			OCCUPANCY: 603			OCCUPANCY: 22			OCCUPANCY: 63			OCCUPANCY: 8		
SPLIT OCCUPANCY / SEX: 24M/24F			SPLIT OCCUPANCY / SEX: 302M/301F			SPLIT OCCUPANCY / SEX: 11M/11F			SPLIT OCCUPANCY / SEX: 32M/31F			SPLIT OCCUPANCY / SEX: 4M/4F		
WATER CLOSETS: 1/125 FOR MEN; 1/65 FOR WOMEN			WATER CLOSETS: 1/25 FOR THE FIRST 50; 1/50 FOR THE REMAINDER			WATER CLOSETS: 1/100 EACH			WATER CLOSETS: 1/100 EACH			WATER CLOSETS: 1/15 EACH		
LAVATORIES: 1/200 FOR BOTH			LAVATORIES: 1/40 FOR THE FIRST 80; 1/80 FOR THE REMAINDER			LAVATORIES: 1/100 EACH			LAVATORIES: 1/100 EACH			LAVATORIES: 1/15 EACH		
DRINKING FOUNTAINS: 1/500 COMBINED			DRINKING FOUNTAINS: 1/100 COMBINED			DRINKING FOUNTAINS: 1/1000 COMBINED			DRINKING FOUNTAINS: 1/1000 COMBINED			DRINKING FOUNTAINS: 1/100 COMBINED		
	REQUIRED	PROVIDED											REQUIRED	PROVIDED
MEN										REQUIRED	PROVIDED	MEN	1	1
WOMEN										11	20	WOMEN	1	1
LAVATORIES										11	13	LAVATORIES	M:1; W:1	M:1; W:1
DRINKING FOUNTAINS										M:9; W:9	M:16; W:13		7	10
SERVICE SINKS													1	4

PLUMBING TOTALS NOTES:
1. WATER CLOSETS/LAVATORIES: DUE TO SECURITY REQUIREMENTS, THE BUILDING HAS BEEN BROKEN DOWN INTO ZONES BASED ON DOOR ACCESS. ACCESS TO ZONES IS PERMISSIBLE TO ONLY CERTAIN EMPLOYEES/PUBLICS, THUS WATER CLOSET AND LAVATORY LOCATIONS HAVE BEEN DESIGNED TO ACCOMMODATE THESE RESTRICTIONS.
2. DRINKING FOUNTAINS: DRINKING FOUNTAIN REQUIREMENTS ARE COMBINED FOR THE ZONES 1, 2, AND 3. ZONE 1 REQUIRES 2 FOUNTAINS. ZONES 2 & 3 HAVE ACCESS TO THESE TWO FOUNTAINS AS WELL AS A BREAK ROOM LOCATED IN EACH ZONE, FULFILLING THE ADDITIONAL DRINKING FOUNTAIN REQUIREMENTS.
3. POLICE SPACES: THROUGHOUT ZONE 4, POLICE EMPLOYEES HAVE ACCESS TO ALL FLOORS OF THE BUILDING, THEREFOR PLUMBING REQUIREMENT COUNTS HAVE BEEN COMBINED FOR THE ZONE. GROUP I–3 REQUIRES SEPARATE PLUMBING FACILITIES FOR INMATES, SO WATER CLOSETS AND LAVATORIES HAVE BEEN PROVIDED TO MEET THIS REQUIREMENT.

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HATTIESBURG PUBLIC SAFETY COMPLEX

HPSC Police and Court Building

Drawing Issued:

Date	Rev.	Description
08-31-2015		DD Check Set
10-20-2015		75% Progress Set
11-02-2015		90% Pricing Set
11-19-2018		100% Bid Docs

Drawn By: CR,CP,AS,RB
Checked By: CR,LA,CP
Client No: -------
Albert & Associates: 12575

REGISTERED ARCHITECT Larry A. Albert Hattiesburg, MS STATE OF MISSISSIPPI

A1.1

CODE REVIEW PLUMBING TOTALS

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com **Albert & McCleskey Associates Architects**

Blocking for Equipment

PROVIDE WALL THICKNESS TO FULLY RECESS ANY EQUIPMENT REQUIRED TO BE RECESSED. VERIFY ALL EQUIPMENT DIMENSIONAL REQUIREMENTS AND LOCATIONS WITH ARCHITECT BEFORE CONSTRUCTING PARTITIONS. SOME PARTITIONS CONTAINING RECESSED EQUIPMENT MAY NEED TO BE THICKER THAN SHOWN ON THIS PLAN. THESE WALLS WILL BE VERIFIED BY ARCHITECT BEFORE CONSTRUCTION AND WILL BE PROVIDED AT THE CONTRACTOR'S EXPENSE. PROVIDE SOLID BLOCKING BEHIND ALL FIXED EQUIPMENT AND ACCESSORIES SHOWN IN THE CONTRACT DOCUMENTS. VERIFY THE LOCATION AND SIZE OF ALL FIXED EQUIPMENT AND ACCESSORIES BEFORE INSTALLING BLOCKING.

Fire Rating Note

FIRE RATED CONSTRUCTION REQUIRED BY CODE IS DEMONSTRATED ONLY ON THIS SHEET AS REPRESENTED BY 1-HOUR OR 2-HOUR DASHED LINES ON PLANS. UL-LISTINGS AND FIRE RATINGS LISTED ABOVE ARE INTENDED ONLY WHEN THESE PARTITION TYPES COINCIDE WITH THE DASHED LINES SHOWN ON PLANS ON THIS SHEET.

Fire Blocking & Draft Stopping

FIRE RATED PARTITIONS SHALL BE COMPLETELY SEALED FROM DECK TO DECK USING RATED SEALANTS AND FIRE STOPPING AS REQUIRED. RE: SECTION 716 IN 2012 IBC.

Fire-Resistance Rate Assemblies

ALL SHAFTS & CHASES	1-HR	UL U497
INTERIOR NON-BEARING PARTITIONS	0-HR	UL U419/U420
COLUMNS	0-HR	
BEAMS	0-HR	
TRUSSES SUPPORTING ROOF	0-HR	
FLOOR & FLOOR/CEILING ASSEMBLIES	0-HR	UL D601
ROOF & ROOF/CEILING ASSEMBLIES	0-HR	

NOTE:
INTERIOR METAL STUD CONTRACTOR/SUPPLIER MUST ENGINEER THE INTERIOR METAL STUDS FOR DEPTH AND GAUGE TO BE OF ADEQUATE STRENGTH TO WITHSTAND DEFECTIONS OF L/240.

OCCUPANT LOAD DETERMINED BY TABLE 1004.1.2 IN IBC 2012

BUILDING FLOOR	NUMBER OF OCCUPANTS	STAIR EGRESS WIDTH REQUIRED (PROVIDED)	EGRESS WIDTH REQUIRED (PROVIDED)	NUMBER OF EXITS REQUIRED (PROVIDED)
FIRST FLOOR	634 Persons	N/A	96" (578")	3 (12)
SECOND FLOOR	284 Persons	57" (246")	43" (170")	2 (4)
THIRD FLOOR	327 Persons	66" (246")	50" (170")	2 (4)

Legend

- 1-HOUR FIRE BARRIER
- 2-HOUR FIRE BARRIER
- NOTE: SEE SHEET A1.6 FOR PARTITION TYPES
- (X) NUMBER OF OCCUPANTS IN A PATH OF EGRESS
- PORTABLE FIRE EXTINGUISHER REFERENCE STANDARDS NFPA10 AND THE 2012 INTERNATIONAL FIRE CODE
- FE#1 SURFACE MOUNTED BRACKET; RE: SPECIFICATIONS
- FE#2 FULLY RECESSED CABINET; RE: SPECIFICATIONS
- **NOTE: FIRE EXTINGUISHERS NOT IN CONTRACT; ONLY CABINETS AND BRACKETS ARE INCLUDED IN CONTRACT.

BRIEFING/MUSTER (A-3)	
SQ. FOOTAGE	710 SF
OCCUPANCY @ 15 SF/PER	48
EGRESS WIDTH REQUIRED	32"
EGRESS WIDTH PROVIDED	34"
NUMBER OF EXITS REQUIRED	1
NUMBER OF EXITS PROVIDED	1

BUSINESS AREA (B)	
SQ. FOOTAGE	5,261 SF
OCCUPANCY @ 100 SF/PER	53
EGRESS WIDTH REQUIRED	64"
EGRESS WIDTH PROVIDED	272"
NUMBER OF EXITS REQUIRED	2
NUMBER OF EXITS PROVIDED	5

DETENTION AREA (I-3, CONDITION 5)	
SQ. FOOTAGE	795 SF
OCCUPANCY @ 100 SF/PER	8
EGRESS WIDTH REQUIRED	32"
EGRESS WIDTH PROVIDED	34"
NUMBER OF EXITS REQUIRED	1
NUMBER OF EXITS PROVIDED	1

OFFICE SUITE (B)	
SQ. FOOTAGE	4,620 SF
OCCUPANCY @ 100 SF/PER	46
EGRESS WIDTH REQUIRED	64"
EGRESS WIDTH PROVIDED	68"
NUMBER OF EXITS REQUIRED	2
NUMBER OF EXITS PROVIDED	2

OFFICE SUITE (B)	
SQ. FOOTAGE	3,765 SF
OCCUPANCY @ 100 SF/PER	38
EGRESS WIDTH REQUIRED	64"
EGRESS WIDTH PROVIDED	68"
NUMBER OF EXITS REQUIRED	2
NUMBER OF EXITS PROVIDED	2

COURT ROOM (A-3)	
SQ. FOOTAGE	2,397 SF
OCCUPANCY (TOTAL)	196
OCCUPANCY @ 20 SF/PERSON: 62	
OCCUPANCY (FIXED): 134	
EGRESS WIDTH REQUIRED	64"
EGRESS WIDTH PROVIDED	136"
NUMBER OF EXITS REQUIRED	2
NUMBER OF EXITS PROVIDED	4

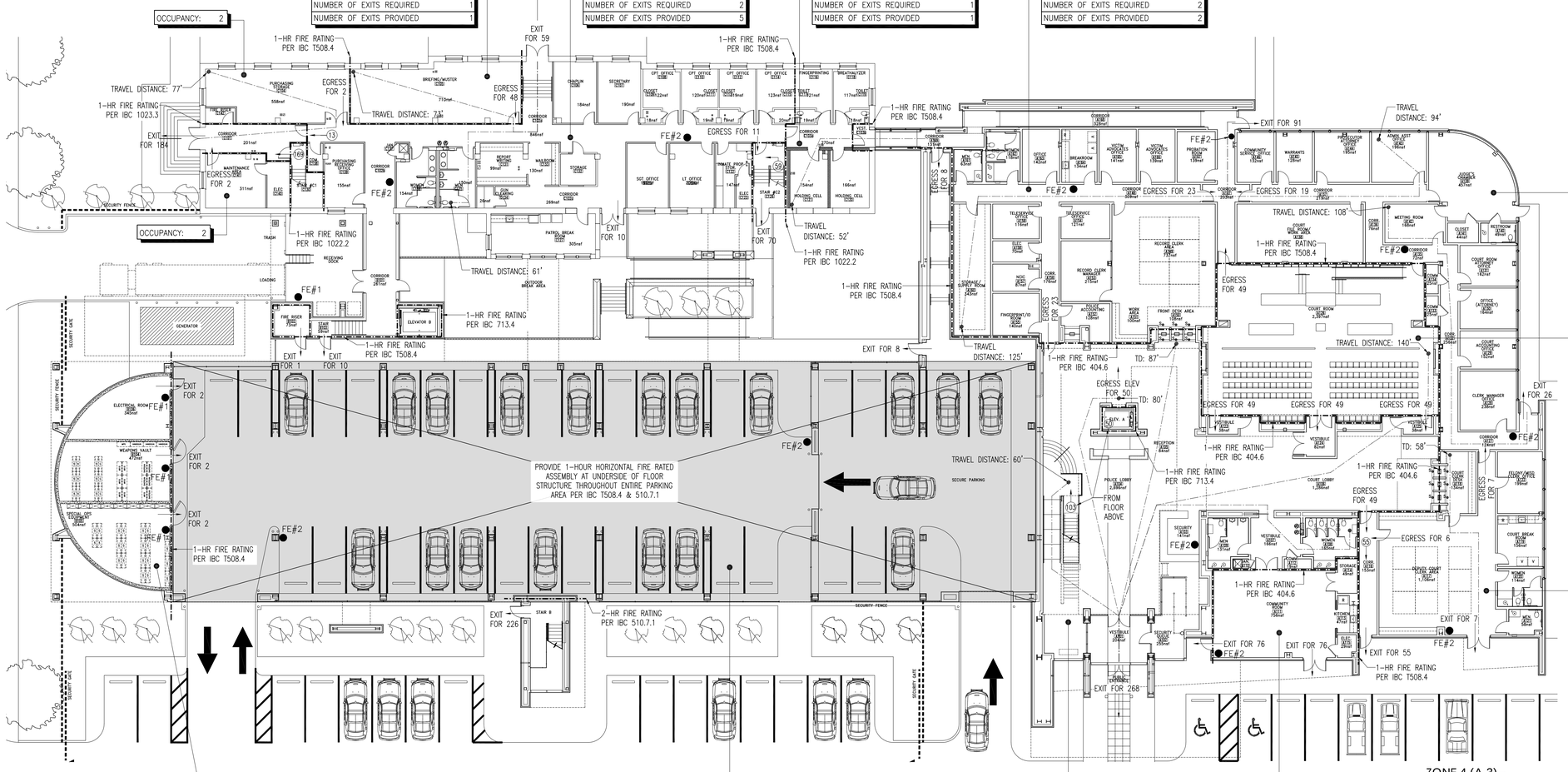
OFFICE SUITE (B)	
SQ. FOOTAGE	1,908 SF
OCCUPANCY @ 100 SF/PER	20
EGRESS WIDTH REQUIRED	32"
EGRESS WIDTH PROVIDED	102"
NUMBER OF EXITS REQUIRED	1
NUMBER OF EXITS PROVIDED	3

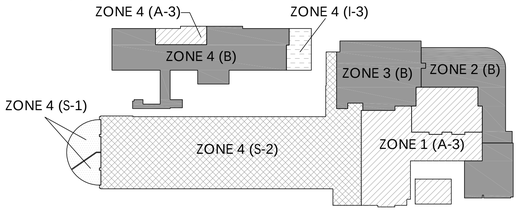
STORAGE (S-1)	
SQ. FOOTAGE	1,397 SF
OCCUPANCY @ 300 SF/PERSON	6
EGRESS WIDTH REQUIRED	32"
EGRESS WIDTH PROVIDED	68"
NUMBER OF EXITS REQUIRED	1
NUMBER OF EXITS PROVIDED	2

OPEN PARKING GARAGE (S-2)	
SQ. FOOTAGE	12,597 SF
OCCUPANCY @ 200 SF/PERSON	63
EGRESS WIDTH REQUIRED	64"
EGRESS WIDTH PROVIDED	444"
NUMBER OF EXITS REQUIRED	2
NUMBER OF EXITS PROVIDED	4

LOBBY (EXIT ACCESS)	
SQ. FOOTAGE	5,422 SF
MERGING OCCUPANCY	323
EGRESS WIDTH REQUIRED	64"
EGRESS WIDTH PROVIDED	102"
NUMBER OF EXITS REQUIRED	2
NUMBER OF EXITS PROVIDED	2

COMMUNITY ROOM (A-3)	
SQ. FOOTAGE	756 SF
OCCUPANCY @ 5 SF/PERSON	152
EGRESS WIDTH REQUIRED	64"
EGRESS WIDTH PROVIDED	102"
NUMBER OF EXITS REQUIRED	2
NUMBER OF EXITS PROVIDED	2





N

First Floor Life Safety Plan

SCALE: 1/16" = 1'-0"

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HATTIESBURG PUBLIC SAFETY COMPLEX

HPSC Police and Court Building

Drawing Issued:

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Albert & Associates: 12575

REGISTERED ARCHITECT Larry W. Albert Hattiesburg, MS STATE OF MISSISSIPPI

A1.2

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com
Albert & McCleskey Associates Architects

FIRST FLOOR LIFE SAFETY PLAN

Blocking for Equipment

PROVIDE WALL THICKNESS TO FULLY RECESS ANY EQUIPMENT REQUIRED TO BE RECESSED. VERIFY ALL EQUIPMENT DIMENSIONAL REQUIREMENTS AND LOCATIONS WITH ARCHITECT BEFORE CONSTRUCTING PARTITIONS. SOME PARTITIONS CONTAINING RECESSED EQUIPMENT MAY NEED TO BE THICKER THAN SHOWN ON THIS PLAN. THESE WALLS WILL BE VERIFIED BY ARCHITECT BEFORE CONSTRUCTION AND WILL BE PROVIDED AT THE CONTRACTOR'S EXPENSE. PROVIDE SOLID BLOCKING BEHIND ALL FIXED EQUIPMENT AND ACCESSORIES SHOWN IN THE CONTRACT DOCUMENTS. VERIFY THE LOCATION AND SIZE OF ALL FIXED EQUIPMENT AND ACCESSORIES BEFORE INSTALLING BLOCKING.

Fire Rating Note

FIRE RATED CONSTRUCTION REQUIRED BY CODE IS DEMONSTRATED ONLY ON THIS SHEET AS REPRESENTED BY 1-HOUR OR 2-HOUR DASHED LINES ON PLANS. UL-LISTINGS AND FIRE RATINGS LISTED ABOVE ARE INTENDED ONLY WHEN THESE PARTITION TYPES COINCIDE WITH THE DASHED LINES SHOWN ON PLANS ON THIS SHEET.

Fire Blocking & Draft Stopping

FIRE RATED PARTITIONS SHALL BE COMPLETELY SEALED FROM DECK TO DECK USING RATED SEALANTS AND FIRE STOPPING AS REQUIRED. RE: SECTION 716 IN 2012 IBC.

Fire-Resistance Rate Assemblies

ALL SHAFTS & CHASES	1-HR	UL U497
INTERIOR NON-BEARING PARTITIONS	0-HR	UL U419/U420
COLUMNS	0-HR	
BEAMS	0-HR	
TRUSSES SUPPORTING ROOF	0-HR	
FLOOR & FLOOR/CEILING ASSEMBLIES	0-HR	UL D601
ROOF & ROOF/CEILING ASSEMBLIES	0-HR	

NOTE:
INTERIOR METAL STUD CONTRACTOR/SUPPLIER MUST ENGINEER THE INTERIOR METAL STUDS FOR DEPTH AND GAUGE TO BE OF ADEQUATE STRENGTH TO WITHSTAND DEFECTIONS OF L/240.

OCCUPANT LOAD DETERMINED BY TABLE 1004.1.2 IN IBC 2012

BUILDING FLOOR	NUMBER OF OCCUPANTS	STAIR EGRESS WIDTH REQUIRED (PROVIDED)	EGRESS WIDTH REQUIRED (PROVIDED)	NUMBER OF EXITS REQUIRED (PROVIDED)
FIRST FLOOR	634 Persons	N/A	96" (578")	3 (12)
SECOND FLOOR	284 Persons	57" (246")	43" (170")	2 (4)
THIRD FLOOR	327 Persons	66" (246")	50" (170")	2 (4)

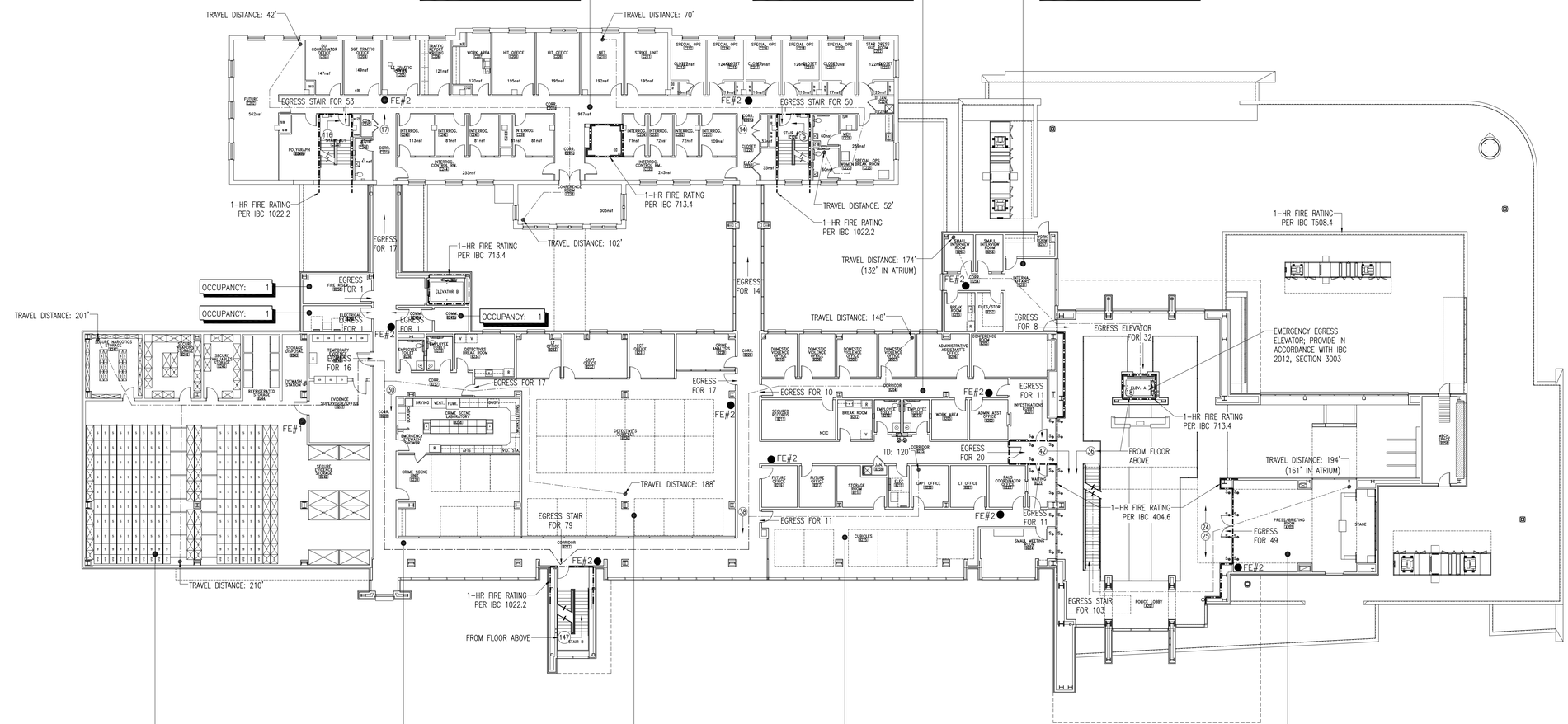
Legend

- 1-HOUR FIRE BARRIER
- 2-HOUR FIRE BARRIER
- NOTE: SEE SHEET A1.6 FOR PARTITION TYPES
- (X) — NUMBER OF OCCUPANTS IN A PATH OF EGRESS
- ● PORTABLE FIRE EXTINGUISHER REFERENCE STANDARDS NFPA10 AND THE 2012 INTERNATIONAL FIRE CODE
- FE#1 SURFACE MOUNTED BRACKET; RE: SPECIFICATIONS
- FE#2 FULLY RECESSED CABINET; RE: SPECIFICATIONS
- **NOTE: FIRE EXTINGUISHERS NOT IN CONTRACT; ONLY CABINETS AND BRACKETS ARE INCLUDED IN CONTRACT.

OFFICE AREA (B)	
SQ. FOOTAGE	7,800 SF
OCCUPANCY @ 100 SF/PER	78
EGRESS WIDTH REQUIRED	64"
EGRESS WIDTH PROVIDED	68"
NUMBER OF EXITS REQUIRED	2
NUMBER OF EXITS PROVIDED	2

OFFICE SUITE (B)	
SQ. FOOTAGE	2,073 SF
OCCUPANCY @ 100 SF/PER	21
EGRESS WIDTH REQUIRED	32"
EGRESS WIDTH PROVIDED	34"
NUMBER OF EXITS REQUIRED	1
NUMBER OF EXITS PROVIDED	2

OFFICE SUITE (B)	
SQ. FOOTAGE	803 SF
OCCUPANCY @ 100 SF/PER	8
EGRESS WIDTH REQUIRED	32"
EGRESS WIDTH PROVIDED	34"
NUMBER OF EXITS REQUIRED	1
NUMBER OF EXITS PROVIDED	1



STORAGE (S-1)	
SQ. FOOTAGE	4,889 SF
OCCUPANCY @ 300 SF/PERSON	16
EGRESS WIDTH REQUIRED	32"
EGRESS WIDTH PROVIDED	40"
NUMBER OF EXITS REQUIRED	1
NUMBER OF EXITS PROVIDED	1

OFFICE AREA (B)	
SQ. FOOTAGE	5,288 SF
OCCUPANCY @ 100 SF/PER	53
EGRESS WIDTH REQUIRED	64"
EGRESS WIDTH PROVIDED	170"
NUMBER OF EXITS REQUIRED	2
NUMBER OF EXITS PROVIDED	4

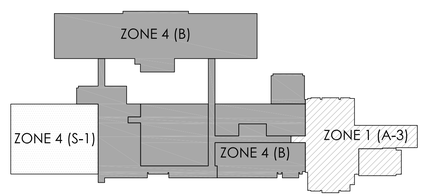
OFFICE SUITE (B)	
SQ. FOOTAGE	3,363 SF
OCCUPANCY @ 100 SF/PER	34
EGRESS WIDTH REQUIRED	34"
EGRESS WIDTH PROVIDED	68"
NUMBER OF EXITS REQUIRED	1
NUMBER OF EXITS PROVIDED	2

OFFICE SUITE (B)	
SQ. FOOTAGE	2,103 SF
OCCUPANCY @ 100 SF/PER	22
EGRESS WIDTH REQUIRED	34"
EGRESS WIDTH PROVIDED	68"
NUMBER OF EXITS REQUIRED	1
NUMBER OF EXITS PROVIDED	2

PRESS/BRIEFING ROOM (A-3)	
SQ. FOOTAGE	735 SF
OCCUPANCY @ 15 SF/PERSON	49
EGRESS WIDTH REQUIRED	32"
EGRESS WIDTH PROVIDED	68"
NUMBER OF EXITS REQUIRED	1
NUMBER OF EXITS PROVIDED	1

Second Floor Life Safety Plan

SCALE: 1/16" = 1'-0"



CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

Drawing Issued:

Date	Rev.	Description
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11-02-2015		90% Pricing Set
11-19-2018		100% Bid Docs

Drawn By: CR,CP,AS,RB
Checked By: CR,LA,CP
Client No: ------
Albert & Associates: 12575

REGISTERED ARCHITECT Larry A. Albert Hattiesburg, MS STATE OF MISSISSIPPI

A1.3

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com
Albert & McCleskey Associates Architects

SECOND FLOOR LIFE SAFETY PLAN

Blocking for Equipment

PROVIDE WALL THICKNESS TO FULLY RECESS ANY EQUIPMENT REQUIRED TO BE RECESSED. VERIFY ALL EQUIPMENT DIMENSIONAL REQUIREMENTS AND LOCATIONS WITH ARCHITECT BEFORE CONSTRUCTING PARTITIONS. SOME PARTITIONS CONTAINING RECESSED EQUIPMENT MAY NEED TO BE THICKER THAN SHOWN ON THIS PLAN. THESE WALLS WILL BE VERIFIED BY ARCHITECT BEFORE CONSTRUCTION AND WILL BE PROVIDED AT THE CONTRACTOR'S EXPENSE. PROVIDE SOLID BLOCKING BEHIND ALL FIXED EQUIPMENT AND ACCESSORIES SHOWN IN THE CONTRACT DOCUMENTS. VERIFY THE LOCATION AND SIZE OF ALL FIXED EQUIPMENT AND ACCESSORIES BEFORE INSTALLING BLOCKING.

Fire Rating Note

FIRE RATED CONSTRUCTION REQUIRED BY CODE IS DEMONSTRATED ONLY ON THIS SHEET AS REPRESENTED BY 1-HOUR OR 2-HOUR DASHED LINES ON PLANS. UL-LISTINGS AND FIRE RATINGS LISTED ABOVE ARE INTENDED ONLY WHEN THESE PARTITION TYPES COINCIDE WITH THE DASHED LINES SHOWN ON PLANS ON THIS SHEET.

Fire Blocking & Draft Stopping

FIRE RATED PARTITIONS SHALL BE COMPLETELY SEALED FROM DECK TO DECK USING RATED SEALANTS AND FIRE STOPPING AS REQUIRED. RE: SECTION 716 IN 2012 IBC.

Fire-Resistance Rate Assemblies

ALL SHAFTS & CHASES	1-HR	UL U497
INTERIOR NON-BEARING PARTITIONS	0-HR	UL U419/U420
COLUMNS	0-HR	
BEAMS	0-HR	
TRUSSES SUPPORTING ROOF	0-HR	
FLOOR & FLOOR/CEILING ASSEMBLIES	0-HR	UL D601
ROOF & ROOF/CEILING ASSEMBLIES	0-HR	

NOTE:
INTERIOR METAL STUD CONTRACTOR/SUPPLIER MUST ENGINEER THE INTERIOR METAL STUDS FOR DEPTH AND GAUGE TO BE OF ADEQUATE STRENGTH TO WITHSTAND DEFECTIONS OF L/240.

OCCUPANT LOAD DETERMINED BY TABLE 1004.1.2 IN IBC 2012

BUILDING FLOOR	NUMBER OF OCCUPANTS	STAIR EGRESS WIDTH REQUIRED (PROVIDED)	EGRESS WIDTH REQUIRED (PROVIDED)	NUMBER OF EXITS REQUIRED (PROVIDED)
FIRST FLOOR	634 Persons	N/A	96" (578")	3 (12)
SECOND FLOOR	284 Persons	57" (246")	43" (170")	2 (4)
THIRD FLOOR	327 Persons	66" (246")	50" (170")	2 (4)

Legend

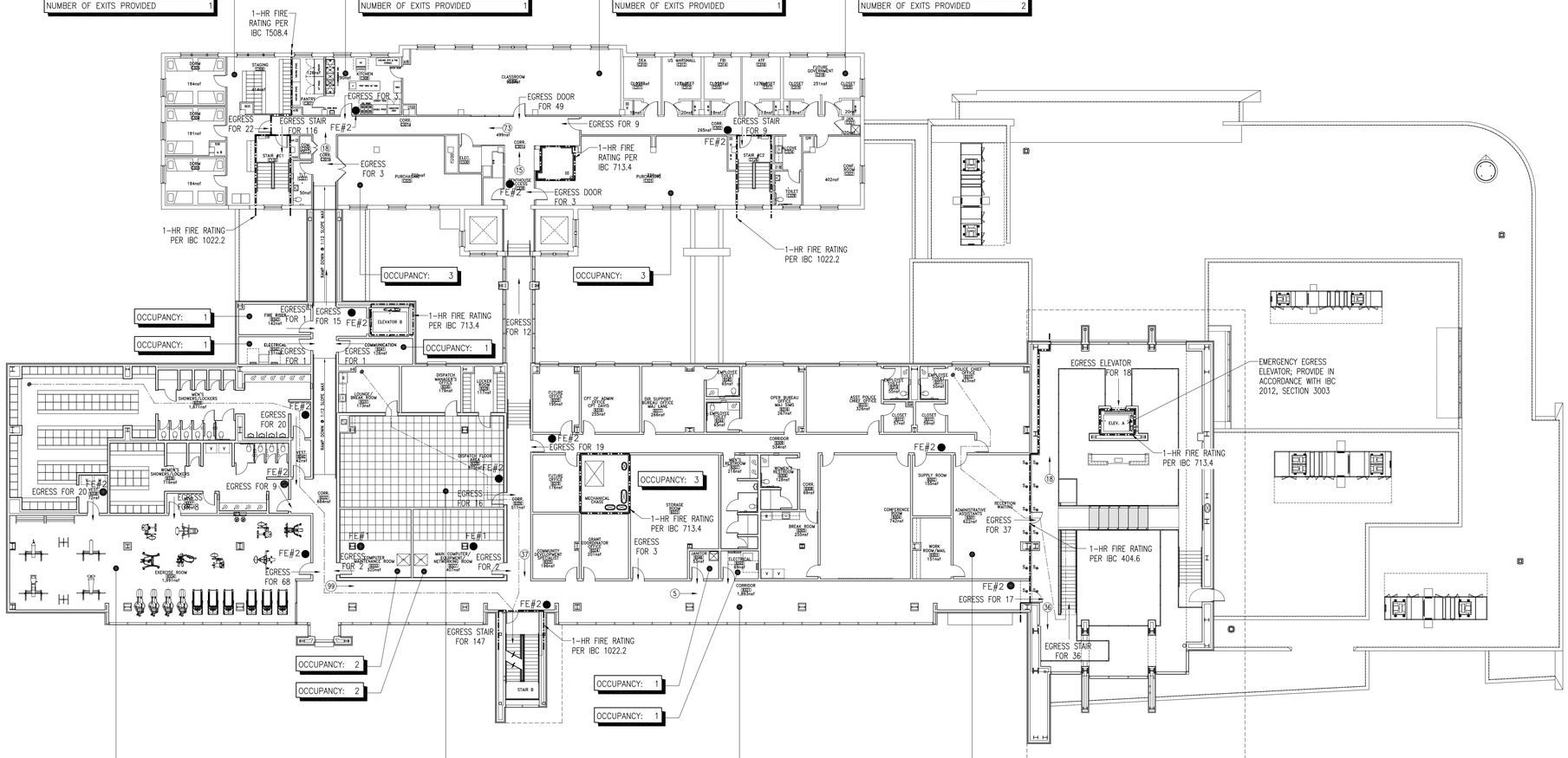
- 1-HOUR FIRE BARRIER
- 2-HOUR FIRE BARRIER
- NOTE: SEE SHEET A1.6 FOR PARTITION TYPES
- (X) NUMBER OF OCCUPANTS IN A PATH OF EGRESS
- ● PORTABLE FIRE EXTINGUISHER REFERENCE STANDARDS NFPA10 AND THE 2012 INTERNATIONAL FIRE CODE
- FE#1 SURFACE MOUNTED BRACKET; RE: SPECIFICATIONS
- FE#2 FULLY RECESSED CABINET; RE: SPECIFICATIONS
- **NOTE: FIRE EXTINGUISHERS NOT IN CONTRACT; ONLY CABINETS AND BRACKETS ARE INCLUDED IN CONTRACT.

DORMITORY, STAGING, LAUNDRY (B)	
SQ. FOOTAGE	1,057 SF
OCCUPANCY @ 50 SF/PERSON	22
EGRESS WIDTH REQUIRED	32"
EGRESS WIDTH PROVIDED	34"
NUMBER OF EXITS REQUIRED	1
NUMBER OF EXITS PROVIDED	1

KITCHEN (B)	
SQ. FOOTAGE	446 SF
OCCUPANCY @ 200 SF/PERSON	3
EGRESS WIDTH REQUIRED	32"
EGRESS WIDTH PROVIDED	34"
NUMBER OF EXITS REQUIRED	1
NUMBER OF EXITS PROVIDED	1

CLASSROOM (B)	
SQ. FOOTAGE	978 SF
OCCUPANCY @ 20 SF/PERSON	49
EGRESS WIDTH REQUIRED	32"
EGRESS WIDTH PROVIDED	34"
NUMBER OF EXITS REQUIRED	1
NUMBER OF EXITS PROVIDED	1

OFFICE SUITE (B)	
SQ. FOOTAGE	1,829 SF
OCCUPANCY @ 100 SF/PERSON	18
EGRESS WIDTH REQUIRED	32"
EGRESS WIDTH PROVIDED	68"
NUMBER OF EXITS REQUIRED	1
NUMBER OF EXITS PROVIDED	2

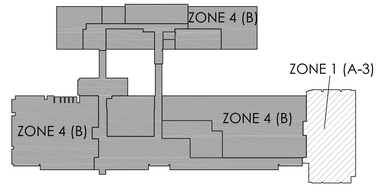


EXERCISE ROOM AND LOCKERS (B)	
SQ. FOOTAGE	4,856 SF
OCCUPANCY @ 50 SF/PERSON	97
EGRESS WIDTH REQUIRED	64"
EGRESS WIDTH PROVIDED	102"
NUMBER OF EXITS REQUIRED	2
NUMBER OF EXITS PROVIDED	3

OFFICE SUITE (B)	
SQ. FOOTAGE	1,532 SF
OCCUPANCY @ 100 SF/PERSON	16
EGRESS WIDTH REQUIRED	32"
EGRESS WIDTH PROVIDED	34"
NUMBER OF EXITS REQUIRED	1
NUMBER OF EXITS PROVIDED	1

OFFICE AREA (B)	
SQ. FOOTAGE	4,697 SF
OCCUPANCY @ 100 SF/PERSON	47
EGRESS WIDTH REQUIRED	64"
EGRESS WIDTH PROVIDED	136"
NUMBER OF EXITS REQUIRED	2
NUMBER OF EXITS PROVIDED	4

OFFICE SUITE (B)	
SQ. FOOTAGE	5,689 SF
OCCUPANCY @ 100 SF/PERSON	57
EGRESS WIDTH REQUIRED	64"
EGRESS WIDTH PROVIDED	68"
NUMBER OF EXITS REQUIRED	2
NUMBER OF EXITS PROVIDED	2



Third Floor Life Safety Plan

SCALE: 1/16" = 1'-0"

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HPSC Police and Court Building

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Checked By: CR,LA,CP
Client No: ——
Albert & Associates: 12575

REGISTERED ARCHITECT Larry M Albert Hattiesburg, MS STATE OF MISSISSIPPI

A1.4

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com
Albert & McCleskey Associates Architects

Blocking for Equipment

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COLUMNS	0-HR	
BEAMS	0-HR	
TRUSSES SUPPORTING ROOF	0-HR	
FLOOR & FLOOR/CEILING ASSEMBLIES	0-HR	UL D601
ROOF & ROOF/CEILING ASSEMBLIES	0-HR	

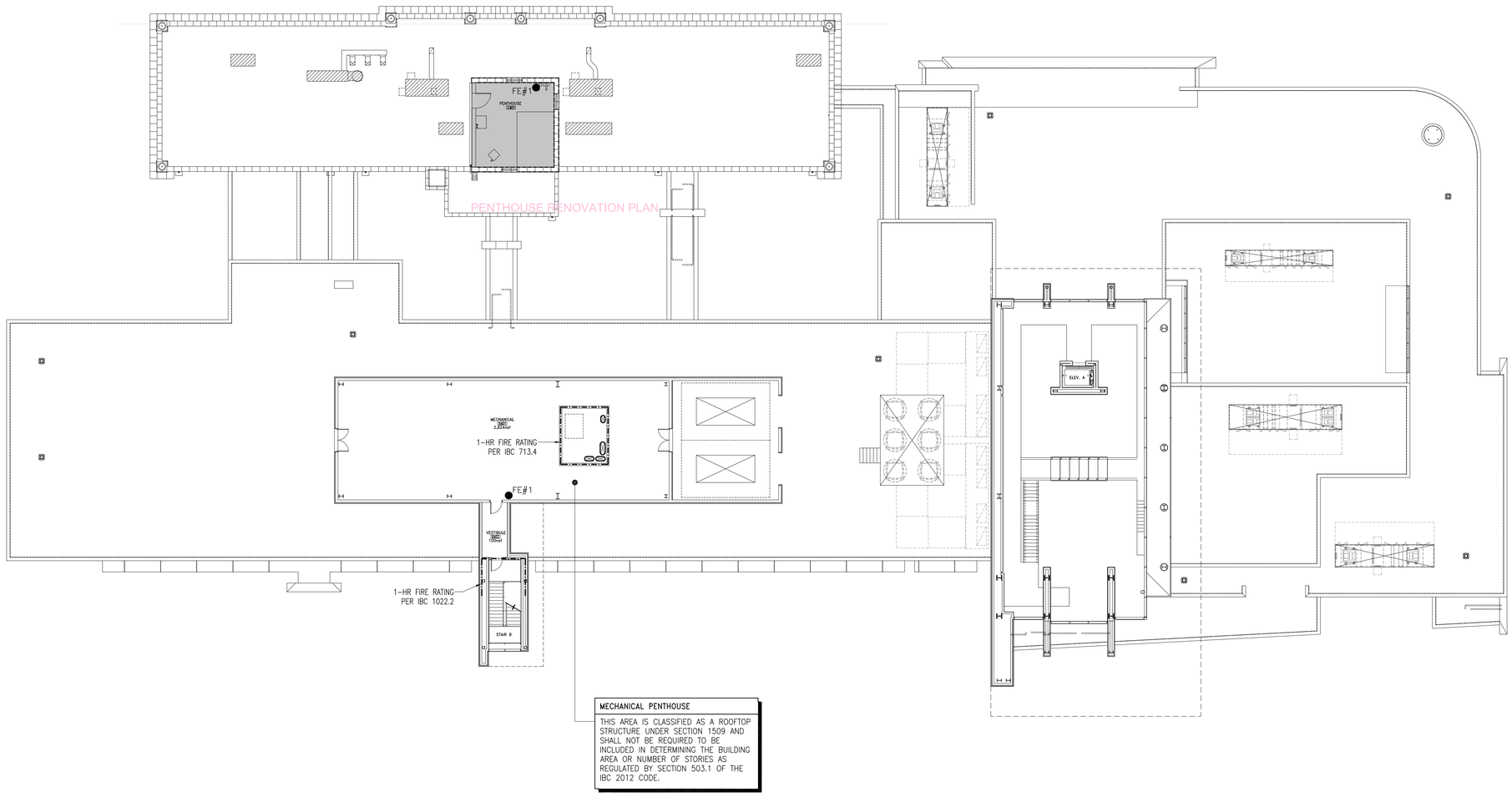
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SECOND FLOOR	284 Persons	57" (246")	43" (170")	2 (4)
THIRD FLOOR	327 Persons	66" (246")	50" (170")	2 (4)

Legend

- 1-HOUR FIRE BARRIER
- 2-HOUR FIRE BARRIER
- NOTE: SEE SHEET A1.6 FOR PARTITION TYPES
- (X) NUMBER OF OCCUPANTS IN A PATH OF EGRESS
- ● PORTABLE FIRE EXTINGUISHER REFERENCE STANDARDS NFPA10 AND THE 2012 INTERNATIONAL FIRE CODE
- FE#1 SURFACE MOUNTED BRACKET; RE: SPECIFICATIONS
- FE#2 FULLY RECESSED CABINET; RE: SPECIFICATIONS
- **NOTE: FIRE EXTINGUISHERS NOT IN CONTRACT; ONLY CABINETS AND BRACKETS ARE INCLUDED IN CONTRACT.



N

Mechanical Penthouse / Roof Life Safety Plan

SCALE: 1/16" = 1'-0"

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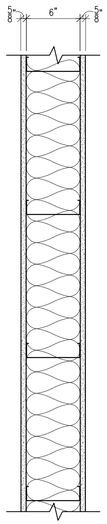
Albert & Associates: 12575

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A1.5

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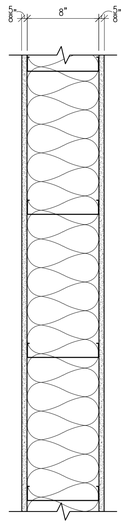
MECH. PENTHOUSE /ROOF LIFE SAFETY PLAN



PARTITION TYPES A1 A2

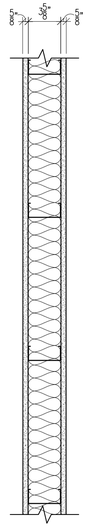
6" METAL STUDS AT 16" O.C. BRACED AT 4'-0" O.C. ABOVE CEILING TO DECK ABOVE. SHEATH WITH (1) LAYER OF 5/8" GYPSUM BOARD ON EACH SIDE FROM FLOOR TO DECK AND SEAL TIGHT; FILL WALL WITH ACOUSTIC BATT INSULATION CONTINUOUS FROM FLOOR TO DECK. FINISH AS SCHEDULED. AT TYPE A2, PROVIDE FIRE RATING PER WALL AS SHOWN ON LIFE SAFETY PLANS INCLUDING PROTECTION ON PENETRATIONS AND SEALANT TYPE USED.

A1
A2



PARTITION TYPES B

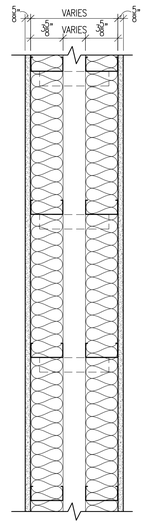
8" METAL STUDS AT 16" O.C. BRACED AT 4'-0" O.C. ABOVE CEILING TO DECK ABOVE. SHEATH WITH (1) LAYER OF 5/8" GYPSUM BOARD ON EACH SIDE FROM FLOOR TO DECK AND SEAL TIGHT; FILL WALL WITH ACOUSTIC BATT INSULATION CONTINUOUS FROM FLOOR TO DECK. FINISH AS SCHEDULED.



PARTITION TYPES C

3-5/8" METAL STUDS AT 16" O.C. BRACED AT 4'-0" O.C. ABOVE CEILING TO DECK ABOVE. SHEATH WITH (1) LAYER OF 5/8" GYPSUM BOARD ON EACH SIDE FROM FLOOR TO DECK AND SEAL TIGHT; FILL WALL WITH ACOUSTIC BATT INSULATION CONTINUOUS FROM FLOOR TO DECK. FINISH AS SCHEDULED.

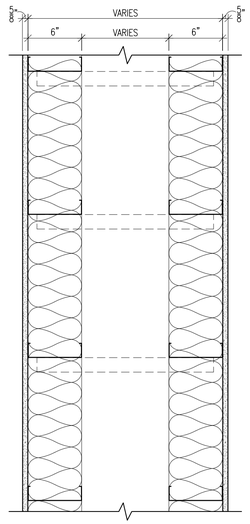
**WIDTH AS NOTED ON PLAN



PARTITION TYPES D

(2) 3-5/8" METAL STUDS AT 16" O.C. BRACED AT 4'-0" O.C. ABOVE CEILING TO DECK ABOVE AND BRACED ACROSS INTERSTITIAL SPACE TO EACH OTHER AT 8'-0" O.C. VERTICALLY TYP. SHEATH WITH (1) LAYER OF 5/8" GYPSUM BOARD ON EACH SIDE FROM FLOOR TO DECK AND SEAL TIGHT; FILL WALL WITH ACOUSTIC BATT INSULATION CONTINUOUS FROM FLOOR TO DECK. FINISH AS SCHEDULED.

**WIDTH AS NOTED ON PLAN

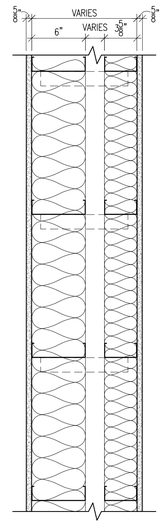


PARTITION TYPES E1 E2

(2) 6" METAL STUDS AT 16" O.C. BRACED AT 4'-0" O.C. ABOVE CEILING TO DECK ABOVE AND BRACED ACROSS INTERSTITIAL SPACE TO EACH OTHER AT 8'-0" O.C. VERTICALLY TYP. SHEATH WITH (1) LAYER OF 5/8" GYPSUM BOARD ON EACH SIDE FROM FLOOR TO DECK AND SEAL TIGHT; FILL WALL WITH ACOUSTIC BATT INSULATION CONTINUOUS FROM FLOOR TO DECK. FINISH AS SCHEDULED. AT TYPE E2, PROVIDE FIRE RATING PER WALL AS SHOWN ON LIFE SAFETY PLANS INCLUDING PROTECTION ON PENETRATIONS AND SEALANT TYPE USED.

E1
E2

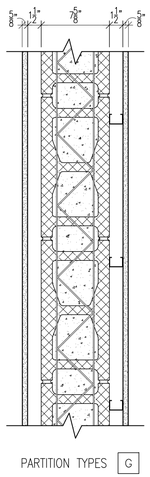
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PARTITION TYPES F1 F2

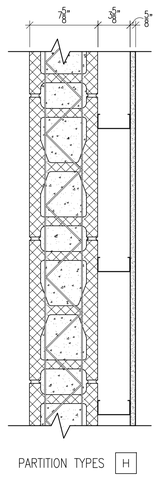
(1) 6" METAL STUDS AND (1) 3-5/8" METAL STUDS AT 16" O.C. BRACED AT 4'-0" O.C. ABOVE CEILING TO DECK ABOVE AND BRACED ACROSS INTERSTITIAL SPACE TO EACH OTHER AT 8'-0" O.C. VERTICALLY TYP. SHEATH WITH (1) LAYER OF 5/8" GYPSUM BOARD ON EACH SIDE FROM FLOOR TO DECK AND SEAL TIGHT; FILL WALL WITH ACOUSTIC BATT INSULATION CONTINUOUS FROM FLOOR TO DECK. FINISH AS SCHEDULED. AT TYPE F2, PROVIDE FIRE RATING PER WALL AS SHOWN ON LIFE SAFETY PLANS INCLUDING PROTECTION ON PENETRATIONS AND SEALANT TYPE USED.

F1
F2



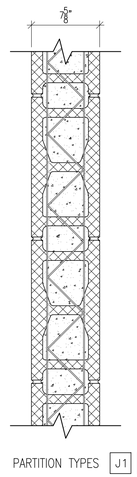
PARTITION TYPES G

8" CMU FROM FLOOR TO DECK ABOVE. PROVIDE REINFORCING AS INDICATED IN STRUCTURAL DRAWINGS. PROVIDE 1-1/2" METAL FURRING STUDS AT 16" O.C. AND SHEATH WITH 5/8" GYP. BD. FROM FLOOR TO 8" ABOVE CEILING ON BOTH SIDES; FINISH AS SCHEDULED.



PARTITION TYPES H

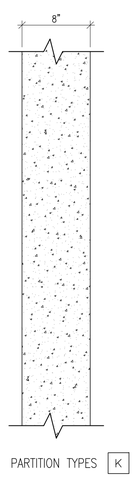
8" CMU FROM FLOOR TO DECK ABOVE. PROVIDE REINFORCING AS INDICATED IN STRUCTURAL DRAWINGS. AT CORRIDOR SIDE, PROVIDE 3-5/8" METAL STUDS AT 16" O.C. AND SHEATH WITH 5/8" GYP. BD. FROM FLOOR TO 8" ABOVE CEILING; FINISH AS SCHEDULED.



PARTITION TYPES J1 J2

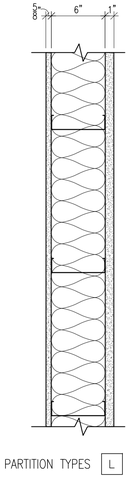
8" CMU FROM FLOOR TO DECK ABOVE. PROVIDE REINFORCING AS INDICATED IN STRUCTURAL DRAWINGS. FINISH AS SCHEDULED. PROVIDE FIRE RATING PER WALL AS SHOWN ON LIFE SAFETY PLANS INCLUDING PROTECTION ON PENETRATIONS AND SEALANT TYPE USED. AT TYPE J2, PROVIDE FIRE RATING PER WALL AS SHOWN ON LIFE SAFETY PLANS INCLUDING PROTECTION ON PENETRATIONS AND SEALANT TYPE USED.

F1
F2



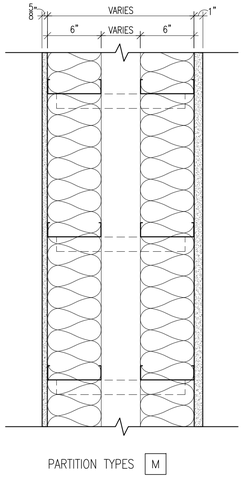
PARTITION TYPES K

8" CONCRETE WALL FROM FLOOR TO DECK ABOVE. PROVIDE REINFORCING AS INDICATED IN STRUCTURAL DRAWINGS. FROM FLOOR TO 8" ABOVE CEILING; FINISH AS SCHEDULED.



PARTITION TYPES L

6" METAL STUDS AT 16" O.C. BRACED AT 4'-0" O.C. ABOVE CEILING TO DECK ABOVE. SHEATH WITH (1) LAYER OF 5/8" TYPE "X" GYPSUM BOARD ON FINISH SIDE FROM FLOOR TO DECK AND (1) LAYER OF 1" SHAFT LINER ON THE SHAFT SIDE; SEAL TIGHT. FILL WITH MINERAL WOOL CONTINUOUS FROM FLOOR TO DECK. FINISH AS SCHEDULED. PROVIDE FIRE RATING PER WALL AS SHOWN ON LIFE SAFETY PLANS INCLUDING PROTECTION ON PENETRATIONS AND SEALANT TYPE USED.



PARTITION TYPES M

(2) 6" METAL STUDS AT 16" O.C. BRACED AT 4'-0" O.C. ABOVE CEILING TO DECK ABOVE AND BRACED ACROSS INTERSTITIAL SPACE TO EACH OTHER AT 8'-0" O.C. VERTICALLY. SHEATH WITH (1) LAYER OF 5/8" TYPE "X" GYPSUM BOARD ON FINISH SIDE FROM FLOOR TO DECK AND (1) LAYER OF 1" SHAFT LINER ON THE SHAFT SIDE; SEAL TIGHT. FILL WITH MINERAL WOOL CONTINUOUS FROM FLOOR TO DECK. FINISH AS SCHEDULED. PROVIDE FIRE RATING PER WALL AS SHOWN ON LIFE SAFETY PLANS INCLUDING PROTECTION ON PENETRATIONS AND SEALANT TYPE USED.

PARTITION TYPES

NOTE: ALL PARTITIONS ARE TO BE TYPE 'A' UNLESS MARKED OTHERWISE ON THE PLAN; USE MOISTURE RESISTANT GYPSUM BOARD AT RESTROOMS AND SIDES OF SINK WALLS.

NOTE: SEE STRUCTURAL DRAWINGS FOR ALL SHEAR WALL LOCATIONS; THESE STRUCTURAL DRAWINGS WILL OVERRULE ANY SPECIFIED MATERIAL OR ASSEMBLY SHOWN.

CITY OF HATTIESBURG MISSISSIPPI 1884

HATTIESBURG PUBLIC SAFETY COMPLEX

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REGISTERED ARCHITECT Larry A. Albert Hattiesburg, MS STATE OF MISSISSIPPI

A1.6

Floor Plan Legend

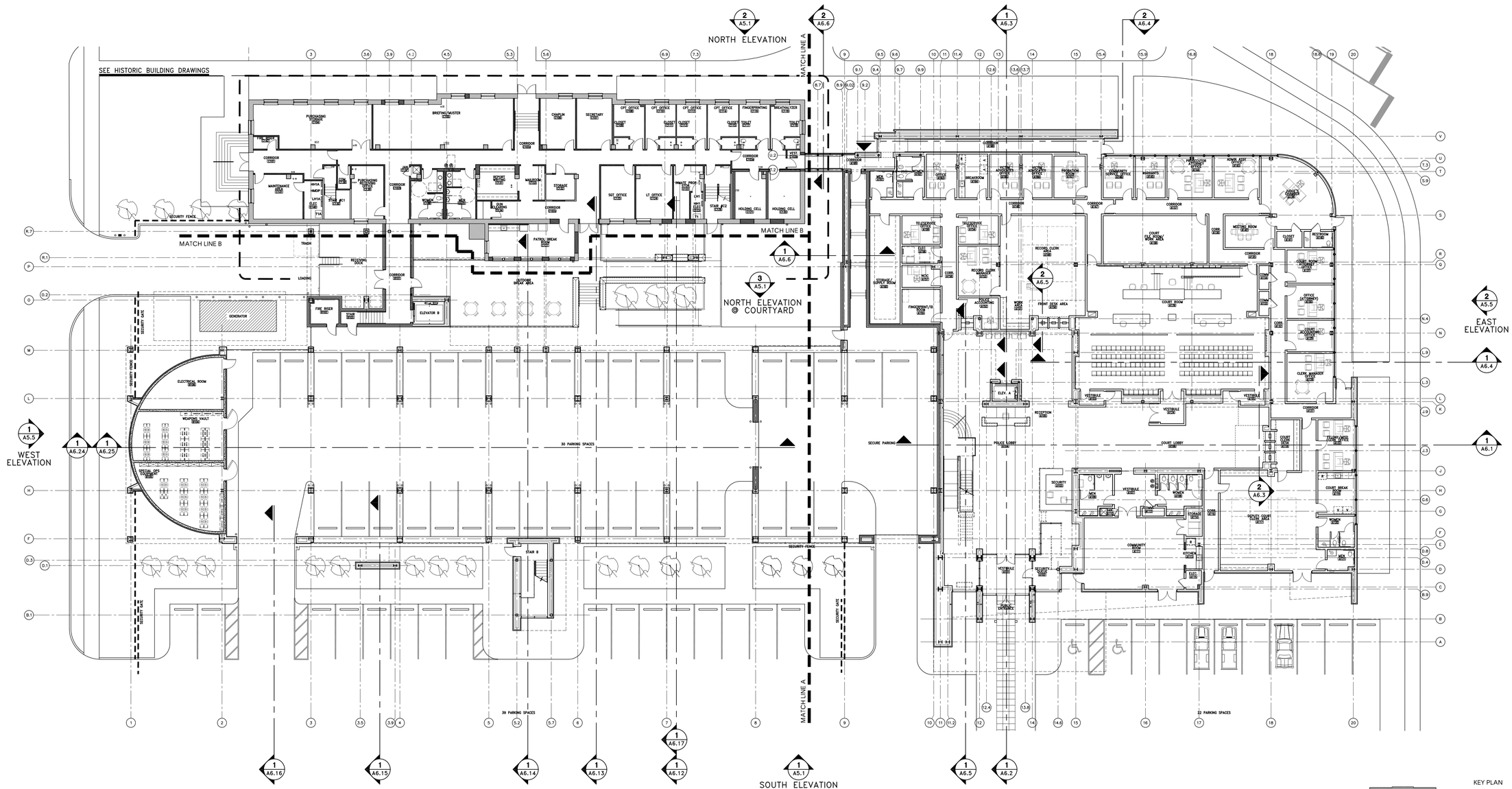
101	DOOR REFERENCE MARK; RE: DOOR SCHEDULE (A8.x SHEETS)
A	WINDOW MARK; RE: WINDOW ELEVATIONS (A8.x SHEETS)
	DOOR SWING
	METAL STUD WALLS
	CMU BLOCK WALLS
	CONCRETE WALLS

General Plan Notes

1. ALL DIMENSIONS ARE TO THE FACE OF FINISH OR FACE OF BLOCK UNLESS NOTED OTHERWISE.
2. IN MASONRY WALL CONSTRUCTION DIMENSIONS ARE TO ROUGH OPENINGS.
3. IN STUD WALL CONSTRUCTION DIMENSIONS ARE TO CENTERLINE OF OPENINGS.
4. ALL DOORS ARE 6" FROM FACE OF STUD OR 8" FROM FACE OF CMU UNLESS DIMENSIONED OTHERWISE.
5. CONTRACTOR TO CONSULT ARCHITECT IMMEDIATELY IF DISCREPANCIES ARE FOUND BETWEEN ARCHITECTURAL AND ENGINEERING DRAWINGS.
6. ALL ANGLES ARE 90° OR 45° UNLESS DIMENSIONED OTHERWISE.
7. SEE A3.x SHEETS FOR ROOF PLANS.
8. SEE A4.X SHEETS FOR REFLECTED CEILING PLANS.
9. SEE A5.x SHEETS FOR EXTERIOR ELEVATIONS.
10. SEE A6.x SHEETS FOR BUILDING SECTIONS.
11. SEE A8.x SHEETS FOR DOOR SCHEDULE/FRAME ELEVATIONS AND WINDOW SCHEDULE/WINDOW ELEVATIONS.
12. SEE A9.x SHEETS FOR FINISH FLOOR PLANS.
13. SEE A10.x SHEETS FOR INTERIOR ELEVATIONS.
14. SEE A11.x SHEETS FOR VERTICAL CIRCULATION.

Blocking for Equipment:

PROVIDE WALL THICKNESS TO FULLY RECESS ANY EQUIPMENT REQUIRED TO BE RECESSED. VERIFY ALL EQUIPMENT DIMENSIONAL REQUIREMENTS AND LOCATIONS WITH ARCHITECT BEFORE CONSTRUCTING PARTITIONS. SOME PARTITIONS CONTAINING RECESSED EQUIPMENT MAY NEED TO BE THICKER THAN SHOWN ON THIS PLAN. THESE WALLS WILL BE VERIFIED BY ARCHITECT BEFORE CONSTRUCTION AND WILL BE PROVIDED AT THE CONTRACTOR'S EXPENSE. PROVIDE SOLID BLOCKING BEHIND ALL FIXED EQUIPMENT AND ACCESSORIES SHOWN IN THE CONTRACT DOCUMENTS. VERIFY THE LOCATION AND SIZE OF ALL FIXED EQUIPMENT AND ACCESSORIES BEFORE INSTALLING BLOCKING.



First Floor Plan Composite

SCALE: 1/16" = 1'-0"

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

Drawing Issued:	
Date	Rev. Description
08-31-2015	DD Check Set
10-20-2015	75% Progress Set
11-02-2015	90% Pricing Set
11-19-2018	100% Bid Docs

Drawn By: CR,CP,AS,RE
Checked By: CR,LA,CF
Client No: ------
Albert & Associates: 1257!

Larry M. Albert, Jr. Hattiesburg, MS

A2.0a

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com **Albert & McCleskey Associates Architects**

Floor Plan Legend

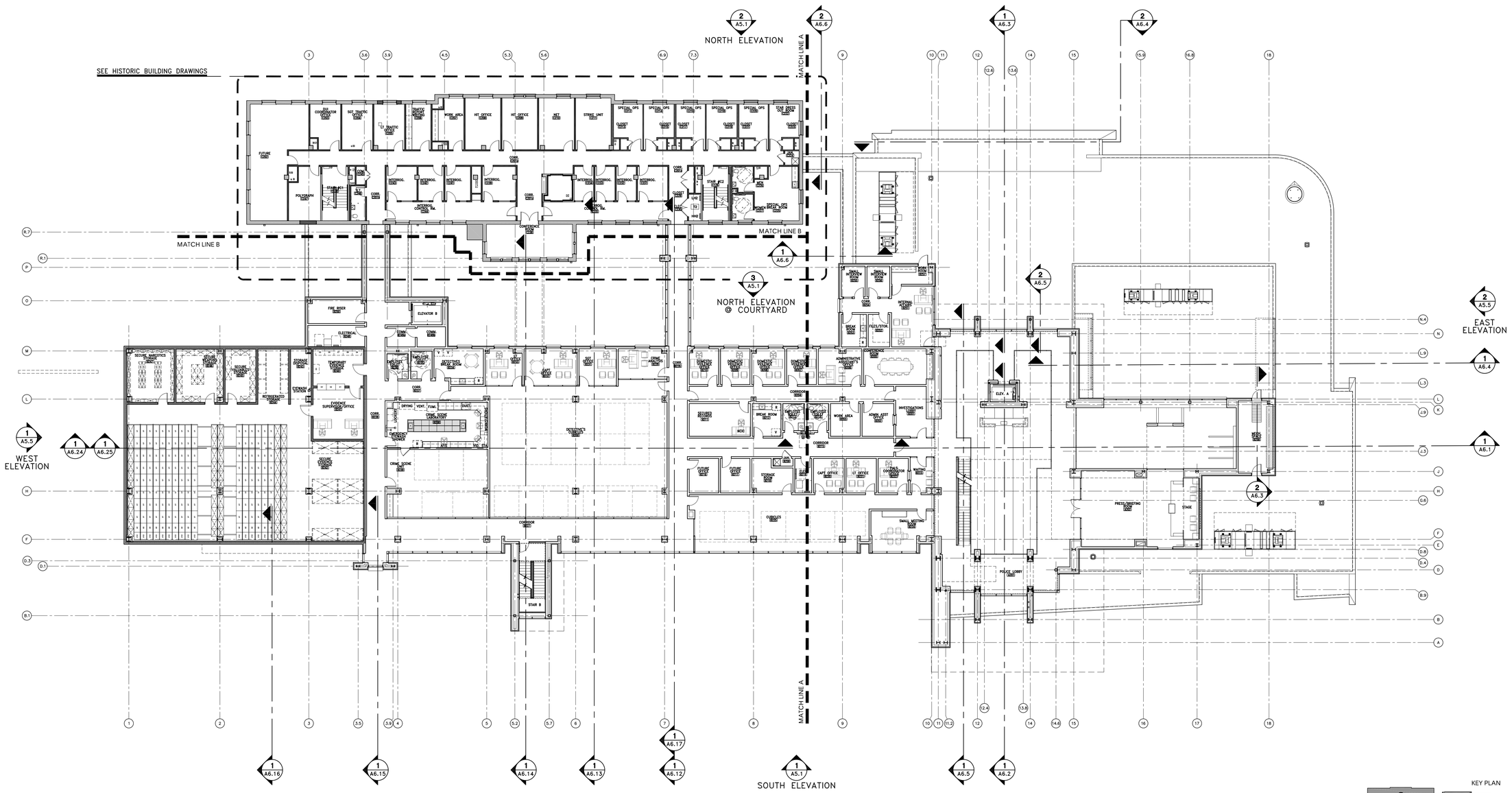
101	DOOR REFERENCE MARK; RE: DOOR SCHEDULE (A8.x SHEETS)
A	WINDOW MARK; RE: WINDOW ELEVATIONS (A8.x SHEETS)
	DOOR SWING
	METAL STUD WALLS
	CMU BLOCK WALLS
	CONCRETE WALLS

General Plan Notes

1. ALL DIMENSIONS ARE TO THE FACE OF FINISH OR FACE OF BLOCK UNLESS NOTED OTHERWISE.
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13. SEE A10.x SHEETS FOR INTERIOR ELEVATIONS.
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Second Floor Plan Composite

SCALE: 1/16" = 1'-0"

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT

HPSC Police and Court Building

Drawing Issued:

Date	Rev.	Description
08-31-2015		DD Check Set
10-20-2015		75% Progress Set
11-02-2015		90% Pricing Set
11-19-2018		100% Bid Docs

Drawn By: CR,CP,AS,RE

Checked By: CR,LA,CF

Client No: ------

Albert & Associates: 1257

REGISTERED ARCHITECT Larry A. Albert Hattiesburg, MS STATE OF MISSISSIPPI

A2.0b

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com **Albert & McCleskey Associates Architects**

Floor Plan Legend

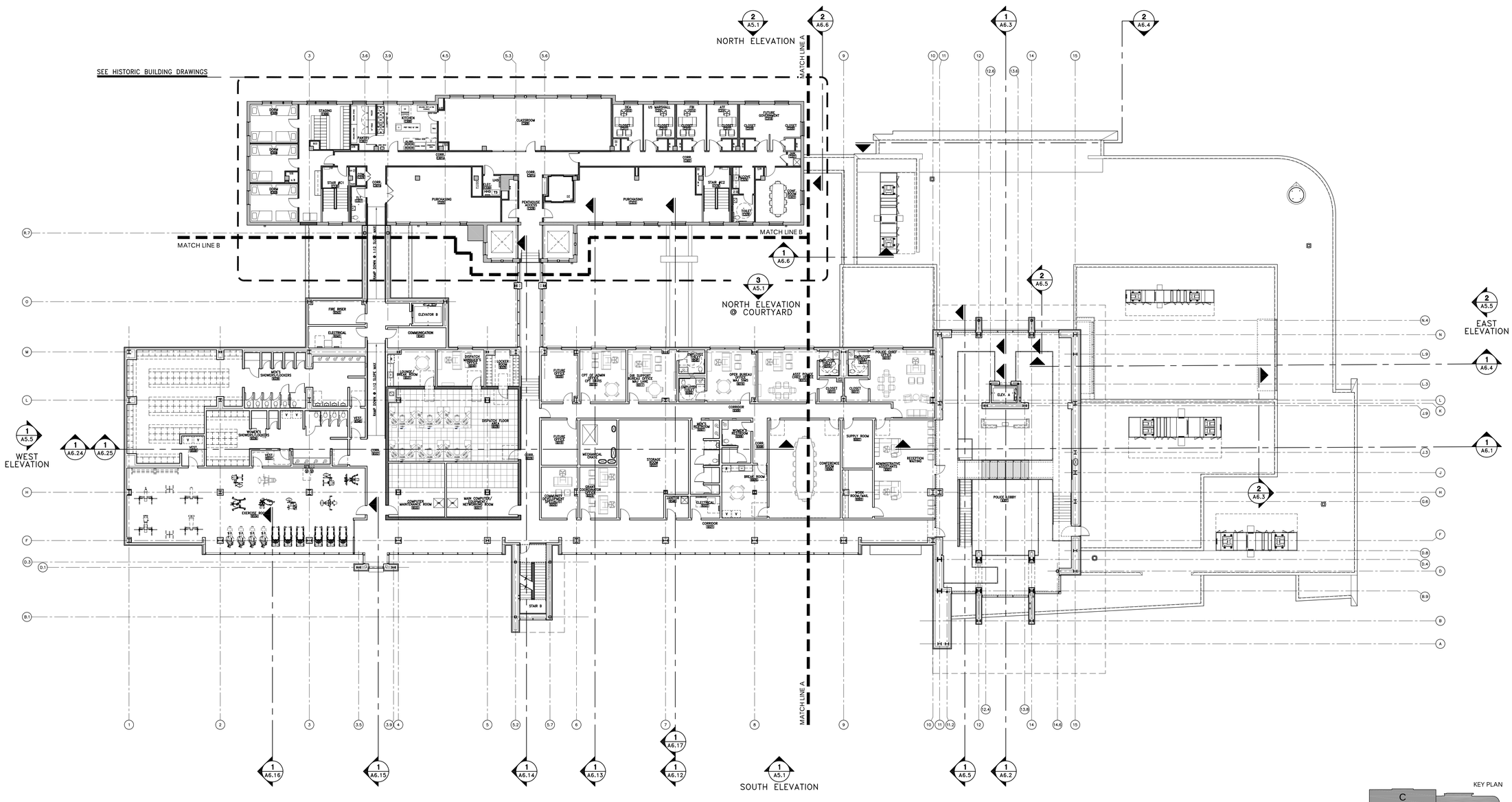
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	METAL STUD WALLS
	CMU BLOCK WALLS
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13. SEE A10.x SHEETS FOR INTERIOR ELEVATIONS.
14. SEE A11.x SHEETS FOR VERTICAL CIRCULATION.

Blocking for Equipment:

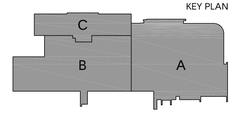
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Third Floor Plan Composite

SCALE: 1/16" = 1'-0"

KEY PLAN



HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

Drawing Issued:

Date	Rev.	Description
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Drawn By: CR,CP,AS,RE

Checked By: CR,LA,CF

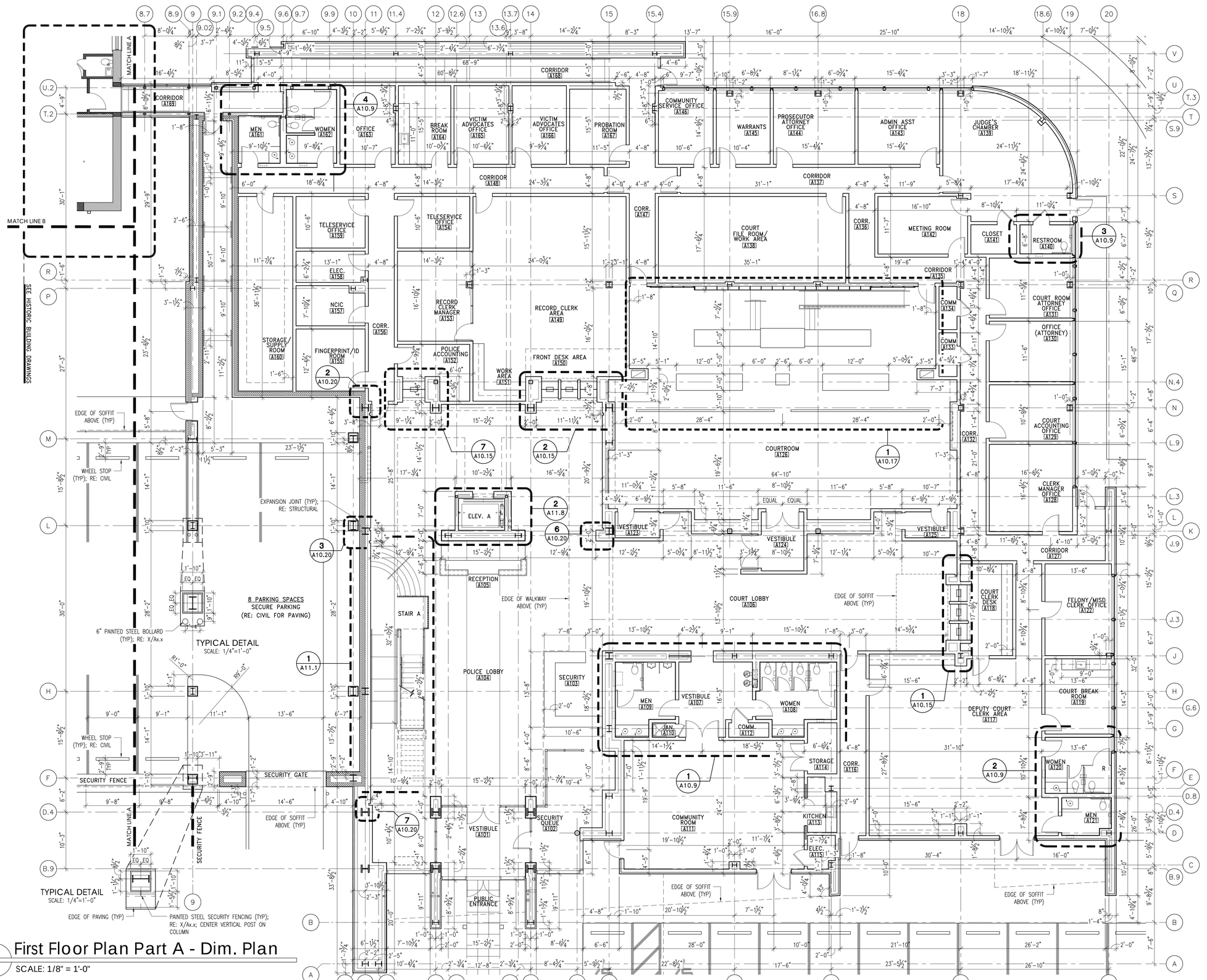
Client No: ------

Albert & Associates: 1257!

REGISTERED ARCHITECT Larry A. Albert Hattiesburg, MS STATE OF MISSISSIPPI

A2.0c

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com **Albert & McCleskey Associates Architects**



N

First Floor Plan Part A - Dim. Plan

SCALE: 1/8" = 1'-0"

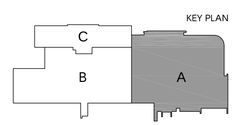
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13. SEE A10.x SHEETS FOR INTERIOR ELEVATIONS.
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Floor Plan Legend

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A	WINDOW MARK; RE: WINDOW ELEVATIONS (A8.x SHEETS)
	DOOR SWING
	METAL STUD WALLS
	CMU BLOCK WALLS
	CONCRETE WALLS

KEY PLAN



CITY OF HATTIESBURG MISSISSIPPI 1884

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT

HPSC Police and Court Building

Drawing Issued:

Date	Rev.	Description
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Drawn By: CR,CP,AS,RE

Checked By: CR,LA,CF

Client No: ------

Albert & Associates: 1257

REGISTERED ARCHITECT Larry A. Albert Hattiesburg, MS STATE OF MISSISSIPPI

A2.1a

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com **Albert & McCleskey Associates Architects**

First Floor Plan Part A - Ref. Plan

SCALE: 1/8" = 1'-0"

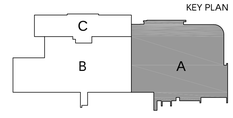
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Floor Plan Legend

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	DOOR SWING
	METAL STUD WALLS
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	CONCRETE WALLS

KEY PLAN



HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■ HATTIESBURG

HPSC Police and Court Building

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Drawn By: CR,CP,AS,RE
Checked By: CR,LA,CF
Client No: ------
Albert & Associates: 1257

Larry A. Albert, Jr. REGISTERED ARCHITECT STATE OF MISSISSIPPI Hattiesburg, MS

A2.1b

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com
Albert & McCleskey Associates Architects

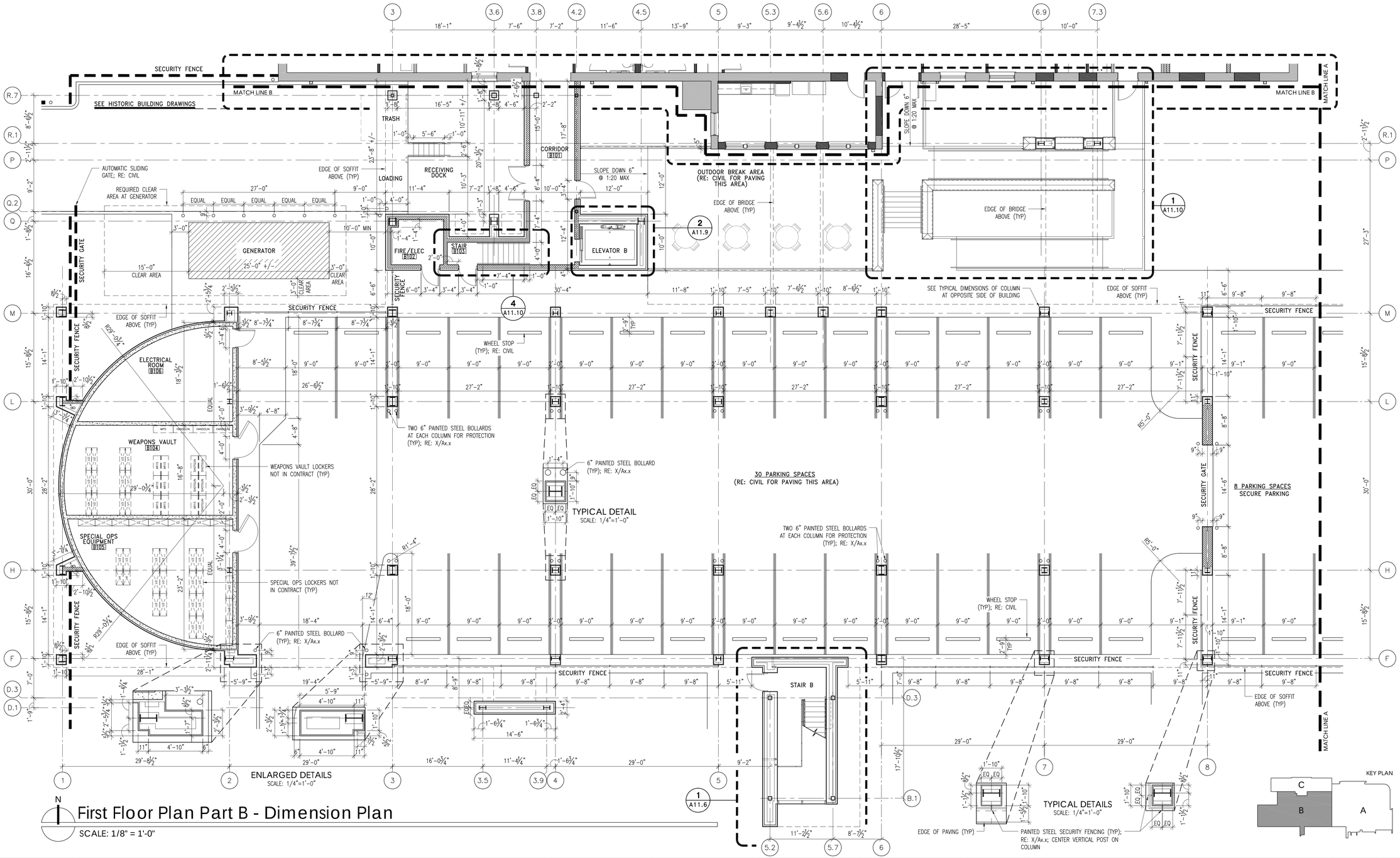
FIRST FLOOR PLAN PART A REF

Floor Plan Legend

101	DOOR REFERENCE MARK; RE: DOOR SCHEDULE (A8.x SHEETS)		METAL STUD WALLS
A	WINDOW MARK; RE: WINDOW ELEVATIONS (A8.x SHEETS)		CMU BLOCK WALLS
	DOOR SWING		CONCRETE WALLS

General Plan Notes

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First Floor Plan Part B - Dimension Plan

SCALE: 1/8" = 1'-0"

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT

HPSC Police and Court Building

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Drawn By: CR,CP,AS,RE

Checked By: CR,LA,CF

Client No: ------

Albert & Associates: 1257t

REGISTERED ARCHITECT Larry A. Albert Hattiesburg, MS STATE OF MISSISSIPPI

A2.2a

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com **Albert & McCleskey Associates Architects**

Floor Plan Legend

101	DOOR REFERENCE MARK; RE: DOOR SCHEDULE (A8.x SHEETS)		METAL STUD WALLS
A	WINDOW MARK; RE: WINDOW ELEVATIONS (A8.x SHEETS)		CMU BLOCK WALLS
	DOOR SWING		CONCRETE WALLS

General Plan Notes

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14. SEE A11.x SHEETS FOR VERTICAL CIRCULATION.

SECURITY FENCE
MATCH LINE B
SEE HISTORIC BUILDING DRAWINGS
TRASH
EDGE OF SOFFIT ABOVE (TYP)
LOADING
RECEIVING DOCK
CORRIDOR B101
B101b
B101c
OUTDOOR BREAK AREA (RE: CIVIL FOR PAVING THIS AREA)
EDGE OF BRIDGE ABOVE (TYP)
EXISTING CONCRETE FOUNDATION REMAINS; MODIFY AS REQUIRED FOR INSTALLATION OF SLOPED WALKWAY; MINIMUM THICKNESS OF NEW CONCRETE WALKWAY SHALL BE 4 INCHES
MATCH LINE A
AUTOMATIC SLIDING GATE; RE: CIVIL
REQUIRED CLEAR AREA AT GENERATOR
GENERATOR
FIRE RISER B102
J2
STAIR B103
B102
B103
ELEVATOR B
2 A11.9
4 A11.10
1 A11.10
2 A5.1
NORTH ELEVATION
SECURITY GATE
SECURITY FENCE
EDGE OF SOFFIT ABOVE (TYP)
ELECTRICAL ROOM B106
B106
K
WEAPONS VAULT B104
MP5
HANDGUN
B104
WEAPONS VAULT LOCKERS NOT IN CONTRACT (TYP)
1 A5.5
WEST ELEVATION
1 A6.24
1 A6.25
30 PARKING SPACES
(RE: CIVIL FOR PAVING THIS AREA)
B107
SECURITY GATE
8 PARKING SPACES
SECURE PARKING
SPECIAL OPS EQUIPMENT B105
B105
SPECIAL OPS LOCKERS NOT IN CONTRACT (TYP)
WHEEL STOP (TYP); RE: CIVIL
B108
STAIR B
DW-18
1 A11.6
1 A6.16
1 A6.15
1 A6.14
1 A6.13
1 A5.1
SOUTH ELEVATION
1 A6.17
1 A6.12
KEY PLAN
C
B
A

N

First Floor Plan Part B - Reference Plan

SCALE: 1/8" = 1'-0"

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT

HPSC Police and Court Building

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A2.2b

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com
Albert & McCleskey Associates Architects

FIRST FLOOR PLAN PART B REF

Second Floor Plan Part A - Dim. Plan

SCALE: 1/8" = 1'-0"

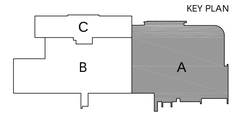
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KEY PLAN



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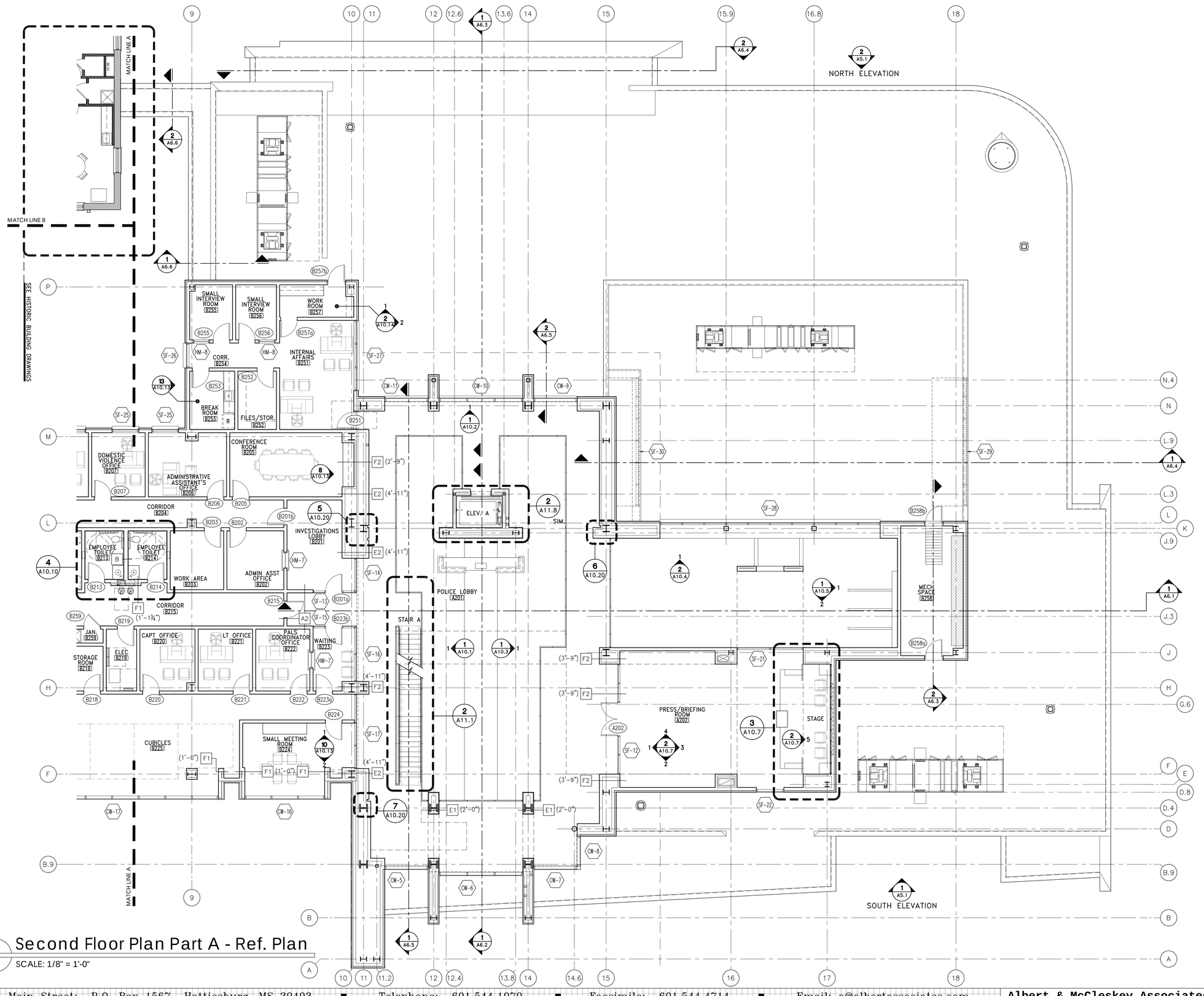
Drawn By: CR,CP,AS,RE
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REGISTERED ARCHITECT Larry A. Albert Hattiesburg, MS STATE OF MISSISSIPPI

A2.3a

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Albert & McCleskey Associates Architects

SECOND FLOOR PLAN PART A DIM



Second Floor Plan Part A - Ref. Plan

SCALE: 1/8" = 1'-0"

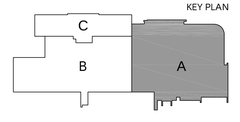
General Plan Notes

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3. IN STUD WALL CONSTRUCTION DIMENSIONS ARE TO CENTERLINE OF OPENINGS.
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5. CONTRACTOR TO CONSULT ARCHITECT IMMEDIATELY IF DISCREPANCIES ARE FOUND BETWEEN ARCHITECTURAL AND ENGINEERING DRAWINGS.
6. ALL ANGLES ARE 90° OR 45° UNLESS DIMENSIONED OTHERWISE.
7. SEE A3.x SHEETS FOR ROOF PLANS.
8. SEE A4.X SHEETS FOR REFLECTED CEILING PLANS.
9. SEE A5.x SHEETS FOR EXTERIOR ELEVATIONS.
10. SEE A6.x SHEETS FOR BUILDING SECTIONS.
11. SEE A8.x SHEETS FOR DOOR SCHEDULE/FRAME ELEVATIONS AND WINDOW SCHEDULE/WINDOW ELEVATIONS.
12. SEE A9.x SHEETS FOR FINISH FLOOR PLANS.
13. SEE A10.x SHEETS FOR INTERIOR ELEVATIONS.
14. SEE A11.x SHEETS FOR VERTICAL CIRCULATION.

Floor Plan Legend

101	DOOR REFERENCE MARK; RE: DOOR SCHEDULE (A8.x SHEETS)
A	WINDOW MARK; RE: WINDOW ELEVATIONS (A8.x SHEETS)
	DOOR SWING
	METAL STUD WALLS
	CMU BLOCK WALLS
	CONCRETE WALLS

KEY PLAN



CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

Drawing Issued:

Date	Rev.	Description
08-31-2015		DD Check Set
10-20-2015		75% Progress Set
11-02-2015		90% Pricing Set
11-19-2018		100% Bid Docs

Drawn By: CR,CP,AS,RE

Checked By: CR,LA,CF

Client No: ------

Albert & Associates: 12575

REGISTERED ARCHITECT Larry M. Albert No. 4951 Hattiesburg, MS STATE OF MISSISSIPPI

A2.3b

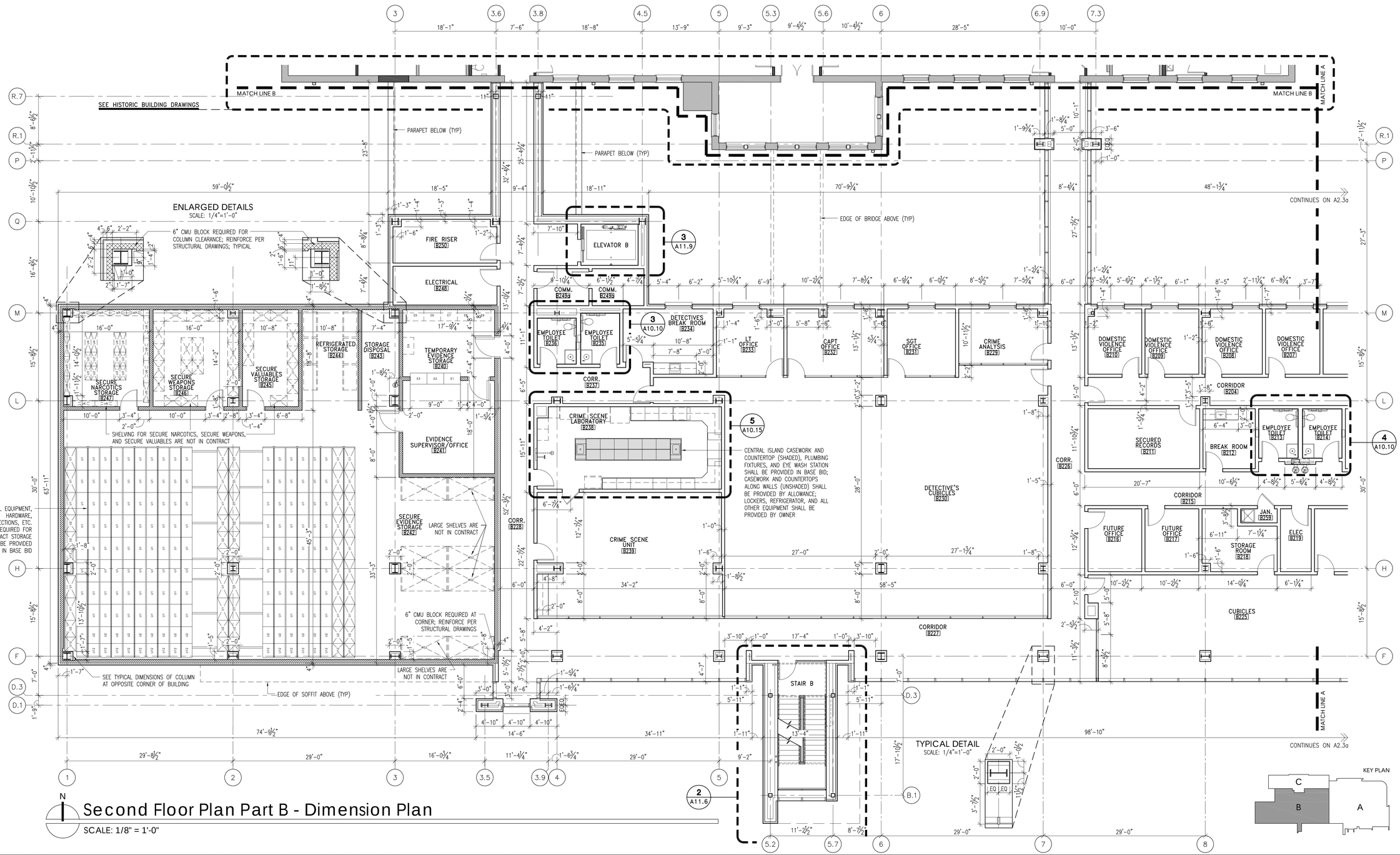
514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com **Albert & McCleskey Associates Architects**

Floor Plan Legend

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A	WINDOW MARK; RE: WINDOW ELEVATIONS (A8.x SHEETS)		CMU BLOCK WALLS
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Second Floor Plan Part B - Dimension Plan

SCALE: 1/8" = 1'-0"

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

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REGISTERED ARCHITECT Larry M Albert 8879 Hattiesburg, MS STATE OF MISSISSIPPI

A2.4a

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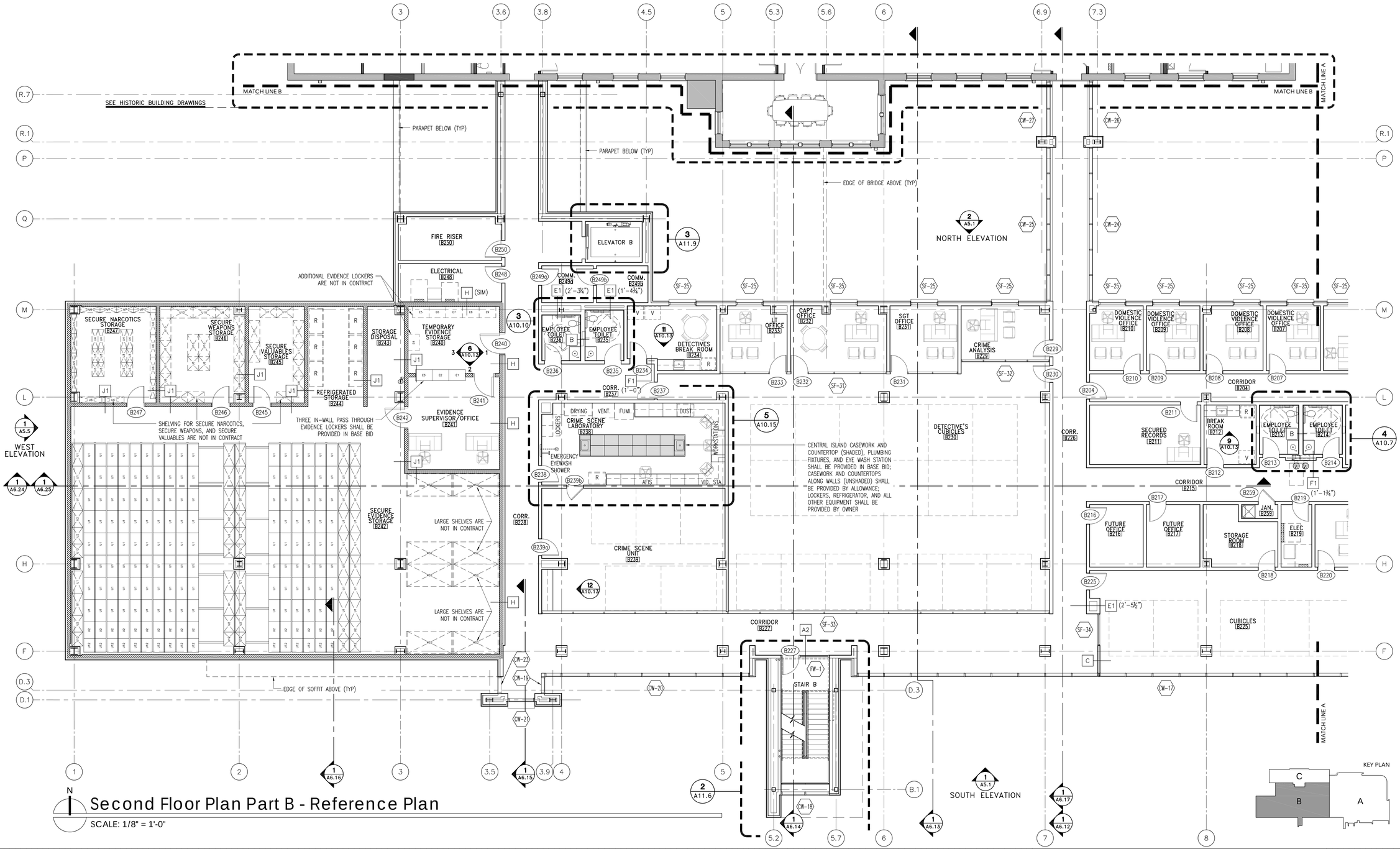
SECOND FLOOR PLAN PART B DIM

Floor Plan Legend

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	DOOR SWING		CONCRETE WALLS

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14. SEE A11.x SHEETS FOR VERTICAL CIRCULATION.



N

Second Floor Plan Part B - Reference Plan

SCALE: 1/8" = 1'-0"

KEY PLAN

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

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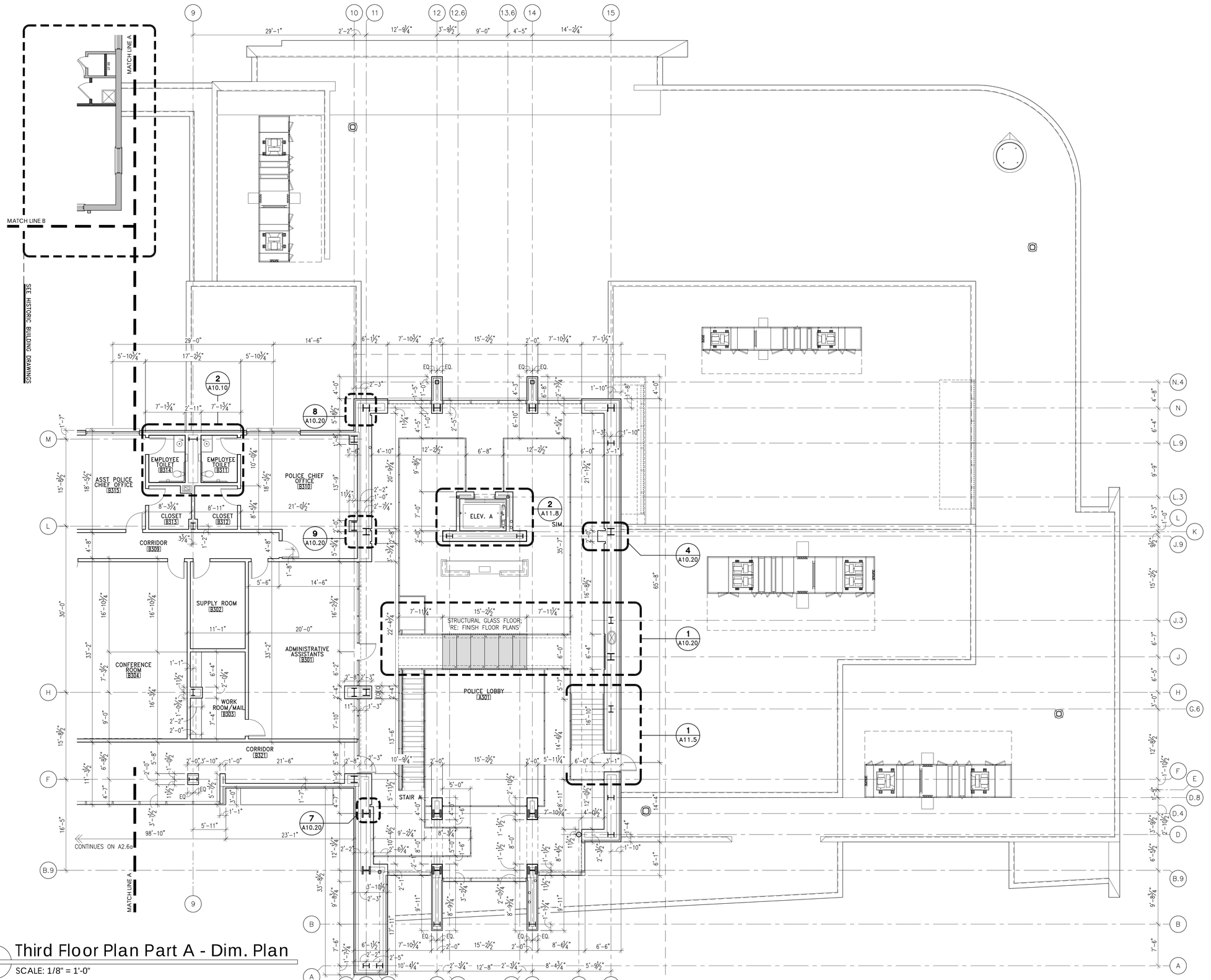
Drawn By: CR,CP,AS,RE
Checked By: CR,LA,CF
Client No: ------
Albert & Associates: 1257

REGISTERED ARCHITECT Larry M Albert Hattiesburg, MS STATE OF MISSISSIPPI

A2.4b

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SECOND FLOOR PLAN PART B REF



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	METAL STUD WALLS
	CMU BLOCK WALLS
	CONCRETE WALLS

Third Floor Plan Part A - Dim. Plan

SCALE: 1/8" = 1'-0"

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

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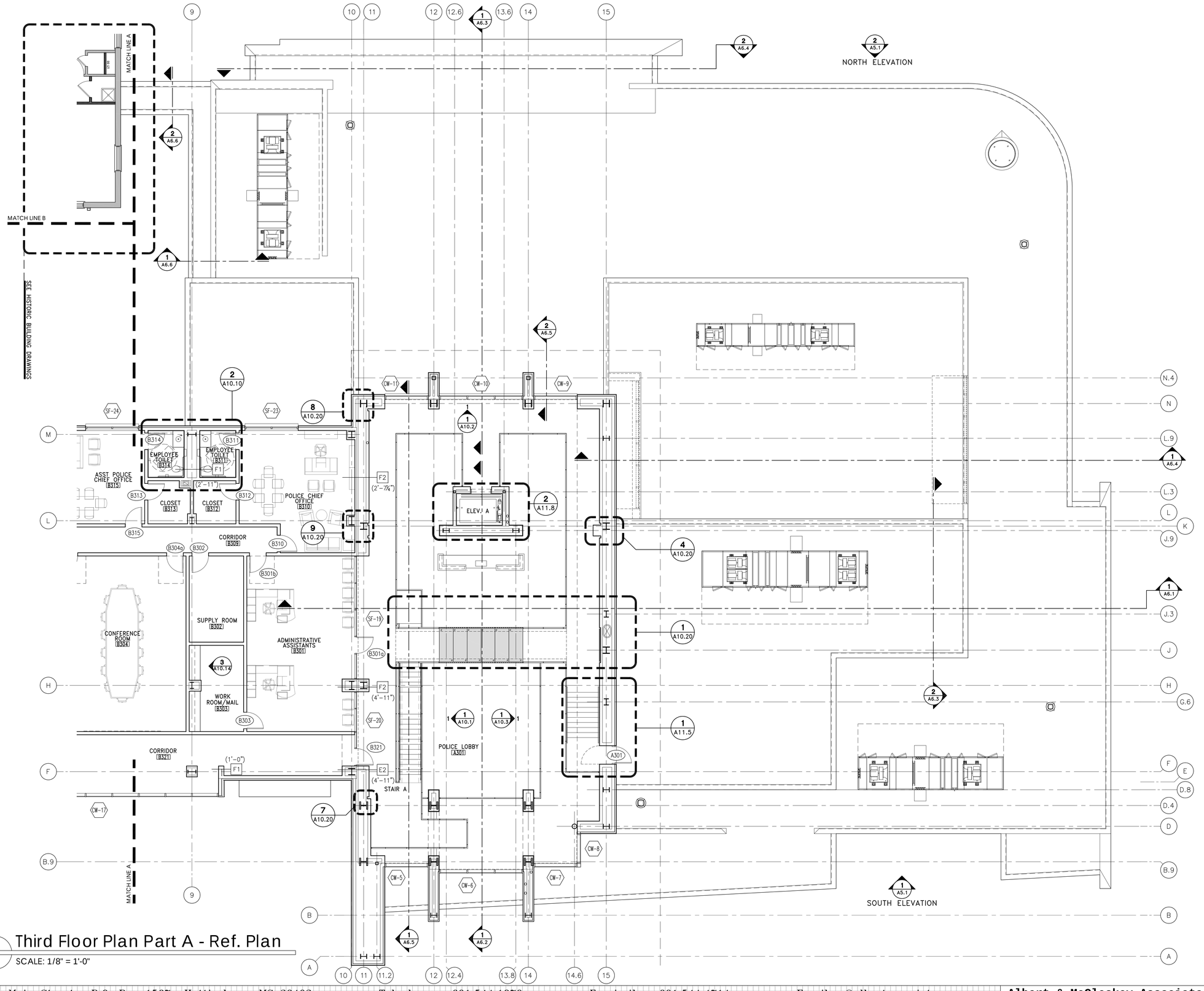
Client No: ------

Albert & Associates: 12575

REGISTERED ARCHITECT Larry M. Albert Hattiesburg, MS STATE OF MISSISSIPPI

A2.5a

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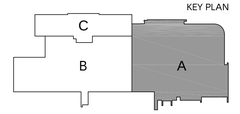
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	METAL STUD WALLS
	CMU BLOCK WALLS
	CONCRETE WALLS

KEY PLAN



Third Floor Plan Part A - Ref. Plan

SCALE: 1/8" = 1'-0"

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT

HPSC Police and Court Building

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Drawn By: CR,CP,AS,RE

Checked By: CR,LA,CF

Client No: ------

Albert & Associates: 1257t

REGISTERED ARCHITECT Larry W. Albert Hattiesburg, MS STATE OF MISSISSIPPI

A2.5b

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com

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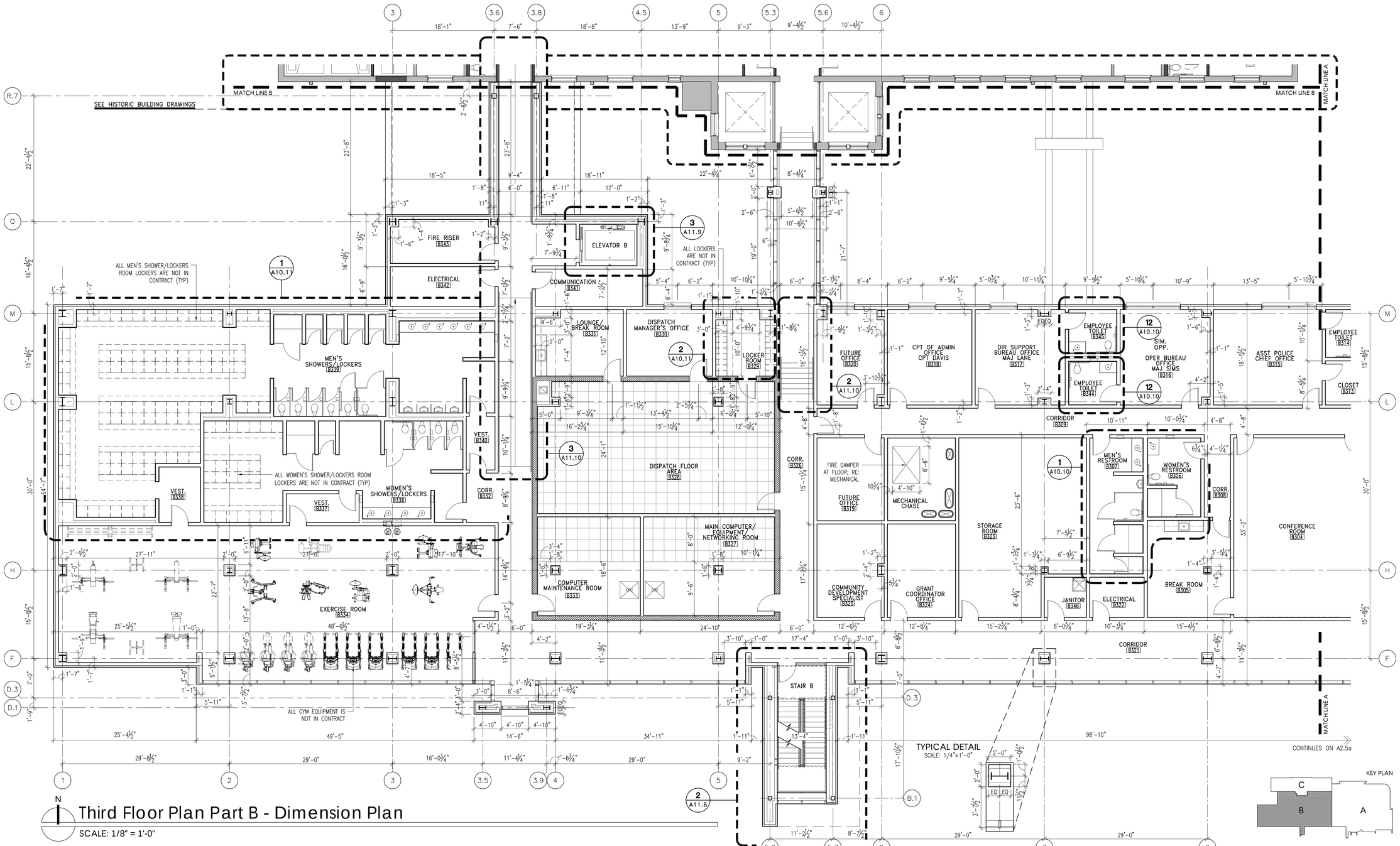
THIRD FLOOR PLAN PART A REF

Floor Plan Legend

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14. SEE A11.x SHEETS FOR VERTICAL CIRCULATION.



Third Floor Plan Part B - Dimension Plan

SCALE: 1/8" = 1'-0"

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

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Larry M. Albert, Hattiesburg, MS

A2.6a

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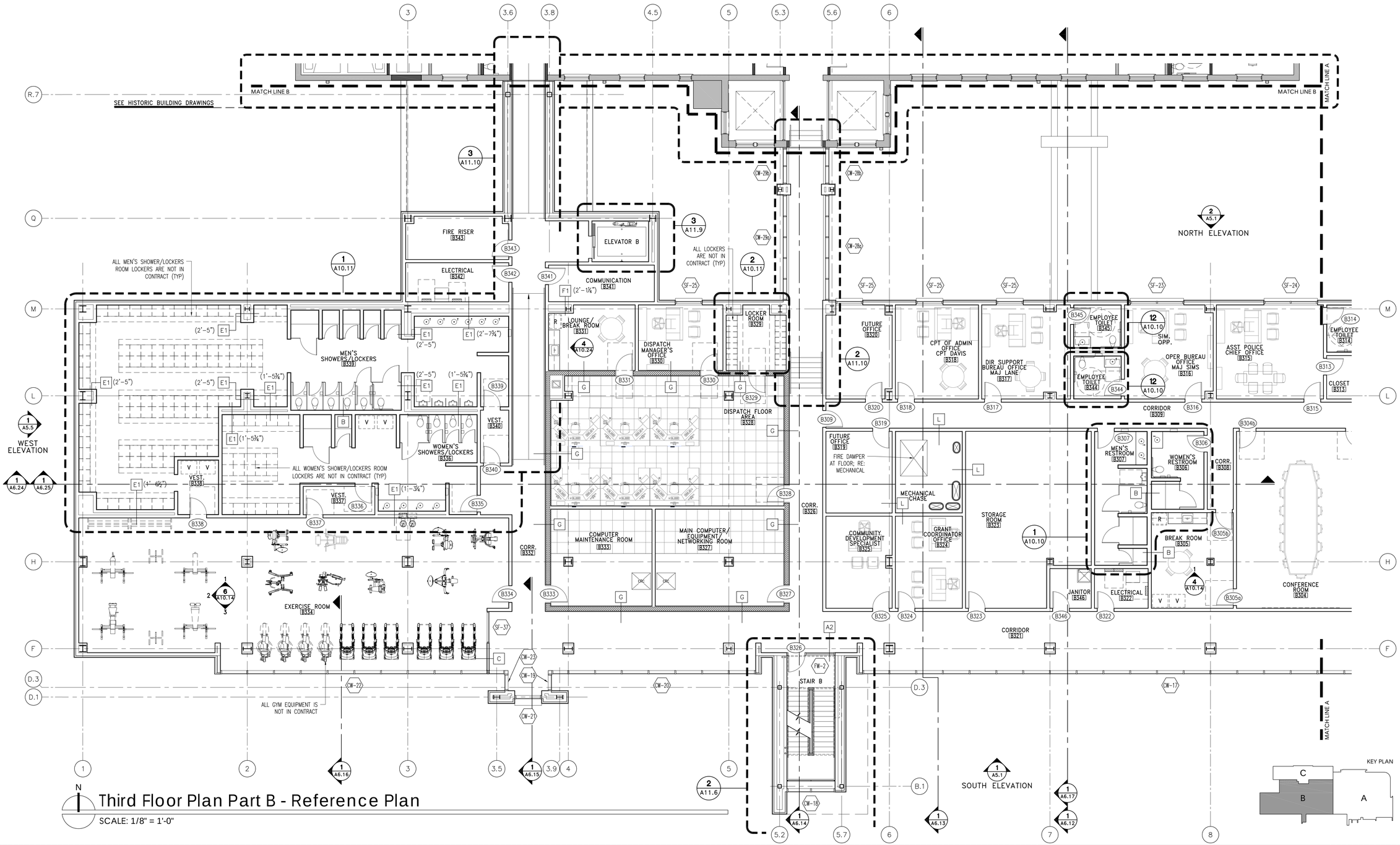
SECOND FLOOR PLAN PART B DIM

Floor Plan Legend

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N

Third Floor Plan Part B - Reference Plan

SCALE: 1/8" = 1'-0"

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Albert & McCleskey Associates Architects

SECOND FLOOR PLAN PART B REF

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

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Client No: ------

Albert & Associates: 1257

Larry A. Albert MS 8787 Hattiesburg, MS REGISTERED ARCHITECT STATE OF MISSISSIPPI

A2.6b

Roof Assembly Notes

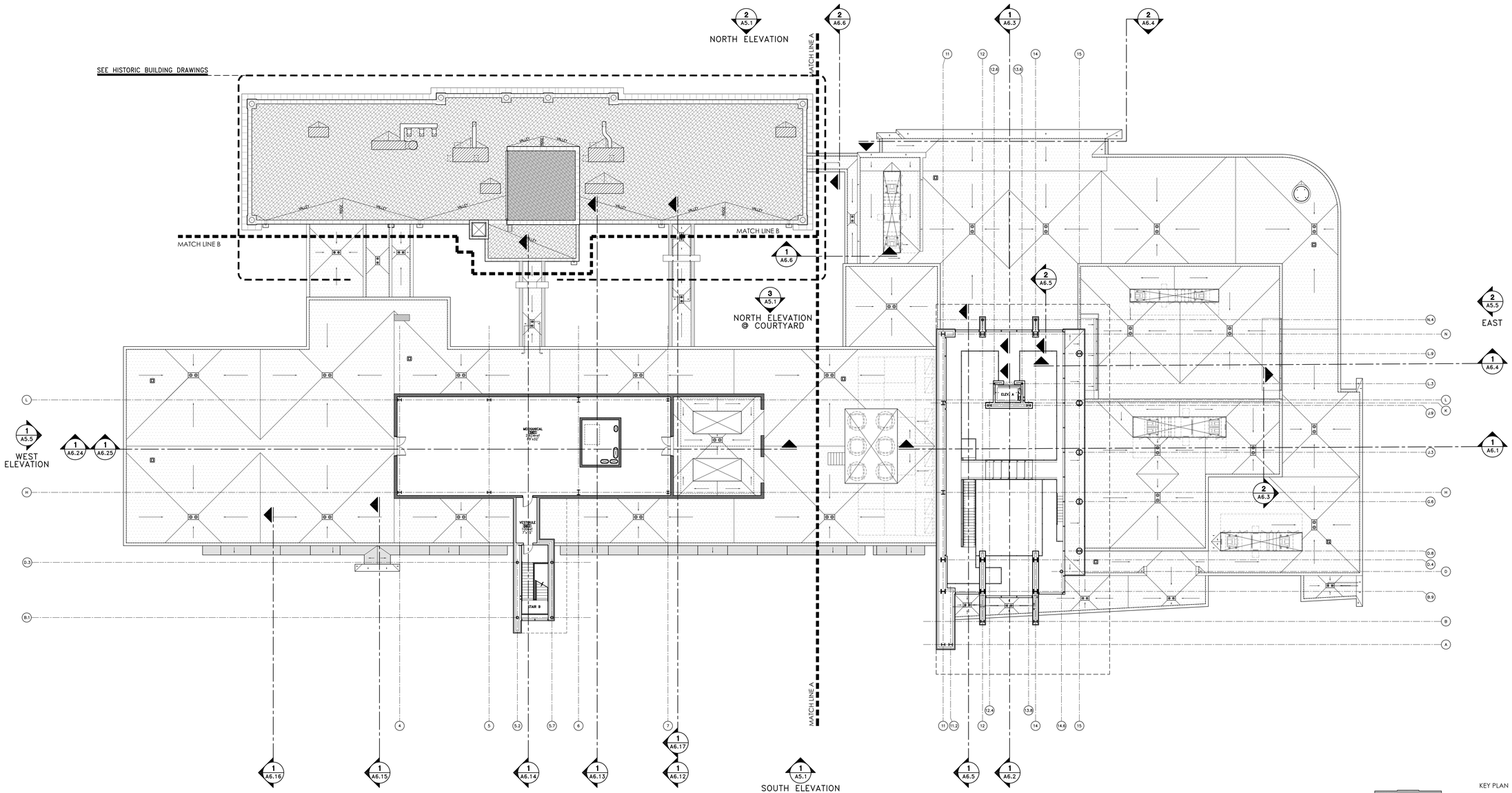
2-PLY MODIFIED BITUMINOUS ROOF AT BUILDINGS A AND B

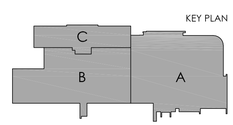
2-PLY MODIFIED BITUMINOUS ROOF ASSEMBLY:

1. 2-PLY MODIFIED BITUMINOUS ROOFING MEMBRANE.
2. ½" COVER BOARD [072100].
3. TAPERED POLYISOCYANURATE INSULATION [072100]; SLOPE AT ¼"/LF MINIMUM.
4. 3" BASE LAYER OF POLYISOCYANURATE INSULATION [072100] UNLESS NOTED OTHERWISE.
5. (1) LAYER OF AIR AND VAPOR BARRIER MEMBRANE OVER ENTIRE ROOF DECK (INSTALL PER MANUFACTURER'S RECOMMENDATIONS).
6. 1½" STEEL ROOF DECKING; RE: STRUCTURAL.

General Roof Notes

1. ALL SHEET METAL WORK INCLUDING FLASHING, GUTTERS, DOWNSPOUTS, CAP FLASHING, ETC. SHALL BE PREFINISHED METAL AND SHALL BE INSTALLED IN ACCORDANCE WITH THE SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA) MANUAL.
2. WATER TEST ALL ROOF PENETRATIONS, GUTTERS, AND DOWNSPOUTS UPON COMPLETION OF PROJECT.
3. PAINT ALL PENETRATIONS TO MATCH ADJACENT ROOF MATERIAL.
4. ARROWS ON ROOF PLAN INDICATE THE DIRECTION OF WATER FLOW; ALL SLOPES ARE TO BE A MINIMUM OF ¼"/LF TOWARDS DRAINS.
5. SEE PLUMBING DRAWINGS ROOF DRAIN SIZES.
6. RE: DIVISION 7 SPECIFICATIONS FOR ROOFING PRODUCTS.
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Roof Plan Composite

SCALE: 1/16" = 1'-0"

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

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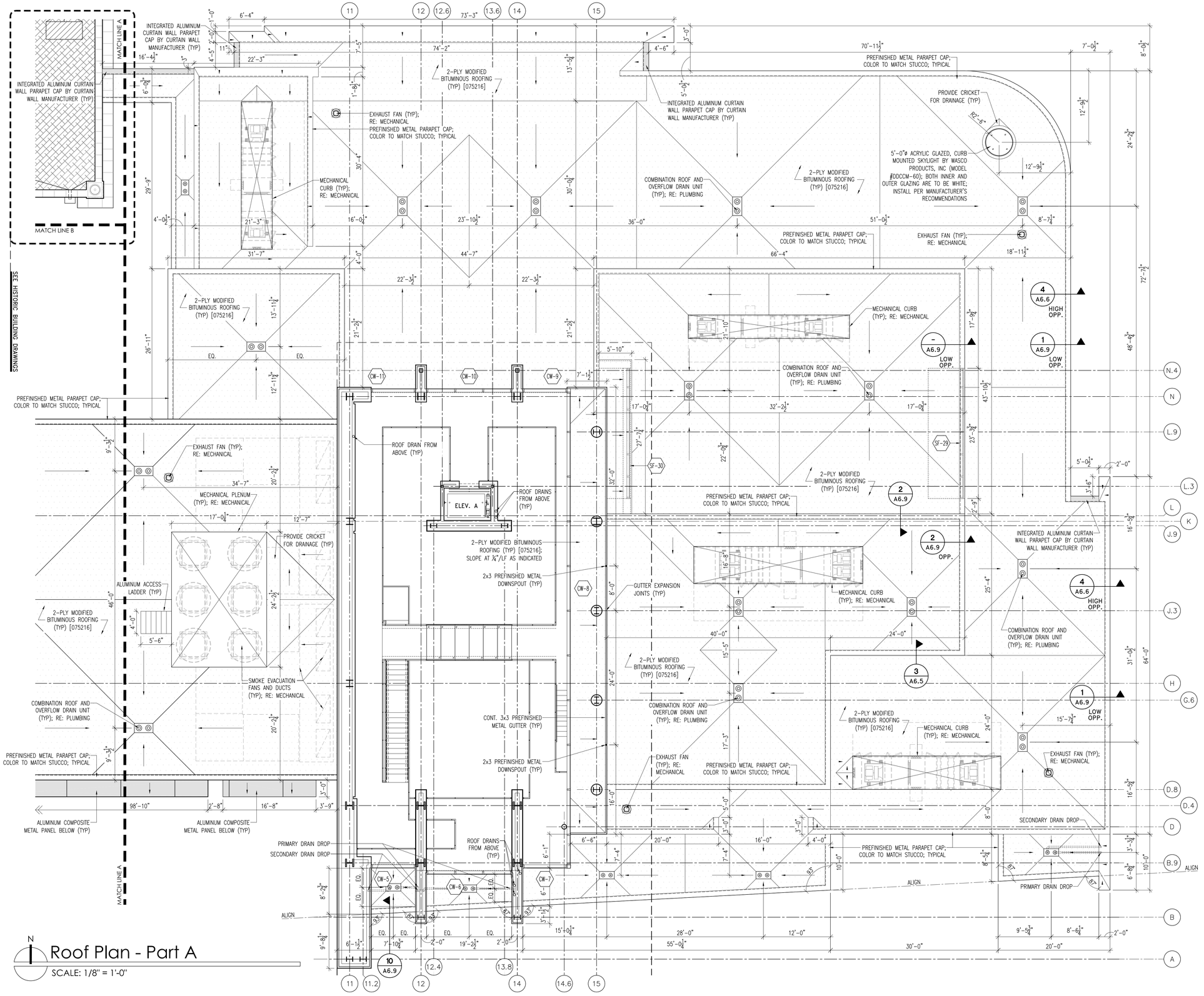
Client No: ------

Albert & Associates: 12575

REGISTERED ARCHITECT Larry M. Albert Hattiesburg, MS STATE OF MISSISSIPPI

A3.0

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Roof Plan - Part A

SCALE: 1/8" = 1'-0"

ROOF DRAINAGE CALCULATIONS

The following conditions were used in sizing the roof drainage system and were based on the requirements the 2012 INTERNATIONAL PLUMBING CODE.

- The roof drainage system was designed to handle a 100 year maximum rainfall of 4.5 inches per hour. This is based on IPC FIGURE 1106.1 100-YEAR, 1-HOUR RAINFALL FOR THE EASTERN UNITED STATES.
- For calculating the size of the roof drainage system , the minimum slope of the horizontal branches was used since it is the most restrictive part of the roof drainage system. From IPC TABLE 1106.3 SIZE OF HORIZONTAL STORM DRAINAGE PIPING, the following horizontal pipe sizes will drain the roof areas shown below for the 100 year maximum rainfall at 4.5 inches per hour based on the minimum 1/8 inch per linear foot horizontal pipe slope.
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- The secondary drainage system shall have the end point of discharge separate from the primary system and discharged above grade in a location normally observed. The secondary drainage system shall be sized based on the rainfall rate for which the primary system is sized. Scuppers shall have an opening dimension of not less than 4 inches. The flow through the primary system shall not be considered when sizing the secondary roof drain system. (IPC 1108.3)
- All drain pipes to be wrapped in sound insulation for horizontal and vertical runs.

PIPE SIZE (1% SLOPE)	MAX ROOF AREA DRAINED
3"ø	657 SQUARE FEET
4"ø	1,504 SQUARE FEET
5"ø	2,672 SQUARE FEET
6"ø	4,280 SQUARE FEET
8"ø	9,200 SQUARE FEET

adapted from Table 1106.3, IPC 2012

Roof Assembly Notes

2-PLY MODIFIED BITUMINOUS ROOF

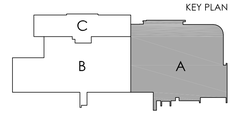
2-PLY MODIFIED BITUMINOUS ROOF ASSEMBLY:

1. 2-PLY MODIFIED BITUMINOUS ROOFING MEMBRANE.
2. ½" COVER BOARD [072100].
3. TAPERED POLYISOCYANURATE INSULATION [072100]; SLOPE AT ¼"/LF MINIMUM.
4. 3" BASE LAYER OF POLYISOCYANURATE INSULATION [072100] UNLESS NOTED OTHERWISE.
5. (1) LAYER OF AIR AND VAPOR BARRIER MEMBRANE OVER ENTIRE ROOF DECK (INSTALL PER MANUFACTURER'S RECOMMENDATIONS).
6. 1½" STEEL ROOF DECKING; RE: STRUCTURAL.

General Roof Notes

1. ALL SHEET METAL WORK INCLUDING FLASHING, GUTTERS, DOWNSPOUTS, CAP FLASHING, ETC. SHALL BE PREFINISHED METAL AND SHALL BE INSTALLED IN ACCORDANCE WITH THE SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA) MANUAL.
2. WATER TEST ALL ROOF PENETRATIONS, GUTTERS, AND DOWNSPOUTS UPON COMPLETION OF PROJECT.
3. PAINT ALL PENETRATIONS TO MATCH ADJACENT ROOF MATERIAL.
4. ARROWS ON ROOF PLAN INDICATE THE DIRECTION OF WATER FLOW; ALL SLOPES ARE TO BE A MINIMUM OF ¼"/LF TOWARDS DRAINS.
5. SEE PLUMBING DRAWINGS ROOF DRAIN SIZES.
6. RE: DIVISION 7 SPECIFICATIONS FOR ROOFING PRODUCTS.
7. CONTRACTOR TO CONSULT ARCHITECT IMMEDIATELY IF DISCREPANCIES ARE FOUND BETWEEN ARCHITECTURAL AND ENGINEERING DRAWINGS.
8. ALL ANGLES ARE 90° OR 45° UNLESS DIMENSIONED OTHERWISE.
9. SEE A2.x SHEETS FOR FLOOR PLANS.
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16. SEE A11.x SHEETS FOR VERTICAL CIRCULATION.

KEY PLAN



CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

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Checked By: CR,LA,CP

Client No: ——

Albert & Associates: 12575

REGISTERED ARCHITECT Larry M. Albert Hattiesburg, MS STATE OF MISSISSIPPI

A3.1a

ROOF DRAINAGE CALCULATIONS

The following conditions were used in sizing the roof drainage system and were based on the requirements the 2012 INTERNATIONAL PLUMBING CODE.

- The roof drainage system was designed to handle a 100 year maximum rainfall of 4.5 inches per hour. This is based on IPC FIGURE 1106.1 100–YEAR ,1–HOUR RAINFALL FOR THE EASTERN UNITED STATES.
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adapted from Table 1106.3, IPC 2012

Roof Assembly Notes

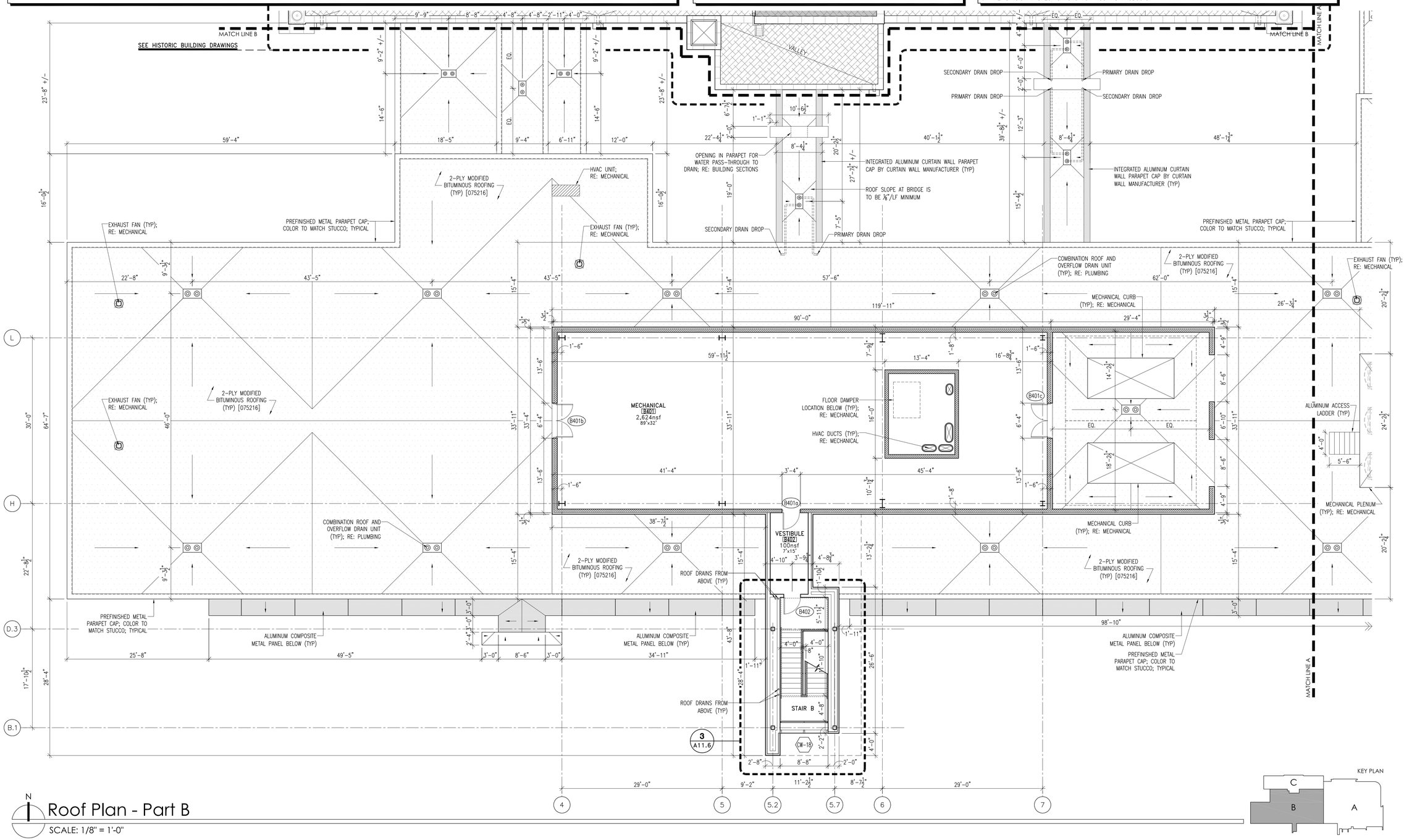
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N

Roof Plan - Part B

SCALE: 1/8" = 1'-0"

KEY PLAN

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT

HPSC Police and Court Building

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Checked By: CR,LA,CP

Client No: ——

Albert & Associates: 12575

REGISTERED ARCHITECT Larry M Albert Hattiesburg, MS STATE OF MISSISSIPPI

A3.1b

ROOF DRAINAGE CALCULATIONS

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Roof Assembly Notes

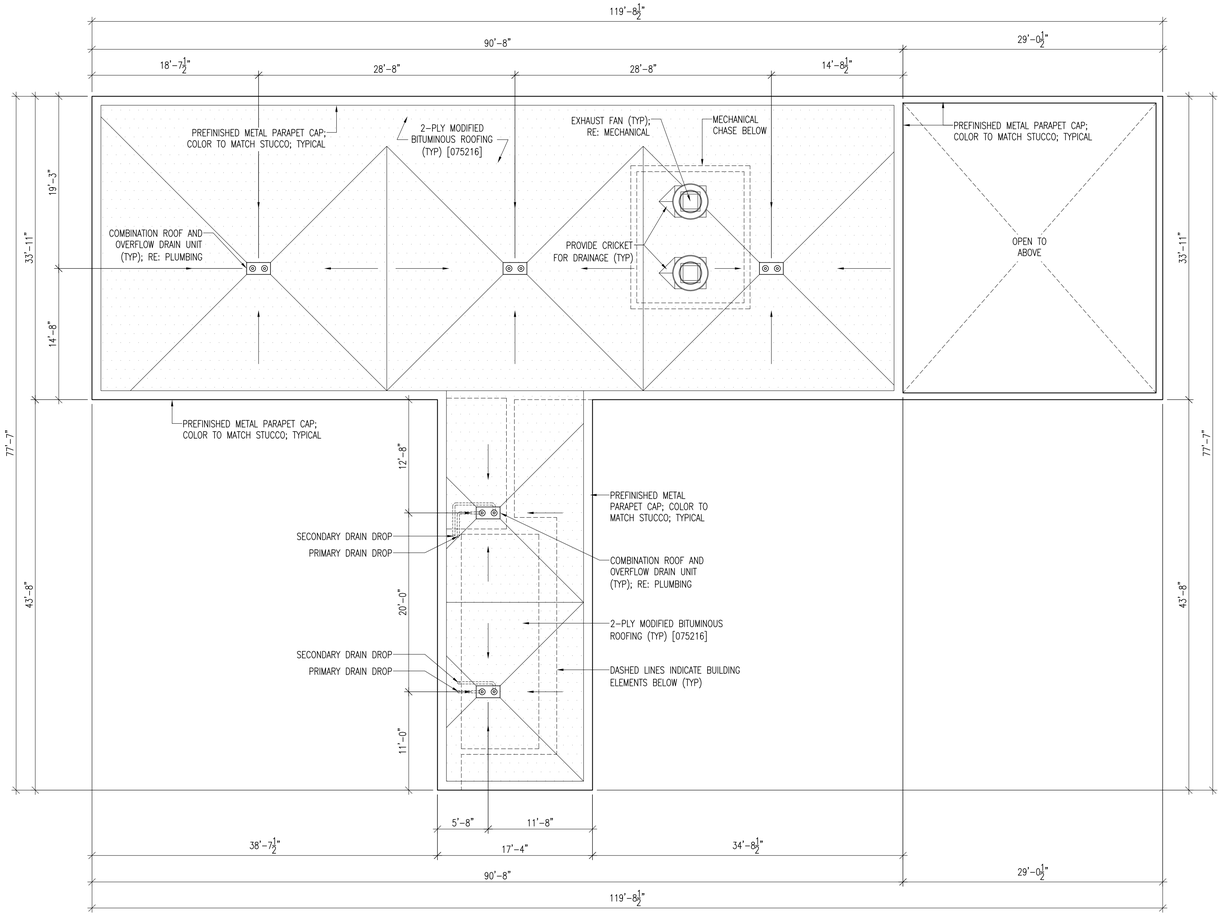
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General Roof Notes

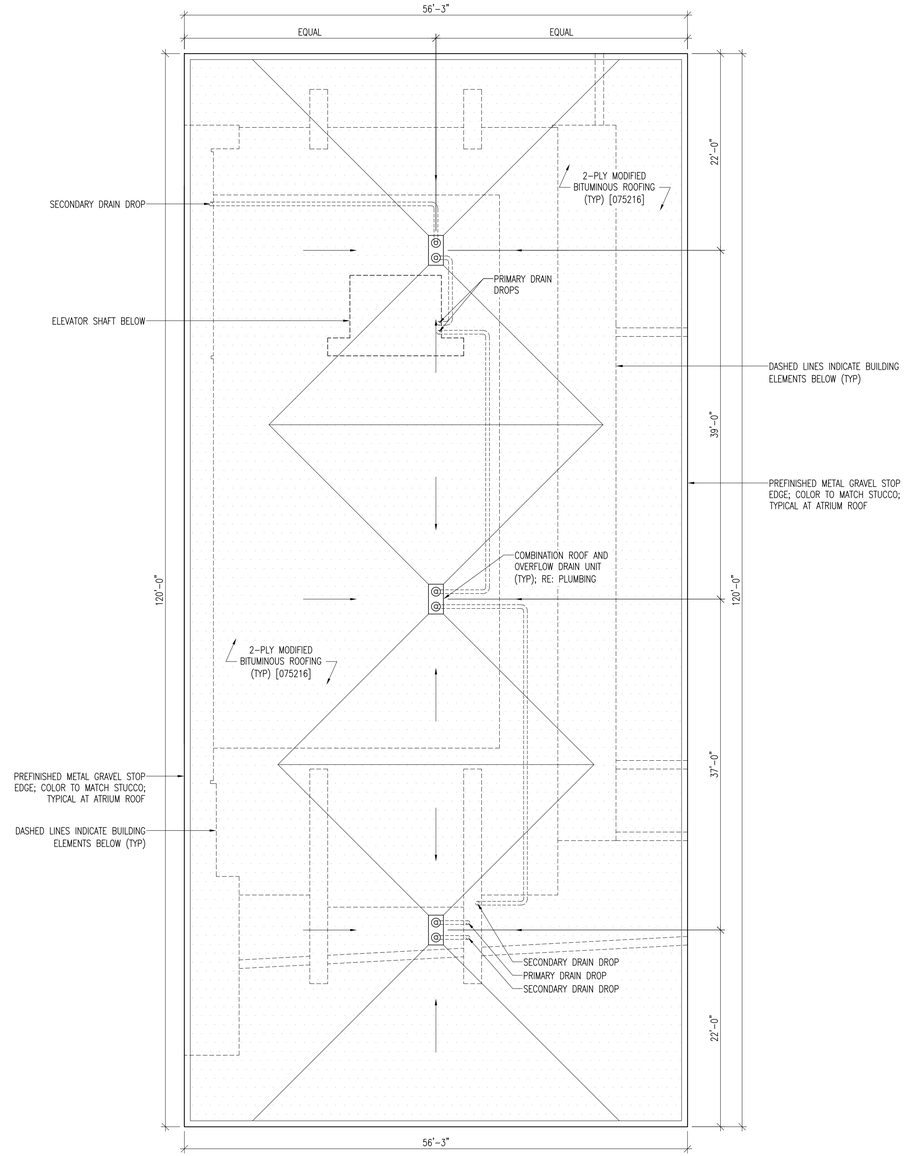
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N

Mechanical Penthouse/Stair Roof Plan

SCALE: 1/8" = 1'-0"



N

Atrium Roof Plan

SCALE: 1/8" = 1'-0"

CITY OF HATTIESBURG MISSISSIPPI

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Checked By: CR,LA,CP

Client No: ------

Albert & Associates: 12575

REGISTERED ARCHITECT Larry A. Albert Jr. Hattiesburg, MS STATE OF MISSISSIPPI

A3.2

RCP Legend

ARCHITECTURAL

- LAT-2 – 24x24 CERAMAGUARD W/ SQUARE EDGE BY ARMSTRONG OR EQUAL (RE: A9.0a)
- LAT-8 – 24x48 DUNE W/ TEGULAR EDGE BY ARMSTRONG OR EQUAL (RE: A9.0a)
- AP-1 – PAINTED ACOUSTICAL PLASTER (RE: A9.0a)
- LAT-3 – 24x24 DUNE W/ TEGULAR EDGE BY ARMSTRONG OR EQUAL (RE: A9.0a)
- PAINTED GYPSUM BOARD CEILING (RE: A9.0a)
- CT-2 – OMITTED
- LAT-6 – 22x94 SOUNDSCAPES BLADES VERTICAL ACOUSTICAL PANELS BY ARMSTRONG OR EQUAL (RE: A9.0a)
- WD-11 – WOOD CEILING (RE: A9.0a)
- COMPOSITE METAL PANEL CEILING W/ ANODIZED ALUMINUM FINISH (EXTERIOR)
- LAT-7 – 24x24 METALWORKS W/ VECTOR EDGEBY ARMSTRONG OR EQUAL (RE: A9.0a)
- SUSPENDED 1½" XPS EXTERIOR INSULATION AND FINISH SYSTEM
- PLAM-3 – PLASTIC LAMINATE WALL SURFACE BY WILSONART OR EQUAL (RE: A9.0a)

ELECTRICAL

B	LED STRIP LIGHT	K4ID	4" APERTURE LED INDIRECT/DIRECT	W	LED TRACK LIGHT
C	LED RECESSED DOWNLIGHT	K4R	4" APERTURE LED RECESSED	X1	SURFACE MOUNT LED EXIT SIGN
CP	LED CYLINDER PENDANT	K4RG	4" APERTURE LED REGRESSED	X2	RECESSED LED EXIT SIGN
D	LED RECESSED DOWNLIGHT (WET)	K4WWR	4" APERTURE LED WALL WASH RECESSED	Z	LED PARKING GARAGE LIGHT
K2R	2" APERTURE LED RECESSED FIXTURE	Q	LED COVE LIGHT		
K2SM	2" APERTURE LED RECESSED FIXTURE	R	38" ø LED PENDANT		
K2WWR	2" APERTURE LED WALL WASH RECESSED	S1	2x4 LED TROFFER		
K4D	4" APERTURE LED DIRECT	S2	2x2 LED TROFFER		

MECHANICAL

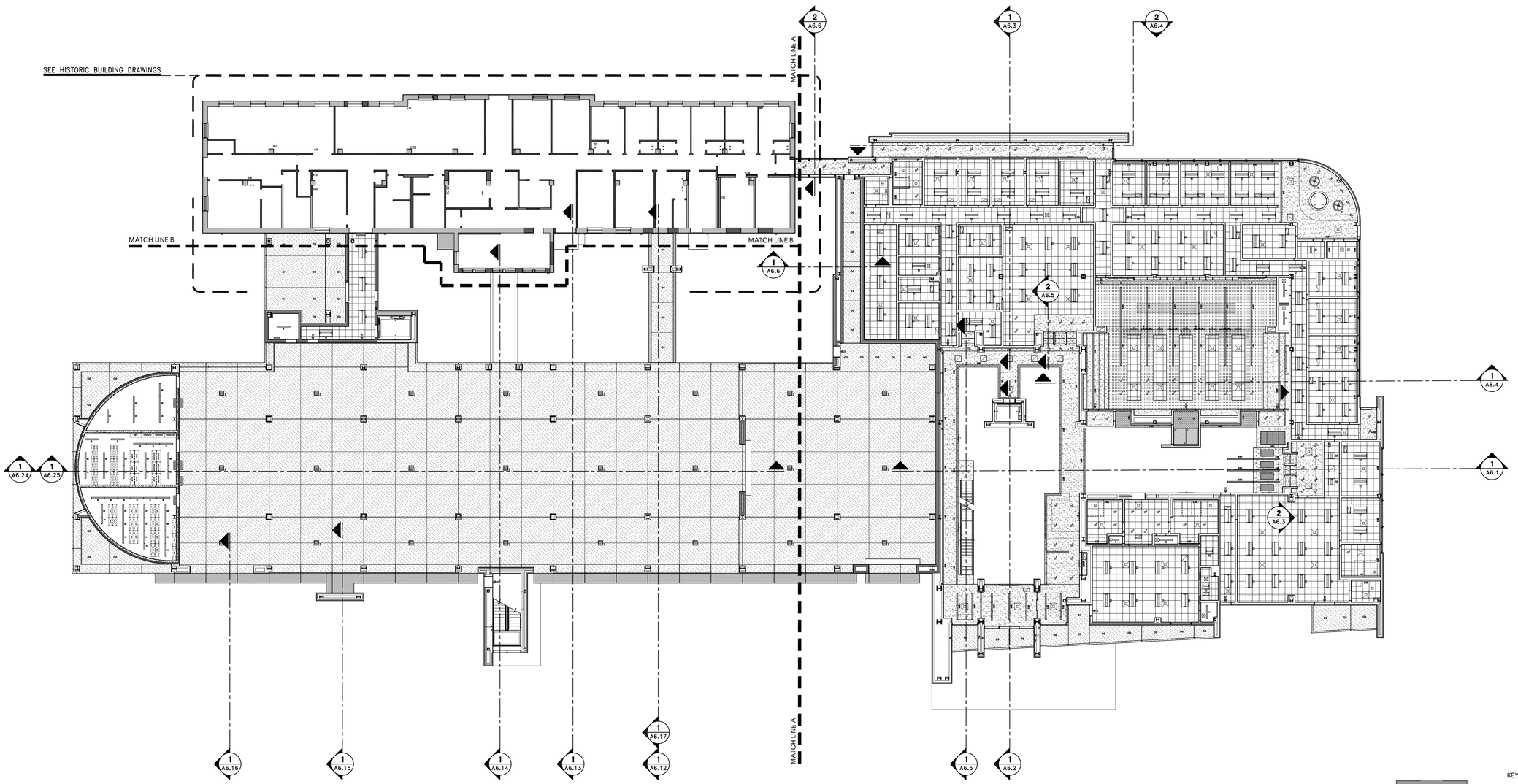
- HVAC SUPPLY DIFFUSER; RE: MECHANICAL
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- HVAC EXHAUST DIFFUSER; RE: MECHANICAL
- LINEAR HVAC SUPPLY DIFFUSER; RE: MECHANICAL
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- 24x24 ACCESS PANEL; COLOR TO MATCH ADJACENT CEILING

General RCP Notes

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2. ALL ANGLES ARE 90° OR 45° UNLESS DIMENSIONED OTHERWISE.
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4. SEE A3.x SHEETS FOR ROOF PLANS.
5. SEE A5.x SHEETS FOR EXTERIOR ELEVATIONS.
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RCP Notes

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3. LIGHT FIXTURE TAGS PROVIDE ON THE DRAWINGS AND WITHIN THE RCP LEGEND REPRESENT TYPES OF FIXTURES, NOT SPECIFIC SPECIFIC. THESE TAGS ARE CLOSELY COORDINATED WITH THOSE FOUND THROUGHOUT THE ELECTRICAL DRAWINGS, THOUGH DIFFERENCES MAY EXIST.
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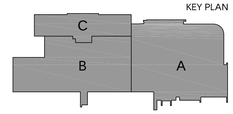


N

First Floor Reflected Ceiling Plan Composite

SCALE: 1/16" = 1'-0"

KEY PLAN



CITY OF HATTIESBURG MISSISSIPPI 1884

HATTIESBURG PUBLIC SAFETY COMPLEX

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REGISTERED ARCHITECT Larry M Albert Jr Hattiesburg, MS STATE OF MISSISSIPPI

A4.0a

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com **Albert & McCleskey Associates Architects**

FIRST FLOOR RCP COMPOSITE

RCP Legend

ARCHITECTURAL

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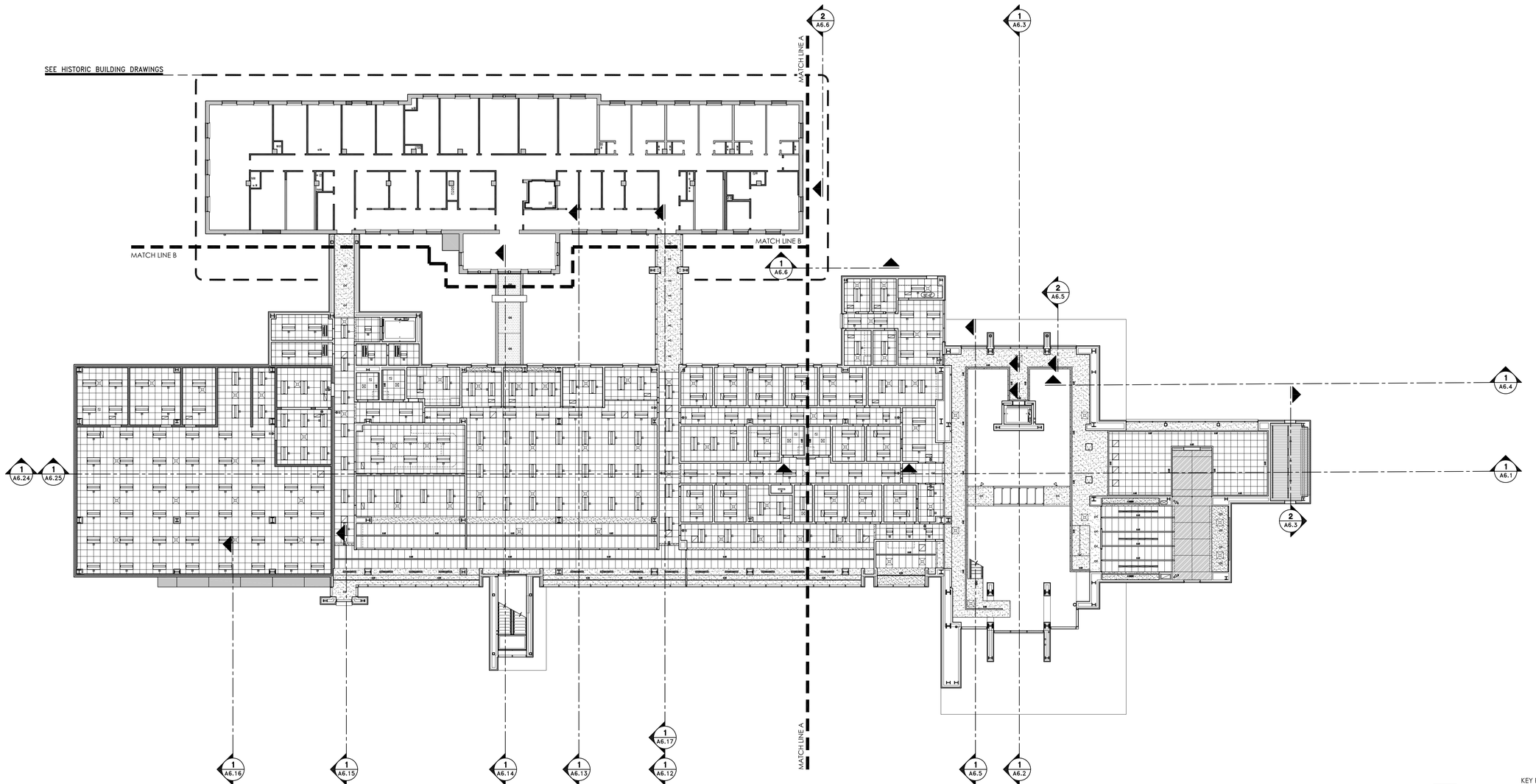
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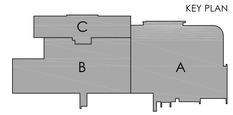


N

Second Floor Reflected Ceiling Plan Composite

SCALE: 1/16" = 1'-0"

KEY PLAN



HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT

HPSC Police and Court Building

Drawing Issued:

Date	Rev.	Description
08-31-2015		DD Check Set
10-20-2015		75% Progress Set
11-02-2015		90% Pricing Set
11-19-2018		100% Bid Docs

Drawn By: CR,CP,AS,RB

Checked By: CR,LA,CP

Client No: ------

Albert & Associates: 12575

REGISTERED ARCHITECT Larry M Albert Hattiesburg, MS STATE OF MISSISSIPPI

A4.0b

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com **Albert & McCleskey Associates Architects**

SECOND FLOOR RCP COMPOSITE

RCP Legend

ARCHITECTURAL

- LAT-2 – 24x24 CERAMAGUARD W/ SQUARE EDGE BY ARMSTRONG OR EQUAL (RE: A9.0a)
- LAT-8 – 24x48 DUNE W/ TEGULAR EDGE BY ARMSTRONG OR EQUAL (RE: A9.0a)
- AP-1 – PAINTED ACOUSTICAL PLASTER (RE: A9.0a)
- LAT-3 – 24x24 DUNE W/ TEGULAR EDGE BY ARMSTRONG OR EQUAL (RE: A9.0a)
- PAINTED GYPSUM BOARD CEILING (RE: A9.0a)
- CT-2 – OMITTED
- LAT-6 – 22x94 SOUNDSCAPES BLADES VERTICAL ACOUSTICAL PANELS BY ARMSTRONG OR EQUAL (RE: A9.0a)
- WD-11 – WOOD CEILING (RE: A9.0a)
- COMPOSITE METAL PANEL CEILING W/ ANODIZED ALUMINUM FINISH (EXTERIOR)
- LAT-7 – 24x24 METALWORKS W/ VECTOR EDGEBY ARMSTRONG OR EQUAL (RE: A9.0a)
- SUSPENDED 1½" XPS EXTERIOR INSULATION AND FINISH SYSTEM
- PLAM-3 – PLASTIC LAMINATE WALL SURFACE BY WILSONART OR EQUAL (RE: A9.0a)

ELECTRICAL

B	LED STRIP LIGHT	K4ID	4" APERTURE LED INDIRECT/DIRECT	W	LED TRACK LIGHT
C	LED RECESSED DOWNLIGHT	K4R	4" APERTURE LED RECESSED	X1	SURFACE MOUNT LED EXIT SIGN
CP	LED CYLINDER PENDANT	K4RG	4" APERTURE LED REGRESSED	X2	RECESSED LED EXIT SIGN
D	LED RECESSED DOWNLIGHT (WET)	K4WWR	4" APERTURE LED WALL WASH RECESSED	Z	LED PARKING GARAGE LIGHT
K2R	2" APERTURE LED RECESSED FIXTURE	Q	LED COVE LIGHT		
K2SM	2" APERTURE LED RECESSED FIXTURE	R	38" ø LED PENDANT		
K2WWR	2" APERTURE LED WALL WASH RECESSED	S1	2x4 LED TROFFER		
K4D	4" APERTURE LED DIRECT	S2	2x2 LED TROFFER		

MECHANICAL

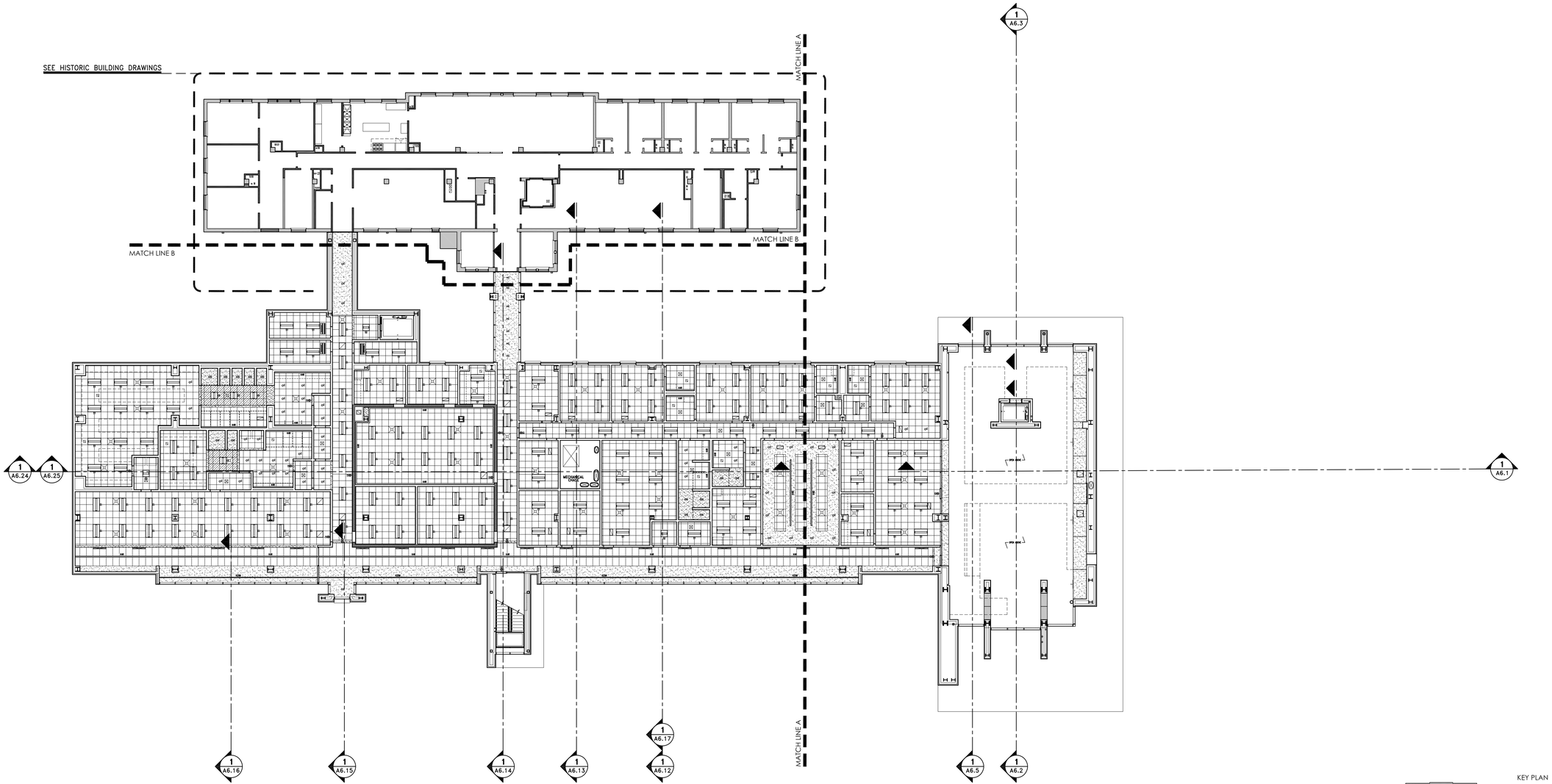
- HVAC SUPPLY DIFFUSER; RE: MECHANICAL
- HVAC RETURN DIFFUSER; RE: MECHANICAL
- HVAC EXHAUST DIFFUSER; RE: MECHANICAL
- LINEAR HVAC SUPPLY DIFFUSER; RE: MECHANICAL
- LINEAR HVAC RETURN DIFFUSER; RE: MECHANICAL
- 24x24 ACCESS PANEL; COLOR TO MATCH ADJACENT CEILING

General RCP Notes

1. CONTRACTOR TO CONSULT ARCHITECT IMMEDIATELY IF DISCREPANCIES ARE FOUND BETWEEN ARCHITECTURAL AND ENGINEERING DRAWINGS.
2. ALL ANGLES ARE 90° OR 45° UNLESS DIMENSIONED OTHERWISE.
3. SEE A2.x SHEETS FOR FLOOR PLANS.
4. SEE A3.x SHEETS FOR ROOF PLANS.
5. SEE A5.x SHEETS FOR EXTERIOR ELEVATIONS.
6. SEE A6.x SHEETS FOR BUILDING SECTIONS.
7. SEE A8.x SHEETS FOR DOOR SCHEDULE/FRAME ELEVATIONS AND WINDOW SCHEDULE/WINDOW ELEVATIONS.
8. SEE A9.x SHEETS FOR FINISH SCHEDULES AND FINISH FLOOR PLANS.
9. SEE A10.x SHEETS FOR INTERIOR ELEVATIONS.
10. SEE A11.x SHEETS FOR VERTICAL CIRCULATION.

RCP Notes

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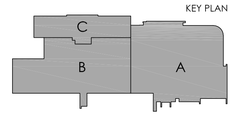


N

Third Floor Reflected Ceiling Plan Composite

SCALE: 1/16" = 1'-0"

KEY PLAN



HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

Drawing Issued:

Date	Rev.	Description
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11-19-2018		100% Bid Docs

Drawn By: CR,CP,AS,RB

Checked By: CR,LA,CP

Client No: ——

Albert & Associates: 12575

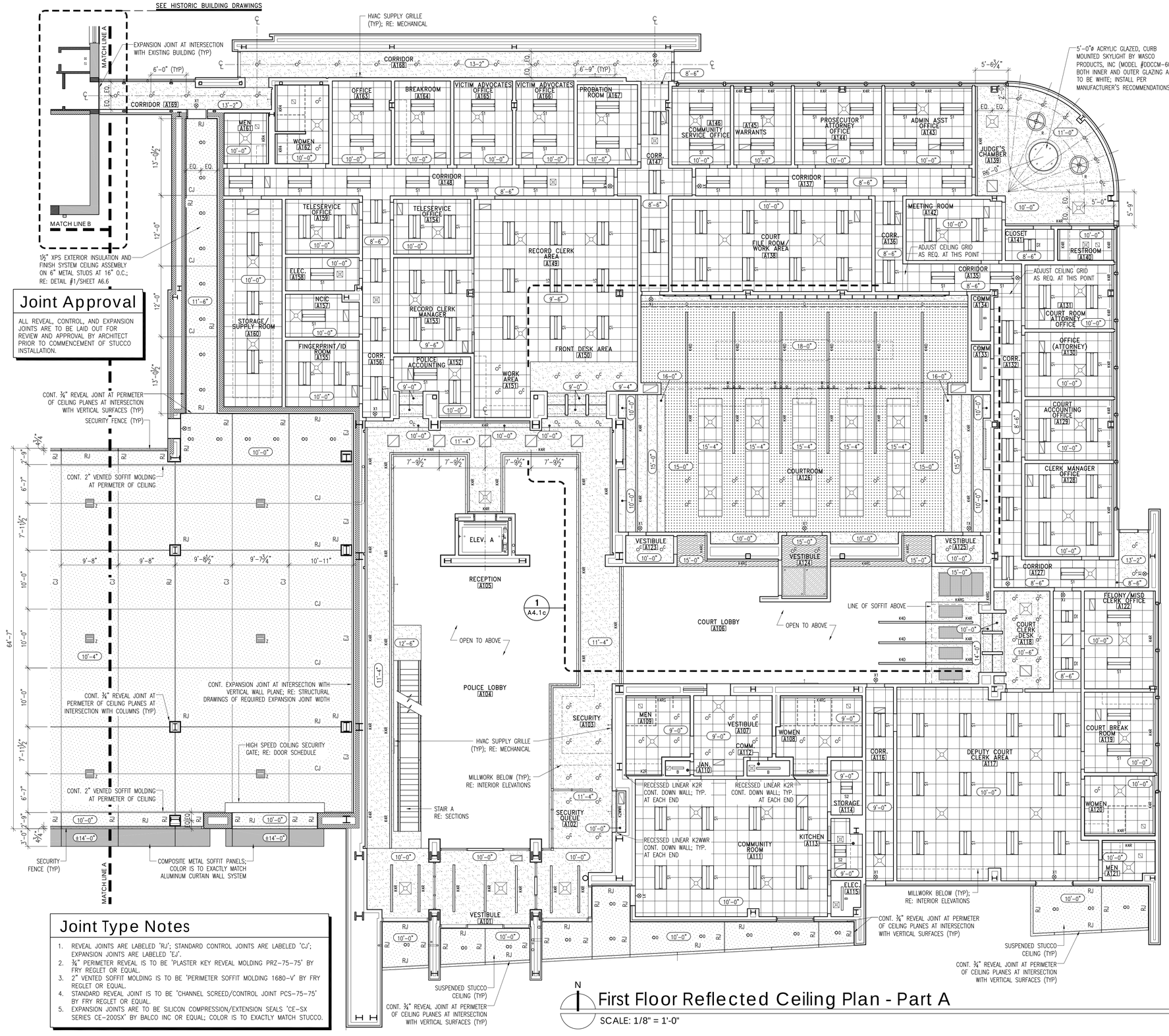
REGISTERED ARCHITECT Larry A Albert Hattiesburg, MS STATE OF MISSISSIPPI

A4.0c

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com

Albert & McCleskey Associates Architects

THIRD FLOOR RCP COMPOSITE



Joint Approval

ALL REVEAL, CONTROL, AND EXPANSION JOINTS ARE TO BE LAID OUT FOR REVIEW AND APPROVAL BY ARCHITECT PRIOR TO COMMENCEMENT OF STUCCO INSTALLATION.

Joint Type Notes

1. REVEAL JOINTS ARE LABELED 'RJ'; STANDARD CONTROL JOINTS ARE LABELED 'CJ'; EXPANSION JOINTS ARE LABELED 'EJ'.
2. ¾" PERIMETER REVEAL IS TO BE 'PLASTER KEY REVEAL MOLDING PRZ-75-75' BY FRY REGLET OR EQUAL.
3. 2" VENTED SOFFIT MOLDING IS TO BE 'PERIMETER SOFFIT MOLDING 1680-V' BY FRY REGLET OR EQUAL.
4. STANDARD REVEAL JOINT IS TO BE 'CHANNEL SCREED/CONTROL JOINT PCS-75-75' BY FRY REGLET OR EQUAL.
5. EXPANSION JOINTS ARE TO BE SILICON COMPRESSION/EXTENSION SEALS 'CE-SX SERIES CE-200SX' BY BALCO INC OR EQUAL; COLOR IS TO EXACTLY MATCH STUCCO.

First Floor Reflected Ceiling Plan - Part A

SCALE: 1/8" = 1'-0"

RCP Notes

1. SEE MECHANICAL DRAWINGS FOR ANY MECHANICAL FIXTURES THAT MAY NOT BE SHOWN ON THIS PLAN.
2. SEE ELECTRICAL DRAWINGS FOR ANY ELECTRICAL FIXTURES THAT MAY NOT BE SHOWN ON THIS PLAN.
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Gen. RCP Notes

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4. SEE A3.x SHEETS FOR ROOF PLANS.
5. SEE A5.x SHEETS FOR EXTERIOR ELEVATIONS.
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7. SEE A8.x SHEETS FOR DOOR SCHEDULE/FRAME ELEVATIONS AND WINDOW SCHEDULE/WINDOW ELEVATIONS.
8. SEE A9.x SHEETS FOR FINISH SCHEDULES AND FINISH FLOOR PLANS.
9. SEE A10.x SHEETS FOR INTERIOR ELEVATIONS.
10. SEE A11.x SHEETS FOR VERTICAL CIRCULATION.

RCP Legend

ARCHITECTURAL

- LAT-2 – 24x24 CERAMAGUARD W/ SQUARE EDGE BY ARMSTRONG OR EQUAL (RE: A9.0a)
- LAT-3 – 24x24 DUNE W/ TEGULAR EDGE BY ARMSTRONG OR EQUAL (RE: A9.0a)
- LAT-6 – 22x94 SOUNDSCAPES BLADES VERTICAL ACOUSTICAL PANELS BY ARMSTRONG OR EQUAL (RE: A9.0a)
- LAT-7 – 24x24 METALWORKS W/ VECTOR EDGE BY ARMSTRONG OR EQUAL (RE: A9.0a)
- LAT-8 – 24x48 DUNE W/ TEGULAR EDGE BY ARMSTRONG OR EQUAL (RE: A9.0a)
- PAINTED GYPSUM BOARD CEILING (RE: A9.0a)
- WD-11 – WOOD CEILING (RE: A9.0a)
- SUSPENDED 1½" XPS EXTERIOR INSULATION AND FINISH SYSTEM
- AP-1 – PAINTED ACOUSTICAL PLASTER (RE: A9.0a)
- CT-2 – OMITTED
- COMPOSITE METAL PANEL CEILING W/ ANODIZED ALUMINUM FINISH (EXTERIOR)
- PLAM-3 – PLASTIC LAMINATE WALL SURFACE BY WILSONART OR EQUAL (RE: A9.0a)

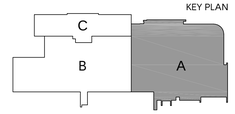
ELECTRICAL

- B — LED STRIP LIGHT
- C — LED RECESSED DOWNLIGHT
- CP — LED CYLINDER PENDANT
- D — LED RECESSED DOWNLIGHT (WET LOCATIONS)
- K2R — 2" APERTURE LED RECESSED FIXTURE
- K2SM — 2" APERTURE LED RECESSED FIXTURE
- K2WWR — 2" APERTURE LED WALL WASH RECESSED
- K4D — 4" APERTURE LED DIRECT
- K4ID — 4" APERTURE LED INDIRECT/DIRECT
- K4R — 4" APERTURE LED RECESSED
- K4RG — 4" APERTURE LED REGRESSED
- K4WWR — 4" APERTURE LED WALL WASH RECESSED
- Q — LED COVE LIGHT
- R — 38" ø LED PENDANT
- S1 — 2x4 LED TROFFER
- S2 — 2x2 LED TROFFER
- W — LED TRACK LIGHT
- X1 — SURFACE MOUNT LED EXIT SIGN
- X2 — RECESSED LED EXIT SIGN
- Z — LED PARKING GARAGE LIGHT

MECHANICAL

- HVAC SUPPLY DIFFUSER; RE: MECHANICAL
- HVAC RETURN DIFFUSER; RE: MECHANICAL
- HVAC EXHAUST DIFFUSER; RE: MECHANICAL
- LINEAR HVAC SUPPLY DIFFUSER; RE: MECHANICAL
- LINEAR HVAC RETURN DIFFUSER; RE: MECHANICAL
- 24x24 ACCESS PANEL; COLOR TO MATCH ADJACENT CEILING

KEY PLAN



CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT

HPSC Police and Court Building

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Drawn By: CR,CP,AS,RE
Checked By: CR,LA,CF
Client No: ------
Albert & Associates: 1257!

REGISTERED ARCHITECT Larry A. Albert Hattiesburg, MS STATE OF MISSISSIPPI

A4.1a

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com **Albert & McCleskey Associates Architects**

RCP Legend

ARCHITECTURAL

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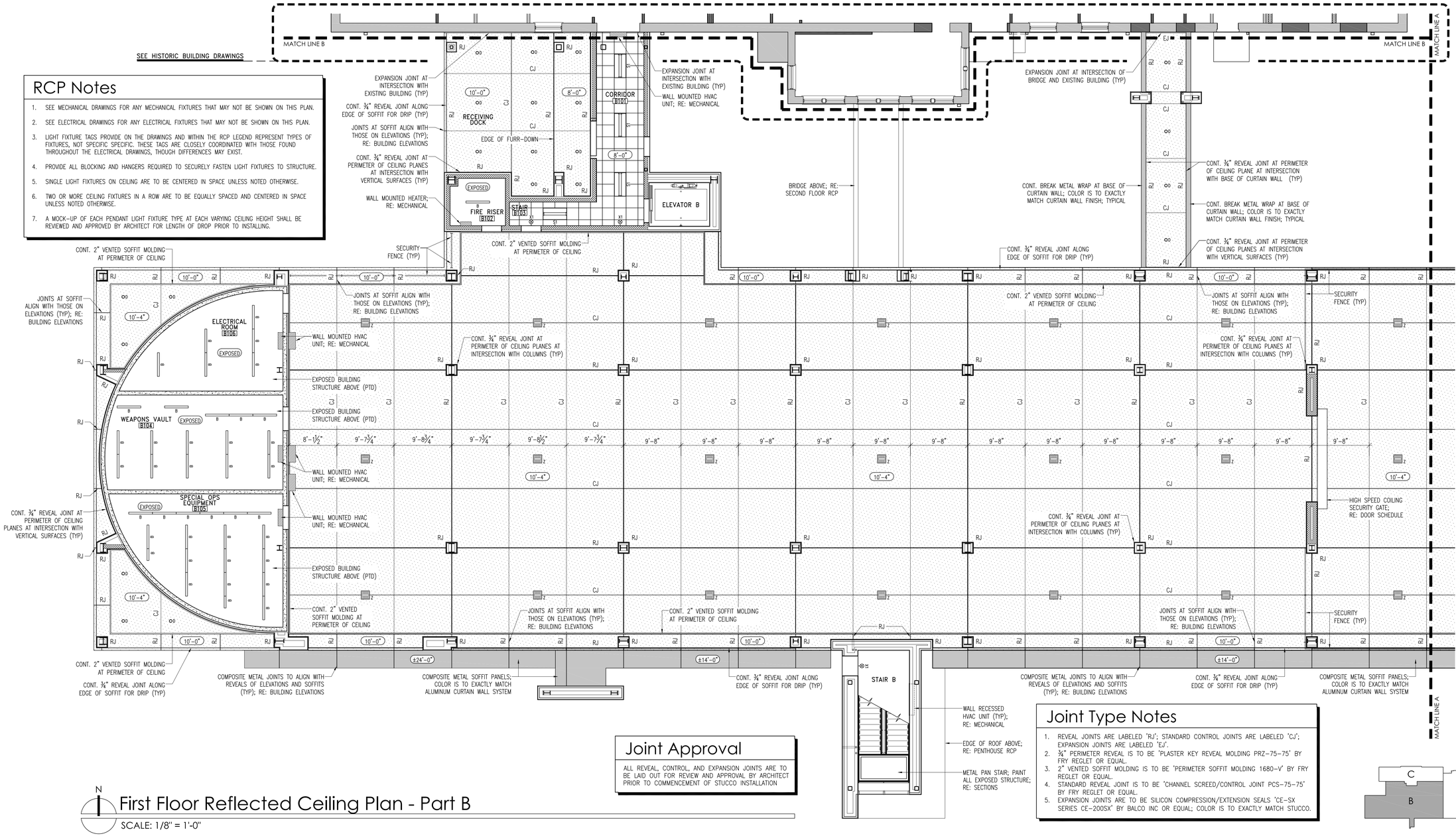
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KEY PLAN

N

First Floor Reflected Ceiling Plan - Part B

SCALE: 1/8" = 1'-0"

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

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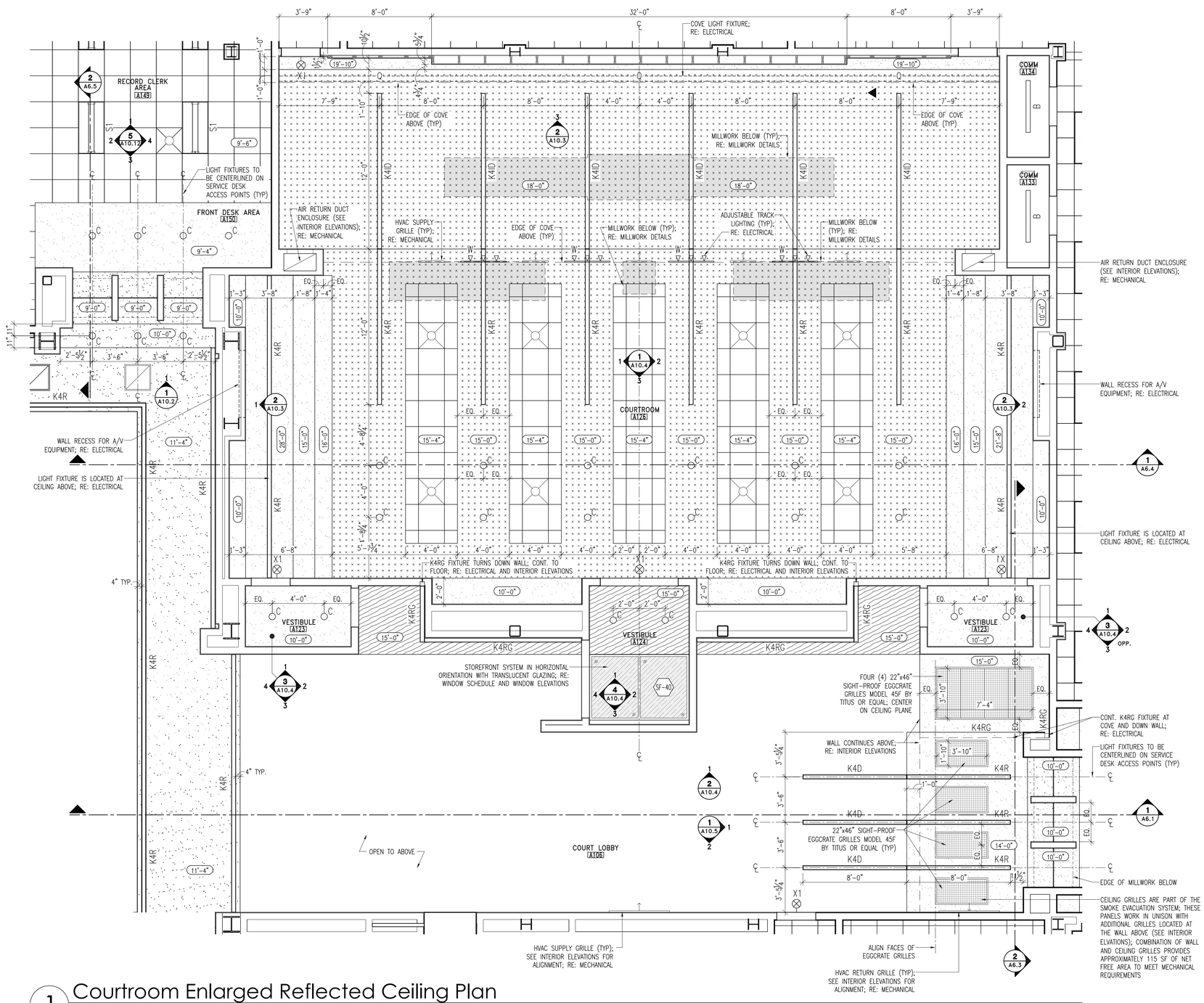
Client No: ------

Albert & Associates: 12575

Larry A. Albert, Hattiesburg, MS — Registered Architect — State of Mississippi

A4.1b

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com **Albert & McCleskey Associates Architects**



1 Courtroom Enlarged Reflected Ceiling Plan

SCALE: 1/4" = 1'-0"

RCP Notes

1. SEE MECHANICAL DRAWINGS FOR ANY MECHANICAL FIXTURES THAT MAY NOT BE SHOWN ON THIS PLAN.
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RCP Legend

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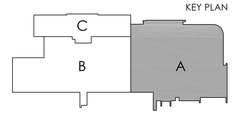
ELECTRICAL

B	LED STRIP LIGHT	
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D	LED RECESSED DOWNLIGHT (WET LOCATIONS)	
K2R	2" APERTURE LED RECESSED FIXTURE	
K2SM	2" APERTURE LED RECESSED FIXTURE	
K2WWR	2" APERTURE LED WALL WASH RECESSED	
K4D	4" APERTURE LED DIRECT	
K4ID	4" APERTURE LED INDIRECT/DIRECT	
K4R	4" APERTURE LED RECESSED	
K4RG	4" APERTURE LED REGRESSED	
K4WWR	4" APERTURE LED WALL WASH RECESSED	
Q	LED COVE LIGHT	
R	38" ø LED PENDANT	
S1	2x4 LED TROFFER	
S2	2x2 LED TROFFER	
W	LED TRACK LIGHT	
X1	SURFACE MOUNT LED EXIT SIGN	
X2	RECESSED LED EXIT SIGN	
Z	LED PARKING GARAGE LIGHT	

MECHANICAL

- HVAC SUPPLY DIFFUSER; RE: MECHANICAL
- HVAC RETURN DIFFUSER; RE: MECHANICAL
- HVAC EXHAUST DIFFUSER; RE: MECHANICAL
- LINEAR HVAC SUPPLY DIFFUSER; RE: MECHANICAL
- LINEAR HVAC RETURN DIFFUSER; RE: MECHANICAL
- 24x24 ACCESS PANEL; COLOR TO MATCH ADJACENT CEILING

KEY PLAN



CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

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Drawn By: CR,CP,AS,RB

Checked By: CR,LA,CP

Client No: ----

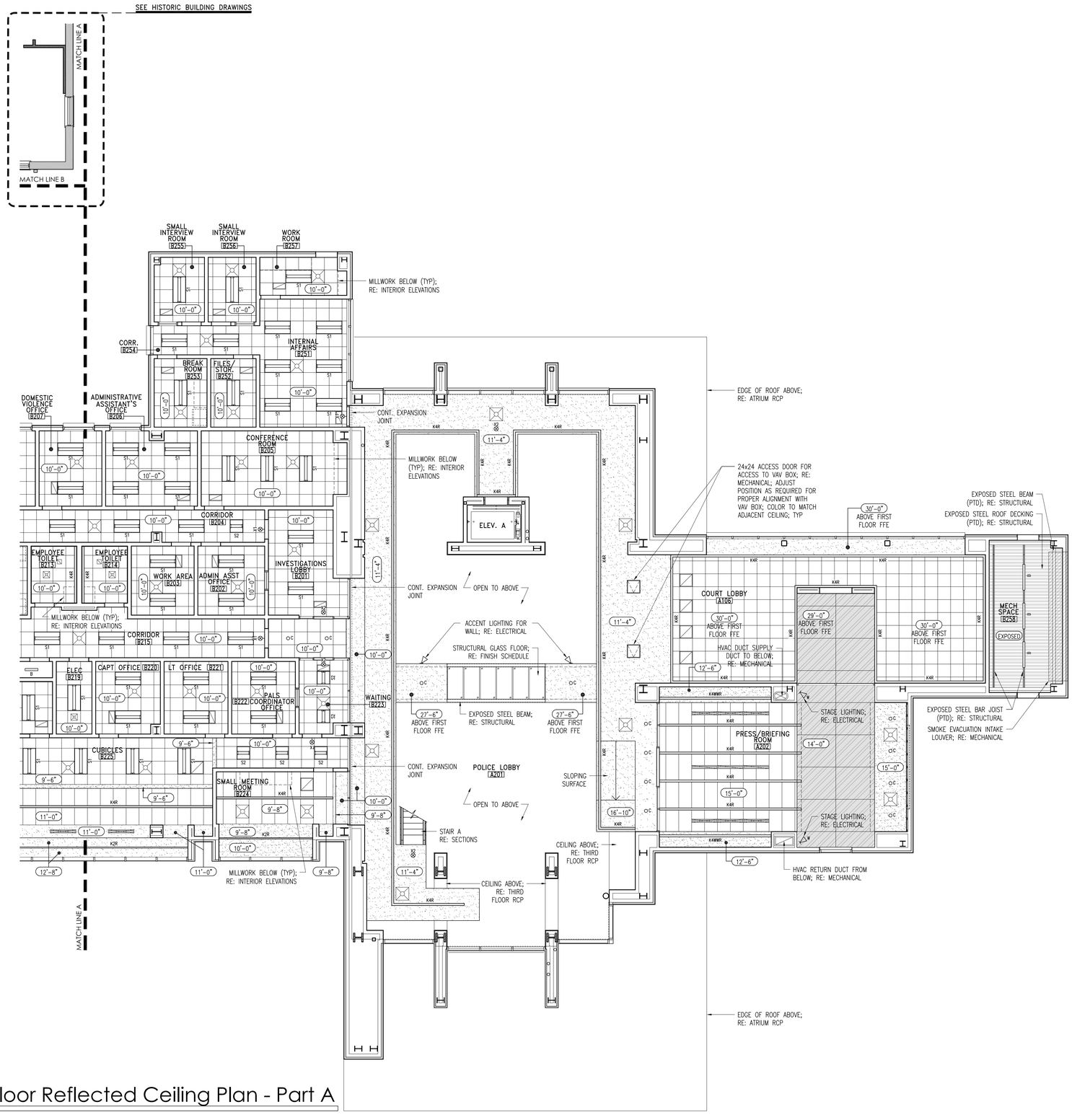
Albert & Associates: 12575

REGISTERED ARCHITECT Larry A Albert Hattiesburg, MS STATE OF MISSISSIPPI

A4.1c

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com **Albert & McCleskey Associates Architects**

COURTROOM ENLARGED RCP



Second Floor Reflected Ceiling Plan - Part A

SCALE: 1/8" = 1'-0"

RCP Notes

1. SEE MECHANICAL DRAWINGS FOR ANY MECHANICAL FIXTURES THAT MAY NOT BE SHOWN ON THIS PLAN.
2. SEE ELECTRICAL DRAWINGS FOR ANY ELECTRICAL FIXTURES THAT MAY NOT BE SHOWN ON THIS PLAN.
3. LIGHT FIXTURE TAGS PROVIDE ON THE DRAWINGS AND WITHIN THE RCP LEGEND REPRESENT TYPES OF FIXTURES, NOT SPECIFIC SPECIFIC. THESE TAGS ARE CLOSELY COORDINATED WITH THOSE FOUND THROUGHOUT THE ELECTRICAL DRAWINGS, THOUGH DIFFERENCES MAY EXIST.
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7. A MOCK-UP OF EACH PENDANT LIGHT FIXTURE TYPE AT EACH VARYING CEILING HEIGHT SHALL BE REVIEWED AND APPROVED BY ARCHITECT FOR LENGTH OF DROP PRIOR TO INSTALLING.

Gen. RCP Notes

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2. ALL ANGLES ARE 90° OR 45° UNLESS DIMENSIONED OTHERWISE.
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4. SEE A3.x SHEETS FOR ROOF PLANS.
5. SEE A5.x SHEETS FOR EXTERIOR ELEVATIONS.
6. SEE A6.x SHEETS FOR BUILDING SECTIONS.
7. SEE A8.x SHEETS FOR DOOR SCHEDULE/FRAME ELEVATIONS AND WINDOW SCHEDULE/WINDOW ELEVATIONS.
8. SEE A9.x SHEETS FOR FINISH SCHEDULES AND FINISH FLOOR PLANS.
9. SEE A10.x SHEETS FOR INTERIOR ELEVATIONS.
10. SEE A11.x SHEETS FOR VERTICAL CIRCULATION.

RCP Legend

ARCHITECTURAL

- LAT-2 – 24x24 CERAMAGUARD W/ SQUARE EDGE BY ARMSTRONG OR EQUAL (RE: A9.0a)
- LAT-3 – 24x24 DUNE W/ TEGULAR EDGE BY ARMSTRONG OR EQUAL (RE: A9.0a)
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- WD-11 – WOOD CEILING (RE: A9.0a)
- SUSPENDED 1½" XPS EXTERIOR INSULATION AND FINISH SYSTEM
- AP-1 – PAINTED ACOUSTICAL PLASTER (RE: A9.0a)
- CT-2 – OMITTED
- COMPOSITE METAL PANEL CEILING W/ ANODIZED ALUMINUM FINISH (EXTERIOR)
- PLAM-3 – PLASTIC LAMINATE WALL SURFACE BY WILSONART OR EQUAL (RE: A9.0a)

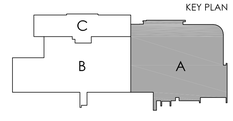
ELECTRICAL

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C	LED RECESSED DOWNLIGHT	
CP	LED CYLINDER PENDANT	
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KEY PLAN



CITY OF HATTIESBURG MISSISSIPPI 1884

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

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Checked By: CR,LA,CP

Client No: ------

Albert & Associates: 12575

REGISTERED ARCHITECT Larry M. Albert Hattiesburg, MS STATE OF MISSISSIPPI

A4.2a

RCP Legend

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ELECTRICAL

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X2	RECESSED LED EXIT SIGN
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MECHANICAL

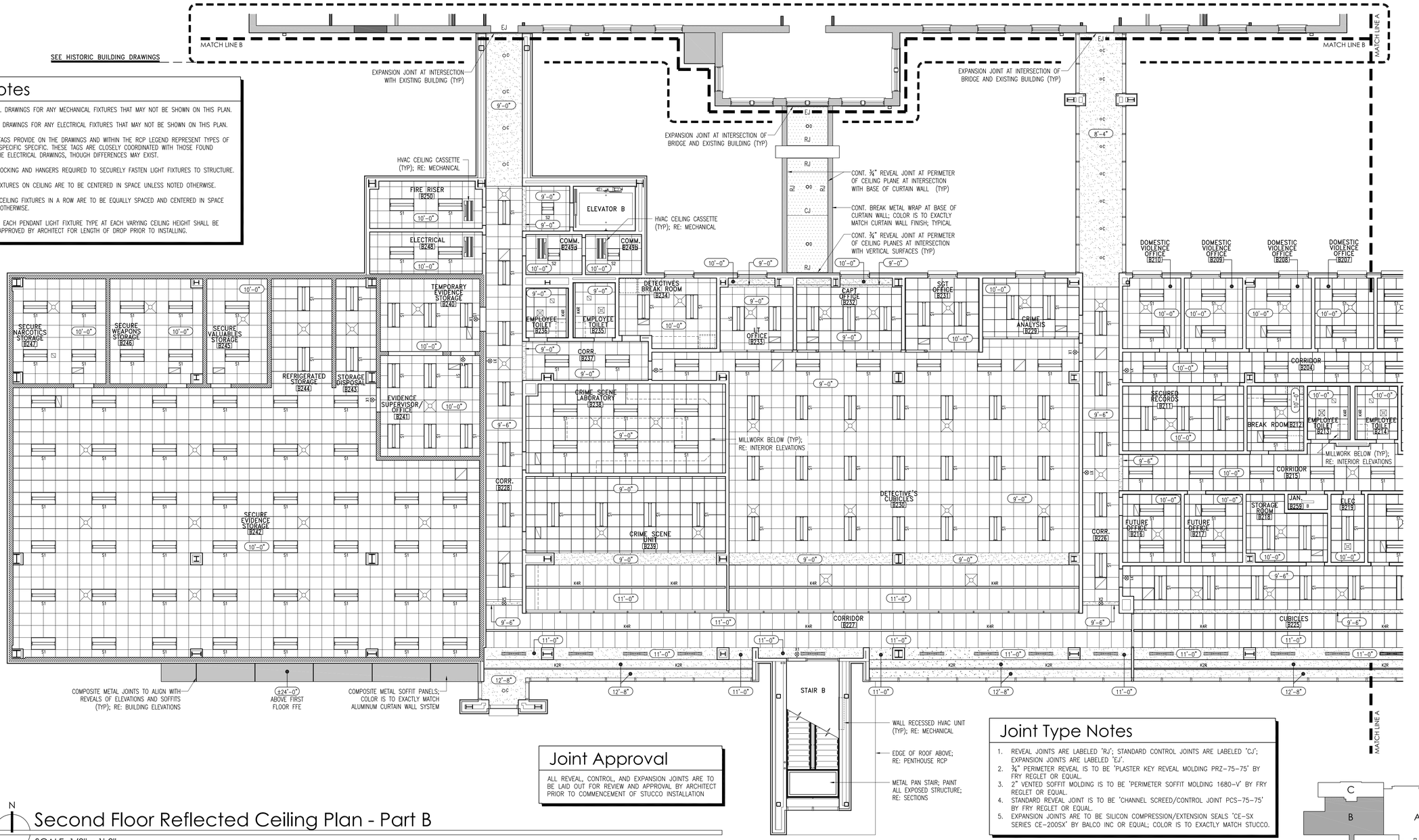
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Joint Approval

ALL REVEAL, CONTROL, AND EXPANSION JOINTS ARE TO BE LAID OUT FOR REVIEW AND APPROVAL BY ARCHITECT PRIOR TO COMMENCEMENT OF STUCCO INSTALLATION

Joint Type Notes

1. REVEAL JOINTS ARE LABELED 'RJ'; STANDARD CONTROL JOINTS ARE LABELED 'CJ'; EXPANSION JOINTS ARE LABELED 'EJ'.
2. ¾" PERIMETER REVEAL IS TO BE 'PLASTER KEY REVEAL MOLDING PRZ-75-75' BY FRY REGLET OR EQUAL.
3. 2" VENTED SOFFIT MOLDING IS TO BE 'PERIMETER SOFFIT MOLDING 1680-V' BY FRY REGLET OR EQUAL.
4. STANDARD REVEAL JOINT IS TO BE 'CHANNEL SCREED/CONTROL JOINT PCS-75-75' BY FRY REGLET OR EQUAL.
5. EXPANSION JOINTS ARE TO BE SILICON COMPRESSION/EXTENSION SEALS 'CE-SX SERIES CE-200SX' BY BALCO INC OR EQUAL; COLOR IS TO EXACTLY MATCH STUCCO.

KEY PLAN

N

Second Floor Reflected Ceiling Plan - Part B

SCALE: 1/8" = 1'-0"

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

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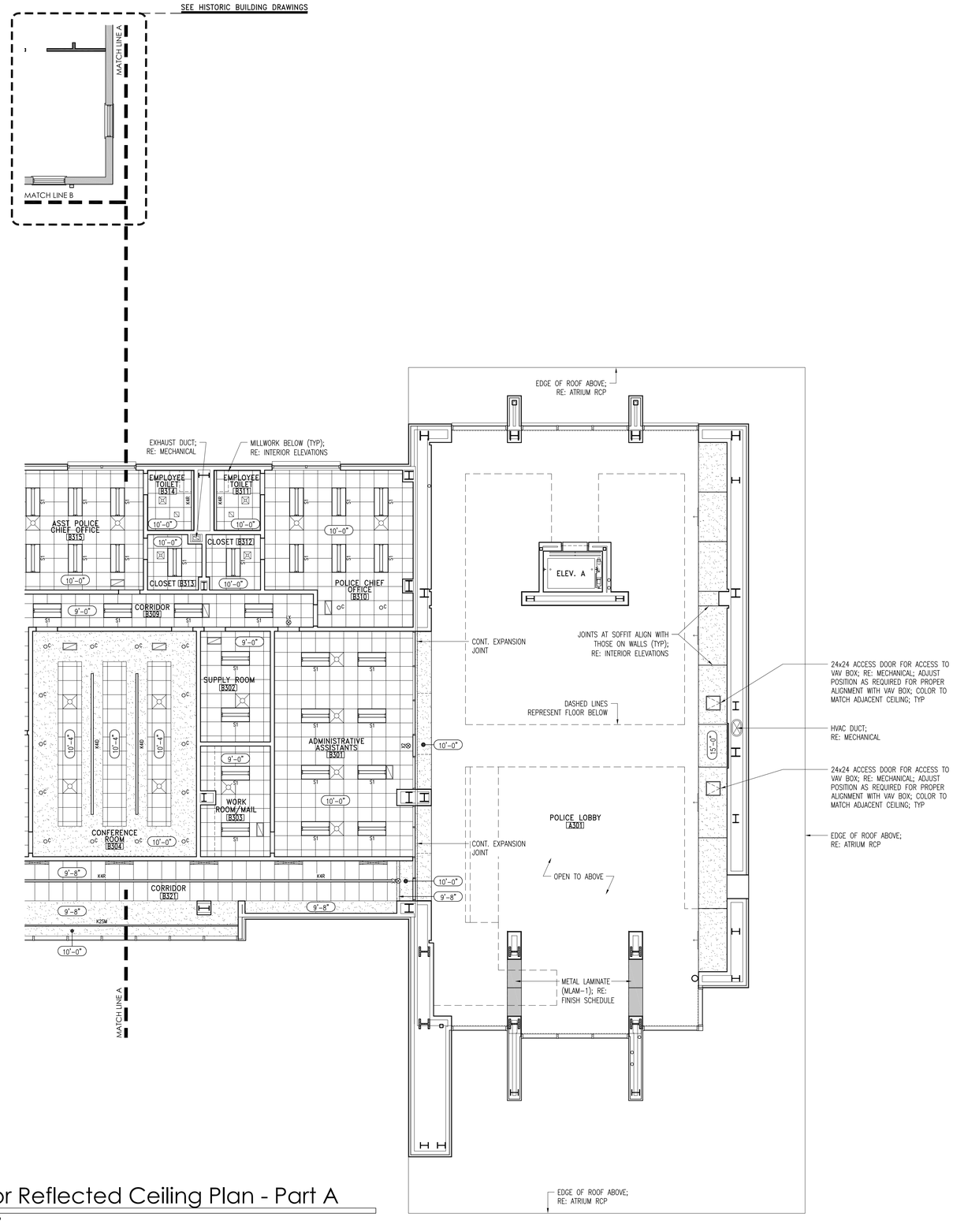
Drawn By: CR,CP,AS,RB
Checked By: CR,LA,CP
Client No: ------
Albert & Associates: 12575

REGISTERED ARCHITECT Larry M Albert Hattiesburg, MS STATE OF MISSISSIPPI

A4.2b

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com **Albert & McCleskey Associates Architects**

SECOND FLOOR RCP PART B



N

Third Floor Reflected Ceiling Plan - Part A

SCALE: 1/8" = 1'-0"

RCP Notes

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RCP Legend

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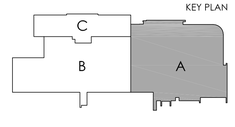
ELECTRICAL

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A4.3a

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THIRD FLOOR RCP PART A

RCP Legend

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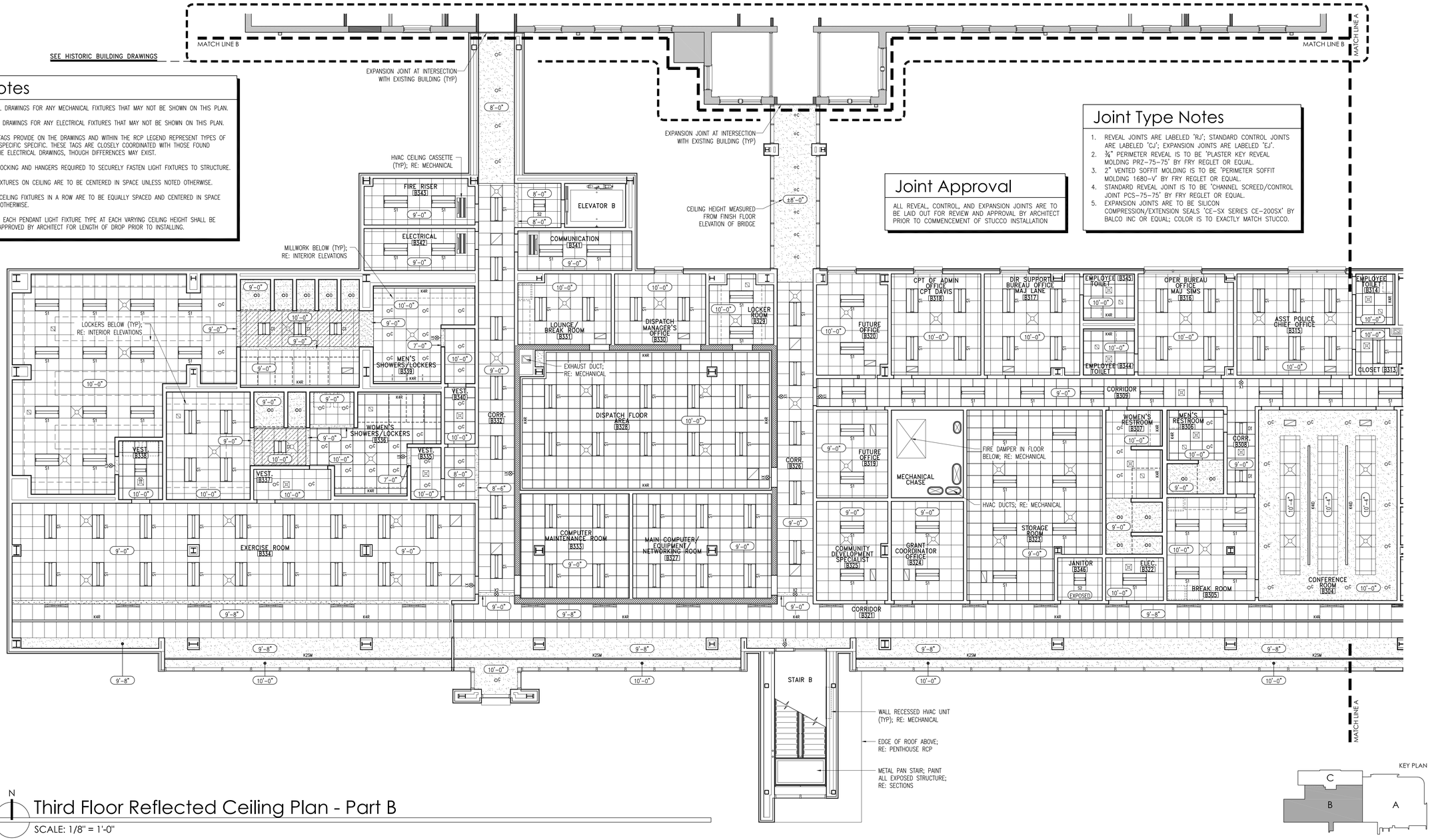
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ALL REVEAL, CONTROL, AND EXPANSION JOINTS ARE TO BE LAID OUT FOR REVIEW AND APPROVAL BY ARCHITECT PRIOR TO COMMENCEMENT OF STUCCO INSTALLATION

Joint Type Notes

1. REVEAL JOINTS ARE LABELED 'RJ'; STANDARD CONTROL JOINTS ARE LABELED 'CJ'; EXPANSION JOINTS ARE LABELED 'EJ'.
2. ¾" PERIMETER REVEAL IS TO BE 'PLASTER KEY REVEAL MOLDING PRZ-75-75' BY FRY REGLET OR EQUAL.
3. 2" VENTED SOFFIT MOLDING IS TO BE 'PERIMETER SOFFIT MOLDING 1680-V' BY FRY REGLET OR EQUAL.
4. STANDARD REVEAL JOINT IS TO BE 'CHANNEL SCREED/CONTROL JOINT PCS-75-75' BY FRY REGLET OR EQUAL.
5. EXPANSION JOINTS ARE TO BE SILICON COMPRESSION/EXTENSION SEALS 'CE-SX SERIES CE-200SX' BY BALCO INC OR EQUAL; COLOR IS TO EXACTLY MATCH STUCCO.



N

Third Floor Reflected Ceiling Plan - Part B

SCALE: 1/8" = 1'-0"

KEY PLAN

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

Drawing Issued:

Date	Rev.	Description
08-31-2015		DD Check Set
10-20-2015		75% Progress Set
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11-19-2018		100% Bid Docs

Drawn By: CR,CP,AS,RB

Checked By: CR,LA,CP

Client No: ------

Albert & Associates: 12575

Larry M Albert, Registered Architect, State of Mississippi, Hattiesburg, MS

A4.3b

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com **Albert & McCleskey Associates Architects**

SECOND FLOOR RCP PART B

RCP Legend

ARCHITECTURAL

- LAT-2 – 24x24 CERAMAGUARD W/ SQUARE EDGE BY ARMSTRONG OR EQUAL (RE: A9.0a)
- LAT-3 – 24x24 DUNE W/ TEGULAR EDGE BY ARMSTRONG OR EQUAL (RE: A9.0a)
- LAT-6 – 22x94 SOUNDSCAPES BLADES VERTICAL ACOUSTICAL PANELS BY ARMSTRONG OR EQUAL (RE: A9.0a)
- LAT-7 – 24x24 METALWORKS W/ VECTOR EDGEBY ARMSTRONG OR EQUAL (RE: A9.0a)
- LAT-8 – 24x48 DUNE W/ TEGULAR EDGE BY ARMSTRONG OR EQUAL (RE: A9.0a)
- PAINTED GYPSUM BOARD CEILING (RE: A9.0a)
- WD-11 – WOOD CEILING (RE: A9.0a)
- SUSPENDED 1½" XPS EXTERIOR INSULATION AND FINISH SYSTEM
- AP-1 – PAINTED ACOUSTICAL PLASTER (RE: A9.0a)
- CT-2 – OMITTED
- COMPOSITE METAL PANEL CEILING W/ ANODIZED ALUMINUM FINISH (EXTERIOR)
- PLAM-3 – PLASTIC LAMINATE WALL SURFACE BY WILSONART OR EQUAL (RE: A9.0a)

ELECTRICAL

B	LED STRIP LIGHT	K2WWR	2" APERTURE LED WALL WASH RECESSED	Q	LED COVE LIGHT	X2	RECESSED LED EXIT SIGN
C	LED RECESSED DOWNLIGHT	K4D	4" APERTURE LED DIRECT	R	38" ø LED PENDANT	Z	LED PARKING GARAGE LIGHT
CP	LED CYLINDER PENDANT	K4ID	4" APERTURE LED INDIRECT/DIRECT	S1	2x4 LED TROFFER		
D	LED RECESSED DOWNLIGHT (WET)	K4R	4" APERTURE LED RECESSED	S2	2x2 LED TROFFER		
K2R	2" APERTURE LED RECESSED FIXTURE	K4RG	4" APERTURE LED REGRESSED	W	LED TRACK LIGHT		
K2SM	2" APERTURE LED RECESSED FIXTURE	K4WWR	4" APERTURE LED WALL WASH RECESSED	X1	SURFACE MOUNT LED EXIT SIGN		

MECHANICAL

- HVAC SUPPLY DIFFUSER; RE: MECHANICAL
- HVAC RETURN DIFFUSER; RE: MECHANICAL
- HVAC EXHAUST DIFFUSER; RE: MECHANICAL
- LINEAR HVAC SUPPLY DIFFUSER; RE: MECHANICAL
- LINEAR HVAC RETURN DIFFUSER; RE: MECHANICAL
- 24x24 ACCESS PANEL; COLOR TO MATCH ADJACENT CEILING

General RCP Notes

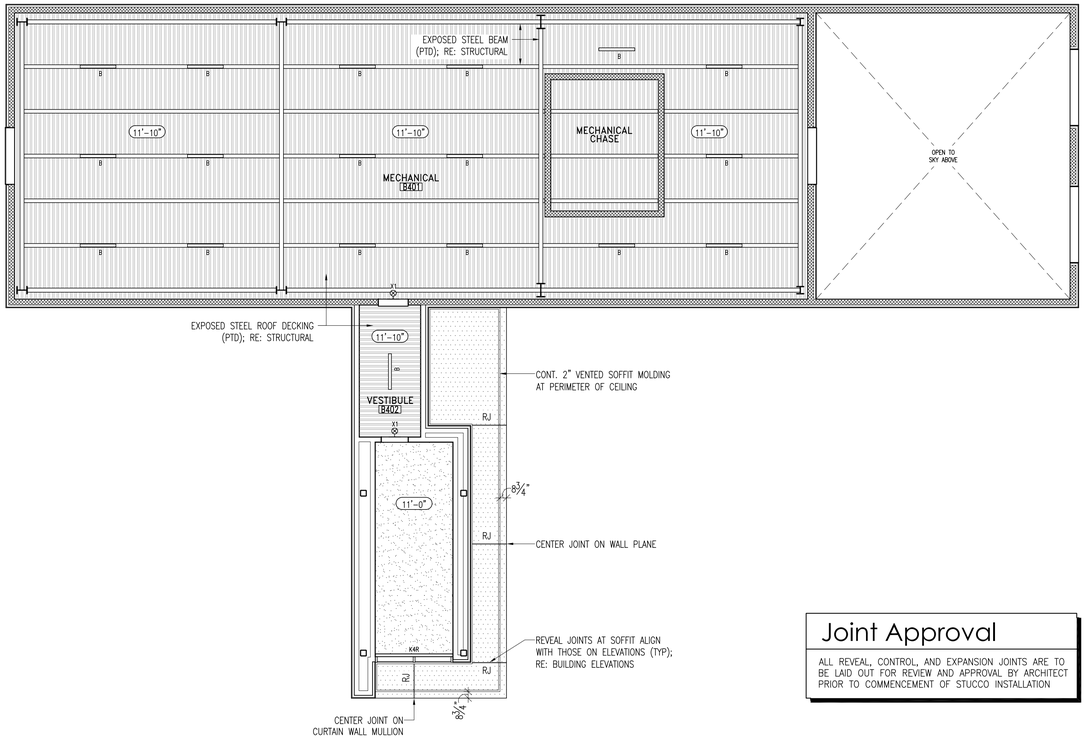
1. CONTRACTOR TO CONSULT ARCHITECT IMMEDIATELY IF DISCREPANCIES ARE FOUND BETWEEN ARCHITECTURAL AND ENGINEERING DRAWINGS.
2. ALL ANGLES ARE 90° OR 45° UNLESS DIMENSIONED OTHERWISE.
3. SEE A2.x SHEETS FOR FLOOR PLANS.
4. SEE A3.x SHEETS FOR ROOF PLANS.
5. SEE A5.x SHEETS FOR EXTERIOR ELEVATIONS.
6. SEE A6.x SHEETS FOR BUILDING SECTIONS.
7. SEE A8.x SHEETS FOR DOOR SCHEDULE/FRAME ELEVATIONS AND WINDOW SCHEDULE/WINDOW ELEVATIONS.
8. SEE A9.x SHEETS FOR FINISH SCHEDULES AND FINISH FLOOR PLANS.
9. SEE A10.x SHEETS FOR INTERIOR ELEVATIONS.
10. SEE A11.x SHEETS FOR VERTICAL CIRCULATION.

RCP Notes

1. SEE MECHANICAL DRAWINGS FOR ANY MECHANICAL FIXTURES THAT MAY NOT BE SHOWN ON THIS PLAN.
2. SEE ELECTRICAL DRAWINGS FOR ANY ELECTRICAL FIXTURES THAT MAY NOT BE SHOWN ON THIS PLAN.
3. LIGHT FIXTURE TAGS PROVIDE ON THE DRAWINGS AND WITHIN THE RCP LEGEND REPRESENT TYPES OF FIXTURES, NOT SPECIFIC SPECIFIC. THESE TAGS ARE CLOSELY COORDINATED WITH THOSE FOUND THROUGHOUT THE ELECTRICAL DRAWINGS, THOUGH DIFFERENCES MAY EXIST.
4. PROVIDE ALL BLOCKING AND HANGERS REQUIRED TO SECURELY FASTEN LIGHT FIXTURES TO STRUCTURE.
5. SINGLE LIGHT FIXTURES ON CEILING ARE TO BE CENTERED IN SPACE UNLESS NOTED OTHERWISE.
6. TWO OR MORE CEILING FIXTURES IN A ROW ARE TO BE EQUALLY SPACED AND CENTERED IN SPACE UNLESS NOTED OTHERWISE.
7. A MOCK-UP OF EACH PENDANT LIGHT FIXTURE TYPE AT EACH VARYING CEILING HEIGHT SHALL BE REVIEWED AND APPROVED BY ARCHITECT FOR LENGTH OF DROP PRIOR TO INSTALLING.

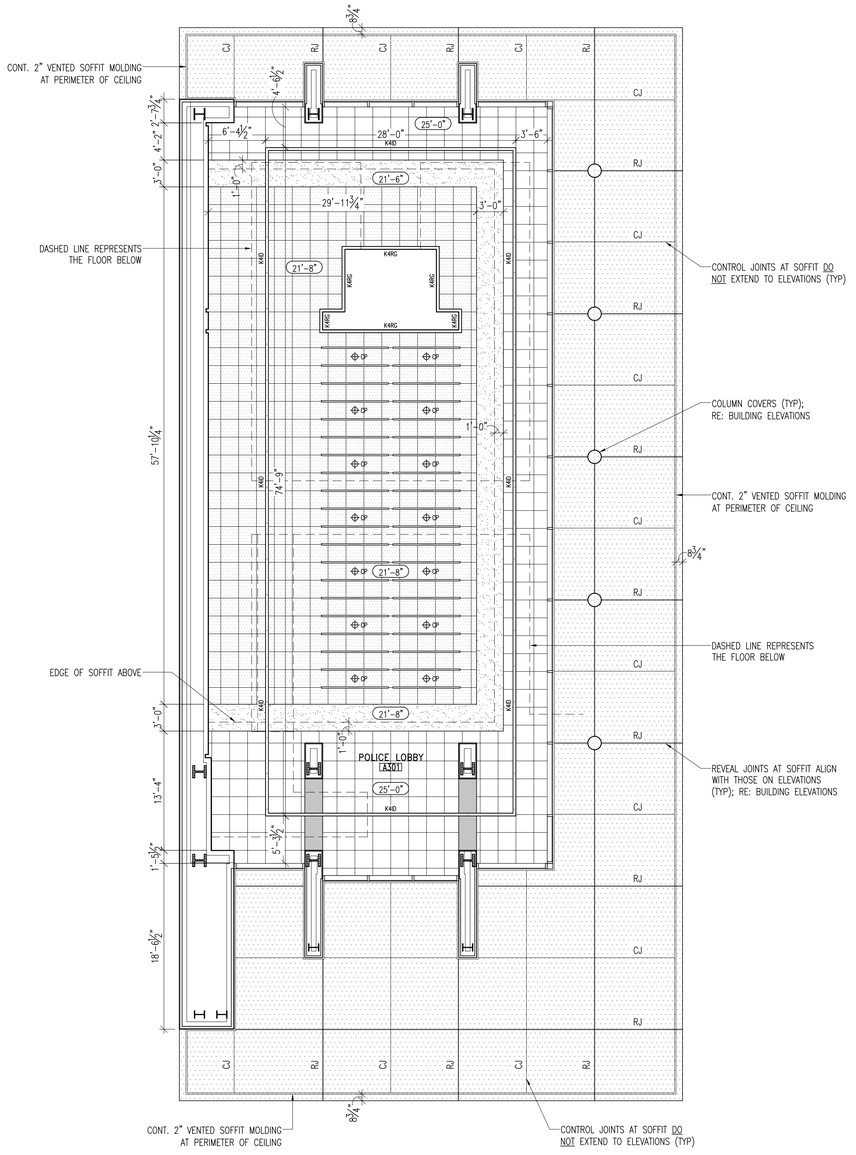
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Joint Approval

ALL REVEAL, CONTROL, AND EXPANSION JOINTS ARE TO BE LAID OUT FOR REVIEW AND APPROVAL BY ARCHITECT PRIOR TO COMMENCEMENT OF STUCCO INSTALLATION



N

Mechanical Penthouse/Stair Reflected Ceiling Plan

SCALE: 1/8" = 1'-0"

N

Atrium Reflected Ceiling Plan

SCALE: 1/8" = 1'-0"

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

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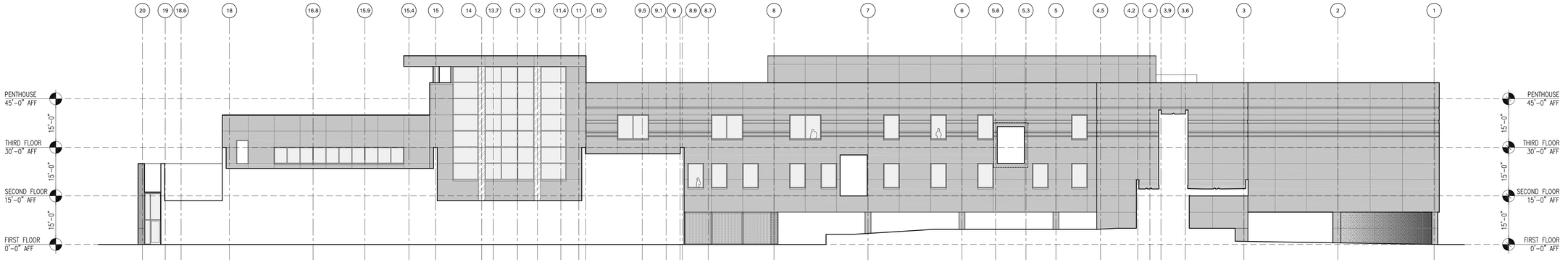
Client No: ——

Albert & Associates: 12575

REGISTERED ARCHITECT Larry M Albert Hattiesburg, MS STATE OF MISSISSIPPI

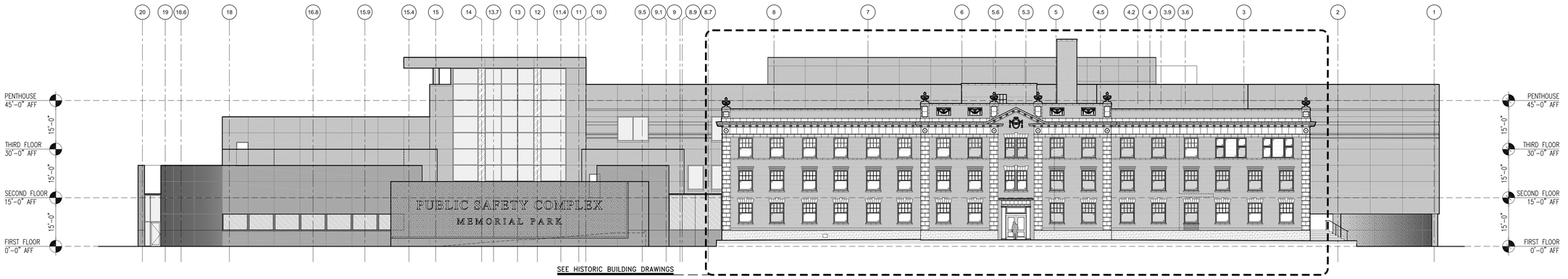
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3 North Elevation @ Courtyard

SCALE: 1/16" = 1'-0"



2 North Elevation

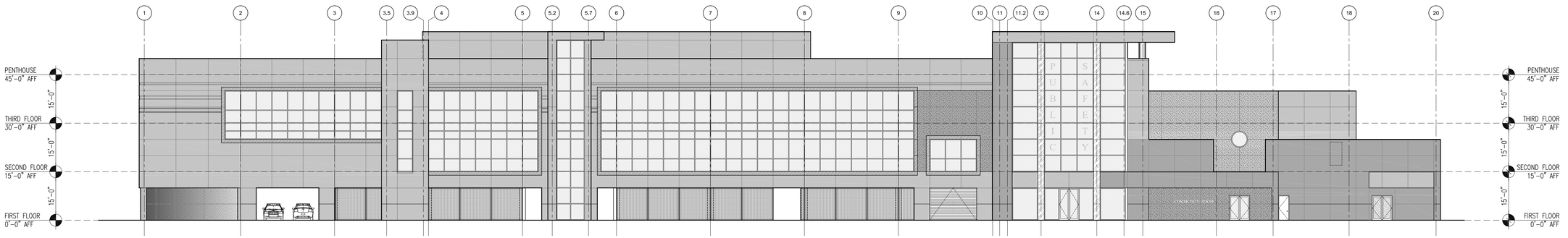
SCALE: 1/16" = 1'-0"

Elevations Finishes

- CEMENT BOARD STUCCO SYSTEM WITH 1.5" INBOUND CONTINUOUS INSULATION (ci) EQUAL TO STOQUIK SILVER DRAINSCREEN BY STO CORP; TEXTURE: FINE; COLOR: TBD
- CEMENT BOARD STUCCO SYSTEM WITH 1.5" INBOUND CONTINUOUS INSULATION (ci) EQUAL TO STOQUIK SILVER DRAINSCREEN BY STO CORP; TEXTURE: MILANO; COLOR: TBD
- EIFS SYSTEM WITH 1.5" INBOUND CONTINUOUS INSULATION (ci) EQUAL TO STOTHERM ci XPS BY STO CORP; TEXTURE; FINE; COLOR: TBD
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- EIFS SYSTEM WITH 1.5" INBOUND CONTINUOUS INSULATION (ci) EQUAL TO STOTHERM ci XPS BY STO CORP; TEXTURE; MILANO; COLOR: TBD
- GLAZING; RE: SHEET A8.2 WINDOW SCHEDULE & ELEVATIONS
- ALUMINUM COMPOSITE METAL PANELS COLOR TO EXACTLY MATCH CURTAIN WALL SYSTEMS

Elevations Note

HATCHES REFERENCED ON THE BUILDING ELEVATIONS ARE MEANT TO QUANTIFY AND DIFFERENTIATE BETWEEN THE EXTERIOR ENVELOPE SYSTEMS AND FINISH TEXTURES USED. THE CONTRACTOR SHALL PREPARE FOR AT LEAST FIVE (5) FINISH COLORS TO BE DETERMINED (TBD) AND SUBMIT A COLOR CHART TO THE ARCHITECT FOR COLORS SELECTION. A COMPLETED MOCK-UP OF FINISH TEXTURES AND COLORS SELECTED SHALL BE SUBMITTED TO THE ARCHITECT FOR REVIEW.



1 South Elevation

SCALE: 1/16" = 1'-0"

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

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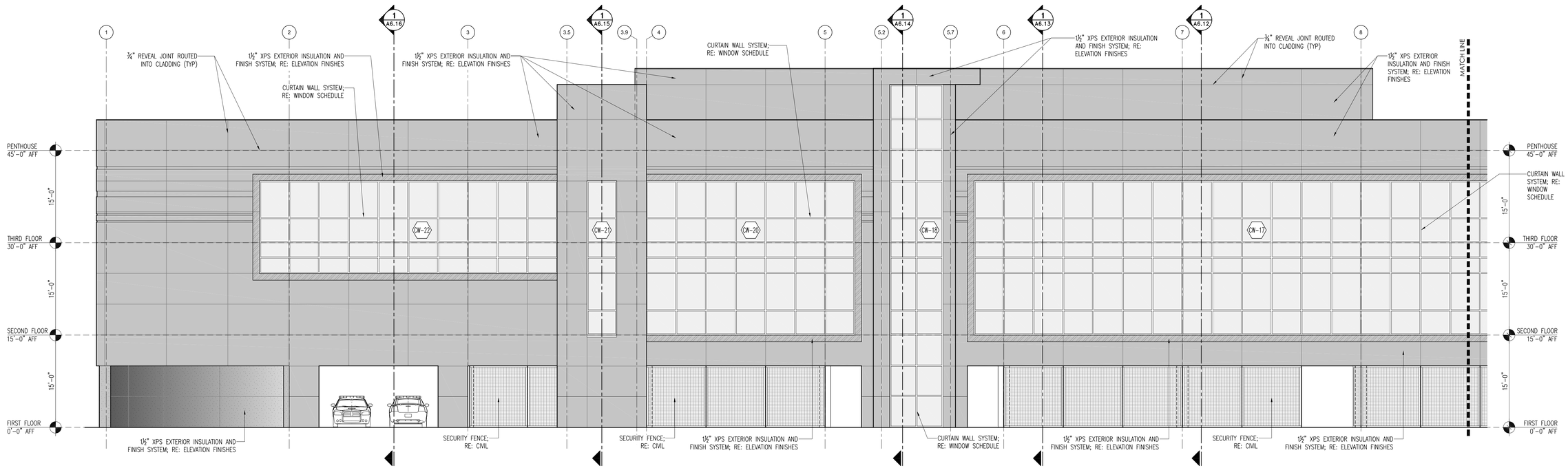
Albert & Associates: 12575

REGISTERED ARCHITECT Larry M Albert Hattiesburg, MS STATE OF MISSISSIPPI

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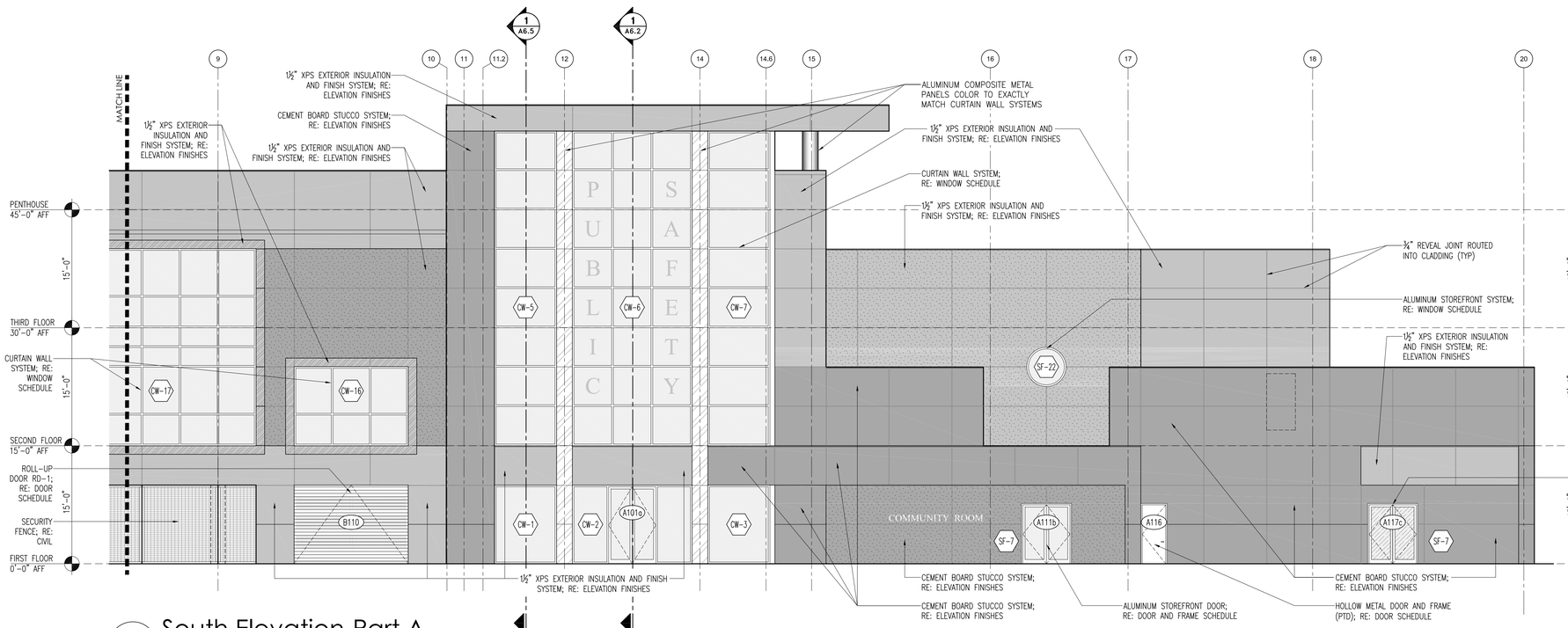
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BUILDING ELEVATIONS



2 South Elevation - Part B

SCALE: 1/8" = 1'-0"



1 South Elevation-Part A

SCALE: 1/8" = 1'-0"

Elevations Note

HATCHES REFERENCED ON THE BUILDING ELEVATIONS ARE MEANT TO QUANTIFY AND DIFFERENTIATE BETWEEN THE EXTERIOR ENVELOPE SYSTEMS AND FINISH TEXTURES USED. THE CONTRACTOR SHALL PREPARE FOR AT LEAST FIVE (5) FINISH COLORS TO BE DETERMINED (TBD) AND SUBMIT A COLOR CHART TO THE ARCHITECT FOR COLORS SELECTION. A COMPLETED MOCK-UP OF FINISH TEXTURES AND COLORS SELECTED SHALL BE SUBMITTED TO THE ARCHITECT FOR REVIEW.

Elevation Finishes

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CITY OF HATTIESBURG MISSISSIPPI 1884

HATTIESBURG PUBLIC SAFETY COMPLEX

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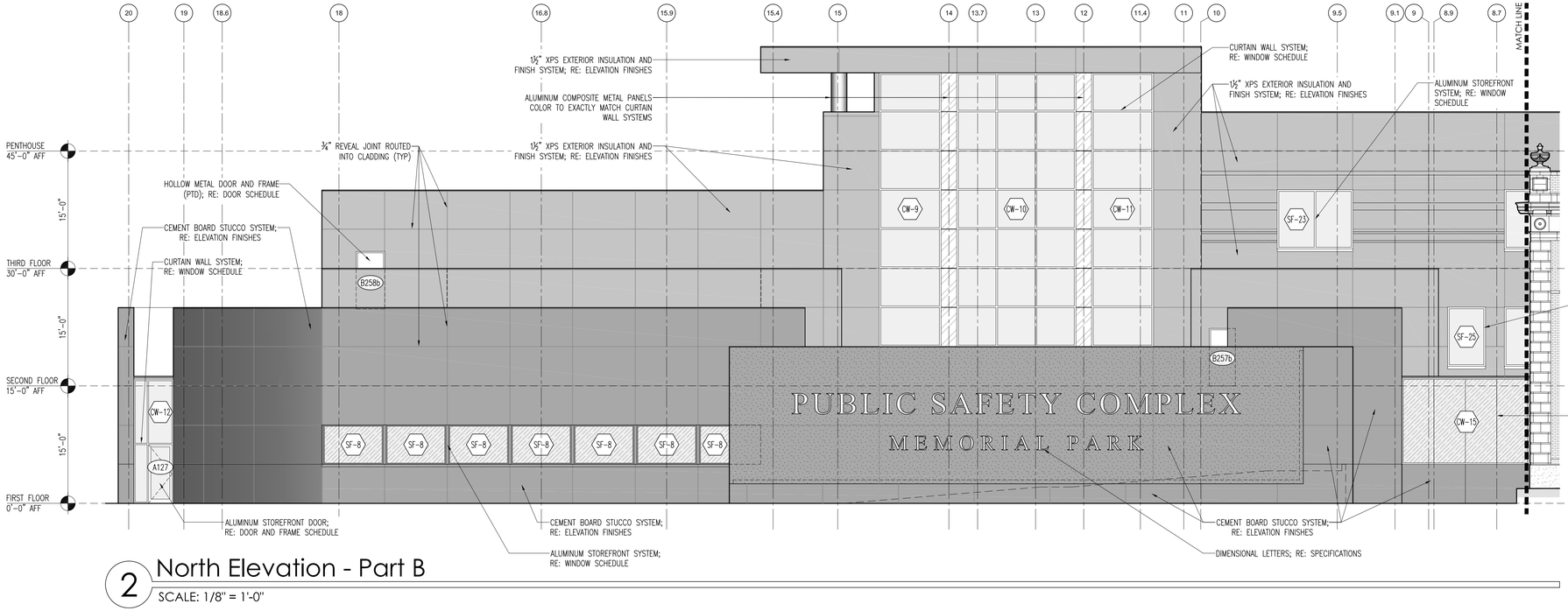
Albert & Associates: 12575

REGISTERED ARCHITECT Larry M Albert Hattiesburg, MS STATE OF MISSISSIPPI

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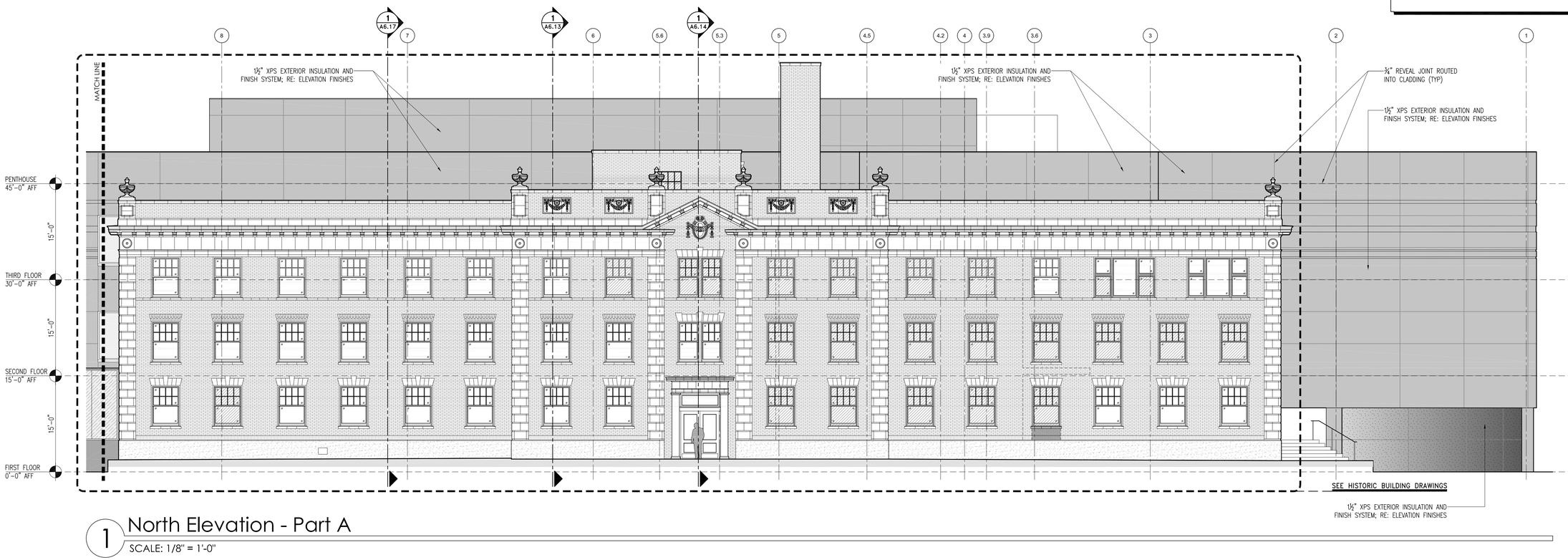
BUILDING ELEVATIONS

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2 North Elevation - Part B

SCALE: 1/8" = 1'-0"



1 North Elevation - Part A

SCALE: 1/8" = 1'-0"

Elevations Note

HATCHES REFERENCED ON THE BUILDING ELEVATIONS ARE MEANT TO QUANTIFY AND DIFFERENTIATE BETWEEN THE EXTERIOR ENVELOPE SYSTEMS AND FINISH TEXTURES USED. THE CONTRACTOR SHALL PREPARE FOR AT LEAST FIVE (5) FINISH COLORS TO BE DETERMINED (TBD) AND SUBMIT A COLOR CHART TO THE ARCHITECT FOR COLORS SELECTION. A COMPLETED MOCK-UP OF FINISH TEXTURES AND COLORS SELECTED SHALL BE SUBMITTED TO THE ARCHITECT FOR REVIEW.

Elevation Finishes

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CITY OF HATTIESBURG MISSISSIPPI

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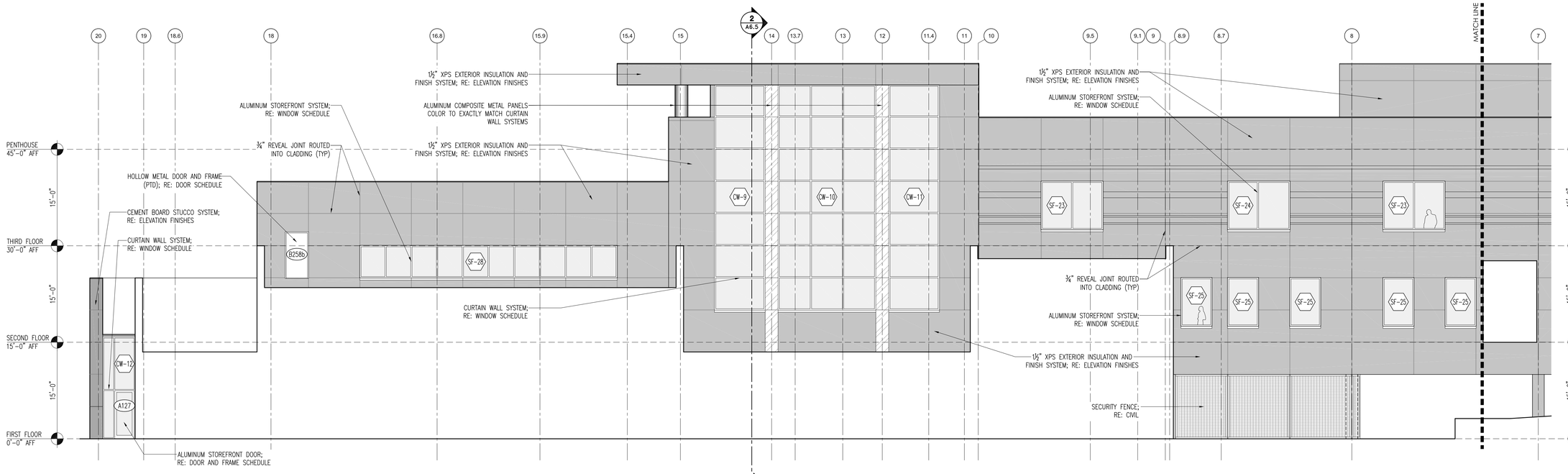
Albert & Associates: 12575

REGISTERED ARCHITECT Larry A. Albert Jr. Hattiesburg, MS STATE OF MISSISSIPPI

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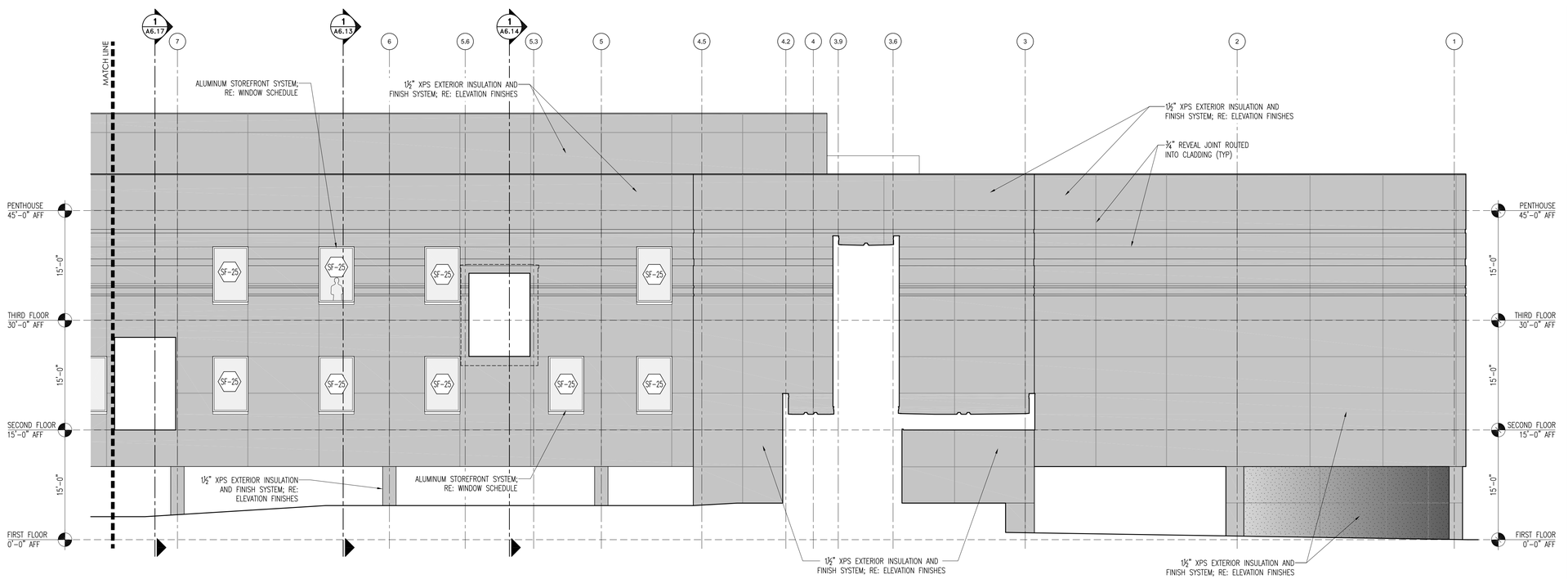
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BUILDING ELEVATIONS



2 North Elevation - Part B

SCALE: 1/8" = 1'-0"



1 North Elevation - Part A

SCALE: 1/8" = 1'-0"

Elevations Note

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CITY OF HATTIESBURG MISSISSIPPI 1884

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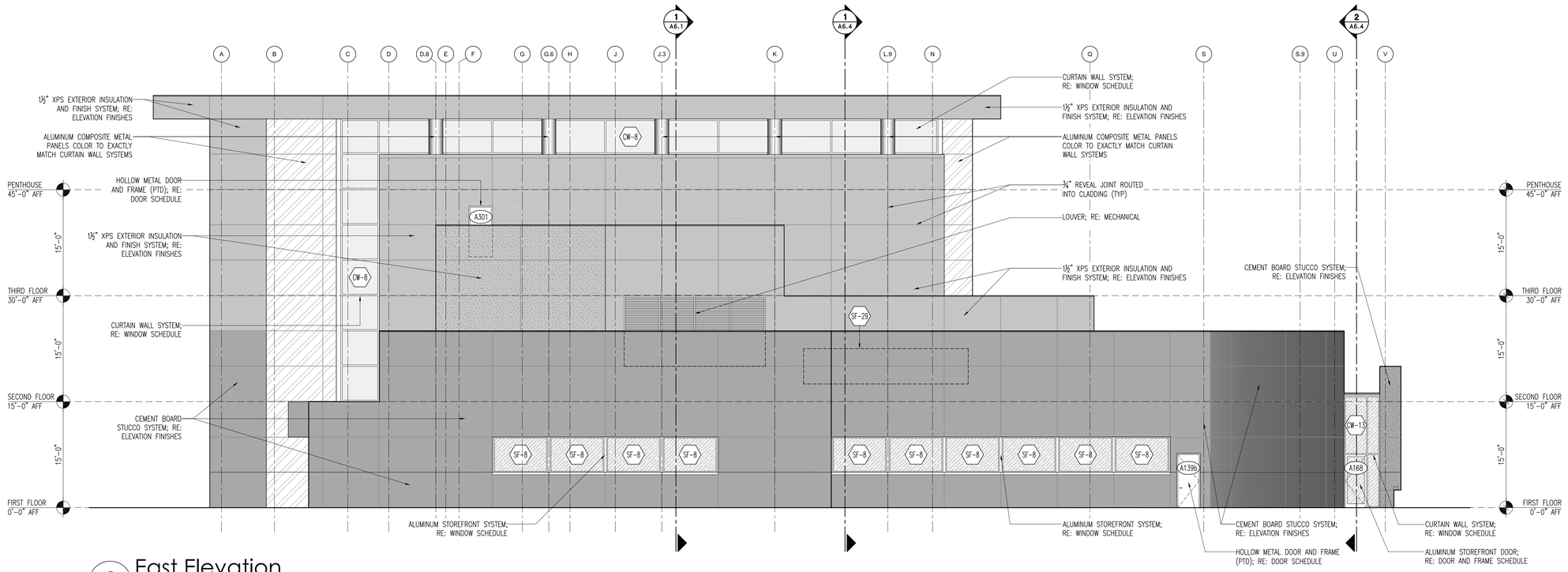
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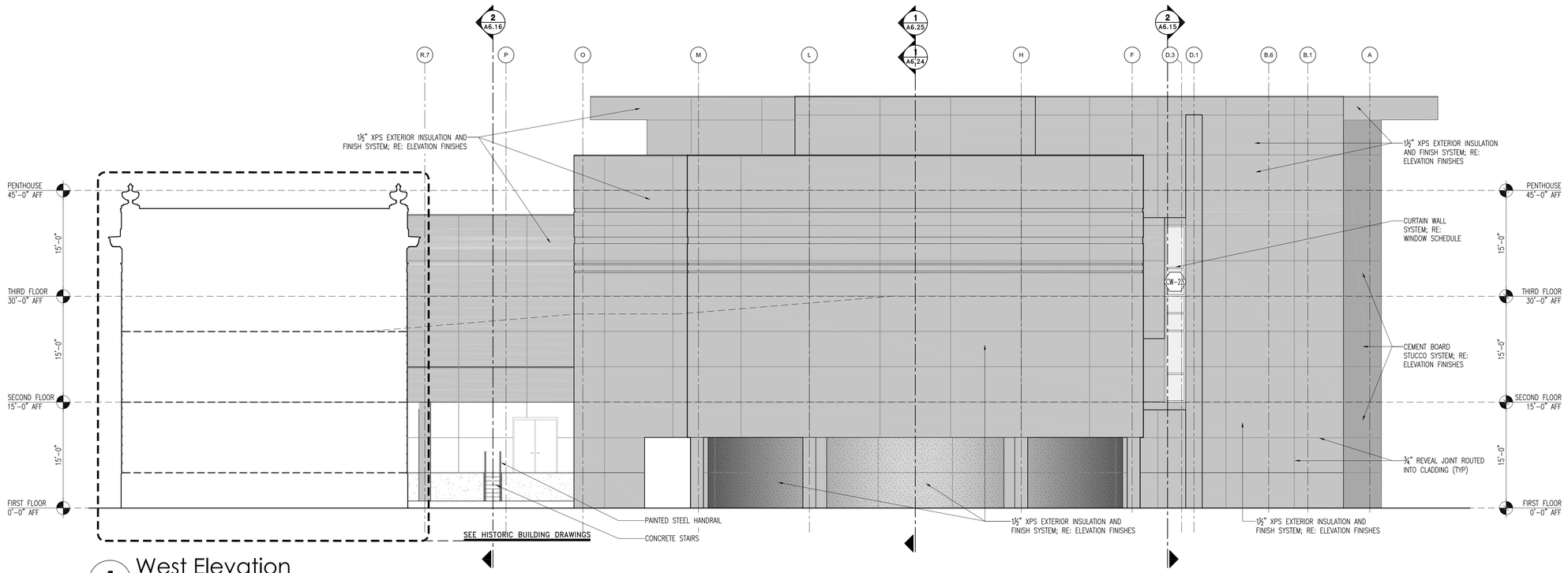
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BUILDING ELEVATIONS



2 East Elevation

SCALE: 1/8" = 1'-0"



1 West Elevation

SCALE: 1/8" = 1'-0"

Elevations Note

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CITY OF HATTIESBURG MISSISSIPPI 1884

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

Drawing Issued:

Date	Rev.	Description
08-31-2015		DD Check Set
10-20-2015		75% Progress Set
11-02-2015		90% Pricing Set
11-19-2018		100% Bid Docs

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Checked By: CR,LA,CP

Client No: ------

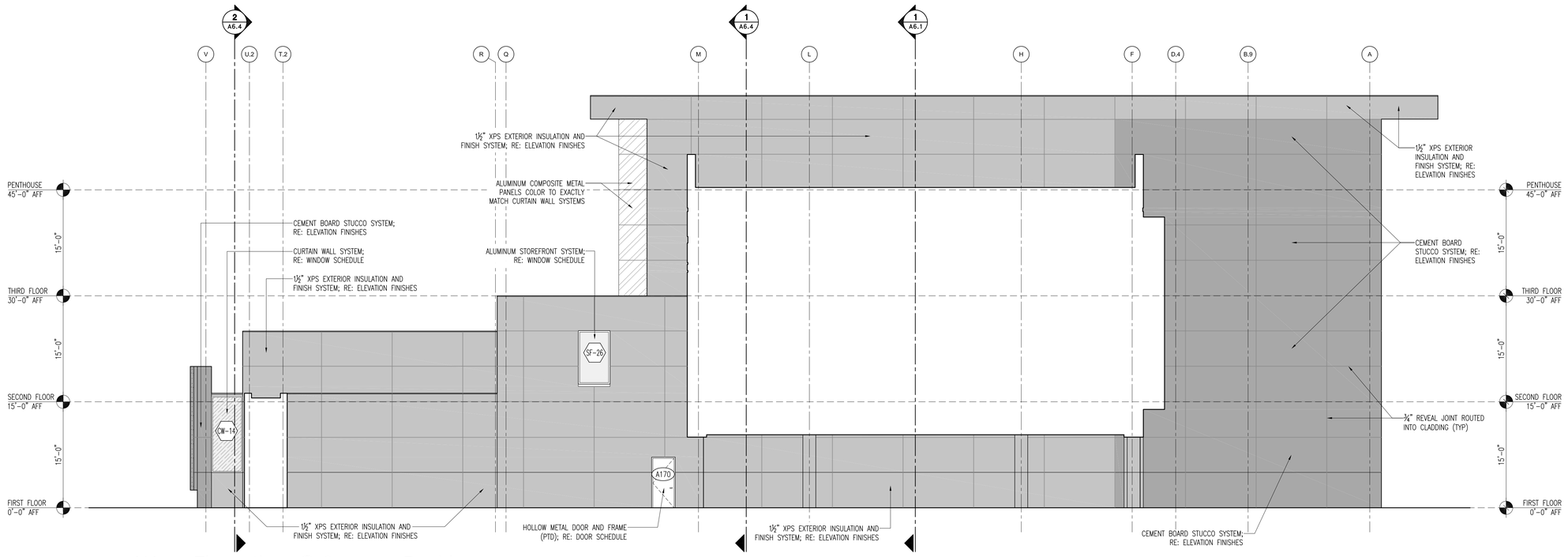
Albert & Associates: 12575

REGISTERED ARCHITECT Larry A. Albert Hattiesburg, MS STATE OF MISSISSIPPI

A5.5

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com **Albert & McCleskey Associates Architects**

BUILDING ELEVATIONS



1 West Elevation @ Secure Parking

SCALE: 1/8" = 1'-0"

Elevations Note

HATCHES REFERENCED ON THE BUILDING ELEVATIONS ARE MEANT TO QUANTIFY AND DIFFERENTIATE BETWEEN THE EXTERIOR ENVELOPE SYSTEMS AND FINISH TEXTURES USED. THE CONTRACTOR SHALL PREPARE FOR AT LEAST FIVE (5) FINISH COLORS TO BE DETERMINED (TBD) AND SUBMIT A COLOR CHART TO THE ARCHITECT FOR COLORS SELECTION. A COMPLETED MOCK-UP OF FINISH TEXTURES AND COLORS SELECTED SHALL BE SUBMITTED TO THE ARCHITECT FOR REVIEW.

Elevation Finishes

- CEMENT BOARD STUCCO SYSTEM WITH 1.5" INBOUND CONTINUOUS INSULATION (ci) EQUAL TO STOQUIK SILVER DRAINSCREEN BY STO CORP; TEXTURE: FINE; COLOR: TBD
- CEMENT BOARD STUCCO SYSTEM WITH 1.5" INBOUND CONTINUOUS INSULATION (ci) EQUAL TO STOQUIK SILVER DRAINSCREEN BY STO CORP; TEXTURE: MILANO; COLOR: TBD
- EIFS SYSTEM WITH 1.5" INBOUND CONTINUOUS INSULATION (ci) EQUAL TO STOTHERM ci XPS BY STO CORP; TEXTURE; FINE; COLOR: TBD
- EIFS SYSTEM WITH 1.5" INBOUND CONTINUOUS INSULATION (ci) EQUAL TO STOTHERM ci XPS BY STO CORP; TEXTURE; MILANO; COLOR: TBD
- EIFS SYSTEM WITH 1.5" INBOUND CONTINUOUS INSULATION (ci) EQUAL TO STOTHERM ci XPS BY STO CORP; TEXTURE; MILANO; COLOR: TBD
- GLAZING; RE: SHEET A8.2 WINDOW SCHEDULE & ELEVATIONS
- ALUMINUM COMPOSITE METAL PANELS COLOR TO EXACTLY MATCH CURTAIN WALL SYSTEMS

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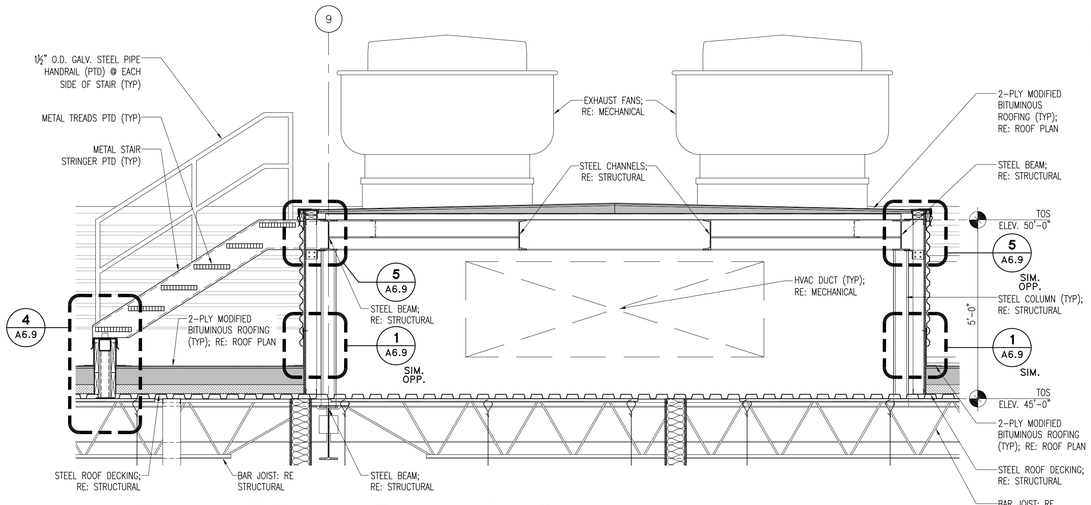
Albert & Associates: 12575

REGISTERED ARCHITECT Larry M Albert Jr. Hattiesburg, MS STATE OF MISSISSIPPI

A5.6

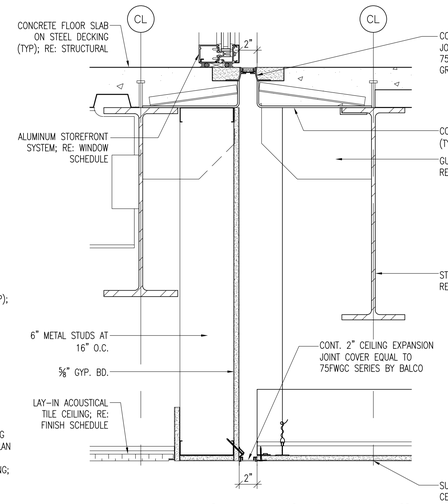
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BUILDING ELEVATIONS



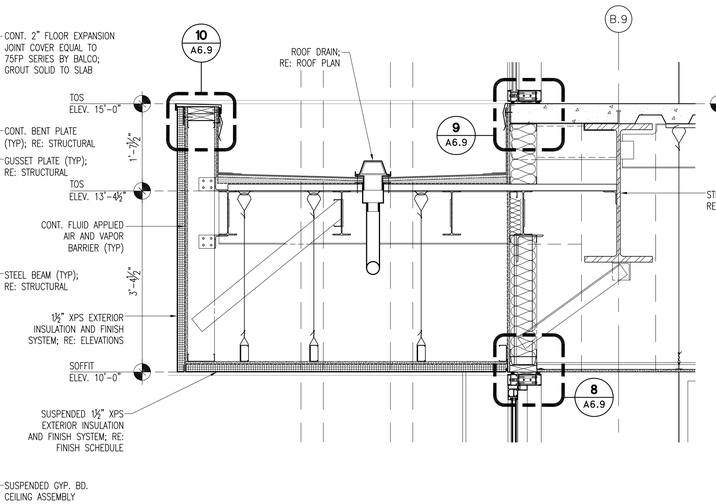
4 Section @ Smoke Evacuation Plenum

SCALE: 1/2" = 1'-0"



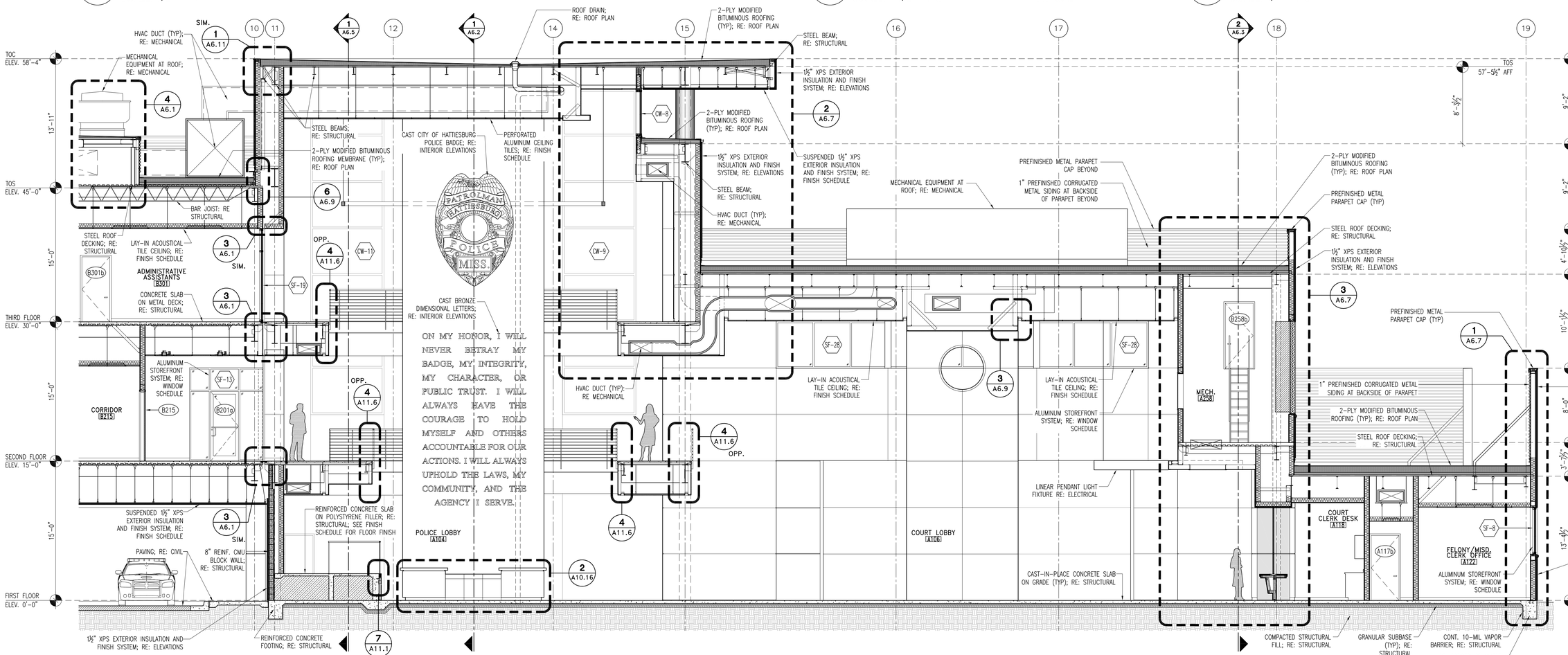
3 Expansion Joint Detail

SCALE: 1 1/2" = 1'-0" TYPICAL



2 High Roof Detail

SCALE: 3/4" = 1'-0"



1 Longitudinal Section @ Police/Court Lobby

SCALE: 3/16" = 1'-0"

NOTE: INTERIOR ELEVATIONS IN BUILDING SECTIONS ARE ILLUSTRATIONAL ONLY AND MAY NOT FULLY DEPICT THE DESIGN OF THE SPACE. SEE INTERIOR ELEVATIONS IN A9.x SHEETS FOR INTENDED DESIGN OF SPACES.

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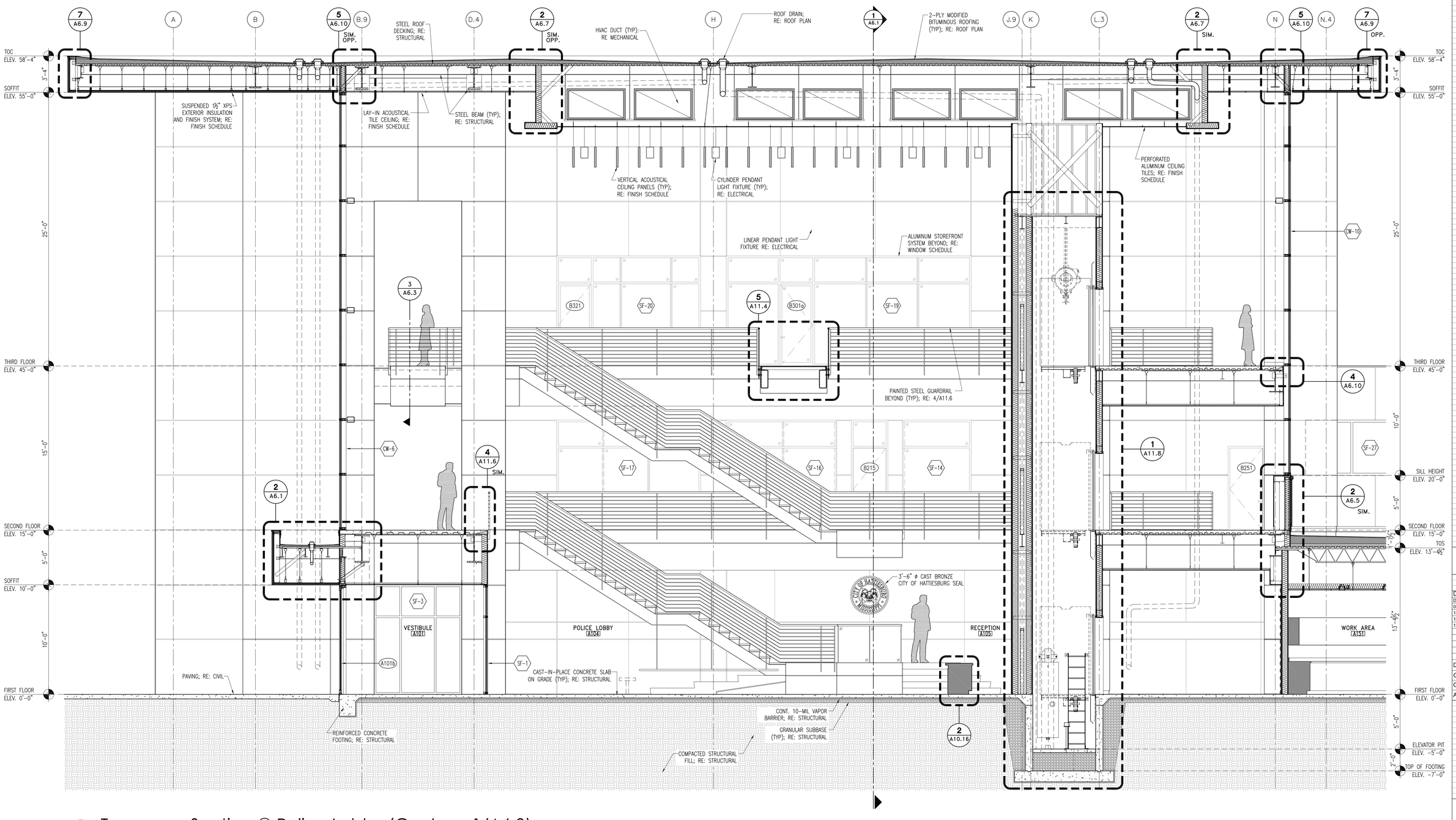
Albert & Associates: 12575

REGISTERED ARCHITECT Larry M Albert Hattiesburg, MS STATE OF MISSISSIPPI

A6.1

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BUILDING SECTIONS



1 Transverse Section @ Police Lobby (Cont. on 1/A6.3)

SCALE: 1/4" = 1'-0"

NOTE: INTERIOR ELEVATIONS IN BUILDING SECTIONS ARE ILLUSTRATIONAL ONLY AND MAY NOT FULLY DEPICT THE DESIGN OF THE SPACE. SEE INTERIOR ELEVATIONS IN A9.x SHEETS FOR INTENDED DESIGN OF SPACES.

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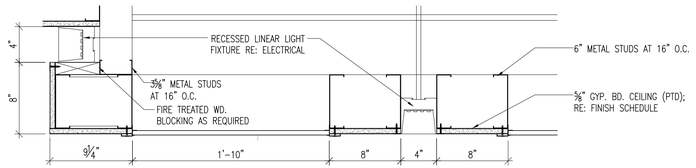
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Albert & Associates: 12575

REGISTERED ARCHITECT Larry A. Albert Hattiesburg, MS STATE OF MISSISSIPPI

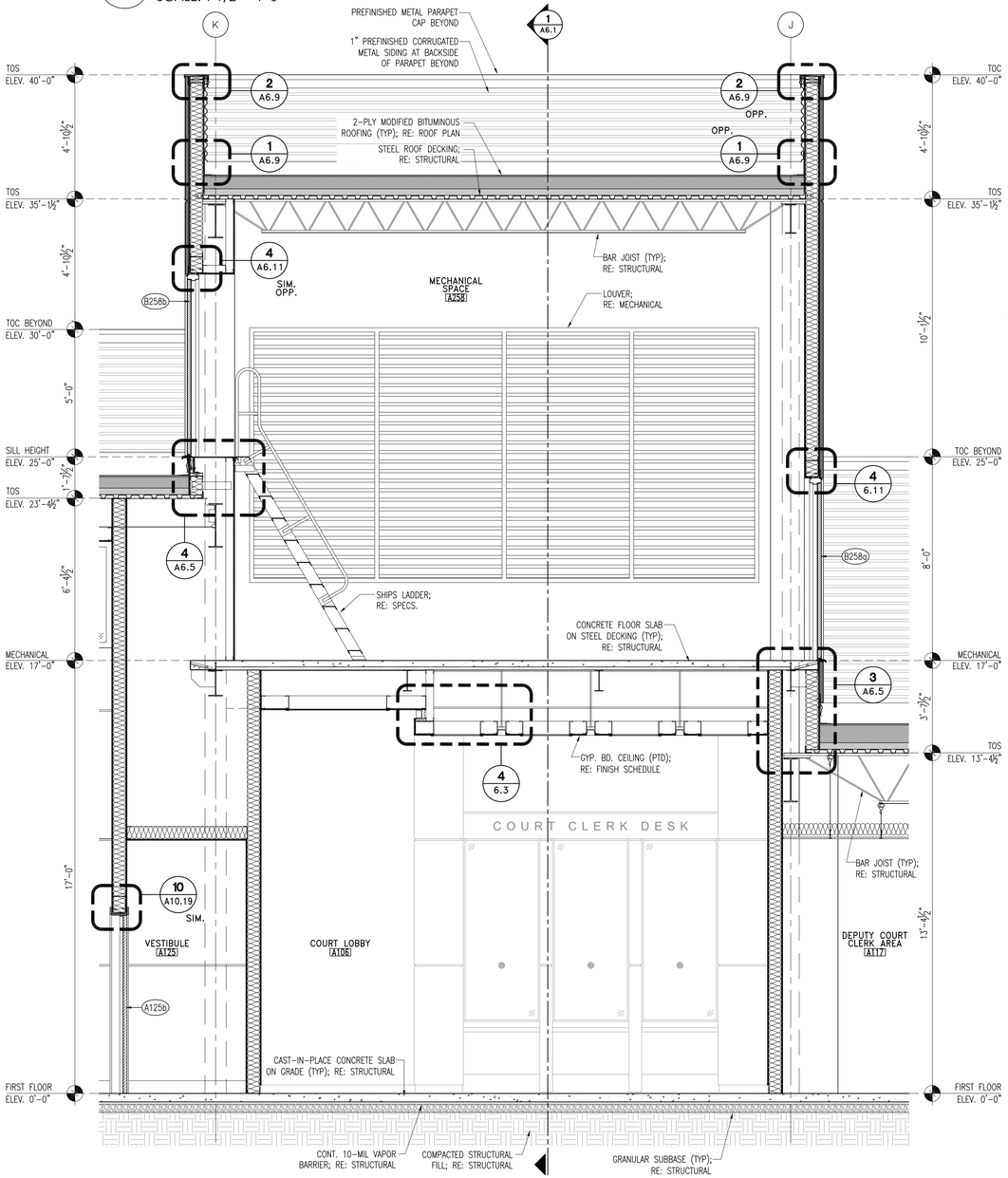
A6.2

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4 Ceiling Detail @ Court Clerk Desk

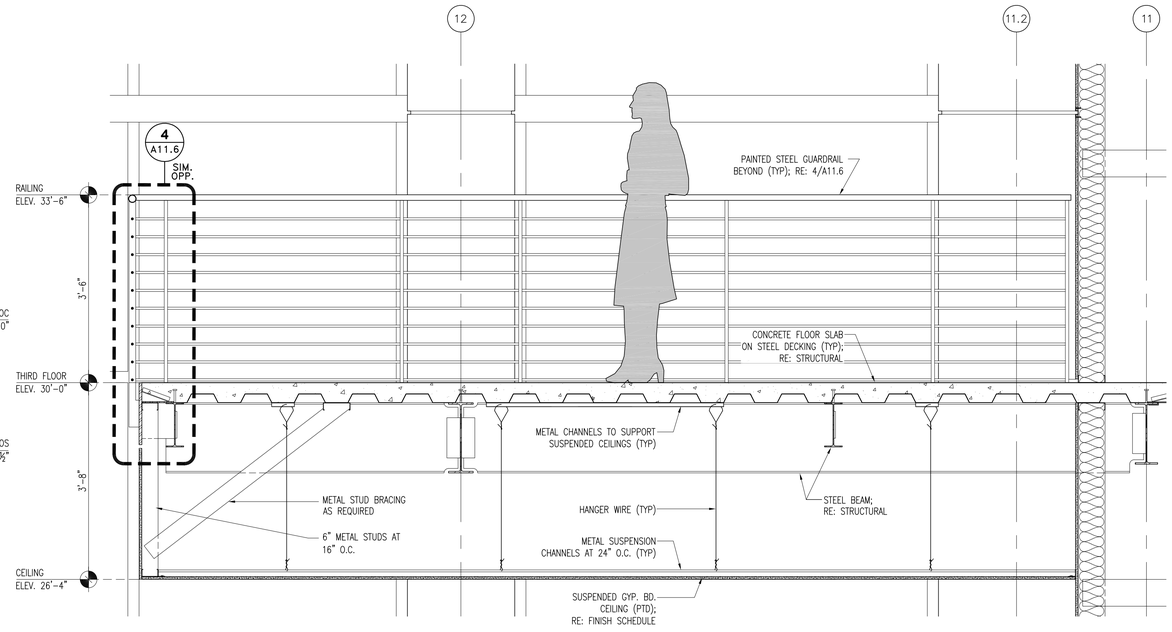
SCALE: 1 1/2" = 1'-0"



2 Section @ Mechanical Space

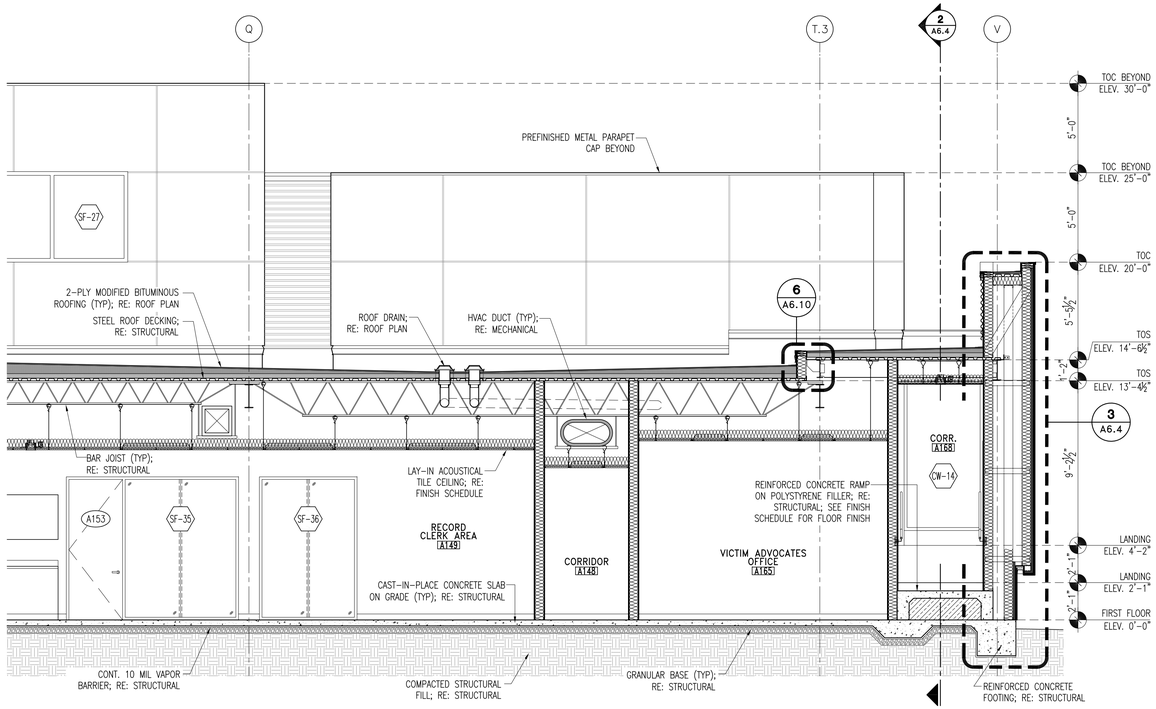
SCALE: 3/8" = 1'-0"

NOTE: INTERIOR ELEVATIONS IN BUILDING SECTIONS ARE ILLUSTRATIONAL ONLY AND MAY NOT FULLY DEPICT THE DESIGN OF THE SPACE. SEE INTERIOR ELEVATIONS IN A9.x SHEETS FOR INTENDED DESIGN OF SPACES.



3 Section @ Third Floor Walkway

SCALE: 3/4" = 1'-0"



1 Transverse Section @ Police Lobby (Cont. from 1/A6.2)

SCALE: 1/4" = 1'-0"

NOTE: INTERIOR ELEVATIONS IN BUILDING SECTIONS ARE ILLUSTRATIONAL ONLY AND MAY NOT FULLY DEPICT THE DESIGN OF THE SPACE. SEE INTERIOR ELEVATIONS IN A9.x SHEETS FOR INTENDED DESIGN OF SPACES.

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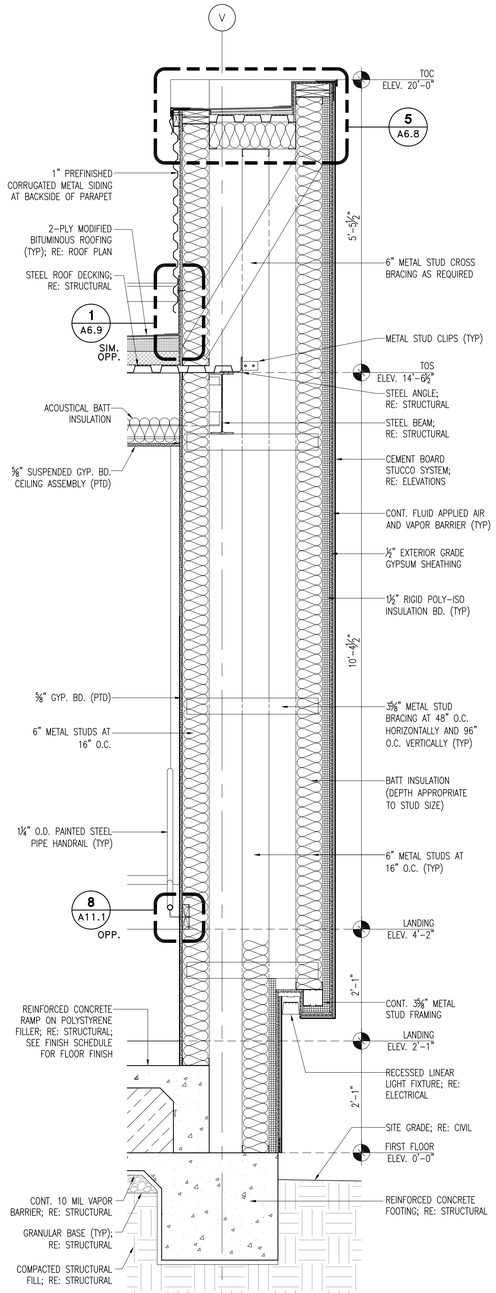
Albert & Associates: 12575

REGISTERED ARCHITECT Larry M Albert Hattiesburg, MS STATE OF MISSISSIPPI

A6.3

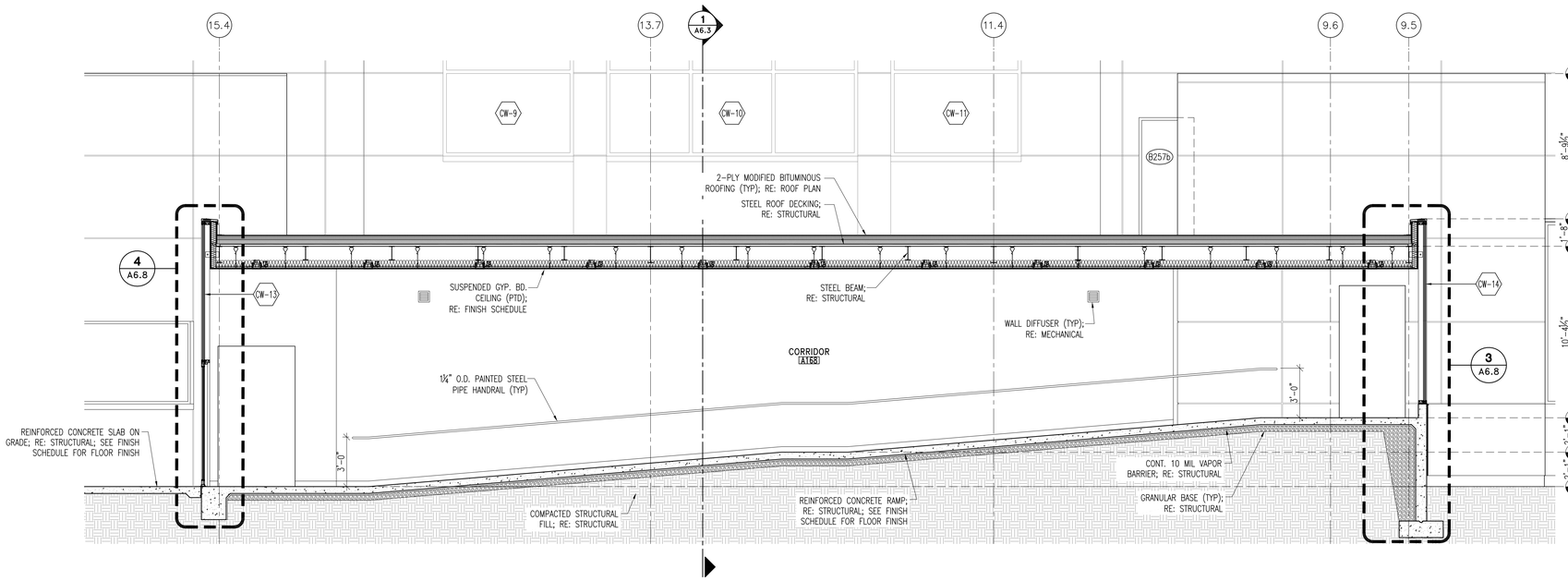
514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com **Albert & McCleskey Associates Architects**

BUILDING SECTIONS



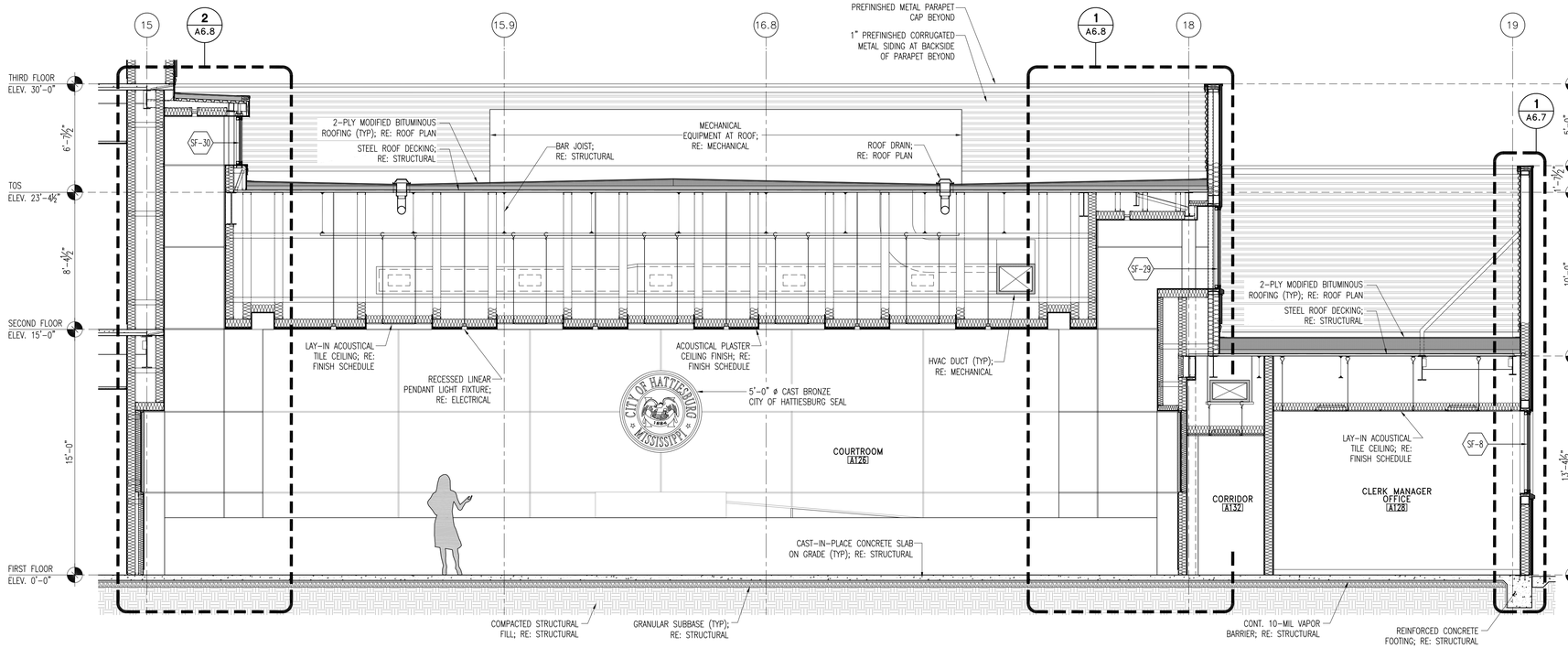
3 Wall Section

SCALE: 3/4" = 1'-0"



2 Section @ Corridor Ramp

SCALE: 1/4" = 1'-0"



1 Section @ Courtroom

SCALE: 1/4" = 1'-0"

NOTE: INTERIOR ELEVATIONS IN BUILDING SECTIONS ARE ILLUSTRATIONAL ONLY AND MAY NOT FULLY DEPICT THE DESIGN OF THE SPACE. SEE INTERIOR ELEVATIONS IN A9.x SHEETS FOR INTENDED DESIGN OF SPACES.

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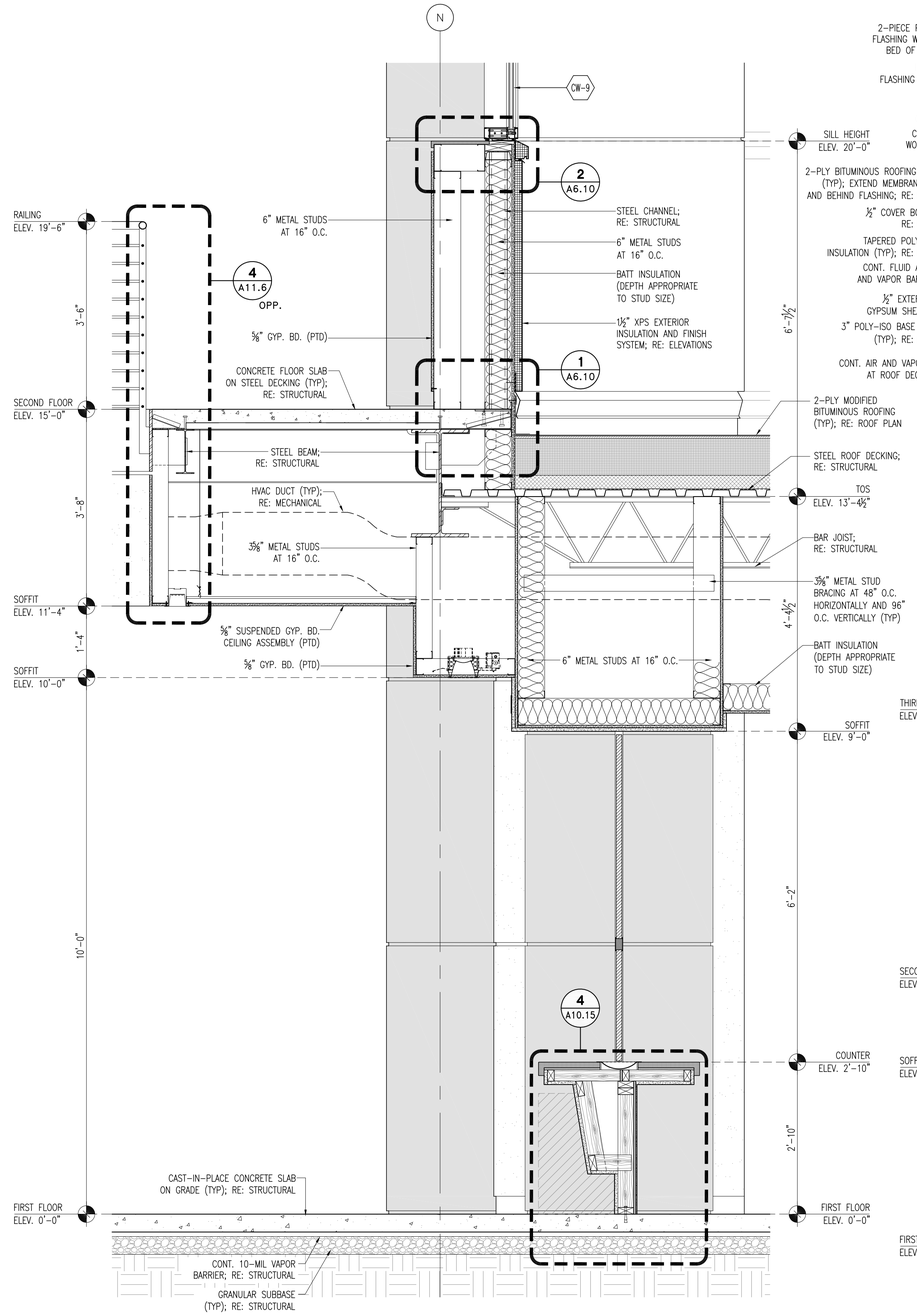
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Albert & Associates: 12575

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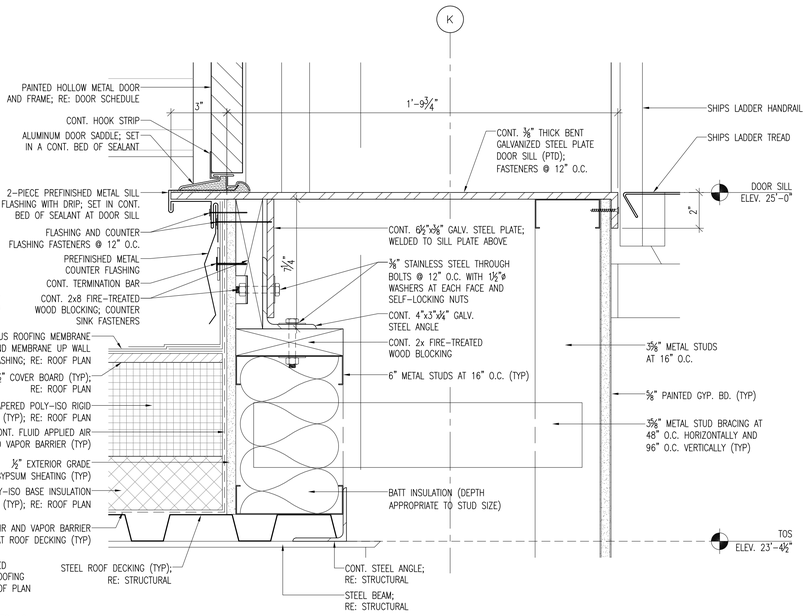
A6.4

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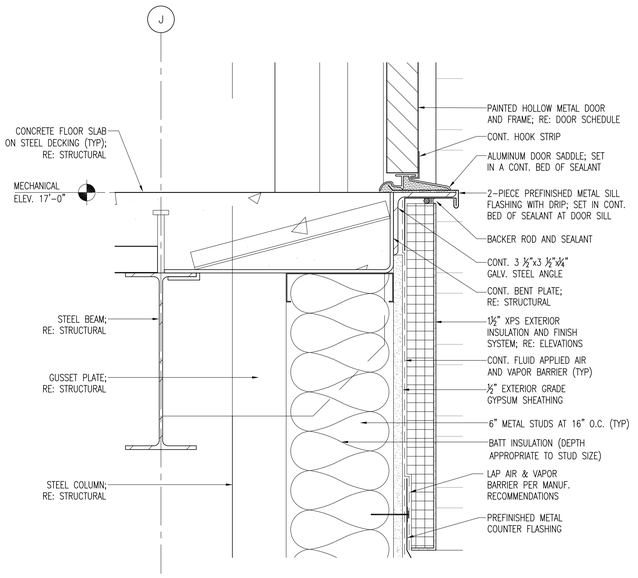
2 Section @ Record Clerk Desk

SCALE: 3/4" = 1'-0"



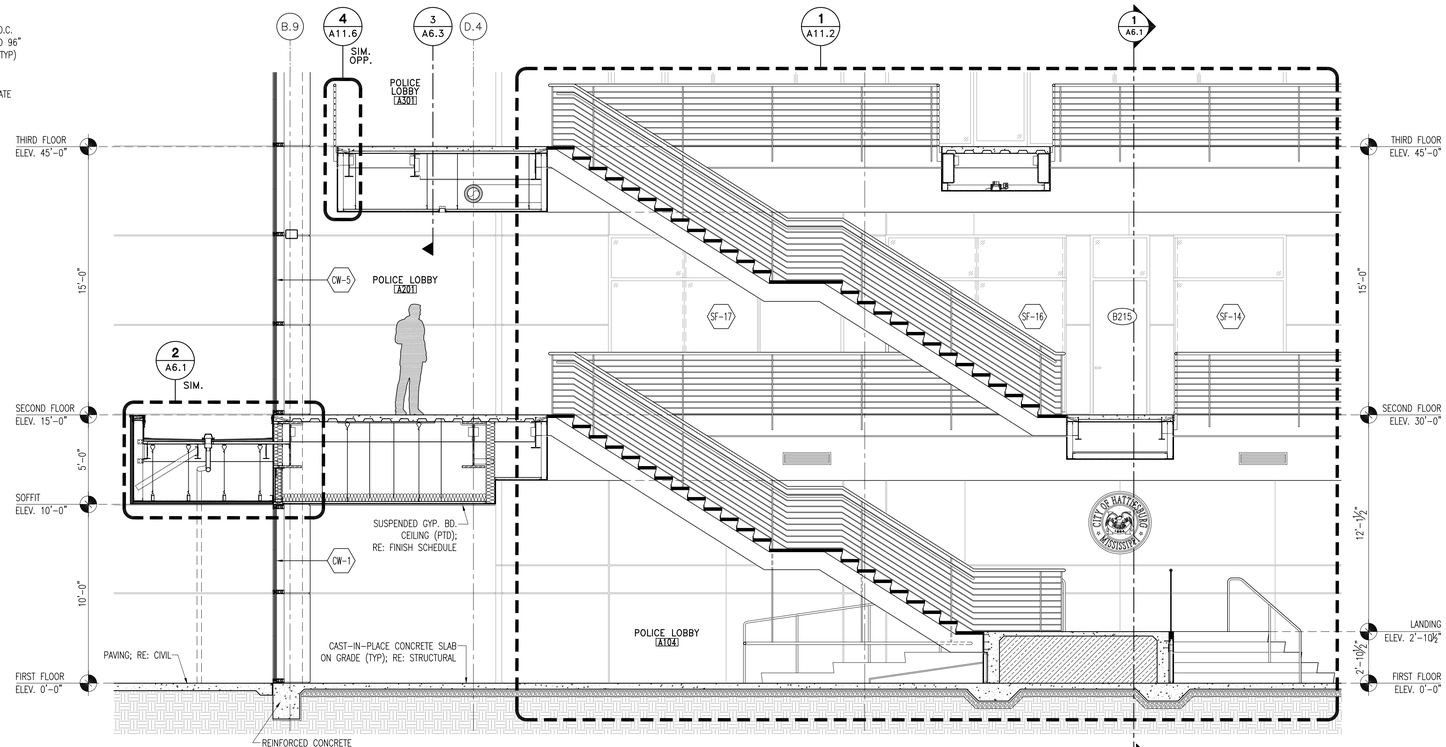
4 Door Sill Detail @ Mechanical [B258]

SCALE: 3" = 1'-0"



3 Door Sill Detail @ Mechanical [B258]

SCALE: 3" = 1'-0"



1 Section @ Police Lobby

SCALE: 1/4" = 1'-0"

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CITY OF HATTIESBURG MISSISSIPPI 1884

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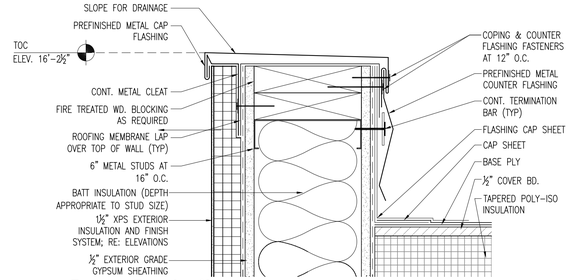
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Albert & Associates: 12575

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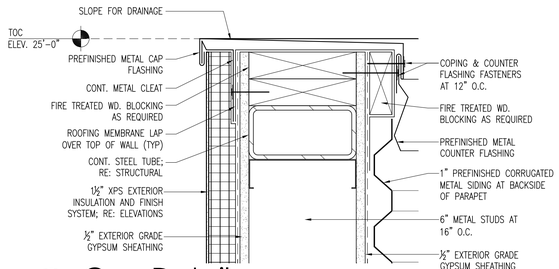
A6.5

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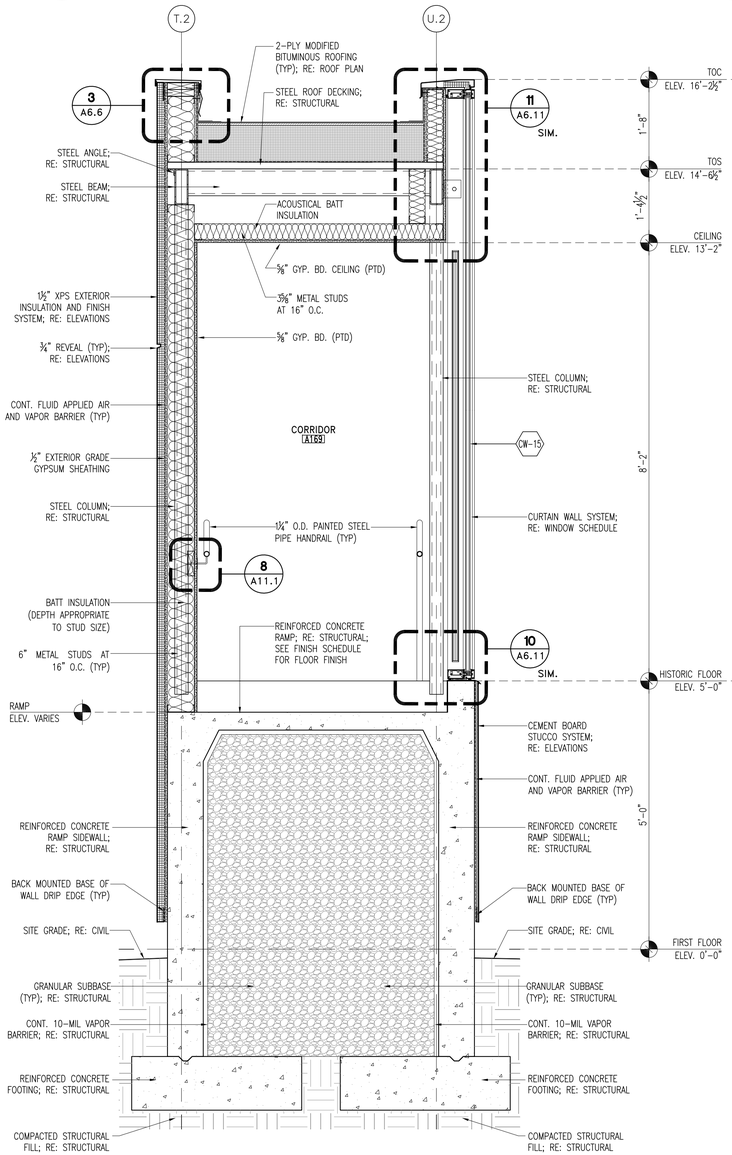
3 Cap Detail

SCALE: 3" = 1'-0" TYPICAL



4 Cap Detail

SCALE: 3" = 1'-0" TYPICAL



2 Section @ Connector Ramp

SCALE: 3/4" = 1'-0"

1 Section @ Exterior Stair / Mechanical Screen Wall

SCALE: 3/4" = 1'-0"

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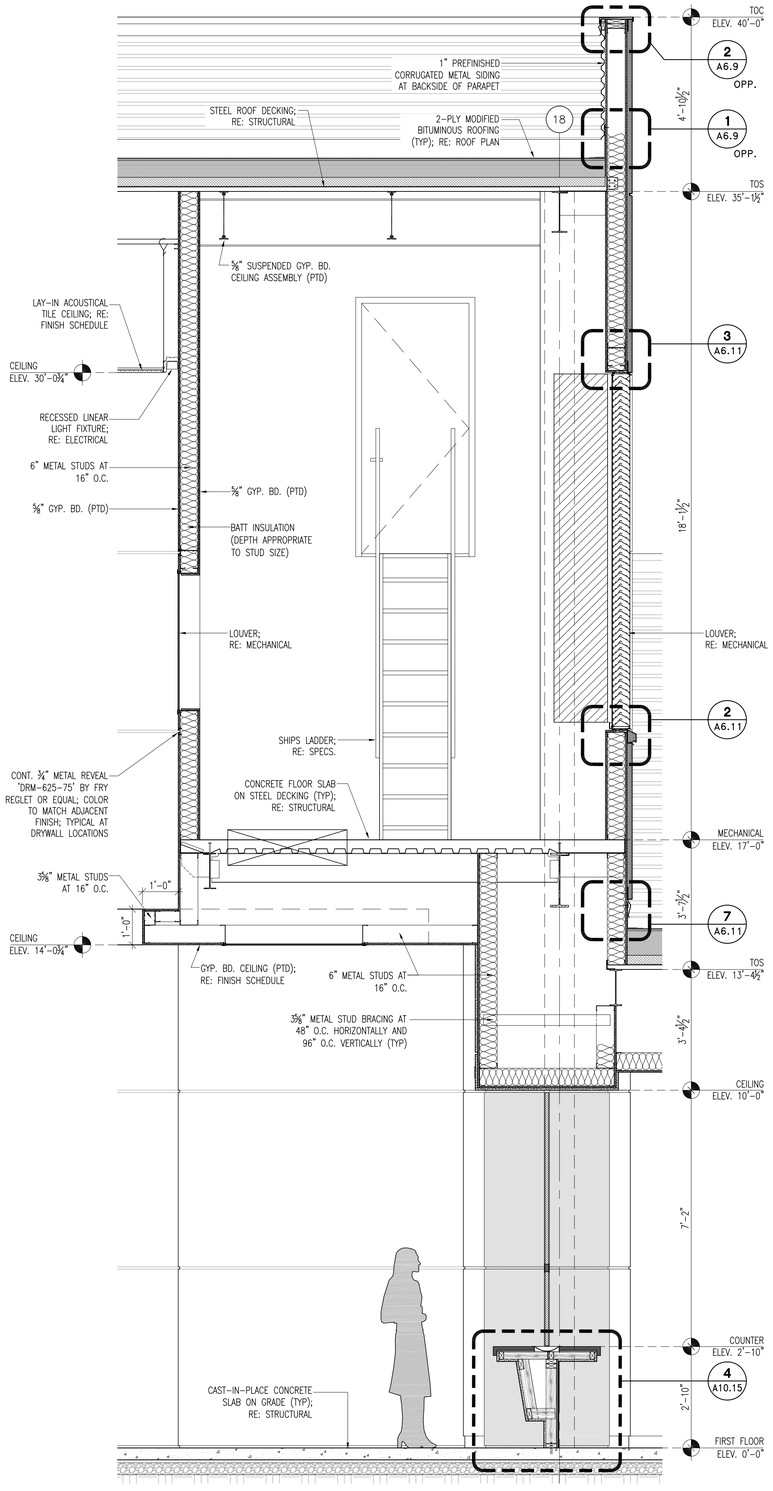
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A6.6

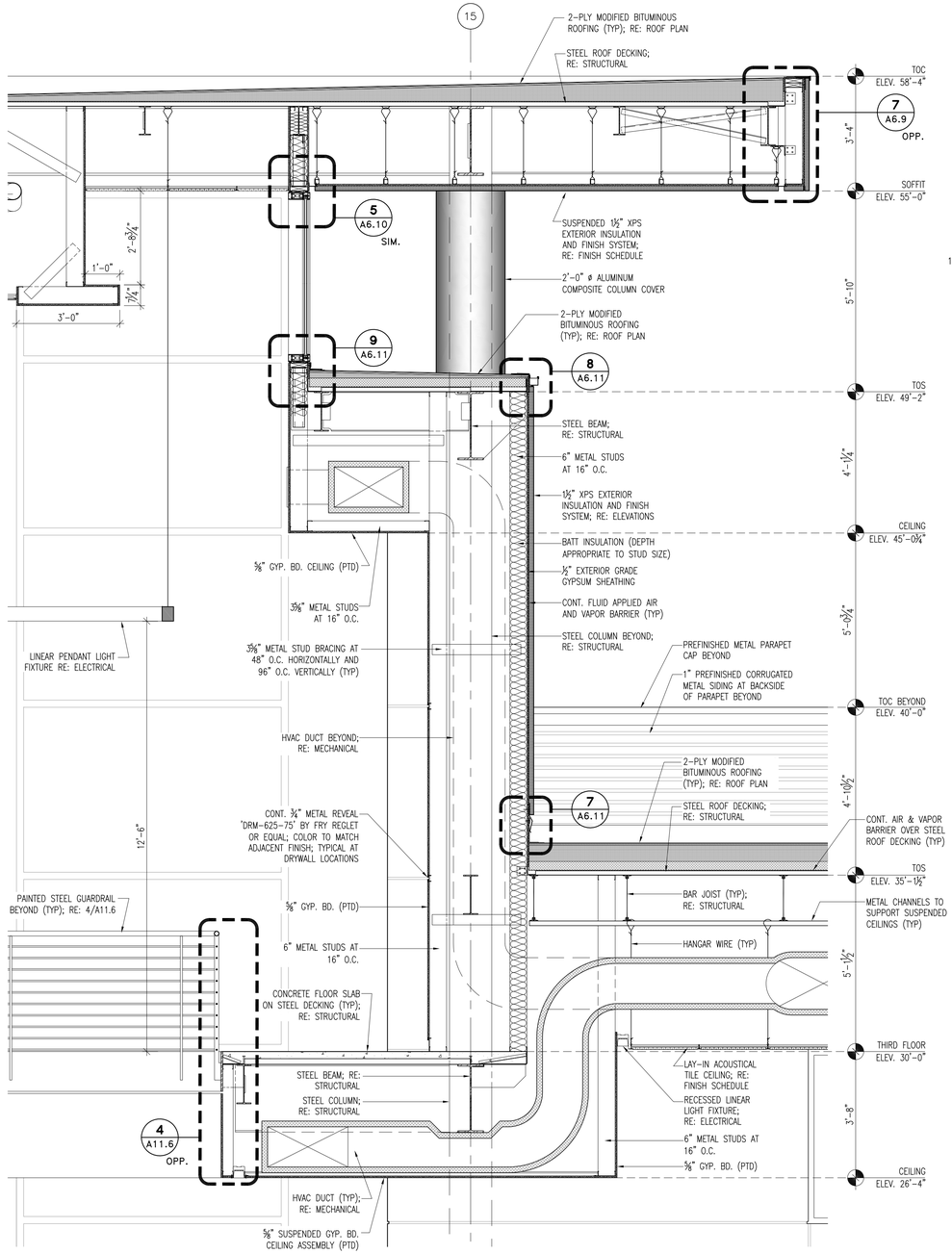
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3 Section @ Court Clerk Desk

SCALE: 1/2" = 1'-0"

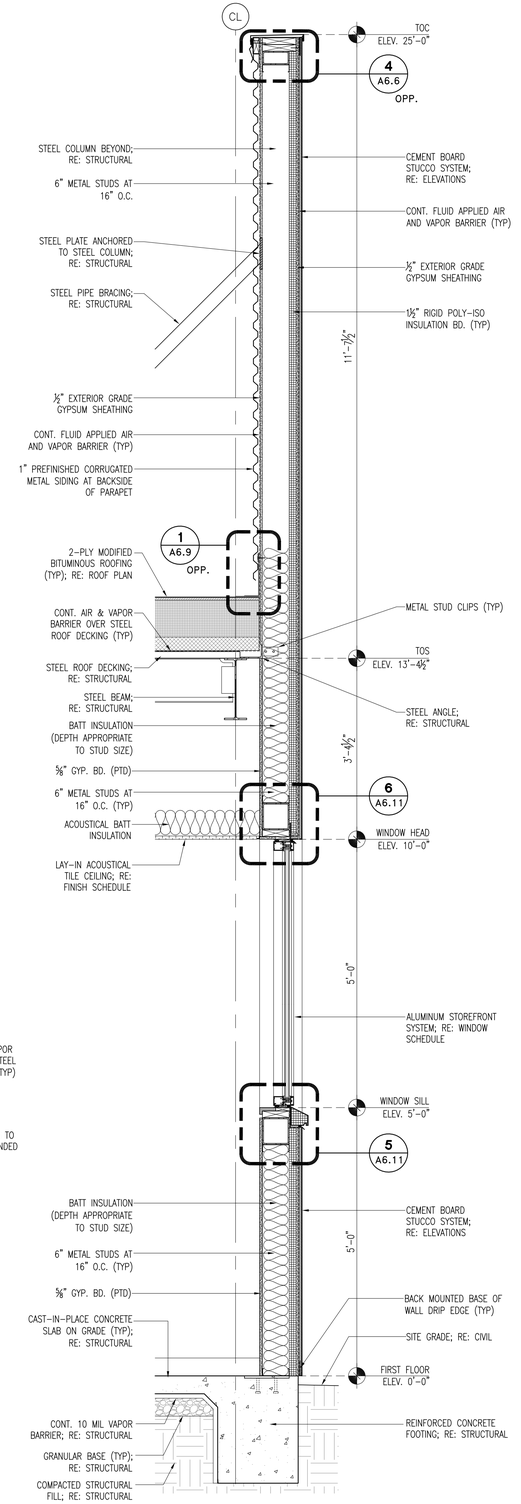
NOTE: INTERIOR ELEVATIONS IN BUILDING SECTIONS ARE ILLUSTRATIONAL ONLY AND MAY NOT FULLY DEPICT THE DESIGN OF THE SPACE. SEE INTERIOR ELEVATIONS IN A9.x SHEETS FOR INTENDED DESIGN OF SPACES.



2 Section @ High Roof of Police Lobby

SCALE: 1/2" = 1'-0"

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1 Wall Section

SCALE: 3/4" = 1'-0"

TYPICAL

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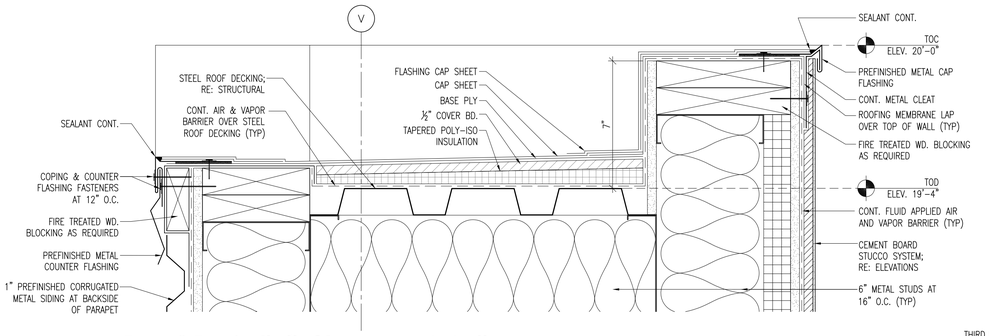
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Albert & Associates: 12575

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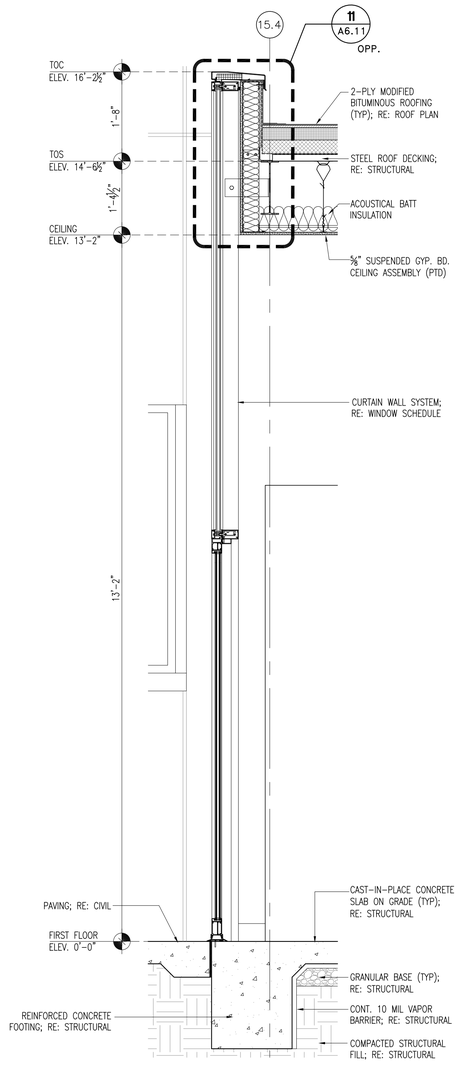
A6.7

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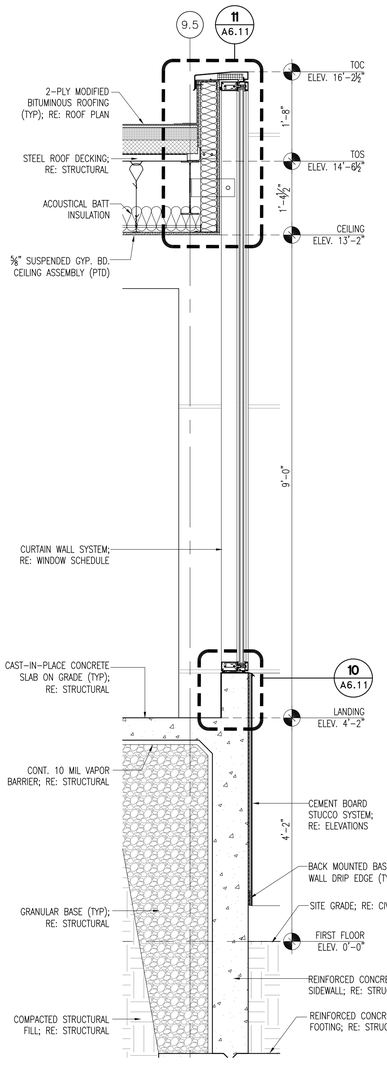
5 Roof Detail @ Signage Wall

SCALE: 3" = 1'-0"



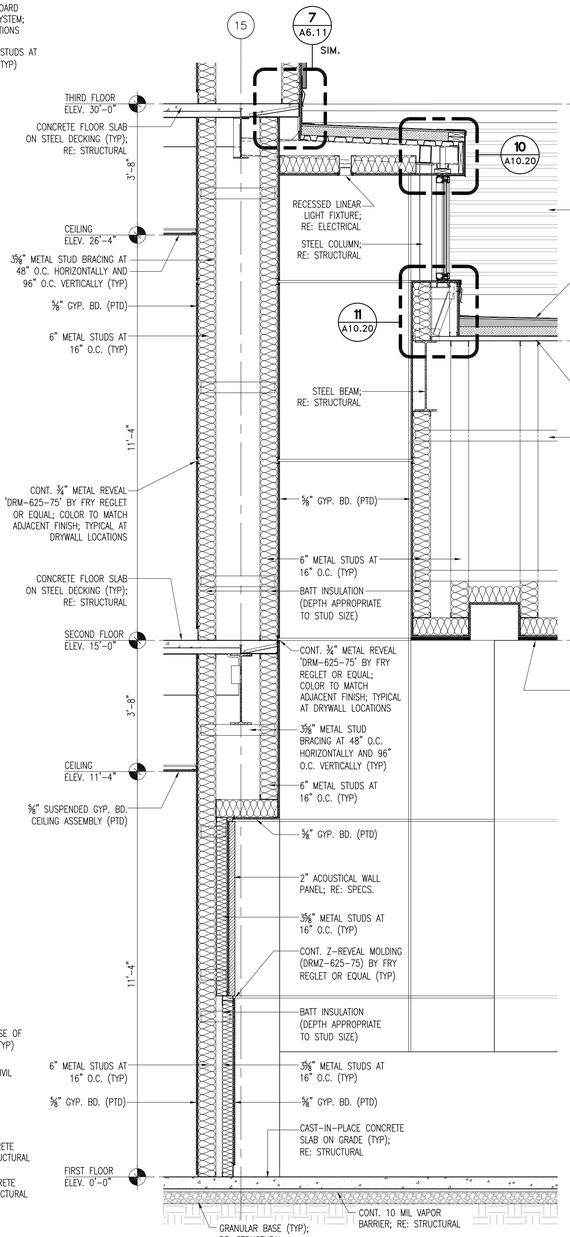
4 Wall Section

SCALE: 3/4" = 1'-0"



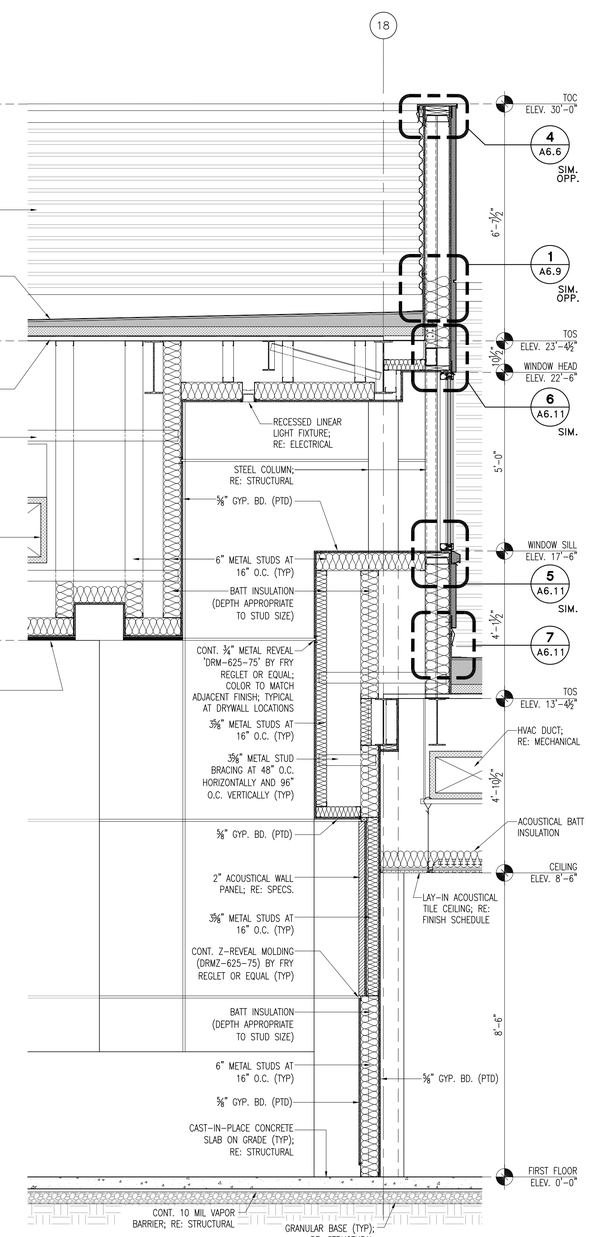
3 Wall Section

SCALE: 3/4" = 1'-0"



2 Wall Section @ Courtroom

SCALE: 1/2" = 1'-0"



1 Wall Section @ Courtroom

SCALE: 1/2" = 1'-0"

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Checked By: CR,LA,CP

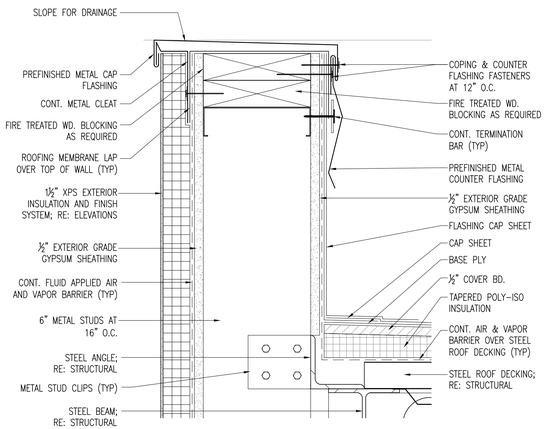
Client No: ------

Albert & Associates: 12575

REGISTERED ARCHITECT Larry M Albert Hattiesburg, MS STATE OF MISSISSIPPI

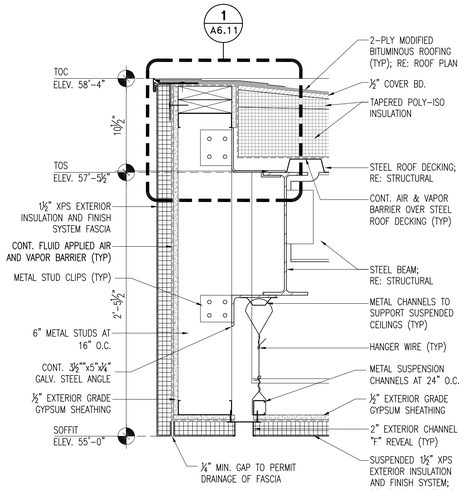
A6.8

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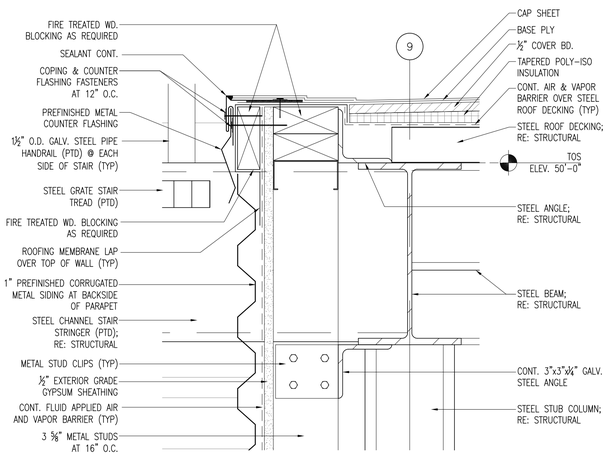
10 Cap Detail

SCALE: 3" = 1'-0" TYPICAL



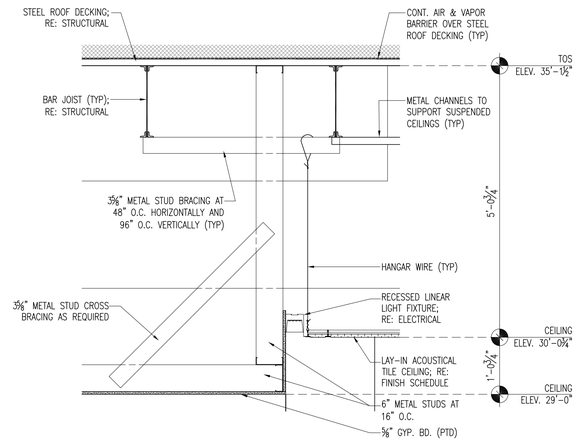
7 High Roof Detail

SCALE: 1 1/2" = 1'-0" TYPICAL



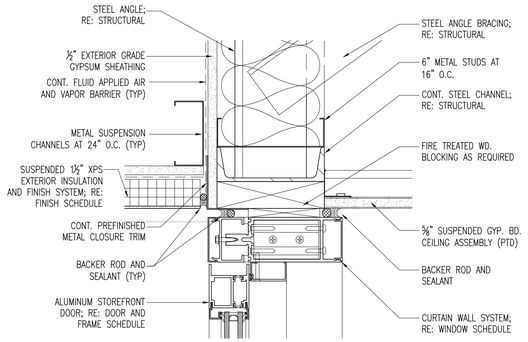
5 Roof Edge Detail

SCALE: 3" = 1'-0" TYPICAL



3 Ceiling Detail

SCALE: 3/4" = 1'-0"

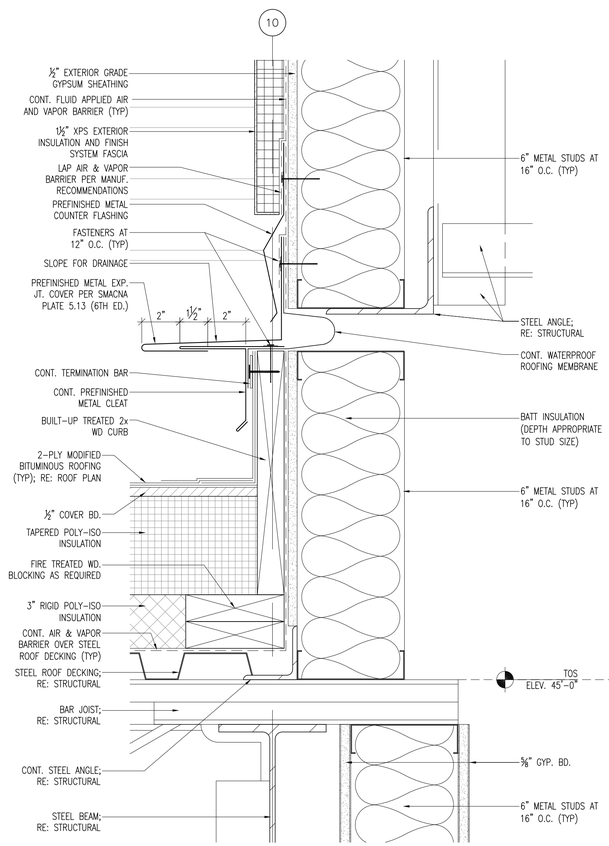


9 Window Sill Detail

SCALE: 3" = 1'-0"

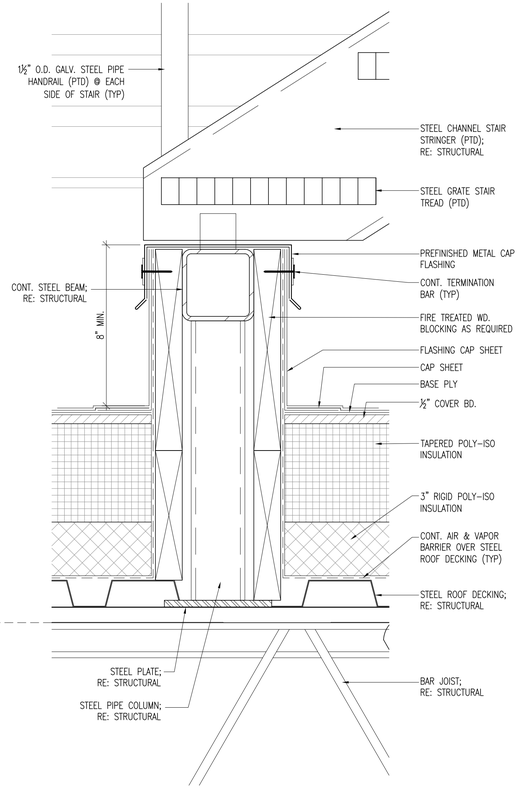
8 Door Head Detail

SCALE: 3" = 1'-0"



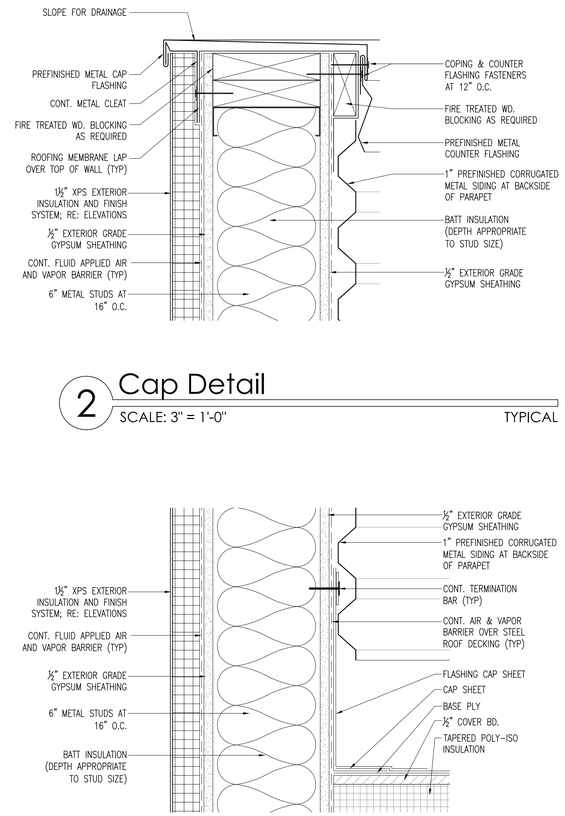
6 Roof Expansion Detail

SCALE: 3" = 1'-0"



4 Stair Detail

SCALE: 3" = 1'-0"



2 Cap Detail

SCALE: 3" = 1'-0" TYPICAL

1 Roof Termination Detail

SCALE: 3" = 1'-0" TYPICAL

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

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Checked By: CR,LA,CP

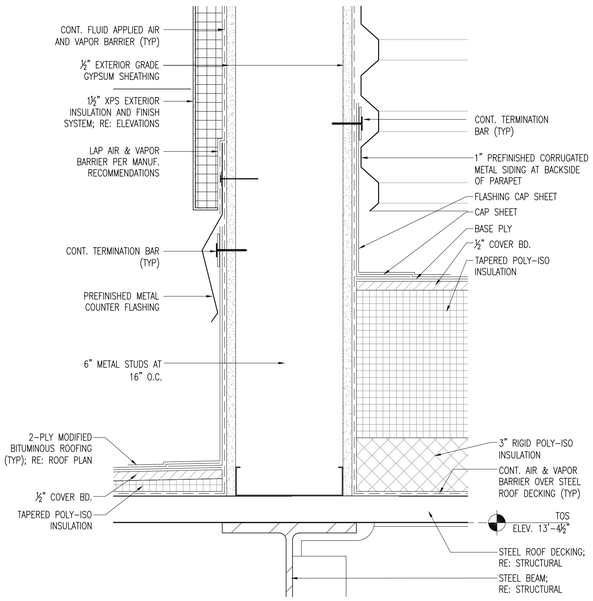
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Albert & Associates: 12575

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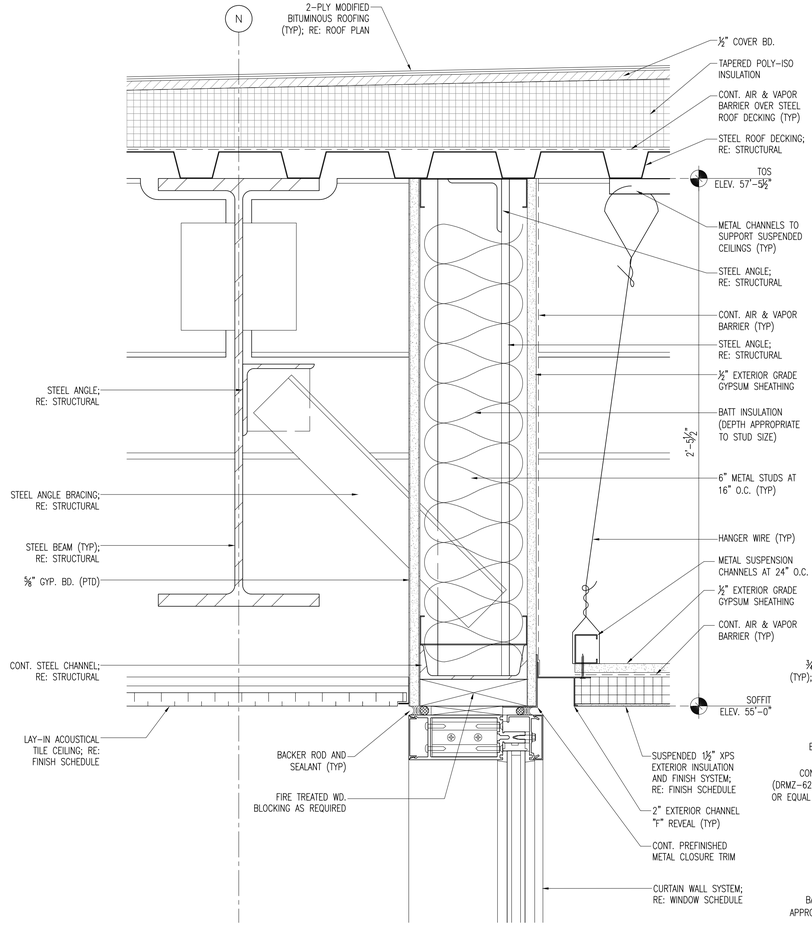
A6.9

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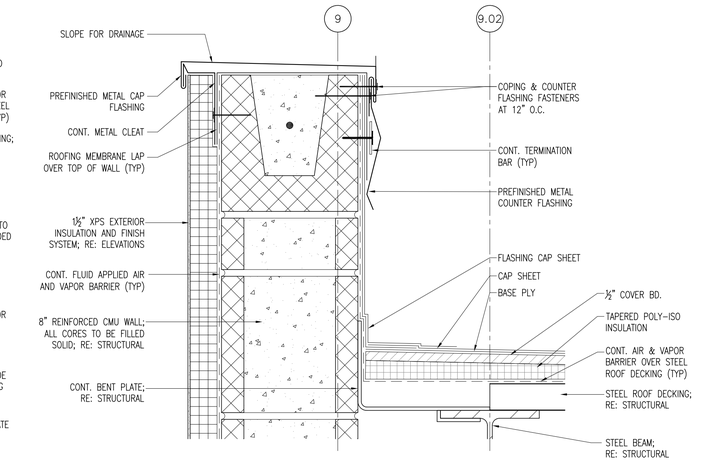
7 Roof Termination Detail

SCALE: 1 1/2" = 1'-0"



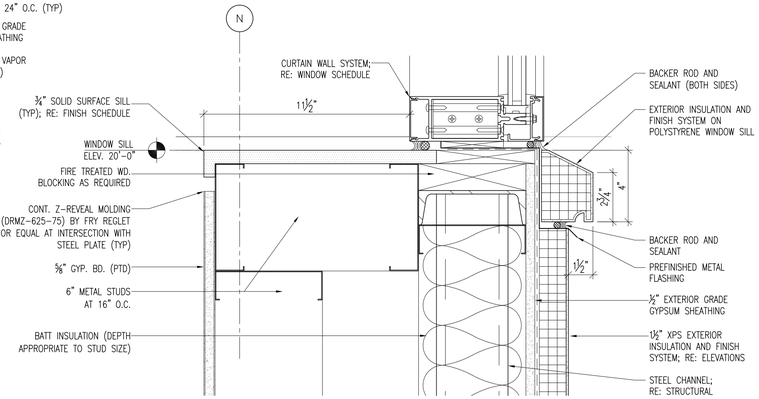
5 Window Head Detail

SCALE: 3" = 1'-0"



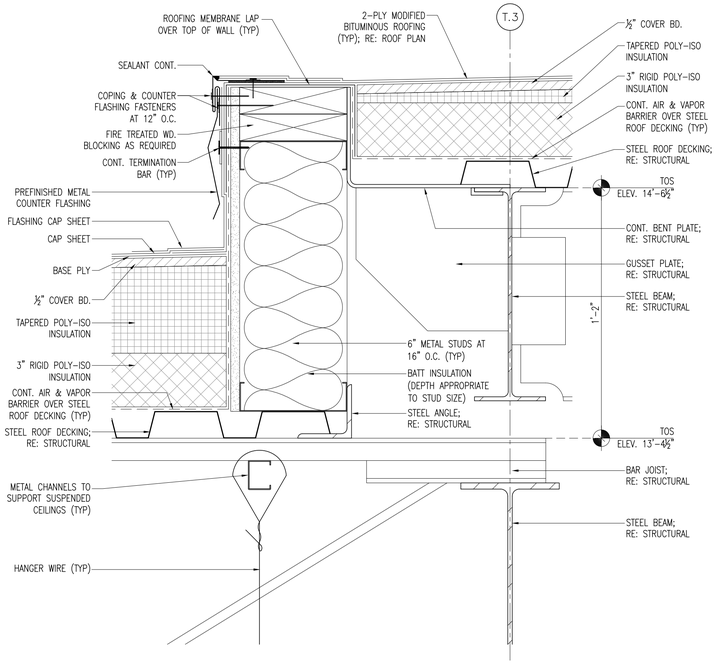
3 Cap Detail

SCALE: 3" = 1'-0" TYPICAL



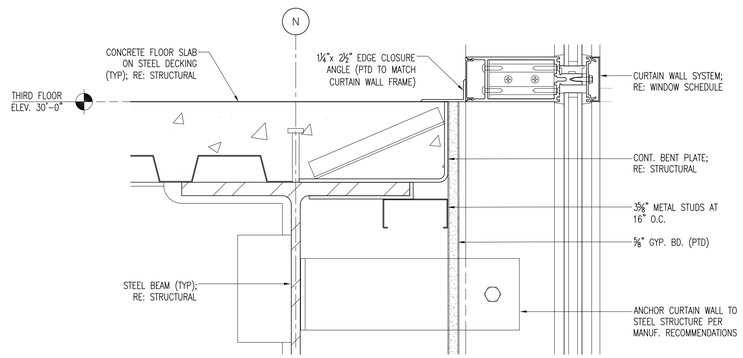
2 Window Sill Detail

SCALE: 3" = 1'-0"



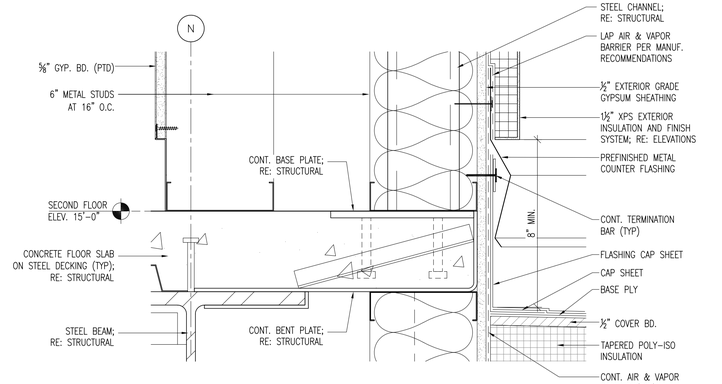
6 Roof Intersection Detail

SCALE: 3" = 1'-0"



4 Window Detail

SCALE: 3" = 1'-0"



1 Roof Termination Detail

SCALE: 3" = 1'-0"

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

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HPSC Police and Court Building

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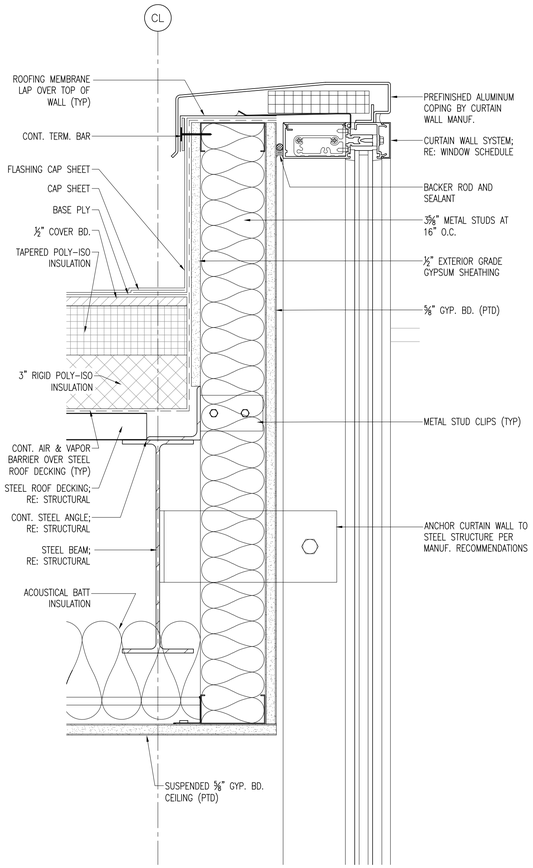
REGISTERED ARCHITECT Larry M Albert Hattiesburg, MS STATE OF MISSISSIPPI

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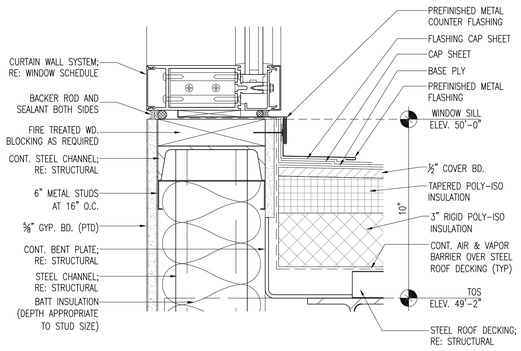
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BUILDING SECTIONS



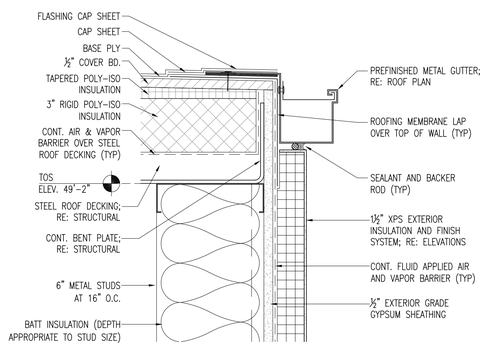
11 Cap Detail

SCALE: 3" = 1'-0" TYPICAL



9 Window/Roof Detail

SCALE: 3" = 1'-0"



8 Gutter Detail

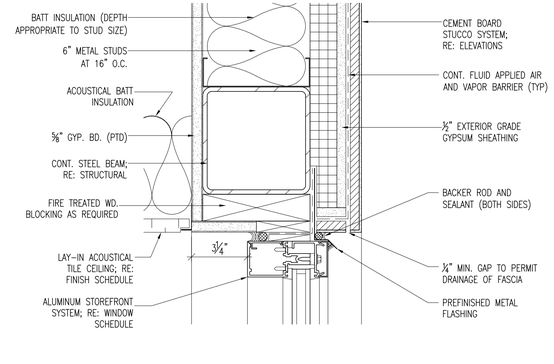
SCALE: 3" = 1'-0"

10 Window Sill Detail

SCALE: 3" = 1'-0" TYPICAL

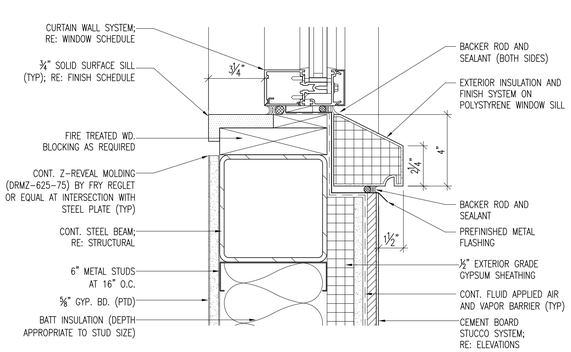
7 Roof Termination Detail

SCALE: 3" = 1'-0" TYPICAL



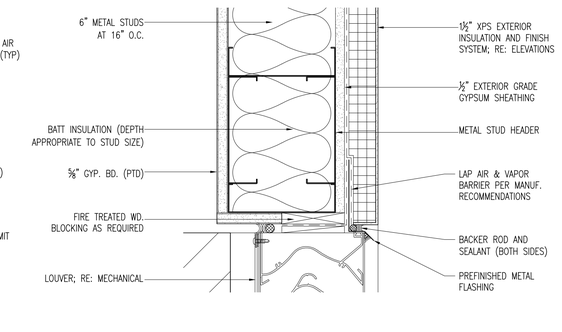
6 Window Head Detail

SCALE: 3" = 1'-0" TYPICAL



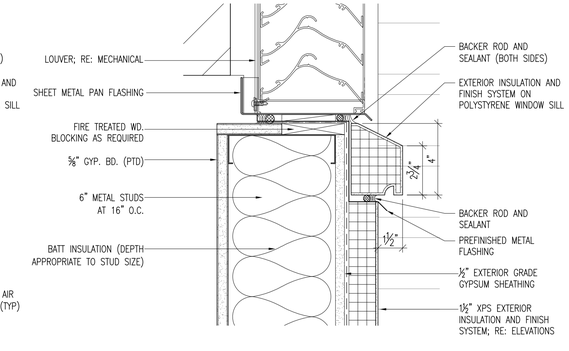
5 Window Sill Detail

SCALE: 3" = 1'-0" TYPICAL



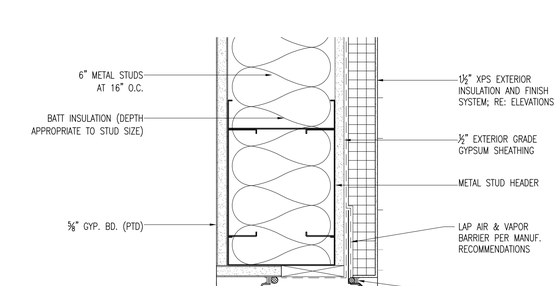
3 Louver Head Detail

SCALE: 3" = 1'-0" TYPICAL



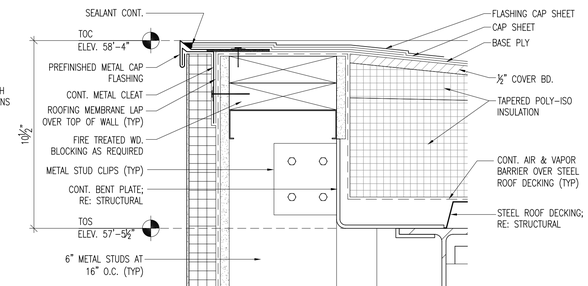
2 Louver Detail

SCALE: 3" = 1'-0" TYPICAL



4 Door Head Detail

SCALE: 3" = 1'-0" TYPICAL



1 Roof Edge Detail

SCALE: 3" = 1'-0" TYPICAL

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

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Drawn By: CR,CP,AS,RB

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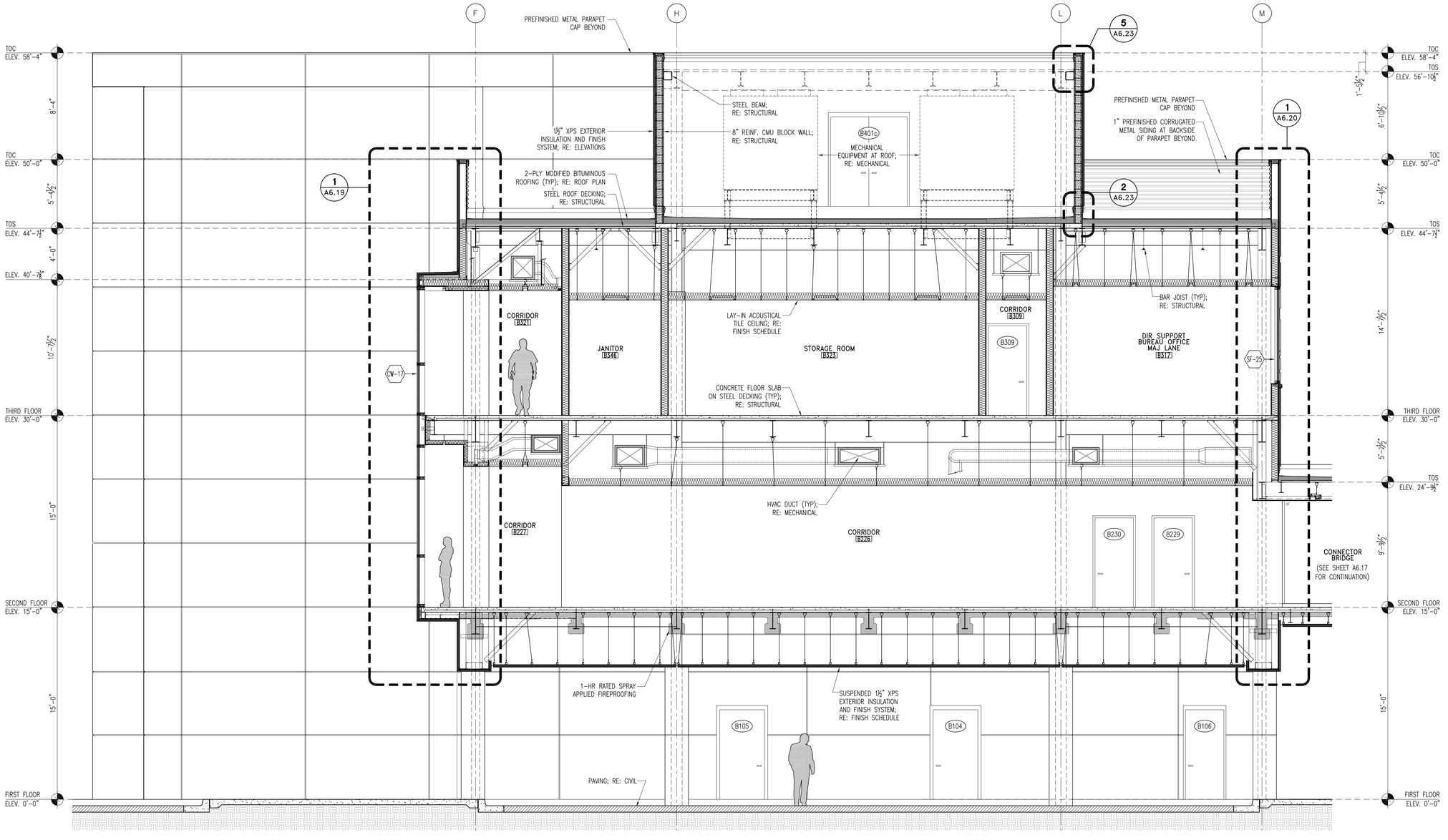
Client No: ------

Albert & Associates: 12575

REGISTERED ARCHITECT Larry A. Albert Hattiesburg, MS STATE OF MISSISSIPPI

A6.11

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1 Transverse Section @ Police Building

SCALE: 1/4" = 1'-0"

NOTE: INTERIOR ELEVATIONS IN BUILDING SECTIONS ARE ILLUSTRATIONAL ONLY AND MAY NOT FULLY DEPICT THE DESIGN OF THE SPACE. SEE INTERIOR ELEVATIONS IN A9.x SHEETS FOR INTENDED DESIGN OF SPACES.

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■ HATTIESBURG

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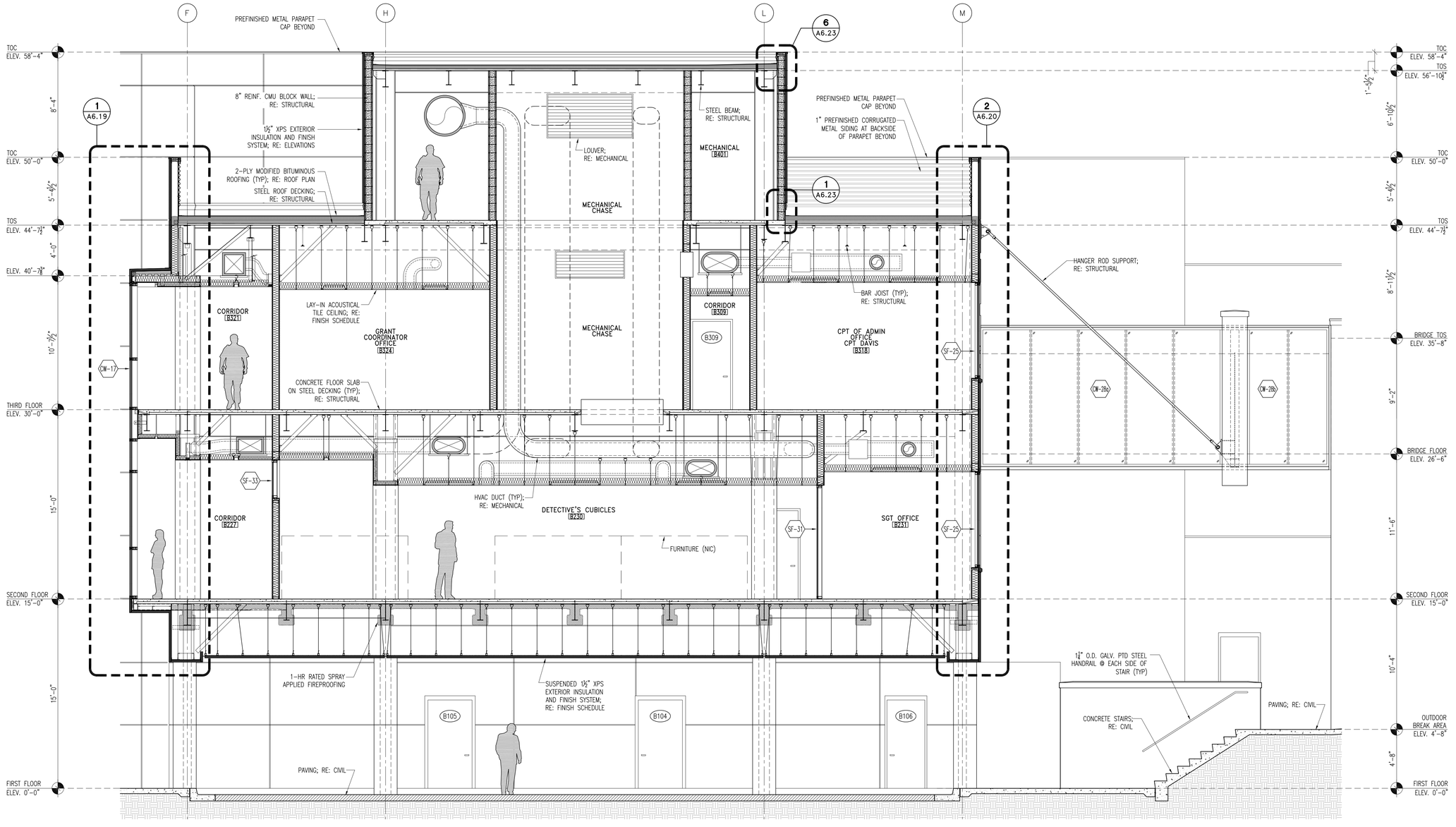
Checked By: CR,LA,CP

Client No: ——

Albert & Associates: 12575

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A6.12



1 Transverse Section @ Police Building

SCALE: 1/4" = 1'-0"

NOTE: INTERIOR ELEVATIONS IN BUILDING SECTIONS ARE ILLUSTRATIONAL ONLY AND MAY NOT FULLY DEPICT THE DESIGN OF THE SPACE. SEE INTERIOR ELEVATIONS IN A9.x SHEETS FOR INTENDED DESIGN OF SPACES.

CITY OF HATTIESBURG MISSISSIPPI

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Checked By: CR,LA,CP

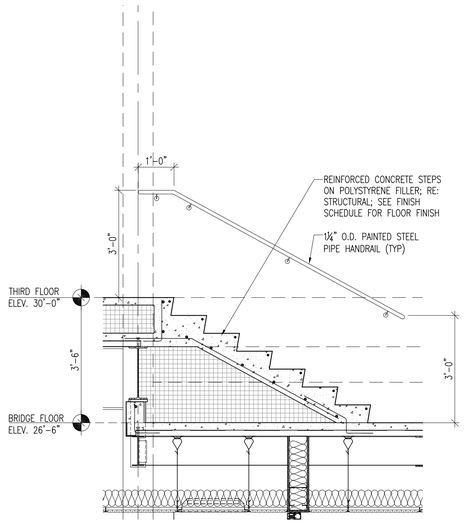
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Albert & Associates: 12575

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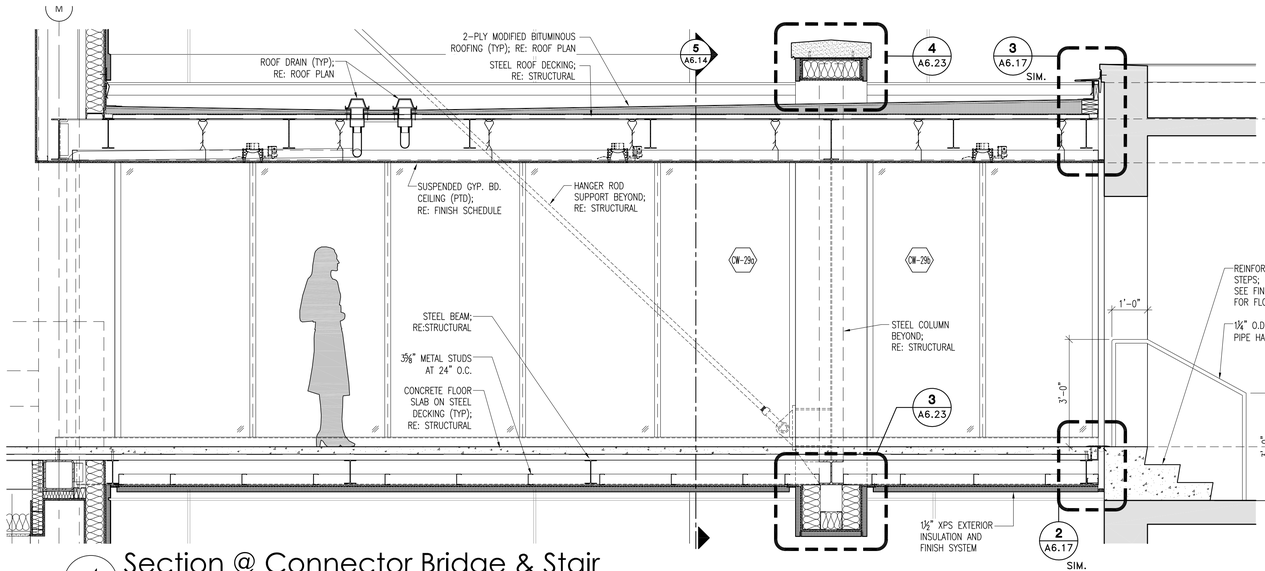
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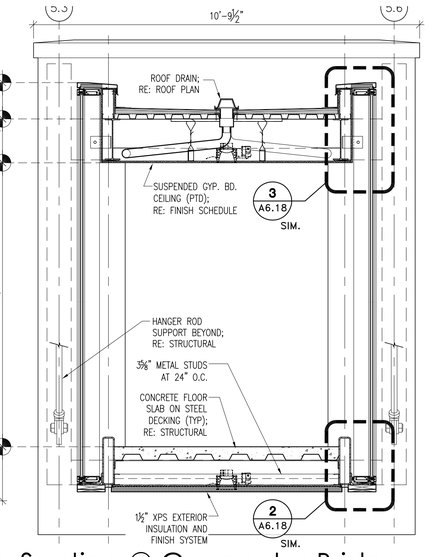
3 Section @ Stair

SCALE:1/2" = 1'-0"



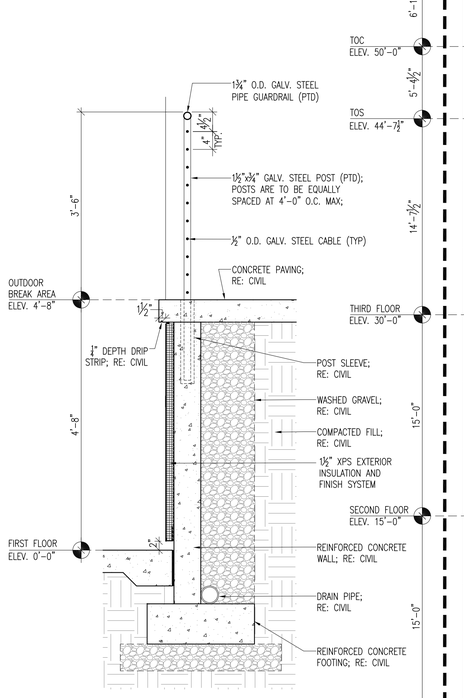
4 Section @ Connector Bridge & Stair

SCALE:1/2" = 1'-0"



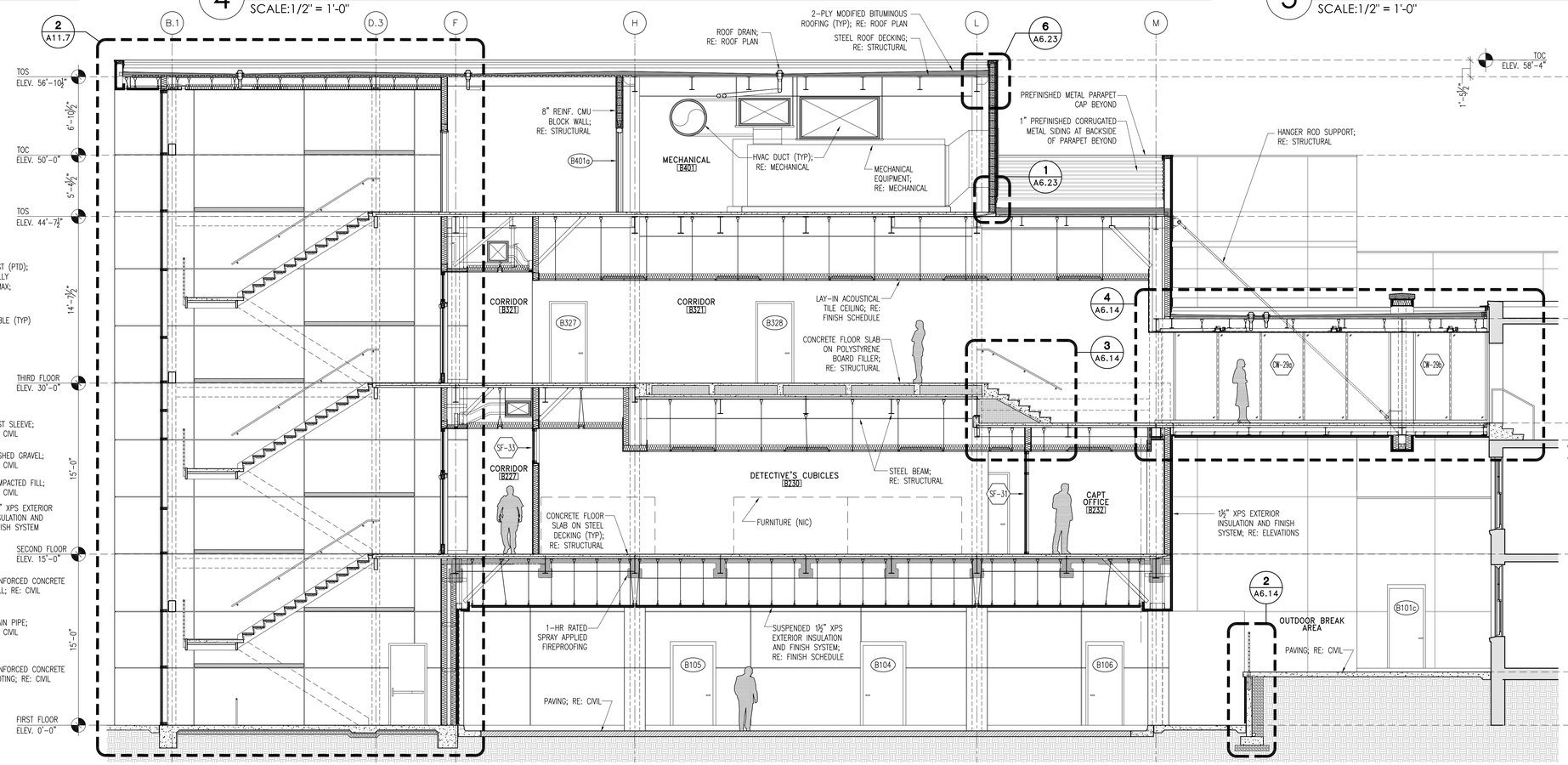
5 Section @ Connector Bridge

SCALE:1/2" = 1'-0"



2 Railing Detail

SCALE: 3/4" = 1'-0"



1 Transverse Section @ Police Building

SCALE: 3/16" = 1'-0"

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CITY OF HATTIESBURG MISSISSIPPI 1884

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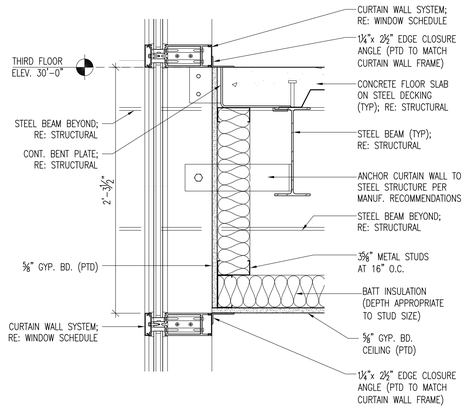
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Albert & Associates: 12575

REGISTERED ARCHITECT Larry M Albert Hattiesburg, MS STATE OF MISSISSIPPI

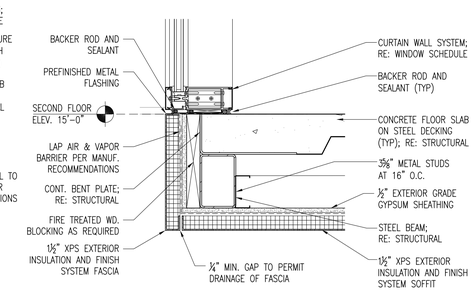
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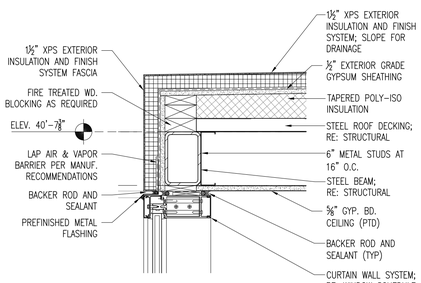
6 Detail @ Curtain Wall

SCALE: 1 1/2" = 1'-0"



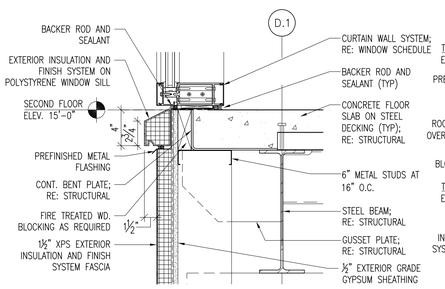
7 Detail @ Curtain Wall

SCALE: 1 1/2" = 1'-0"



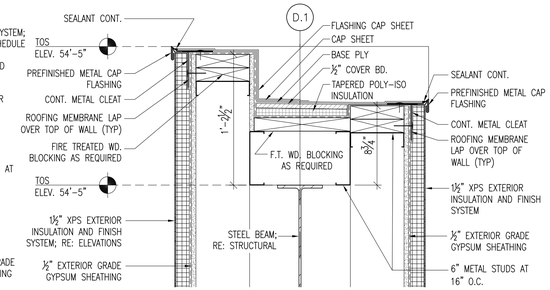
8 Detail @ Curtain Wall

SCALE: 1 1/2" = 1'-0"



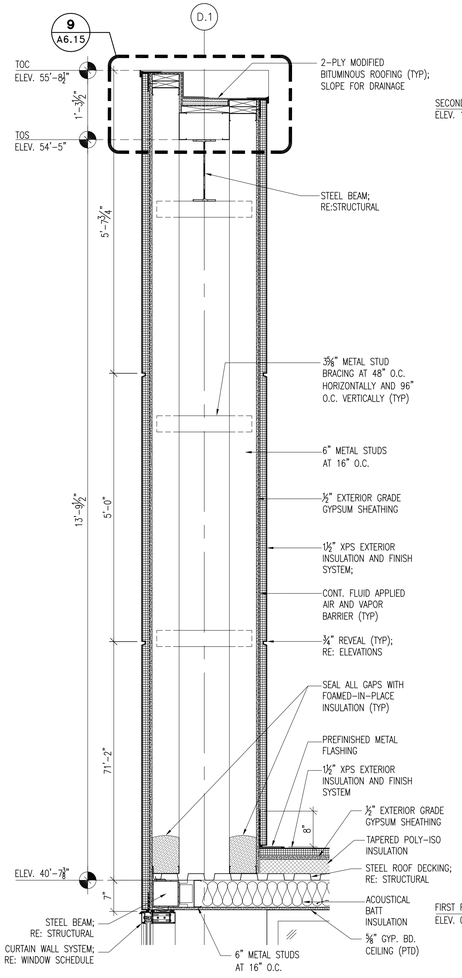
9 Detail @ Parapet

SCALE: 1 1/2" = 1'-0"



5 Detail @ Curtain Wall

SCALE: 1 1/2" = 1'-0"

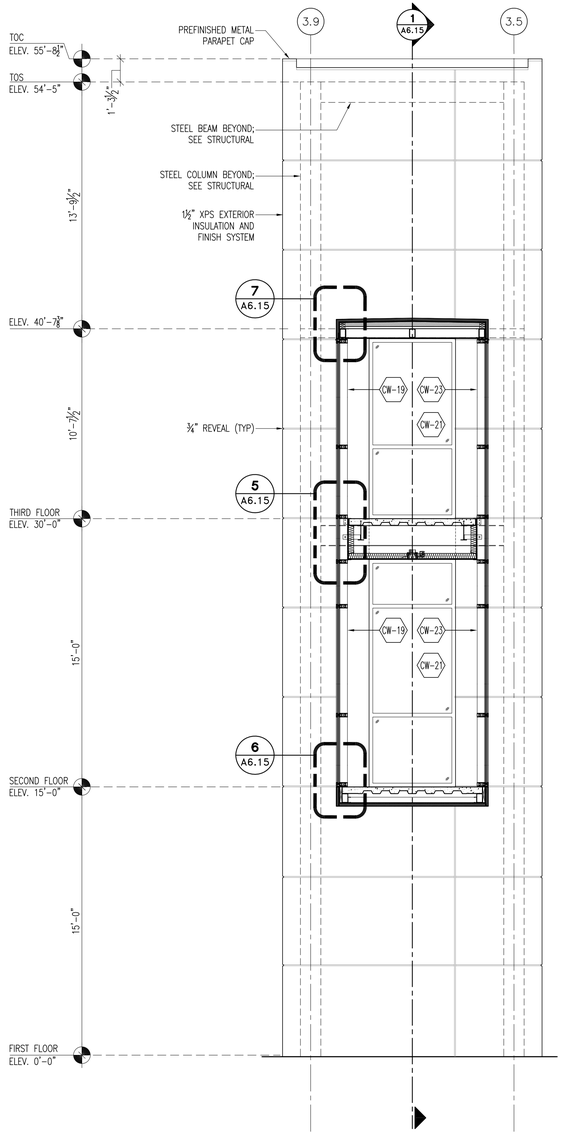


4 Wall Section

SCALE: 3/4" = 1'-0"

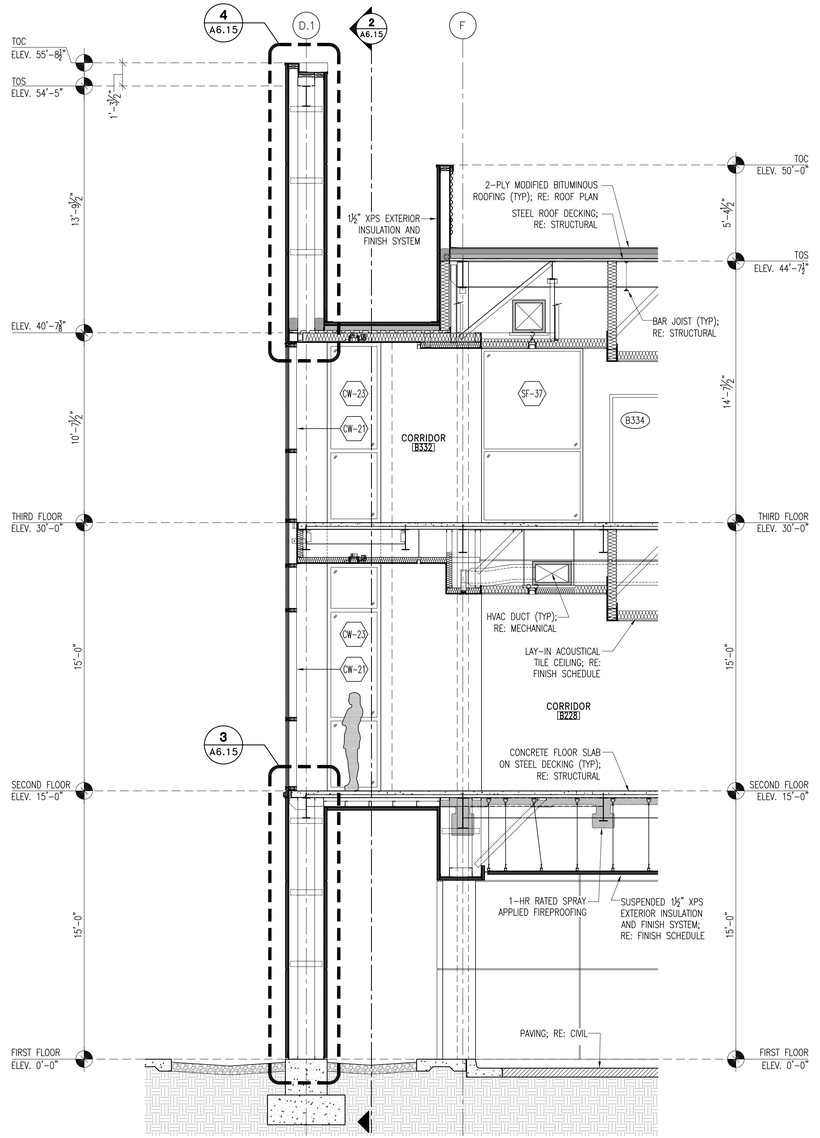
3 Wall Section

SCALE: 3/4" = 1'-0"



2 Section @ Police Building

SCALE: 1/4" = 1'-0"



1 Section @ Police Building

SCALE: 1/4" = 1'-0"

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

Drawing Issued:

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08-31-2015		DD Check Set
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11-02-2015		90% Pricing Set
11-19-2018		100% Bid Docs

Drawn By: CR,CP,AS,RB

Checked By: CR,LA,CP

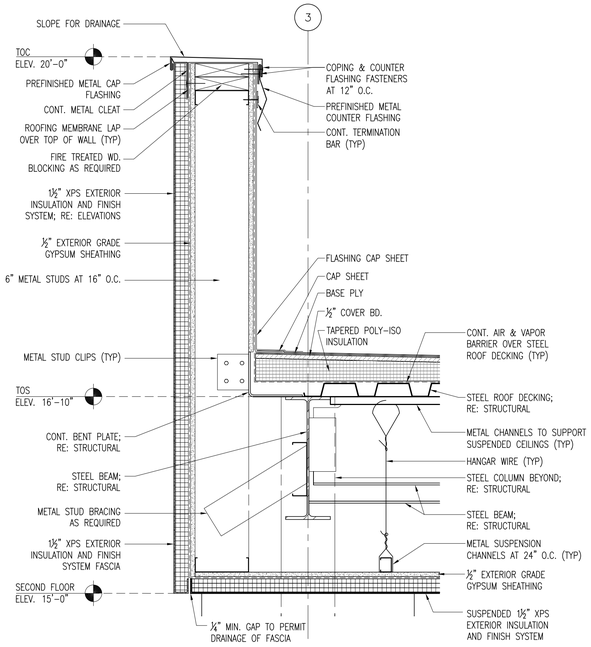
Client No: ------

Albert & Associates: 12575

REGISTERED ARCHITECT Larry A. Albert Hattiesburg, MS STATE OF MISSISSIPPI

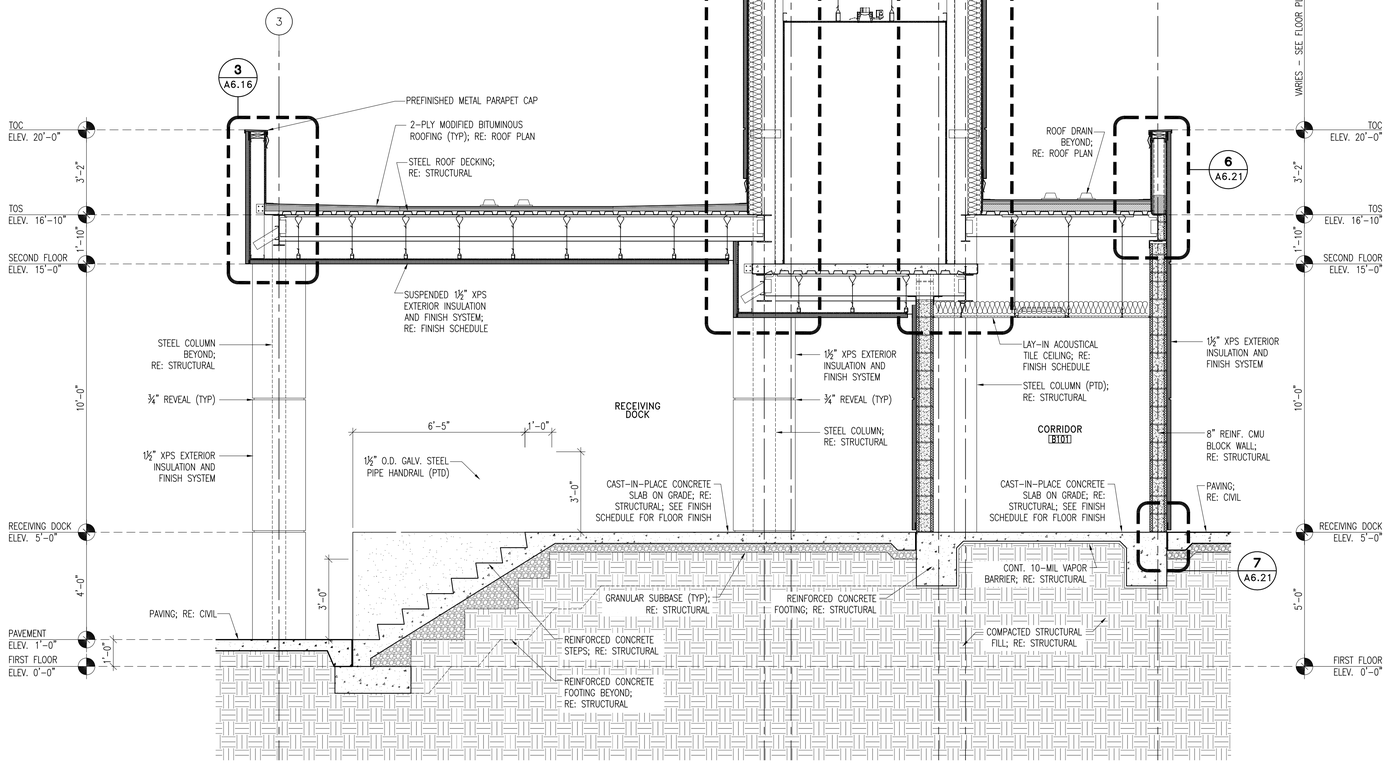
A6.15

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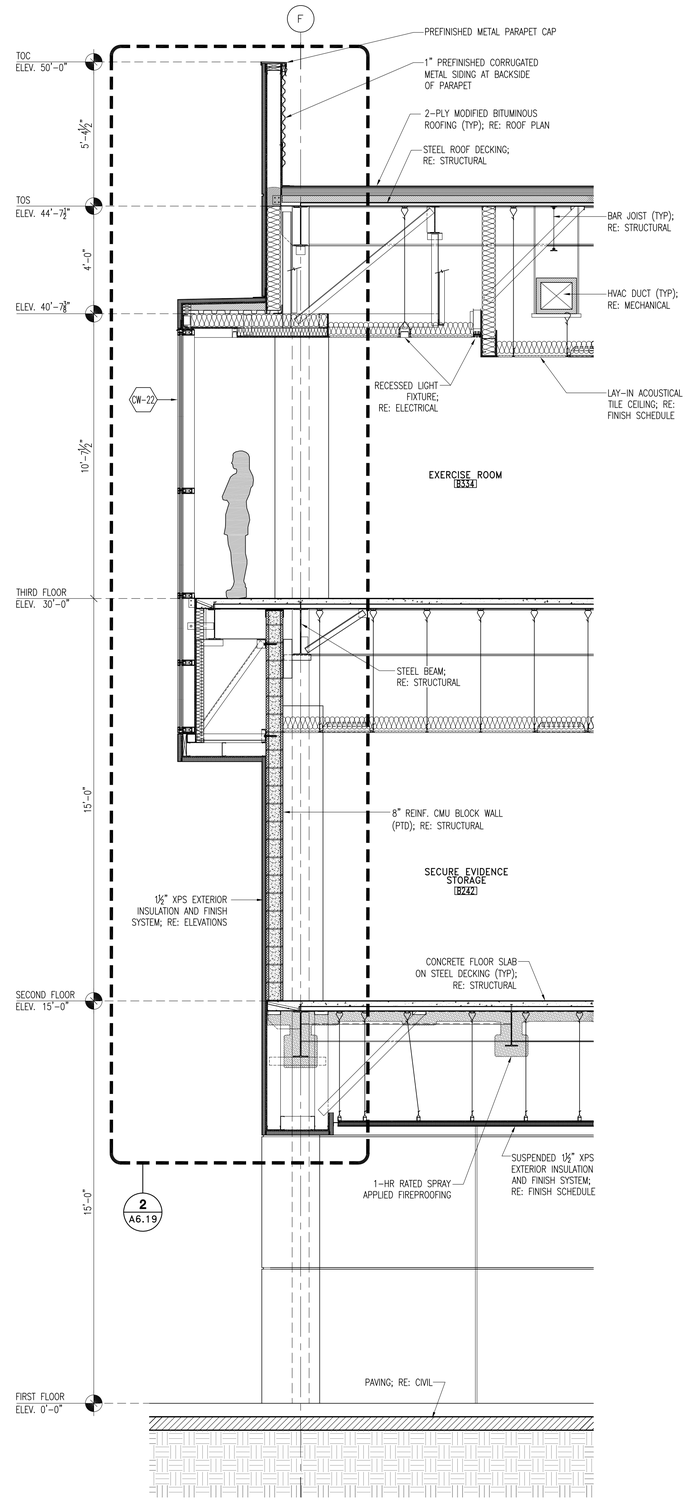
3 Detail @ Loading Dock Parapet

SCALE: 1 1/2" = 1'-0"



2 Section @ Loading Dock

SCALE: 3/8" = 1'-0"



1 Section @ Police Building

SCALE: 3/8" = 1'-0"

CITY OF HATTIESBURG MISSISSIPPI

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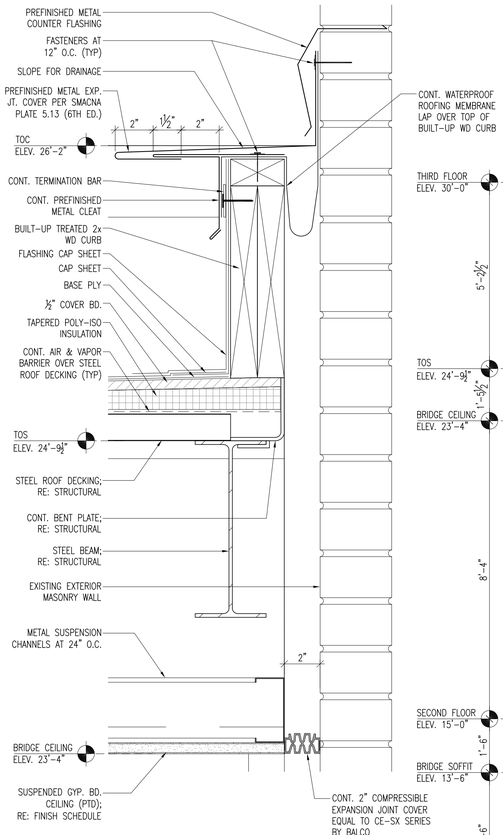
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Albert & Associates: 12575

REGISTERED ARCHITECT Larry A. Albert Hattiesburg, MS STATE OF MISSISSIPPI

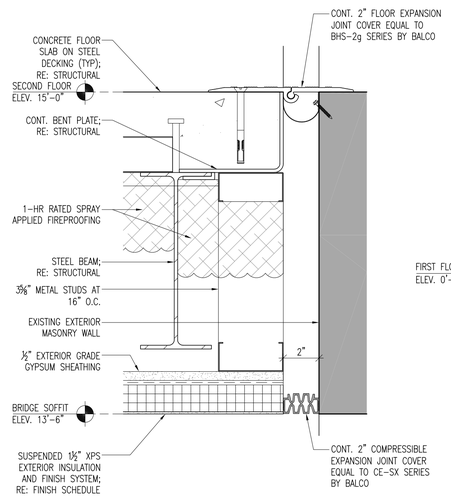
A6.16

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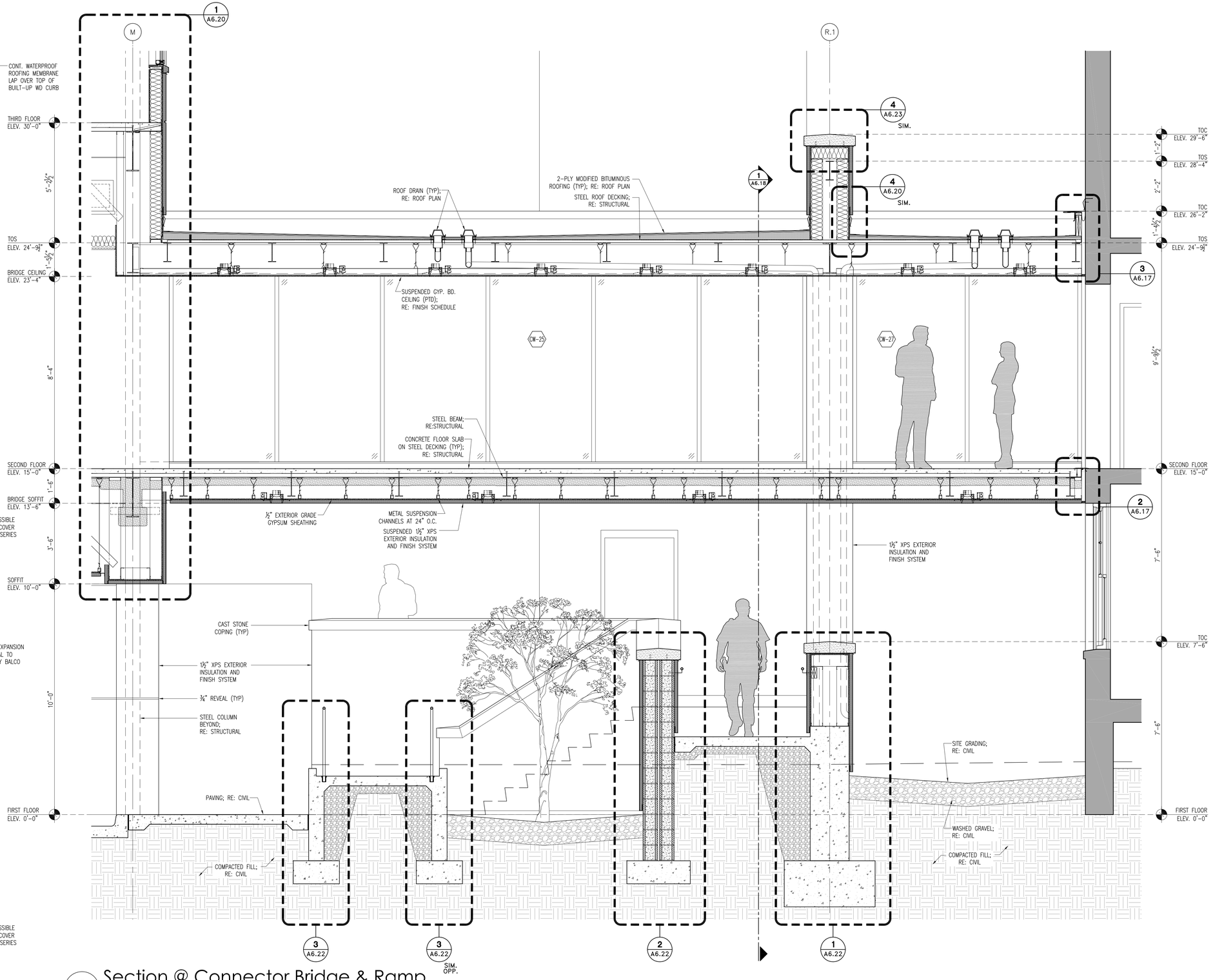
3 Roof Expansion Detail

SCALE: 3" = 1'-0"



2 Floor Expansion Detail

SCALE: 3" = 1'-0"



1 Section @ Connector Bridge & Ramp

SCALE:1/2" = 1'-0"

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Checked By: CR,LA,CP

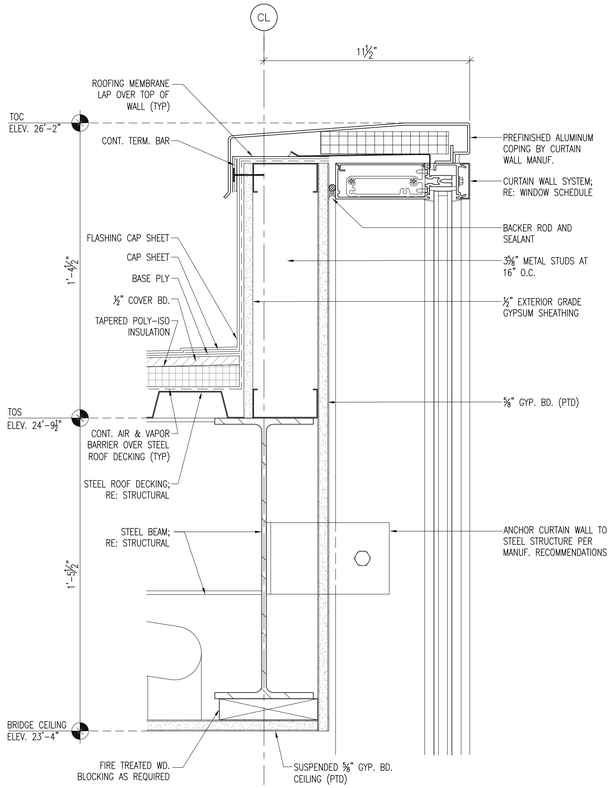
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Albert & Associates: 12575

REGISTERED ARCHITECT Larry A. Albert Hattiesburg, MS STATE OF MISSISSIPPI

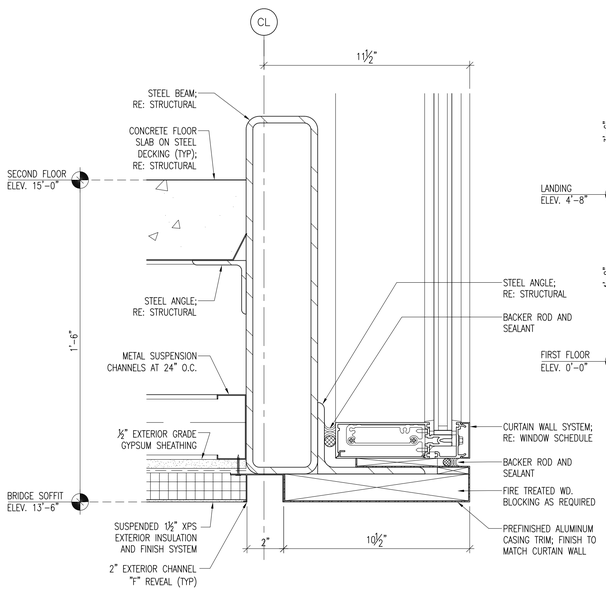
A6.17

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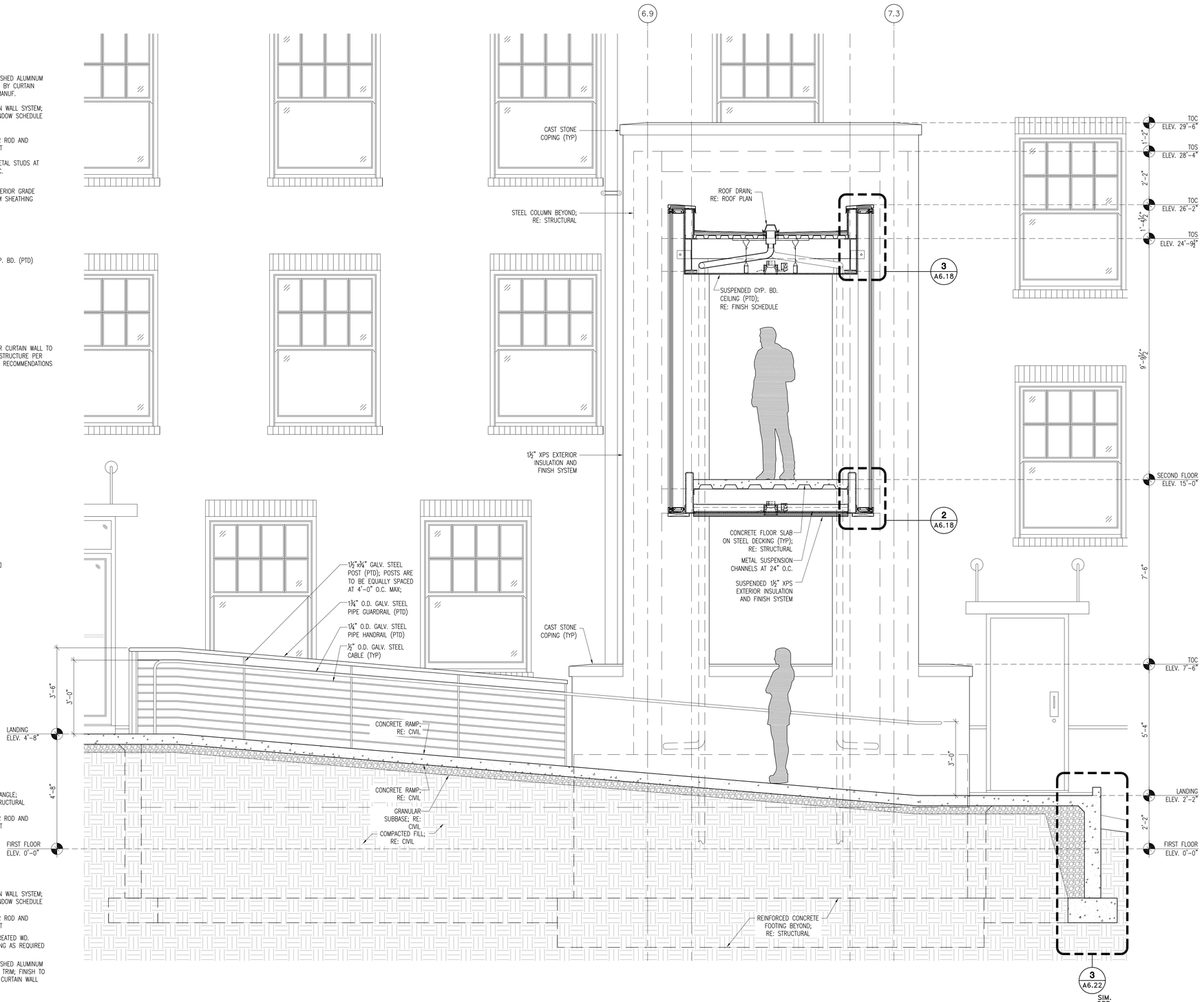
3 Detail @ Curtain Wall

SCALE: 3" = 1'-0"



2 Detail @ Curtain Wall

SCALE: 3" = 1'-0"



1 Section @ Connector Bridge & Ramp

SCALE:1/2" = 1'-0"

CITY OF HATTIESBURG MISSISSIPPI

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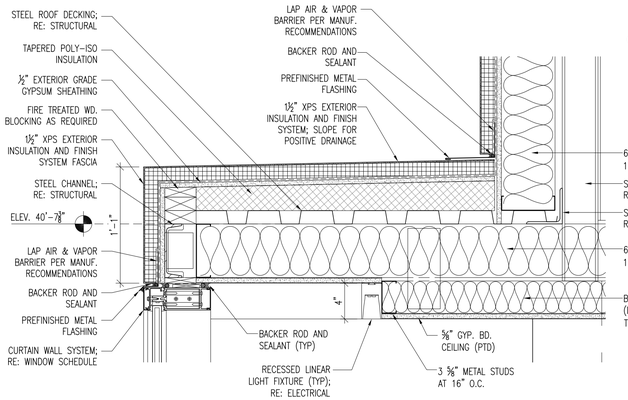
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Albert & Associates: 12575

REGISTERED ARCHITECT Larry M Albert Jr. Hattiesburg, MS STATE OF MISSISSIPPI

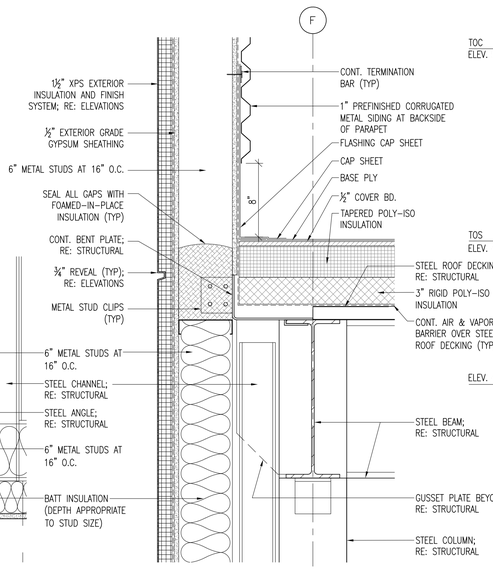
A6.18

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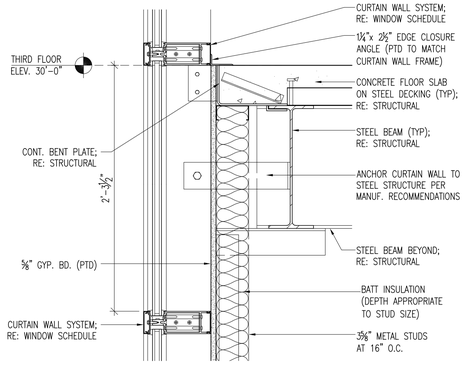
7 Detail @ Curtain Wall

SCALE: 1 1/2" = 1'-0"



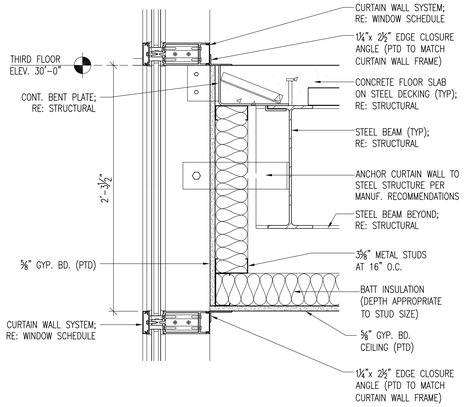
8 Detail @ Parapet Wall

SCALE: 1 1/2" = 1'-0"



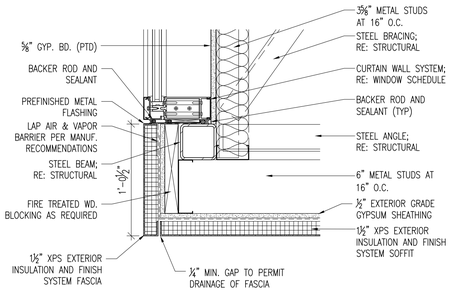
6 Detail @ Curtain Wall

SCALE: 1 1/2" = 1'-0"



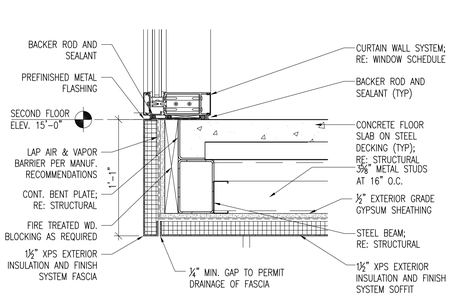
4 Detail @ Curtain Wall

SCALE: 1 1/2" = 1'-0"



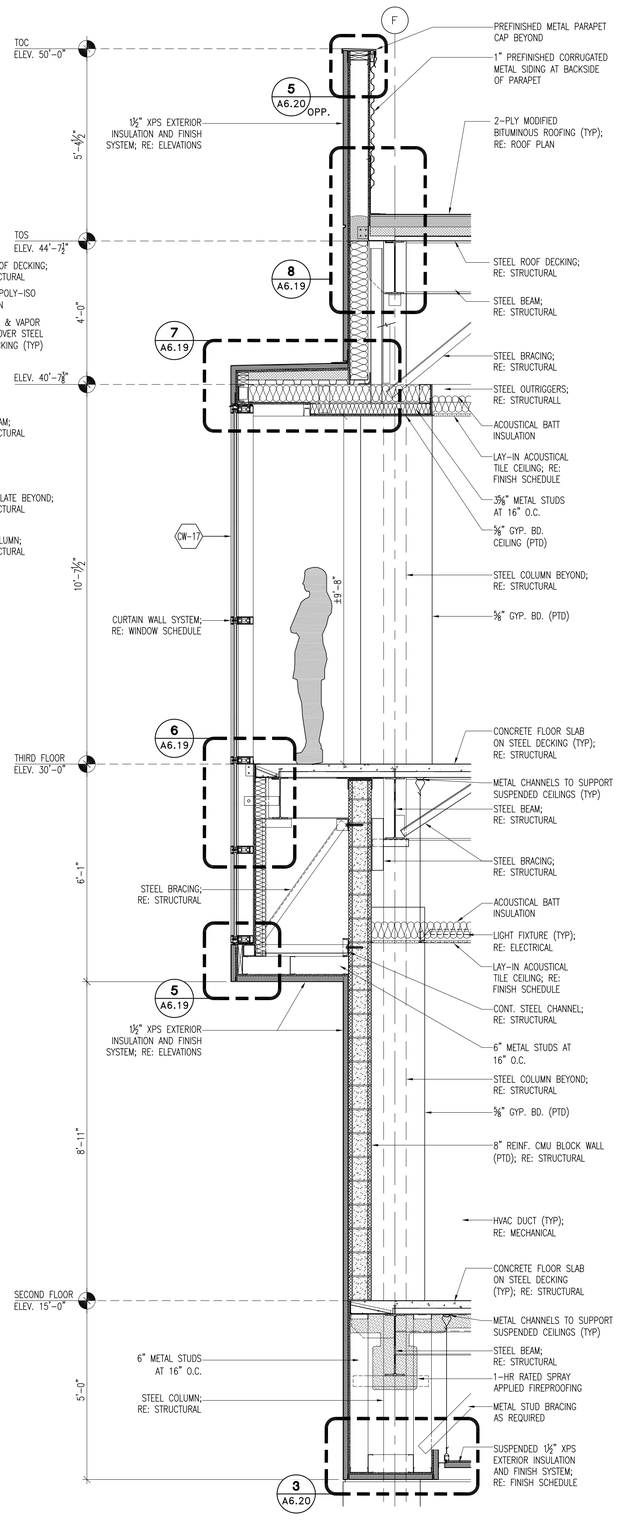
5 Detail @ Curtain Wall

SCALE: 1 1/2" = 1'-0"



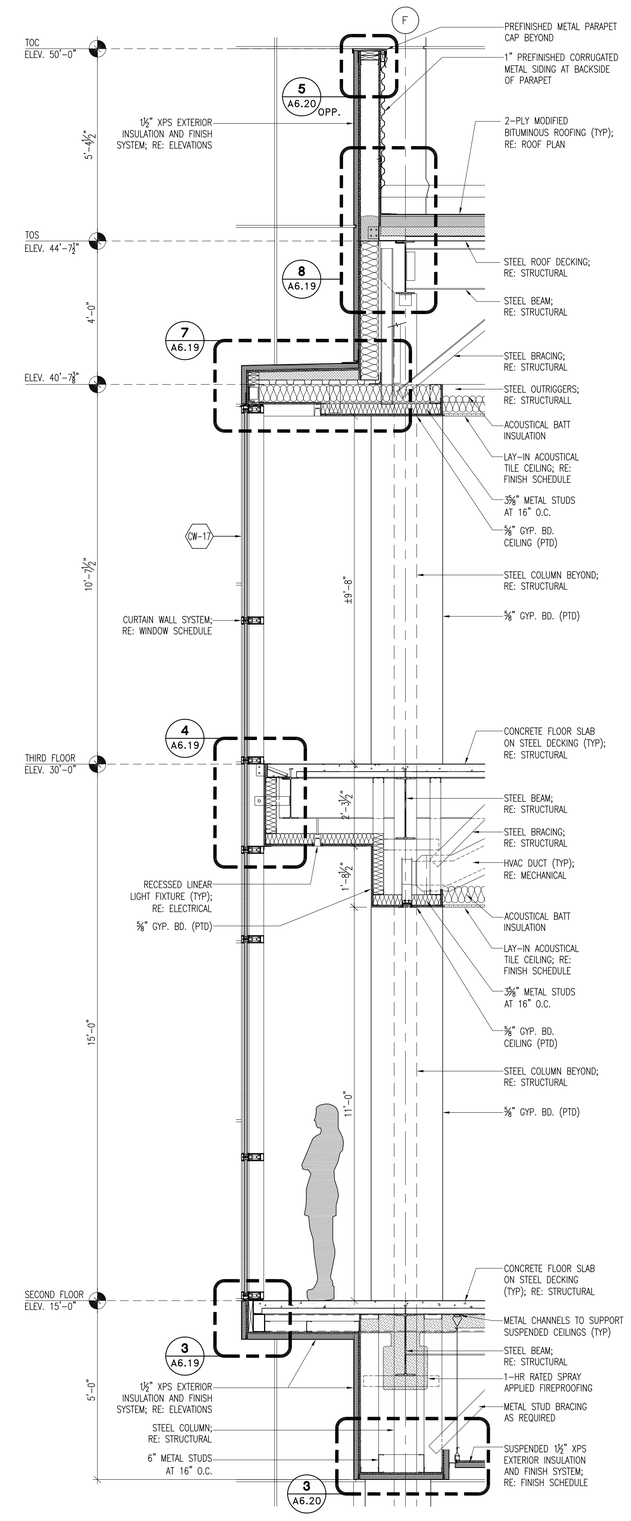
3 Detail @ Curtain Wall

SCALE: 1 1/2" = 1'-0"



2 Section @ Front Curtain Wall Overhang

SCALE: 1/2" = 1'-0"



1 Section @ Front Curtain Wall Overhang

SCALE: 1/2" = 1'-0"

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HPSC Police and Court Building

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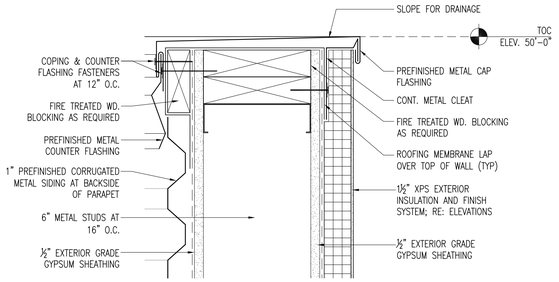
Albert & Associates: 12575

REGISTERED ARCHITECT Larry M. Albert Hattiesburg, MS STATE OF MISSISSIPPI

A6.19

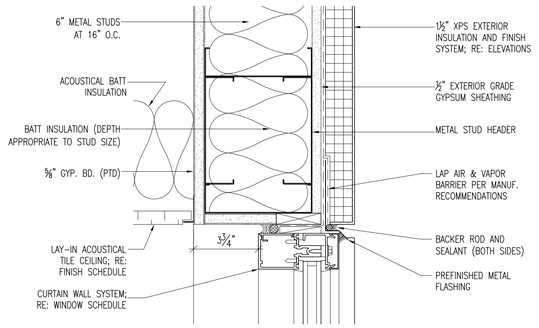
WALL SECTIONS & DETAILS

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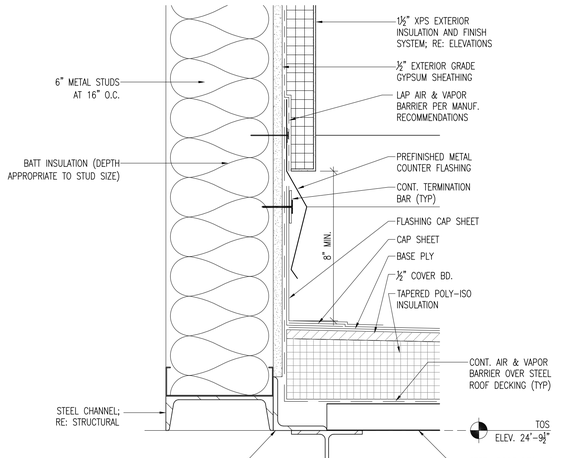
5 Cap Detail

SCALE: 3" = 1'-0"



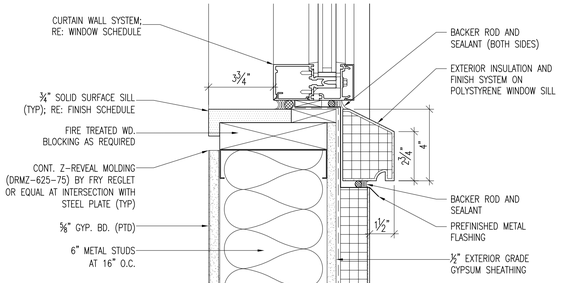
6 Window Head Detail

SCALE: 3" = 1'-0"



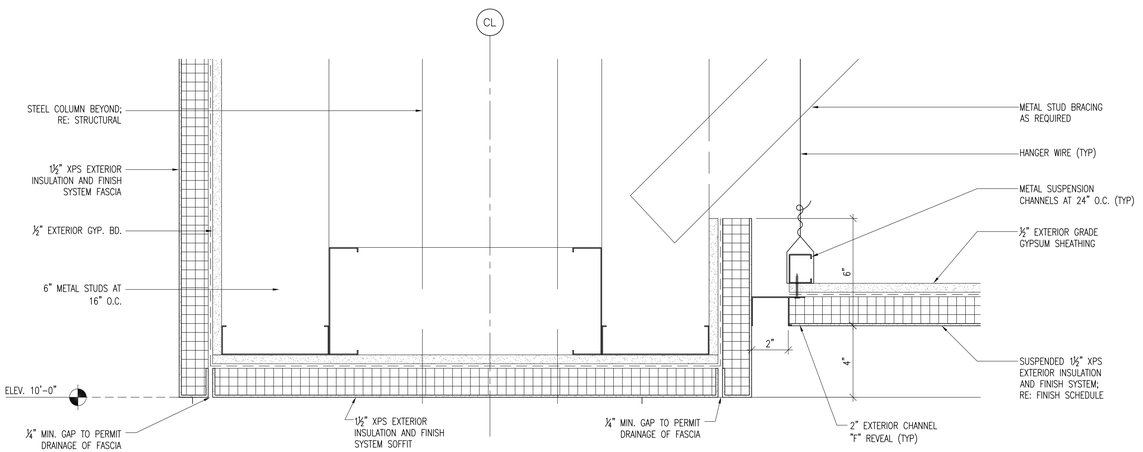
4 Roof Termination Detail

SCALE: 3" = 1'-0"



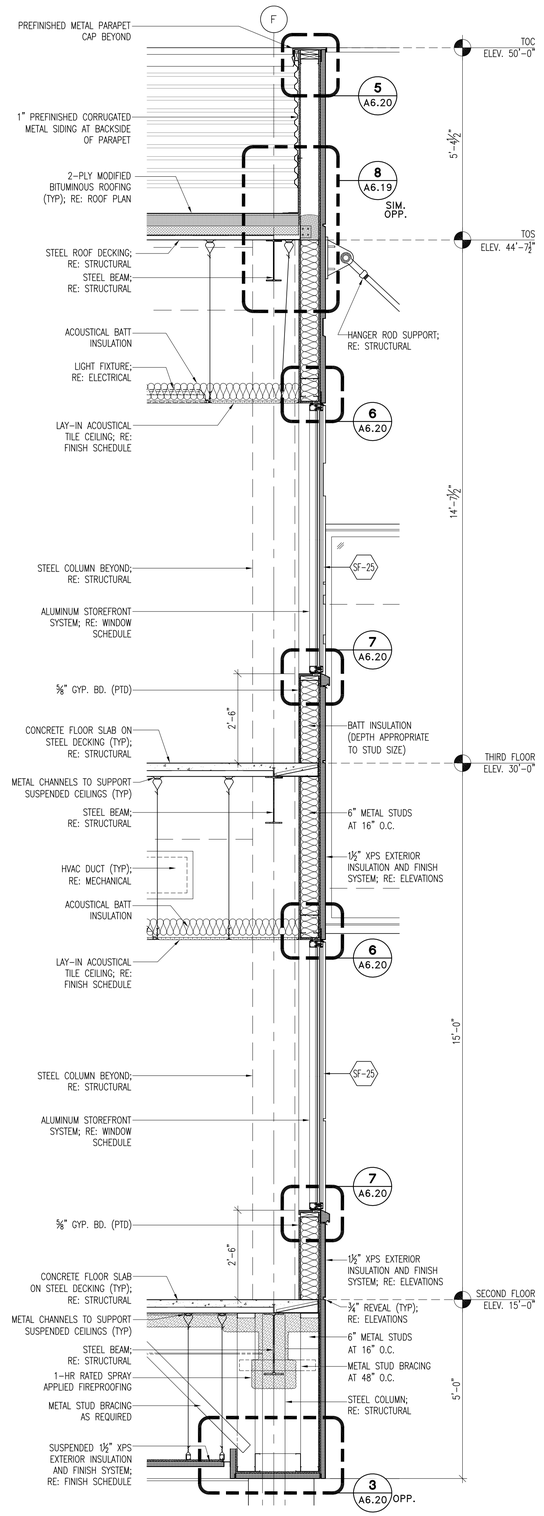
7 Window Sill Detail

SCALE: 3" = 1'-0"



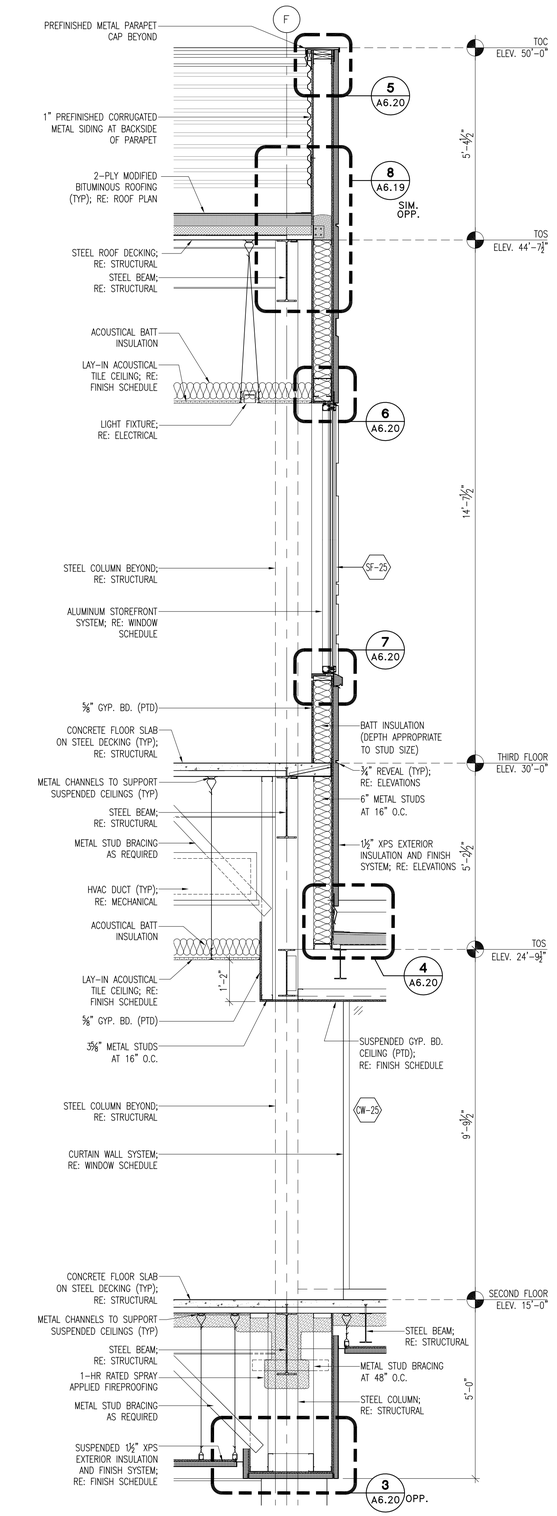
3 Detail @ Exterior Wall Soffit

SCALE: 3" = 1'-0"



2 Section @ Rear Exterior Wall

SCALE: 1/2" = 1'-0"



1 Section @ Rear Exterior Wall

SCALE: 1/2" = 1'-0"

CITY OF HATTIESBURG MISSISSIPPI

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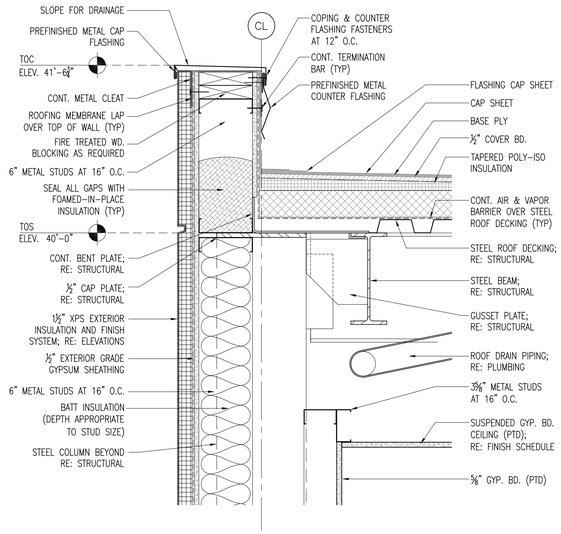
Albert & Associates: 12575

REGISTERED ARCHITECT LARRY A. ALBERT STATE OF MISSISSIPPI Hattiesburg, MS

A6.20

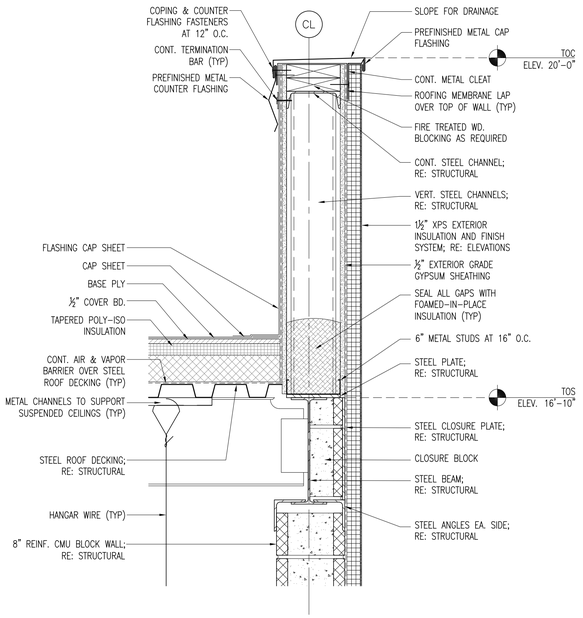
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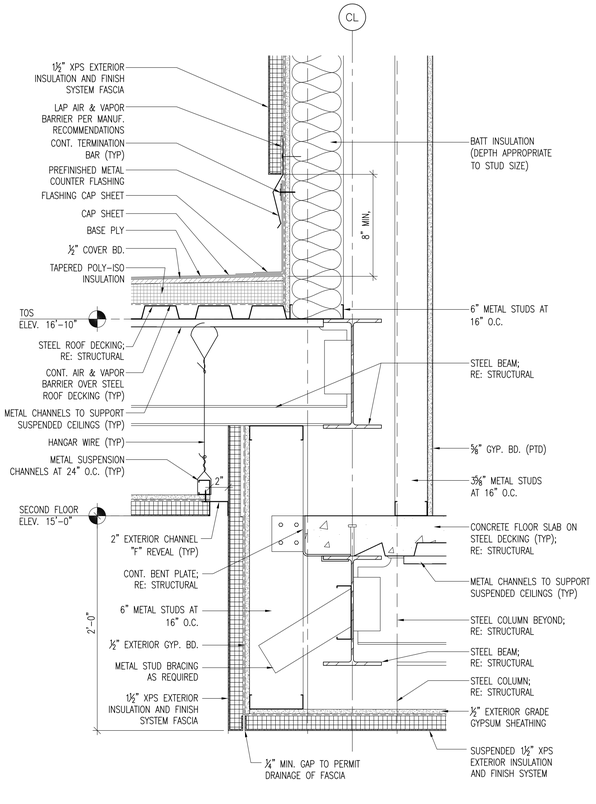
5 Detail @ Loading Dock Parapet

SCALE: 1 1/2" = 1'-0"



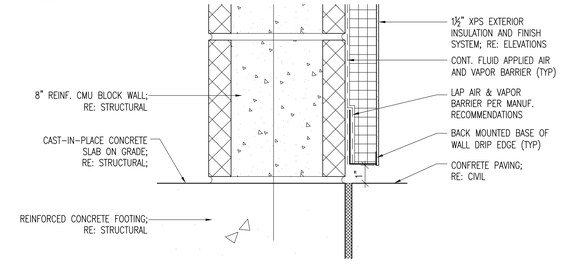
6 Detail @ Loading Dock Parapet

SCALE: 1 1/2" = 1'-0"



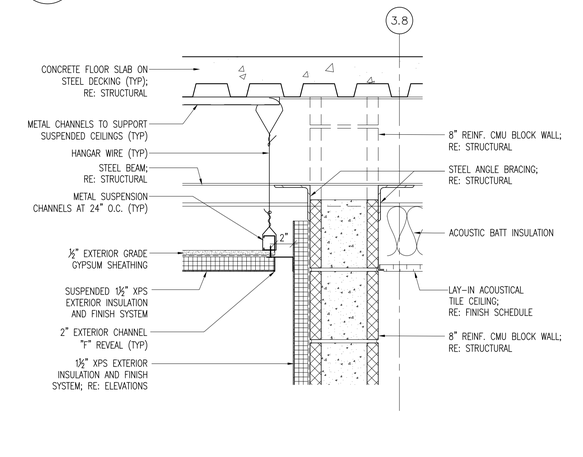
4 Detail @ Loading Dock Ceiling

SCALE: 1 1/2" = 1'-0"



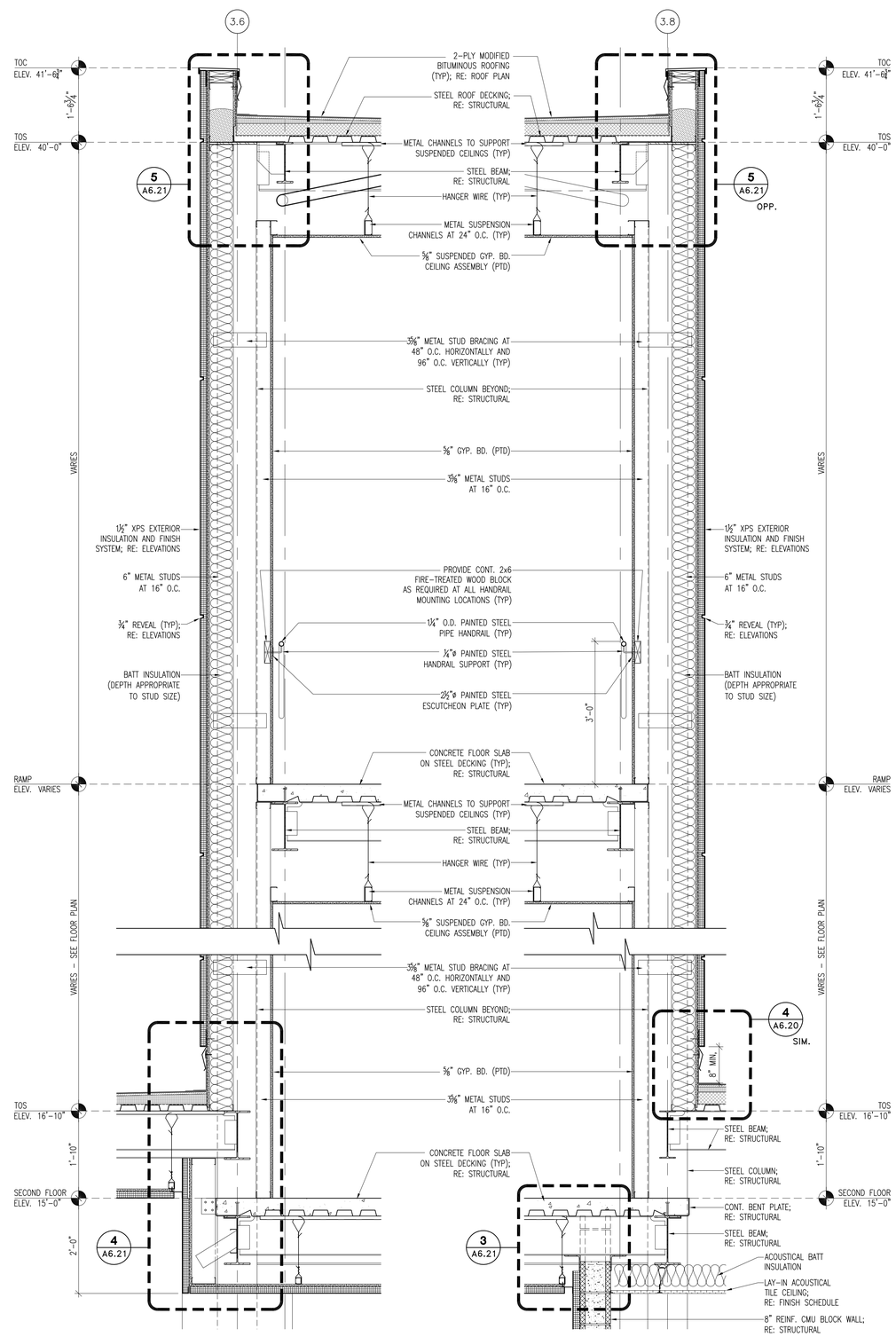
7 Detail @ Exterior Wall Base

SCALE: 3" = 1'-0"



3 Detail @ Loading Dock Ceiling

SCALE: 1 1/2" = 1'-0"



2 Wall Section

SCALE: 3/4" = 1'-0"

1 Wall Section

SCALE: 3/4" = 1'-0"

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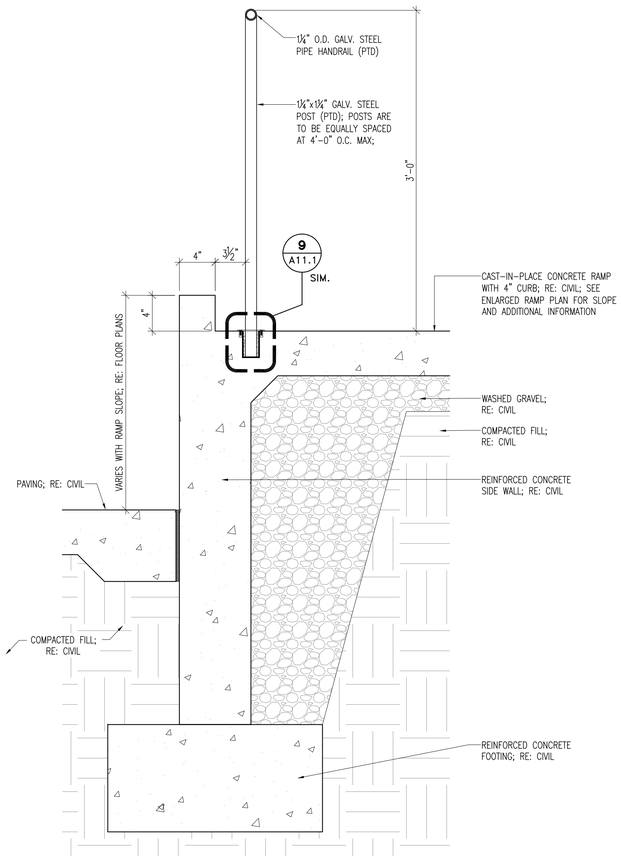
Drawn By: CR,CP,AS,RB
Checked By: CR,LA,CP
Client No: ------
Albert & Associates: 12575

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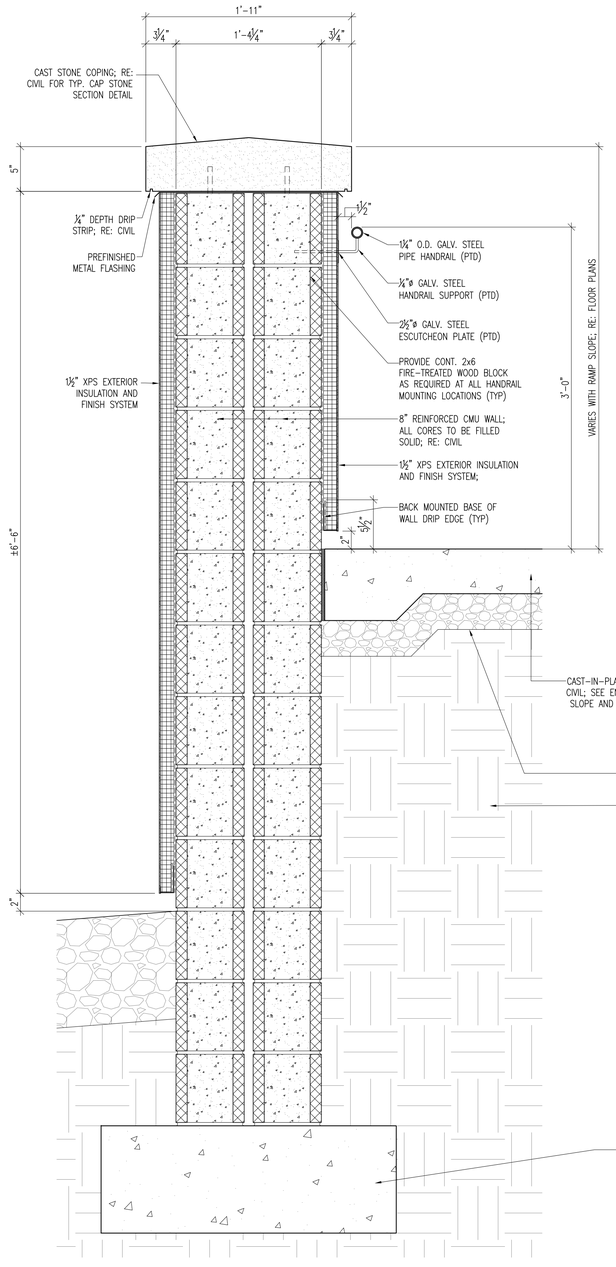
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WALL SECTIONS & DETAILS



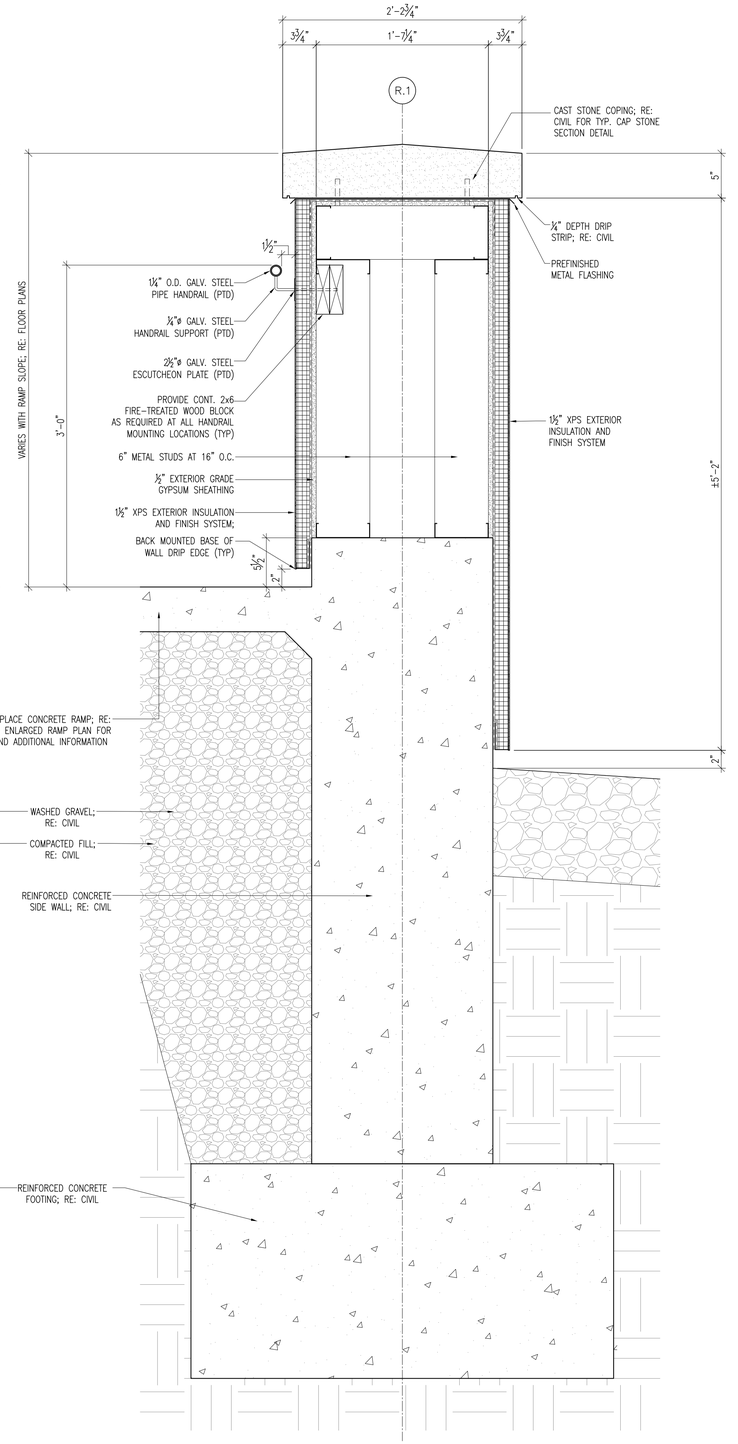
3 Section Detail @ Ramp

SCALE: 1 1/2" = 1'-0"



2 Section Detail @ Ramp

SCALE: 1 1/2" = 1'-0"



1 Section Detail @ Ramp

SCALE: 1 1/2" = 1'-0"

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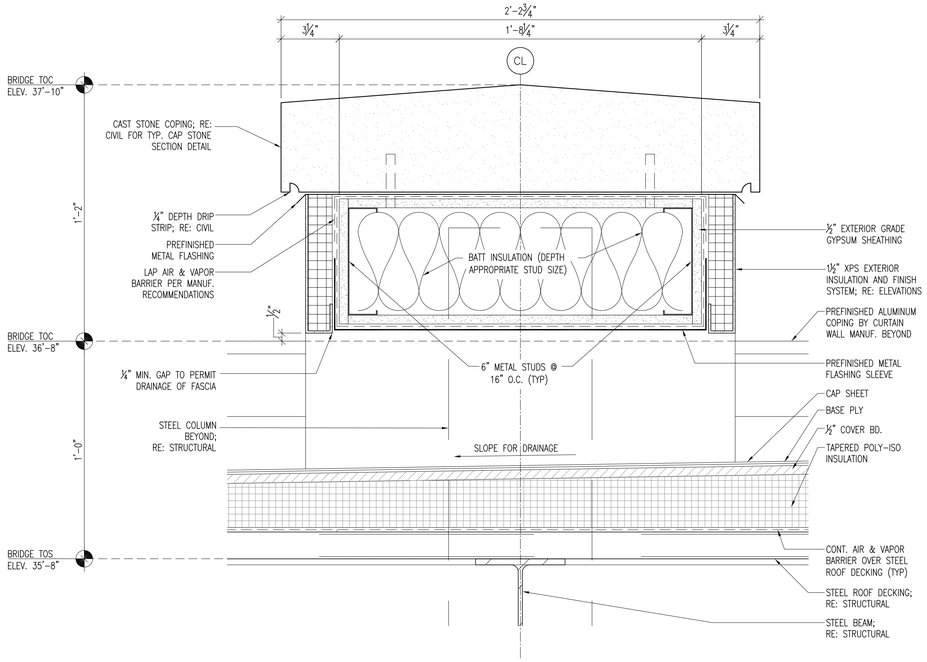
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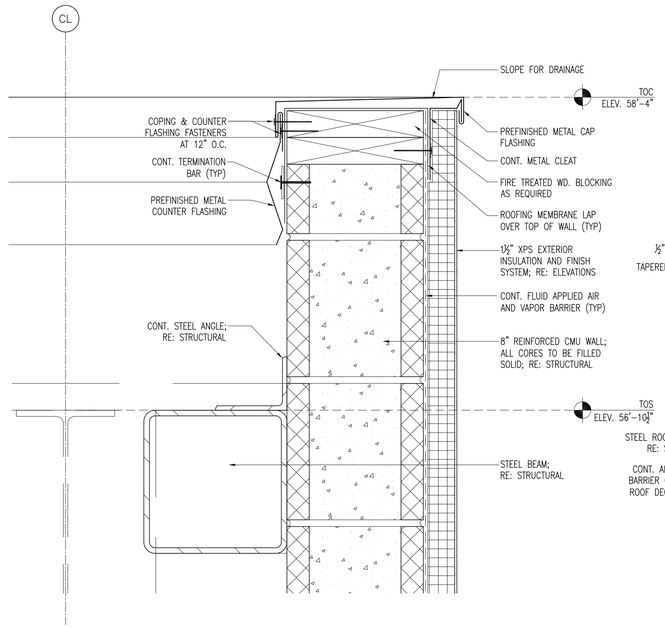
REGISTERED ARCHITECT Larry A. Albert Hattiesburg, MS STATE OF MISSISSIPPI

A6.22

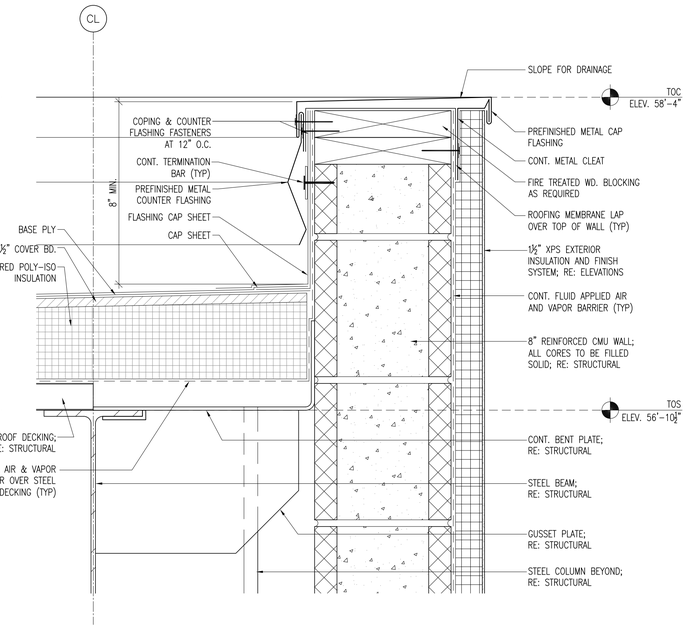
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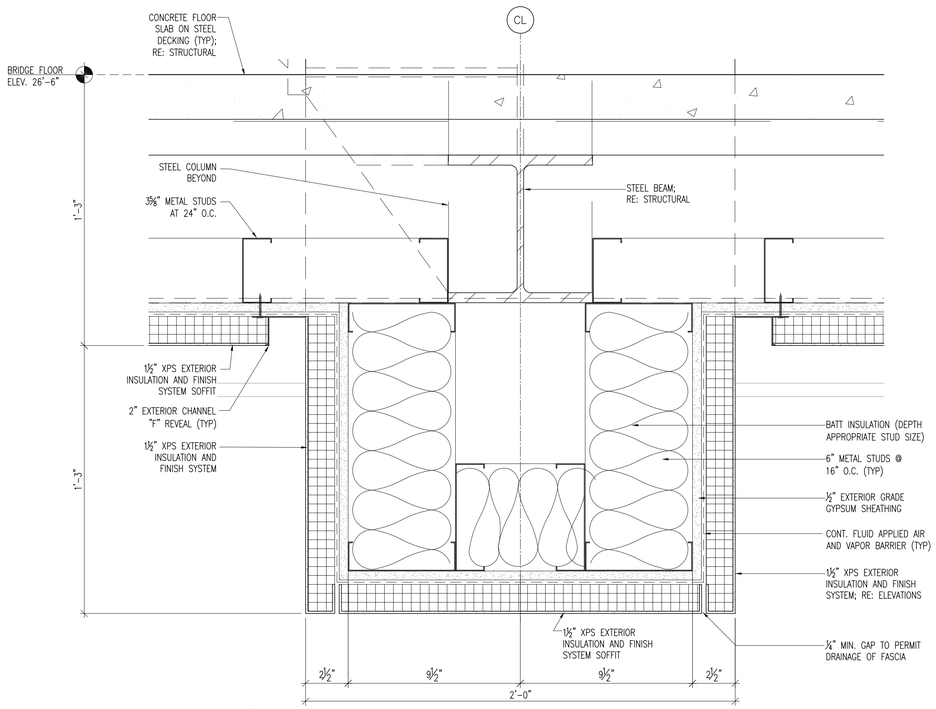
4 Cap Detail
SCALE: 3" = 1'-0"



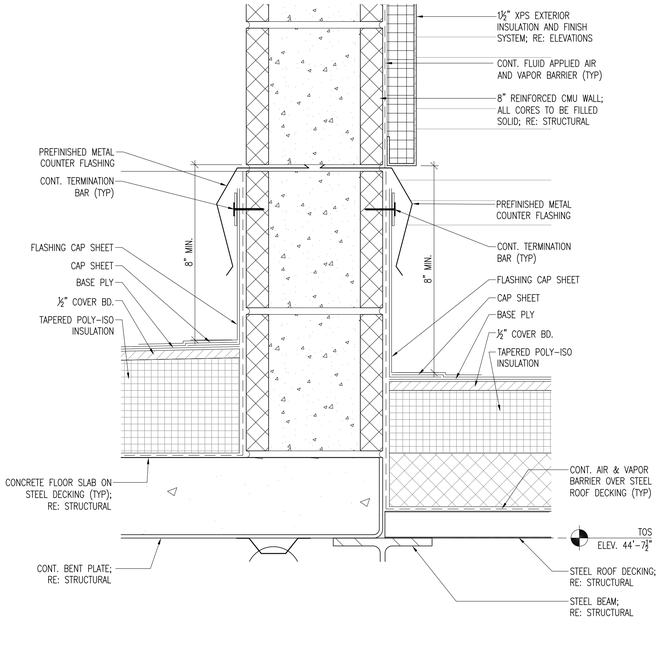
5 Cap Detail
SCALE: 3" = 1'-0"



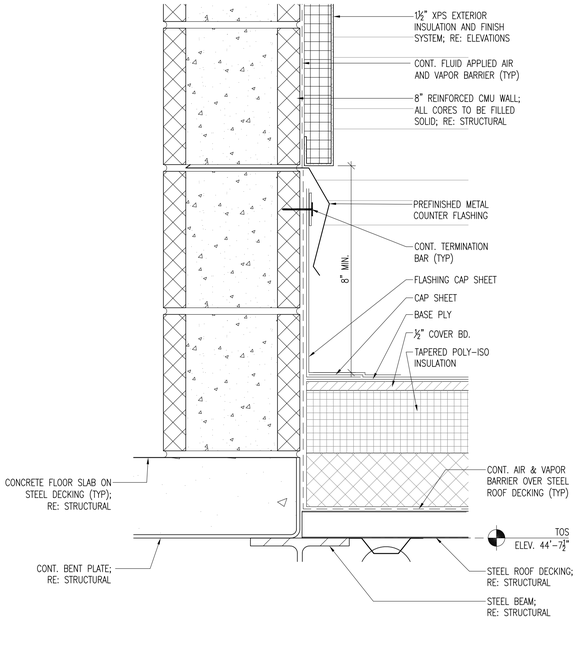
6 Cap Detail
SCALE: 3" = 1'-0"



3 Roof Termination Detail
SCALE: 3" = 1'-0"



2 Roof Termination Detail
SCALE: 3" = 1'-0"



1 Roof Termination Detail
SCALE: 3" = 1'-0"

CITY OF HATTIESBURG MISSISSIPPI 1884

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■ HATTIESBURG POLICE DEPARTMENT ■

HPSC Police and Court Building

Drawing Issued:

Date	Rev.	Description
08-31-2015		DD Check Set
10-20-2015		75% Progress Set
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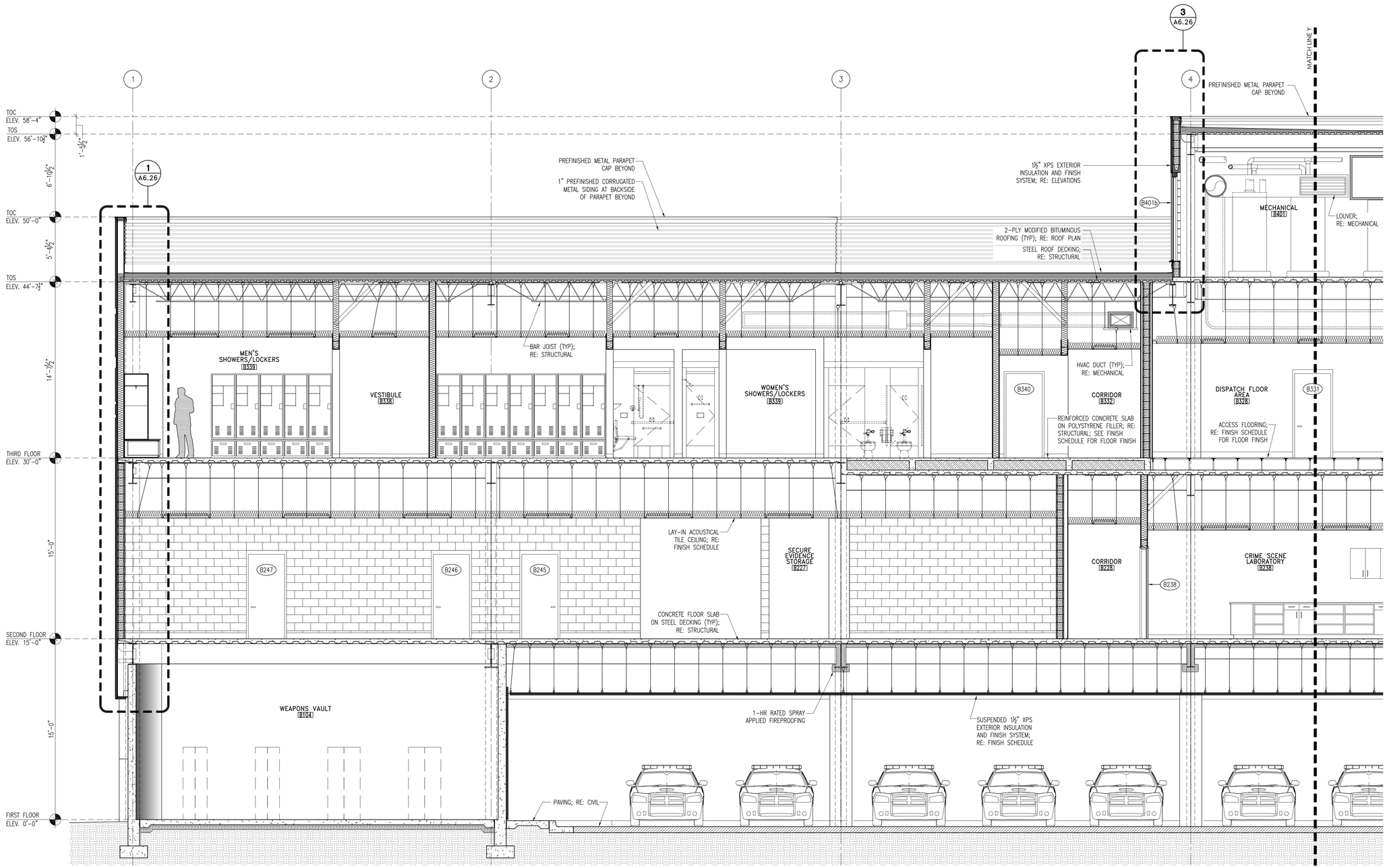
Client No: ——

Albert & Associates: 12575

REGISTERED ARCHITECT Larry M Albert Hattiesburg, MS STATE OF MISSISSIPPI

A6.23

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1 Longitudinal Section @ Police Building

SCALE: 1/4" = 1'-0"

NOTE: INTERIOR ELEVATIONS IN BUILDING SECTIONS ARE ILLUSTRATIONAL ONLY AND MAY NOT FULLY DEPICT THE DESIGN OF THE SPACE. SEE INTERIOR ELEVATIONS IN A9.x SHEETS FOR INTENDED DESIGN OF SPACES.

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

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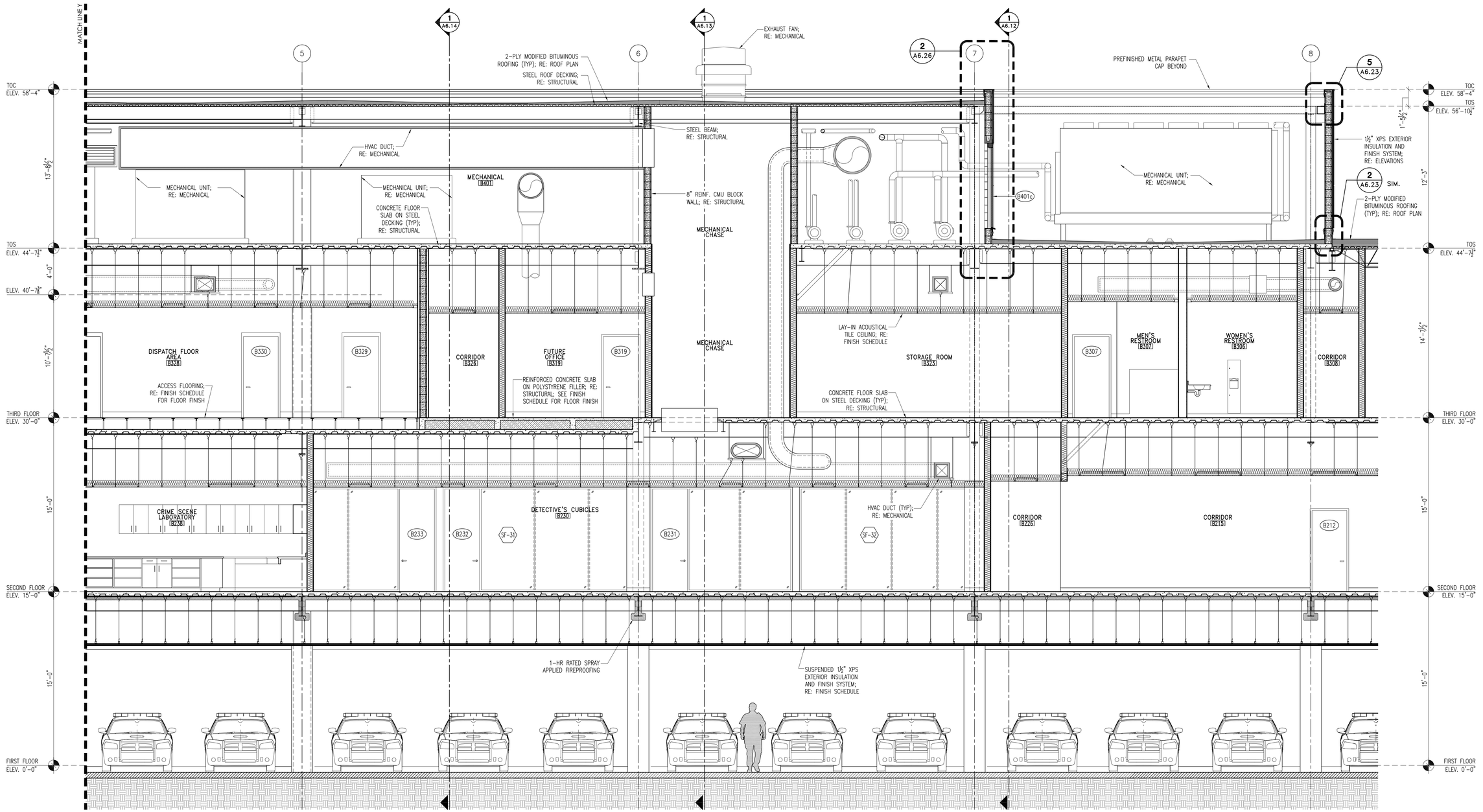
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1 Longitudinal Section @ Police Building (Cont.)

SCALE: 1/4" = 1'-0"

NOTE: INTERIOR ELEVATIONS IN BUILDING SECTIONS ARE ILLUSTRATIONAL ONLY AND MAY NOT FULLY DEPICT THE DESIGN OF THE SPACE. SEE INTERIOR ELEVATIONS IN A9.x SHEETS FOR INTENDED DESIGN OF SPACES.

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT

HATTIESBURG PUBLIC SAFETY COMPLEX

HPSC Police and Court Building

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Drawn By: CR,CP,AS,RB

Checked By: CR,LA,CP

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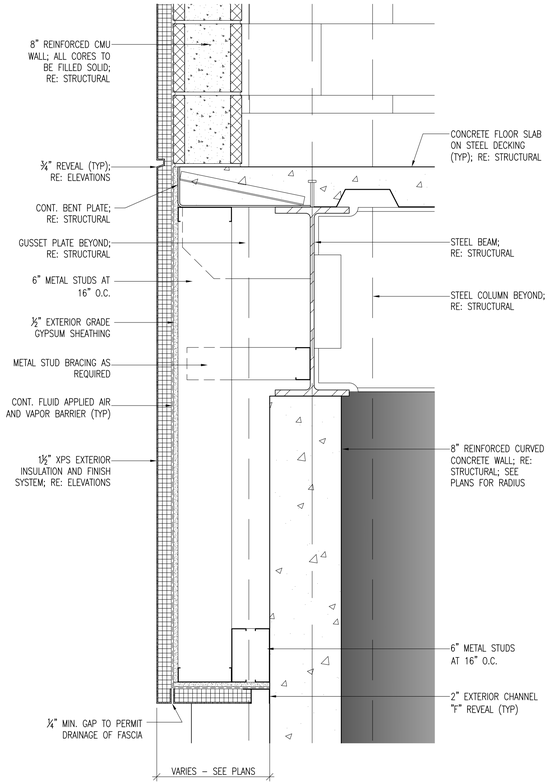
Albert & Associates: 12575



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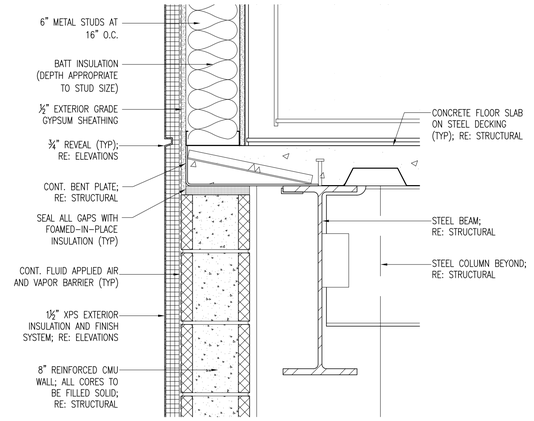
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LONGITUDINAL SECTION - PART B



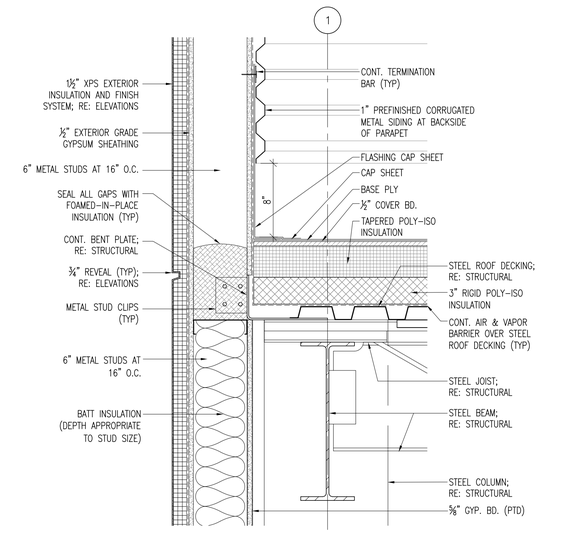
5 Detail @ West Exterior Wall

SCALE: 1 1/2" = 1'-0"



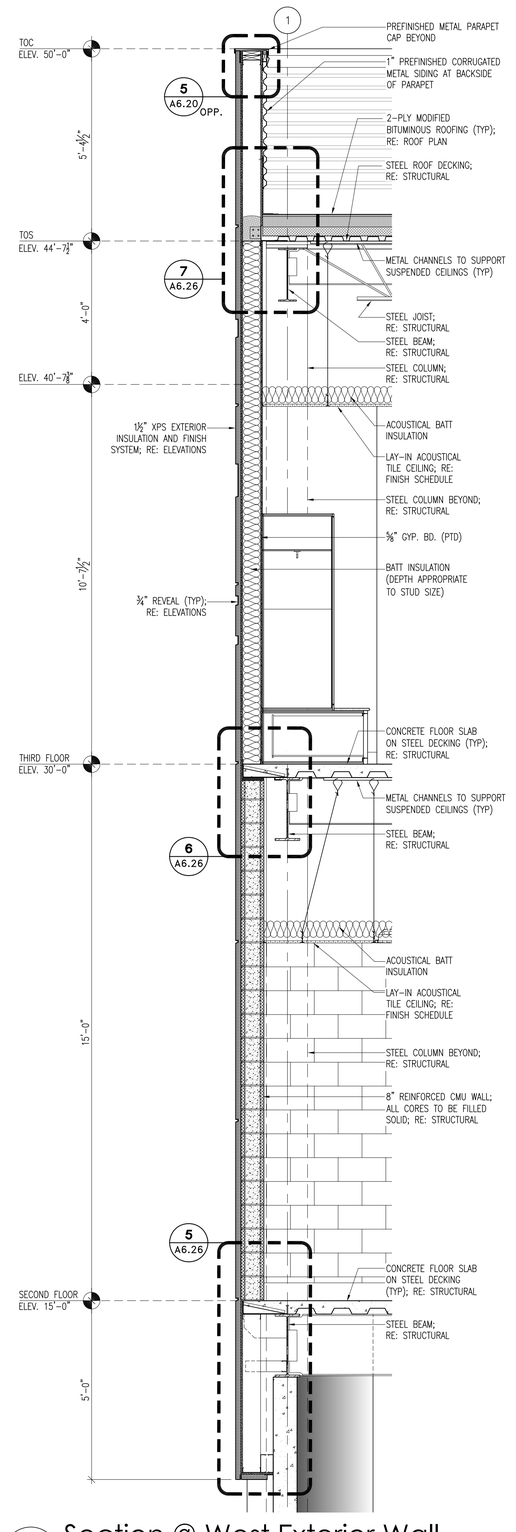
6 Detail @ West Exterior Wall

SCALE: 1 1/2" = 1'-0"



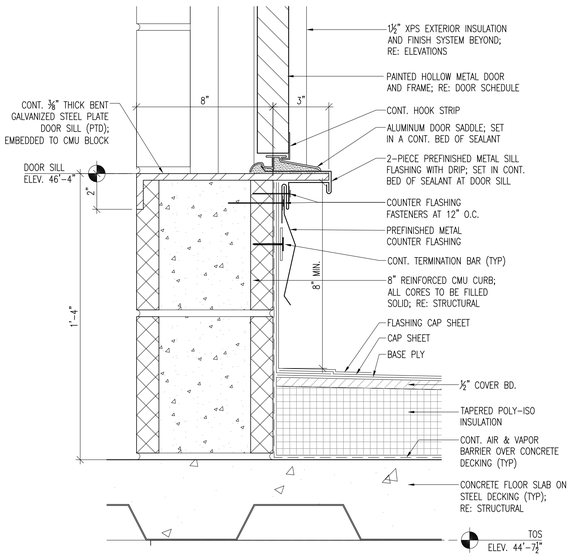
7 Detail @ West Parapet Wall

SCALE: 1 1/2" = 1'-0"



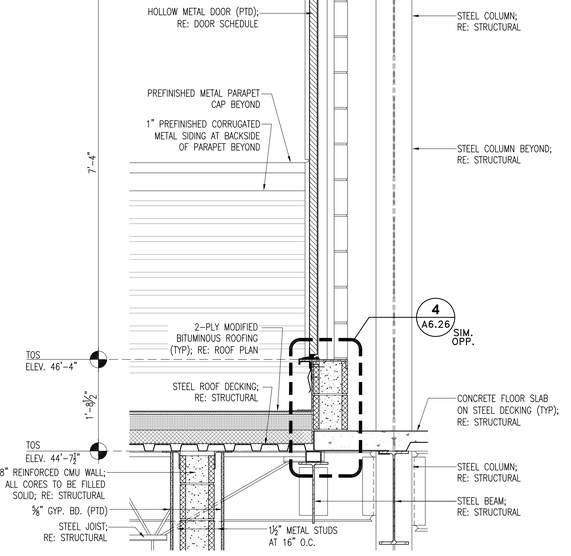
1 Section @ West Exterior Wall

SCALE: 1/2" = 1'-0"



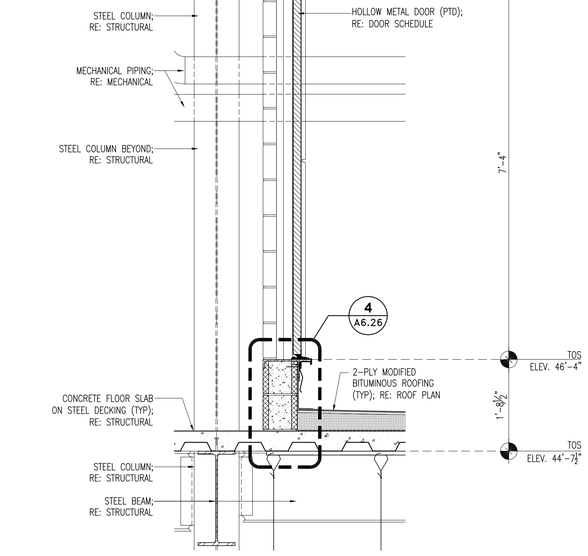
4 Door Sill Detail @ Mechanical [B401]

SCALE: 3" = 1'-0"



3 Section @ Mech. Penthouse Wall

SCALE: 3/4" = 1'-0"



2 Section @ Mech. Penthouse Wall

SCALE: 3/4" = 1'-0"

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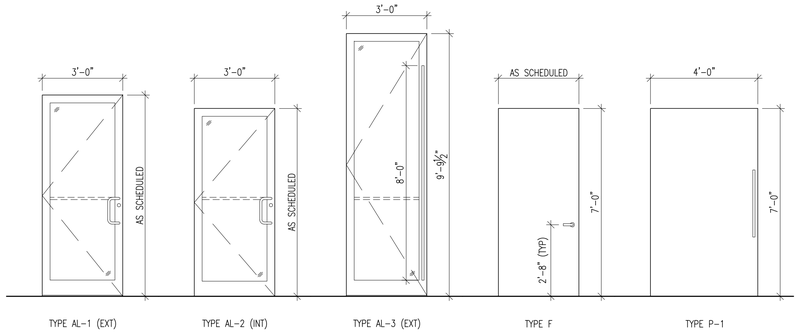
Albert & Associates: 12575

REGISTERED ARCHITECT Larry A. Albert Hattiesburg, MS STATE OF MISSISSIPPI

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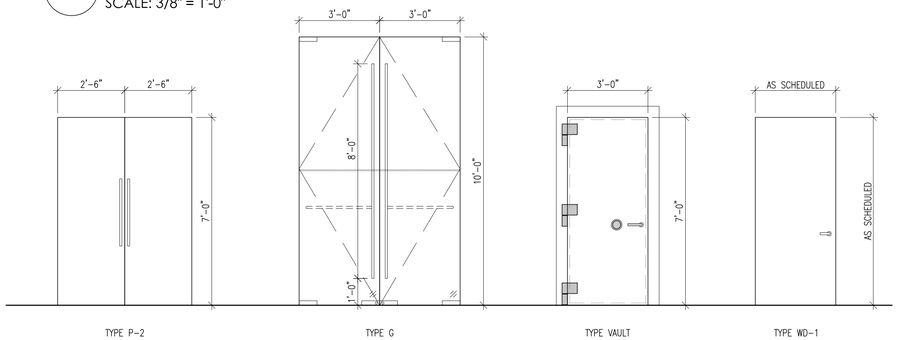
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WALL SECTIONS & DETAILS



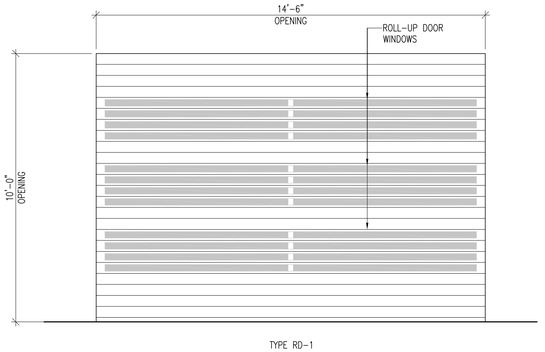
Door Elevations

SCALE: 3/8" = 1'-0"



Door Elevations

SCALE: 3/8" = 1'-0"



Door Elevations

SCALE: 3/8" = 1'-0"

DOOR GENERAL NOTES

A. CAREFULLY FIELD MEASURE AND VERIFY ALL OPENINGS BEFORE ASSEMBLY OF PRODUCTS.
B. SEE DOOR ELEVATIONS AND DETAILS FOR THICKNESS, DIMENSIONS AND GENERAL CONSTRUCTION.
C. PAINT ALL TOPS AND BOTTOMS OF STEEL DOORS THAT ARE EXPOSED TO WEATHER.
D. PROVIDE FULL WIDTH MARBLE THRESHOLDS AT BATHROOM DOORS.
E. ALL HOLLOW METAL FRAMES ARE TO BE FIELD PAINTED. COLOR TO BE SELECTED.
F. ALL GLASS IN INTERIOR WALL FRAMING AND DOORS WILL BE TEMPERED GLASS.
G. REFER TO SPECIFICATIONS FOR DOOR HARDWARE.

DOOR SCHEDULE - COURT (A)

NO.	PAIR	SIZE	DOOR				FRAME				DETAILS			HARDWARE				SECURITY HARDWARE							REMARKS	ROOM NAME
			ELEV.	MATERIAL	LABEL	FINISH	ELEV.	MATERIAL	LABEL	FINISH	T-HOLD	HEAD	JAMB	HARDWARE SET NUMBER	POWER ASSIST OPENER	LEVEL 3 BULLET RESISTANT DOOR	NO HARDWARE OUTSIDE	DOOR VIEWER	CARD READER	BIOMETRIC READER	DOOR CONTACT SWITCH	DOOR RELEASE BUTTON / CALL BUTTON	RFID AND AVI READER	ALARMED EXIT DEVICE		
A101a	●	6'-0" x 9'-9.5"	AL-3	ALUM	–	ANODIZED	CW-2	ALUM	–	ANODIZED	–	#1	#1		●						●				NOTE #1,11	VESTIBULE
A101b	●	6'-0" x 7'-6"	AL-1	ALUM	–	ANODIZED	SF-1	ALUM	–	ANODIZED	–	#1	#1		●		●				●				NOTE #1,4,11	VESTIBULE
A102		3'-0" x 7'-6"	AL-1	ALUM	–	ANODIZED	SF-2	ALUM	–	ANODIZED	–	#1	#1		●						●				NOTE #1,11	VESTIBULE
A104		3'-0" x 7'-0"	F	HM	45 MIN	PAINT	HM-1	HM	45 MIN	PAINT						●		●							NOTE #9	POLICE LOBBY
A106		3'-0" x 7'-0"	F	HM	45 MIN	PAINT	HM-3	HM	45 MIN	PAINT																CORRIDOR
A107		4'-0" x 10'-0"	P-1	HM		PAINT	P-1	NOTE #3		–											●				NOTE #3,7,11	VESTIBULE
A108		3'-0" x 7'-0"	F	WOOD		STAIN	HM-1	HM		PAINT																WOMEN
A109		3'-0" x 7'-0"																								MEN
A110		2'-0" x 7'-0"																								JANITOR
A111a	●	6'-0" x 7'-0"	〃	〃	45 MIN	〃	〃	〃	45 MIN	〃											●					COMMUNITY ROOM
A111b	●	6'-0" x 7'-6"	AL-1	ALUM		ANODIZED	SF-7	ALUM		ANODIZED											●				NOTE #1,11	COMMUNITY ROOM
A111c		3'-0" x 7'-6"	F	HM		PAINT	HM-1	HM		PAINT											●					COMMUNITY ROOM
A112		3'-0" x 7'-0"	F	WOOD		STAIN	HM-1	HM		PAINT																COMMUNICATIONS
A113	●	5'-0" x 7'-0"	P-2	WOOD		STAIN	P-2	NOTE #3		–															NOTE #3,11	KITCHEN
A114	●	5'-0" x 7'-0"	F				HM-1	HM		PAINT																STORAGE
A115		3'-0" x 7'-0"					〃	〃		〃																COMMUNICATIONS
A116		3'-0" x 7'-6"		HM		PAINT	HM-1	HM		PAINT							●	●			●					CORRIDOR
A117a		3'-0" x 7'-0"		HM		PAINT										●		●							NOTE #9	DEPUTY COURT CLERK AREA
A117b		3'-0" x 7'-0"	〃	WOOD		STAIN	〃	〃		〃																DEPUTY COURT CLERK AREA
A117c	●	6'-0" x 7'-6"	AL-1	ALUM		ANODIZED	SF-7	ALUM		ANODIZED		#1	#1					●			●				NOTE #1,11	DEPUTY COURT CLERK AREA
A118		3'-0" x 7'-0"	F	WOOD		STAIN	HM-1	HM		PAINT																COURT CLERK DESK
A119		3'-0" x 7'-0"																								COURT BREAK ROOM
A120		3'-0" x 7'-0"																								WOMEN
A121		3'-0" x 7'-0"																								MEN
A122		3'-0" x 7'-0"	〃	〃		〃	〃	〃		〃																FELONY/MISD CLERK OFFICE
A123a		3'-0" x 7'-0"	WD-1	WOOD		STAIN	WD-1	WOOD		STAIN																COURT LOBBY
A123b		3'-0" x 7'-0"			45 MIN		HM-3	HM	45 MIN	PAINT																VESTIBULE
A124a	●	6'-0" x 9'-8"					WD-1	WOOD		STAIN																COURT LOBBY
A124b	●	6'-0" x 9'-9.25"			45 MIN		HM-3	HM	45 MIN	PAINT																VESTIBULE
A125a		3'-0" x 7'-0"					WD-1	WOOD		STAIN																COURT LOBBY
A125b		3'-0" x 7'-0"			45 MIN		HM-3	HM	45 MIN	PAINT																VESTIBULE
A126a		3'-0" x 7'-0"			45 MIN		WD-1	WOOD	45 MIN	STAIN								●								CORRIDOR
A126b		3'-0" x 7'-0"	〃	〃	45 MIN	〃	WD-1	WOOD	45 MIN	STAIN								●								COURT ROOM
A127		3'-0" x 7'-6"	AL-1	ALUM		ANODIZED	CW-12	ALUM		ANODIZED						●					●			●	NOTE #1,11	CORRIDOR
A128		3'-0" x 7'-0"	F	WOOD		STAIN	HM-1	HM		PAINT																CLERK MANAGER OFFICE
A129		3'-0" x 7'-0"																								COURT ACCOUNTING OFFICE
A130		3'-0" x 7'-0"																								OFFICE (ATTORNEY)
A131		3'-0" x 7'-0"																								COURT ATTORNEY OFFICE
A133		3'-0" x 7'-0"																	●							COMMUNICATIONS
A134		3'-0" x 7'-0"																	●							COMMUNICATIONS
A137		3'-0" x 7'-0"																	●							CORRIDOR
A138		3'-0" x 7'-0"																								COURT FILE ROOM/WORK AREA
A139a		3'-0" x 7'-0"	〃	〃		〃	〃	〃		〃									●							JUDGE'S CHAMBER
A139b		3'-0" x 7'-6"	F	HM		PAINT	HM-1	HM		PAINT					●		●		●		●				NOTE #9	JUDGE'S CHAMBER
A140		3'-0" x 7'-0"	F	WOOD		STAIN	HM-1	HM		PAINT																RESTROOM
A141		3'-0" x 7'-0"																								CLOSET
A142a		3'-0" x 7'-0"																	●							MEETING ROOM
A142b		3'-0" x 7'-0"																								MEETING ROOM
A143		3'-0" x 7'-0"																								ADMIN ASST OFFICE
A144		3'-0" x 7'-0"																								PROSECUTOR ATTORNEY OFFICE
A145		3'-0" x 7'-0"																								WARRANTS
A146		3'-0" x 7'-0"																								COMMUNITY SERVICE OFFICE
A147		3'-0" x 7'-0"																	●							CORRIDOR
A149		3'-0" x 7'-0"																	●							RECORD CLERK AREA
A152		3'-0" x 7'-0"					〃	〃		〃																FINGERPRINT/ID ROOM
A153		3'-0" x 7'-10.25"					SF-35	ALUM		ANODIZED															NOTE #1	RECORD CLERK MANAGER
A154		3'-0" x 7'-0"					HM-1	HM		PAINT																TELESERVICE OFFICE
A155		3'-0" x 7'-0"																	●							PUBLIC INFO OFFICE
A157		3'-0" x 7'-0"																								NCIC
A158		3'-0" x 7'-0"																								ELECTRICAL
A159		3'-0" x 7'-0"																								TELESERVICE OFFICE
A160		3'-0" x 7'-0"																								STORAGE/SUPPLY ROOM
A161		3'-0" x 7'-0"																								MEN
A162		3'-0" x 7'-0"																								WOMEN
A163		3'-0" x 7'-0"																								POLICE ACCOUNTING
A164		3'-0" x 7'-0"																								BREAKROOM
A165		3'-0" x 7'-0"																								VICTIM ADVOCATES OFFICE
A166		3'-0" x 7'-0"																								VICTIM ADVOCATES OFFICE
A167		3'-0" x 7'-0"																								PROBATION ROOM
A168		3'-0" x 7'-6"	AL-1	ALUM		ANODIZED	CW-13	ALUM		ANODIZED							●				●			●	NOTE #1,11	CORRIDOR
A169		3'-0" x 7'-0"	F	HM	45 MIN	PAINT	HM-2	HM	45 MIN	PAINT						●		●	●					●	NOTE #2.9	CORRIDOR
A170		3'-0" x 7'-0"	F	〃		〃	〃	〃		〃						●		●	●					●	NOTE #2.9	COVERED PARKING
A202	●	6'-0" x 10'-0.75"	G	GLASS		–	SF-12	–		–															NOTE #10,11	PRESS/BRIEFING ROOM
A301		3'-0" x 7'-0"	F	HM		PAINT	HM-1	HM		PAINT															NOTE #16	POLICE LOBBY

DOOR REMARKS

1. SEE CURTAIN WALL/STOREFRONT MANUFACTURER FOR MANUFACTURER DETAILS.
2. DOOR TO HAVE ALARMED EXIT DEVICE W/ CARD READER OVERRIDE.
3. POCKET DOOR HARDWARE TO BE PROVIDED IN HARDWARE ALLOWANCE.
4. POWER ASSIST FOR EGRESS ONLY.
5. VAULT DOOR PER SECTION 083459.
6. AUTOMATIC SPRINKLERS SHALL BE INSTALLED ALONG BOTH SIDES OF THE OPENING, WITHIN 12" MAX OF THE WALL PLANE, AND SPACED AT INTERVALS NOT GREATER THAN 6'-0" O.C (IBC2012, SECTION 404.6, EXCEPTION #1)
7. POCKET DOOR TO HAVE LOCKING HARDWARE; KEYED ON BOTH SIDES; DOOR TO BE METAL.
8. OMITTED
9. DOOR AND FRAME TO PROVIDE LEVEL 3 SECURITY PROTECTION UTILIZING HEAVY GAUGE METAL COMPONENTS PER SECTION 081113.
10. ALL GLASS ENTRANCE MODEL NO. 51GSF BY OLDCASTLE OR EQUAL; RE: WINDOW SCHEDULE FOR ADDITIONAL INFORMATION.
11. ALL HARDWARE ON DOOR TO BE PROVIDED BY DOOR MFR EXCEPT CYLINDER LOCK. TYP.
12. PROVIDE FIRE DEPARTMENT KNOX BOX NEXT TO DOOR; COORDINATE DOOR HARDWARE.
13. HIGH SPEED ROLL-DOWN DOOR "ULTRA SECURE" BY ALBANY DOOR SYSTEMS OR EQUAL w/RFID/AVI READER AND AUTOMATIC OPENER.
14. OMITTED.
15. 1-HOUR FIRE RATED DOOR AND FRAME BY SAFTIFIRST OR EQUAL; RE: SECTION 088500.
16. SILL AT 6" A.F.F.; SEE BUILDING SECTIONS.

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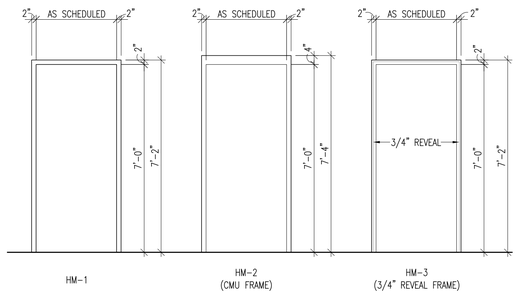
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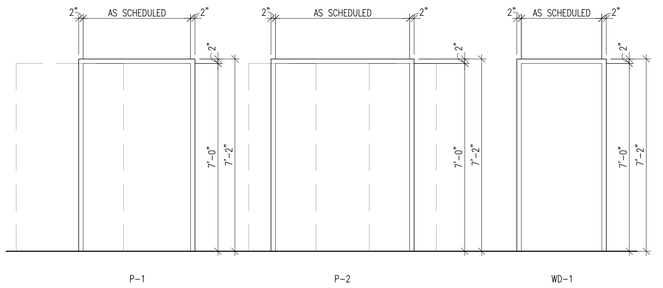
A8.1a

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com



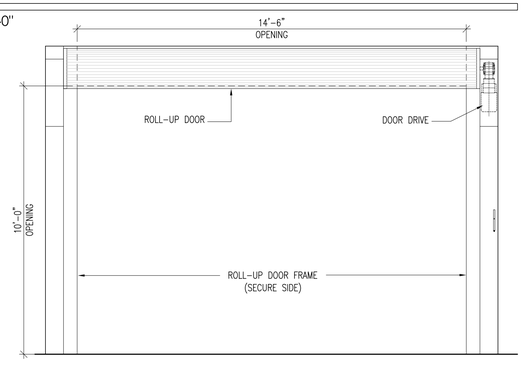
Frame Elevations

SCALE: 3/8" = 1'-0"



Frame Elevations

SCALE: 3/8" = 1'-0"



Frame Elevations

SCALE: 3/8" = 1'-0"

DOOR GENERAL NOTES

A. CAREFULLY FIELD MEASURE AND VERIFY ALL OPENINGS BEFORE ASSEMBLY OF PRODUCTS.
B. SEE DOOR ELEVATIONS AND DETAILS FOR THICKNESS, DIMENSIONS AND GENERAL CONSTRUCTION.
C. PAINT ALL TOPS AND BOTTOMS OF STEEL DOORS THAT ARE EXPOSED TO WEATHER.
D. PROVIDE FULL WIDTH MARBLE THRESHOLDS AT BATHROOM DOORS.
E. ALL HOLLOW METAL FRAMES ARE TO BE FIELD PAINTED. COLOR TO BE SELECTED.
F. ALL GLASS IN INTERIOR WALL FRAMING AND DOORS WILL BE TEMPERED GLASS.
G. REFER TO SPECIFICATIONS FOR DOOR HARDWARE.

DOOR SCHEDULE - POLICE STATION (B) - FIRST & SECOND FLOOR

NO.	PAIR	SIZE	DOOR				FRAME				DETAILS			HARDWARE				SECURITY HARDWARE								REMARKS	ROOM NAME
			ELEV.	MATERIAL	LABEL	FINISH	ELEV.	MATERIAL	LABEL	FINISH	T-HOLD	HEAD	JAMB	HARDWARE SET NUMBER	POWER ASSIST OPENER	LEVEL 3 BULLET RESISTANT DOOR	NO HARDWARE OUTSIDE	DOOR VIEWER	CARD READER	BIOMETRIC READER	DOOR CONTACT SWITCH	DOOR RELEASE BUTTON / CALL BUTTON	RFID AND AVI READER	ALARMED EXIT DEVICE		
B101a		OMITTED																								OMITTED
B101b	●	6'-0" x 7'-0"	F	HM		PAINT	HM-2	HM		PAINT						●					●				NOTE #9	CORRIDOR
B101c		3'-0" x 7'-0"					HM-2									●			●		●				NOTE #9	CORRIDOR
B102		3'-0" x 7'-0"			45 MIN		HM-2		45 MIN							●			●						NOTE #9,12	FIRE RISER
B103		3'-0" x 7'-0"	↓	↓	45 MIN	↓	HM-2	↓	45 MIN	↓						●			●		●				NOTE #9	STAIR
B104		3'-6" x 7'-0"	VAULT	NOTE #5	45 MIN			NOTE #5	45 MIN	NOTE #5								●	●		●				NOTE #5	WEAPONS VAULT
B105		3'-6" x 7'-0"	VAULT	NOTE #5	45 MIN			NOTE #5	45 MIN	NOTE #5								●	●		●				NOTE #5	SPECIAL OPS EQUIPMENT
B106		3'-0" x 7'-0"	F	HM	45 MIN	PAINT	HM-2	HM	45 MIN	PAINT						●			●		●				NOTE #9	ELECTRICAL ROOM
B107		14'-6" x 10'-0"	RD-1	SS	–	–	RD-1	SS	–	–													●		NOTE #13	COVERED PARKING
B108		3'-0" x 7'-6"	F	HM	60 MIN	PAINT	HM-1	HM	60 MIN	PAINT						●		●	●		●				NOTE #9	STAIR B
B110		14'-6" x 10'-0"	RD-1	SS	–	–	RD-1	SS	–	–													●		NOTE #13	COVERED PARKING
B201a		3'-0" x 7'-6"	AL-2	ALUM	NOTE #6	ANODIZED	SF-13	ALUM	NOTE #6	ANODIZED															NOTE #1,6,11	INVESTIGATIONS LOBBY
B201b		3'-0" x 7'-0"	F	HM		PAINT	HM-1	HM		PAINT						●			●						NOTE #9	CORRIDOR
B202		3'-0" x 7'-0"		WOOD		STAIN																				ADMIN ASST OFFICE
B203		3'-0" x 7'-0"																								WORK AREA
B204		3'-0" x 7'-0"																								CORRIDOR
B205		3'-0" x 7'-0"																								CONFERENCE ROOM
B206		3'-0" x 7'-0"																								ADMIN ASST OFFICE
B207		3'-0" x 7'-0"																								DOMESTIC VIOLENCE OFFICE
B208		3'-0" x 7'-0"																								DOMESTIC VIOLENCE OFFICE
B209		3'-0" x 7'-0"																								DOMESTIC VIOLENCE OFFICE
B210		3'-0" x 7'-0"																								DOMESTIC VIOLENCE OFFICE
B211		3'-0" x 7'-0"																	●							SECURED RECORDS
B212		3'-0" x 7'-0"																								BREAK ROOM
B213		3'-0" x 7'-0"																								EMPLOYEE TOILET
B214		3'-0" x 7'-0"		↓		↓																				EMPLOYEE TOILET
B215		3'-0" x 7'-6"		HM	45 MIN	PAINT			45 MIN							●			●						NOTE #9	POLICE LOBBY
B216		3'-0" x 7'-0"		WOOD		STAIN																				FUTURE OFFICE
B217		3'-0" x 7'-0"																								FUTURE OFFICE
B218		3'-0" x 7'-0"																								STORAGE ROOM
B219		3'-0" x 7'-0"																	●							ELECTRICAL
B220		3'-0" x 7'-0"																								CAPT OFICE
B221		3'-0" x 7'-0"																								LT OFICE
B222		3'-0" x 7'-0"		↓		↓																				PALS COORDINATOR OFFICE
B223a		3'-0" x 7'-0"	↓	HM		PAINT	↓	↓		↓						●			●						NOTE #9	WAITING
B223b		3'-0" x 7'-6"	AL-2	ALUM	NOTE #6	ANODIZED	SF-15	ALUM	NOTE #6	ANODIZED															NOTE #1,6,11	WAITING
B224		3'-0" x 7'-0"	F	WOOD		STAIN	HM-1	HM		PAINT																SMALL MEETING ROOM
B225		3'-0" x 7'-0"	F	WOOD		STAIN	HM-1	HM		PAINT																CUBICLES
B227		3'-0" x 7'-6"	AL-2	ALUM	60 MIN	ANODIZED	FW-1	ALUM	60 MIN	ANODIZED															NOTE #1,11,15	STAIR B
B229		3'-0" x 7'-0"	F	WOOD		STAIN	HM-1	HM		PAINT																CRIME ANALYSIS
B230		3'-0" x 7'-0"					HM-1	HM		PAINT																DETECTIVE'S CUBICLES
B231		3'-0" x 8'-10.25"					SF-31	ALUM	–	ANODIZED															NOTE #1	SGT OFFICE
B232		3'-0" x 9'-0"					SF-31	ALUM	–	ANODIZED															NOTE #1	CAPT OFFICE
B233		3'-0" x 9'-0"					SF-31	ALUM	–	ANODIZED															NOTE #1	LT OFFICE
B234		3'-0" x 7'-0"					HM-1	HM		PAINT																DETECTIVES BREAK ROOM
B235		3'-0" x 7'-0"																								EMPLOYEE TOILET
B236		3'-0" x 7'-0"																								EMPLOYEE TOILET
B237		3'-0" x 7'-0"		↓		↓																				CORRIDOR
B238		3'-0" x 7'-0"		HM		PAINT										●				●					NOTE #9	CRIME SCENE LABORATORY
B239a		3'-0" x 7'-0"		WOOD		STAIN																				CRIME SCENE UNIT
B239b		3'-0" x 7'-0"	↓	HM		PAINT	↓	↓		↓						●				●					NOTE #9	CRIME SCENE UNIT
B240		3'-6" x 7'-0"	VAULT	NOTE #5	–	–	–	NOTE #5	–	NOTE #5									●						NOTE #5	TEMPORARY EVIDENCE STORAGE
B241		3'-6" x 7'-0"	VAULT	NOTE #5	–	–	–	NOTE #5	–	NOTE #5									●						NOTE #5	EVIDENCE SUPERVISOR/OFFICE
B242		3'-6" x 7'-0"	VAULT	NOTE #5	–	–	–	NOTE #5	–	NOTE #5									●	●					NOTE #5	SECURE EVIDENCE STORAGE
B245		3'-0" x 7'-0"	F	HM		PAINT	HM-2	HM		PAINT						●				●					NOTE #9	SECURE VALUABLES STORAGE
B246		3'-0" x 7'-0"														●				●					NOTE #9	SECURE WEAPONS STORAGE
B247		3'-0" x 7'-0"		↓		↓	↓									●				●					NOTE #9	SECURE NARCOTICS STORAGE
B248		3'-0" x 7'-0"		WOOD		STAIN	HM-1												●							ELECTRICAL
B249a		3'-0" x 7'-0"																	●							COMMUNICATION
B249b		3'-0" x 7'-0"																	●							COMMUNICATION
B250		3'-0" x 7'-0"																								FIRE RISER
B251		3'-0" x 7'-6"			45 MIN				45 MIN																	INTERNAL AFFAIRS
B252		3'-0" x 7'-0"																	●							FILES/STORAGE
B253		3'-0" x 7'-0"																								BREAK ROOM
B255		3'-0" x 7'-0"																								SMALL INTERVIEW ROOM
B256		3'-0" x 7'-0"																								SMALL INTERVIEW ROOM
B257a		3'-0" x 7'-0"																								WORK ROOM
B257b		3'-0" x 7'-0"		↓																					NOTE #16	WORK ROOM
B258a		3'-0" x 7'-0"		HM																					NOTE #16	MECH SPACE
B258b		3'-0" x 7'-0"		HM		↓																			NOTE #16	MECH SPACE
B259		3'-0" x 7'-0"	↓	WOOD		STAIN	↓	↓		↓																JANITOR

DOOR REMARKS

1. SEE CURTAIN WALL/STOREFRONT MANUFACTURER FOR MANUFACTURER DETAILS.
2. DOOR TO HAVE ALARMED EXIT DEVICE W/ CARD READER OVERRIDE.
3. POCKET DOOR HARDWARE TO BE PROVIDED IN HARDWARE ALLOWANCE.
4. POWER ASSIST FOR EGRESS ONLY.
5. VAULT DOOR PER SECTION 083459.
6. AUTOMATIC SPRINKLERS SHALL BE INSTALLED ALONG BOTH SIDES OF THE OPENING, WITHIN 12" MAX OF THE WALL PLANE, AND SPACED AT INTERVALS NOT GREATER THAN 6'-0" O.C (IBC2012, SECTION 404.6, EXCEPTION #1)
7. POCKET DOOR TO HAVE LOCKING HARDWARE; KEYED ON BOTH SIDES; DOOR TO BE METAL.
8. OMITTED
9. DOOR AND FRAME TO PROVIDE LEVEL 3 SECURITY PROTECTION UTILIZING HEAVY GAUGE METAL COMPONENTS PER SECTION 081113.
10. ALL GLASS ENTRANCE MODEL NO. 51GSF BY OLDCASTLE OR EQUAL; RE: WINDOW SCHEDULE FOR ADDITIONAL INFORMATION.
11. ALL HARDWARE ON DOOR TO BE PROVIDED BY DOOR MFR EXCEPT CYLINDER LOCK. TYP.
12. PROVIDE FIRE DEPARTMENT KNOX BOX NEXT TO DOOR; COORDINATE DOOR HARDWARE.
13. HIGH SPEED ROLL-DOWN DOOR "ULTRA SECURE" BY ALBANY DOOR SYSTEMS OR EQUAL w/RFID/AVI READER AND AUTOMATIC OPENER.
14. OMITTED.
15. 1-HOUR FIRE RATED DOOR AND FRAME BY SAFTIFIRST OR EQUAL; RE: SECTION 088500.
16. SILL AT 6" A.F.F.; SEE BUILDING SECTIONS.

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

Drawing Issued:

Date	Rev.	Description
08-31-2015		DD Check Set
10-20-2015		75% Progress Set
11-02-2015		90% Pricing Set
11-19-2018		100% Bid Docs

Drawn By: CR,CP,AS,RB

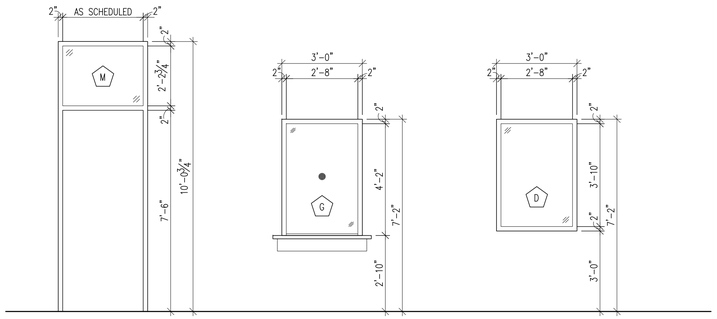
Checked By: CR,LA,CP

Client No: ------

Albert & Associates: 12575

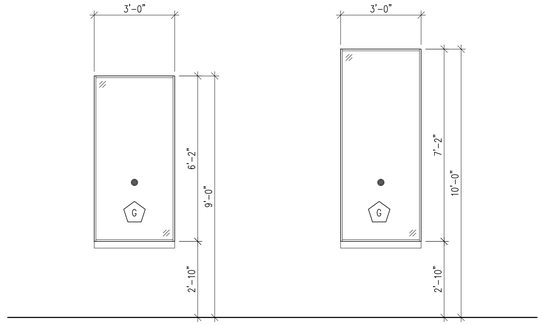
REGISTERED ARCHITECT Larry M Albert Hattiesburg, MS STATE OF MISSISSIPPI

A8.1b



Frame Elevations

SCALE: 3/8" = 1'-0"



Frame Elevations

SCALE: 3/8" = 1'-0"

DOOR SCHEDULE - POLICE STATION (B) - THIRD FLOOR & MECHANICAL PENTHOUSE

NO.	PAIR	SIZE	DOOR				FRAME				DETAILS			HARDWARE			SECURITY HARDWARE							REMARKS	ROOM NAME
			ELEV.	MATERIAL	LABEL	FINISH	ELEV.	MATERIAL	LABEL	FINISH	T-HOLD	HEAD	JAMB	HARDWARE SET NUMBER	POWER ASSIST OPENER	LEVEL 3 BULLET RESISTANT DOOR	NO HARDWARE OUTSIDE	DOOR VIEWER	CARD READER	BIOMETRIC READER	DOOR CONTACT SWITCH	DOOR RELEASE BUTTON / CALL BUTTON	RFID AND AVI READER	ALARMED EXIT DEVICE		
B301a		3'-0" x 7'-6"	AL-2	ALUM	NOTE #6	ANODIZED	SF-19	ALUM	NOTE #6	ANODIZED												●			NOTE #1,6,11	POLICE LOBBY
B301b		3'-0" x 7'-0"	F	HM		PAINT	HM-1	HM		PAINT						●									NOTE #9	ADMINISTRATIVE ASSISTANTS
B302		3'-0" x 7'-0"		WOOD		STAIN																				SUPPLY ROOM
B303		3'-0" x 7'-0"																								WORK ROOM/MAIL
B304a		3'-0" x 7'-0"																								CONFERENCE ROOM
B304b		3'-0" x 7'-0"																								CONFERENCE ROOM
B305a		3'-0" x 7'-0"																								BREAK ROOM
B305b		3'-0" x 7'-0"																								BREAK ROOM
B306		3'-0" x 7'-0"																								RESTROOM W/ SHOWER
B307		3'-0" x 7'-0"																								RESTROOM W/ SHOWERS
B309		3'-0" x 7'-0"		HM		PAINT										●			●						NOTE #9	CORRIDOR
B310		3'-0" x 7'-0"		WOOD		STAIN																				POLICE CHIEF OFFICE
B311		3'-0" x 7'-0"																								EMPLOYEE TOILET
B312		3'-0" x 7'-0"																								CLOSET
B313		3'-0" x 7'-0"																								CLOSET
B314		3'-0" x 7'-0"																								EMPLOYEE TOILET
B315		3'-0" x 7'-0"																								ASST POLICE CHIEF OFFICE
B316		3'-0" x 7'-0"																								OPER. BUREAU OFFICE
B317		3'-0" x 7'-0"																								DIR SUPPORT BUREAU OFFICE
B318		3'-0" x 7'-0"																								CPT OF ADMIN OFFICE
B319		3'-0" x 7'-0"																								FUTURE OFFICE
B320		3'-0" x 7'-0"																								FUTURE OFFICE
B321		3'-0" x 7'-6"	AL-2	ALUM	NOTE #6	ANODIZED	SF-20	ALUM	NOTE #6	ANODIZED									●							POLICE LOBBY
B322		3'-0" x 7'-0"	F	WOOD		STAIN	HM-1	HM		PAINT									●							ELECTRICAL
B323		3'-0" x 7'-0"																								STORAGE ROOM
B324		3'-0" x 7'-0"																								GRANT COORDINATOR OFFICE
B325		3'-0" x 7'-0"																								COMMUNITY DEV. SPECIALIST
B326		3'-0" x 7'-6"	AL-2	ALUM	60 MIN	ANODIZED	FW-2	ALUM	60 MIN	ANODIZED									●						NOTE #1,11,15	STAIR B
B327		3'-0" x 7'-0"	F	HM		PAINT	HM-2	HM		PAINT						●			●						NOTE #9	MAIN COMP/EQUIP/NET. ROOM
B328		3'-0" x 7'-0"		HM		PAINT										●			●						NOTE #9	DISPATCH FLOOR AREA
B329		3'-0" x 7'-0"		WOOD		STAIN																				LOCKER ROOM
B330		3'-0" x 7'-0"																								DISPATCH MANAGER'S OFFICE
B331		3'-0" x 7'-0"																								LOUNGE/BREAK ROOM
B333		3'-0" x 7'-0"		HM		PAINT										●			●						NOTE #9	COMP. MAINTENANCE ROOM
B334		3'-0" x 7'-0"		WOOD		STAIN	HM-1																			EXERCISE ROOM
B335		3'-0" x 7'-0"																								VESTIBULE
B336		3'-0" x 7'-0"																								WOMEN'S SHOWERS/LOCKERS
B337		3'-0" x 7'-0"																								VESTIBULE
B338		3'-0" x 7'-0"																								VESTIBULE
B339		3'-0" x 7'-0"																								MEN'S SHOWERS/LOCKERS
B340		3'-0" x 7'-0"																								VESTIBULE
B341		3'-0" x 7'-0"																	●							COMMUNICATION
B342		3'-0" x 7'-0"																	●							ELECTRICAL
B343		3'-0" x 7'-0"																								FIRE RISER
B344		3'-0" x 7'-0"																								EMPLOYEE TOILET
B345		3'-0" x 7'-0"																								EMPLOYEE TOILET
B346		3'-0" x 7'-0"																								JANITOR
B401a		3'-0" x 7'-0"	F	HM		PAINT	HM-2	HM		PAINT																MECHANICAL
B401b	●	6'-0" x 7'-0"																				●				MECHANICAL
B401c	●	6'-0" x 7'-0"																				●				MECHANICAL
B402		3'-0" x 7'-0"			60 MIN				60 MIN															●		STAIR B

DOOR GENERAL NOTES

A. CAREFULLY FIELD MEASURE AND VERIFY ALL OPENINGS BEFORE ASSEMBLY OF PRODUCTS.
B. SEE DOOR ELEVATIONS AND DETAILS FOR THICKNESS, DIMENSIONS AND GENERAL CONSTRUCTION.
C. PAINT ALL TOPS AND BOTTOMS OF STEEL DOORS THAT ARE EXPOSED TO WEATHER.
D. PROVIDE FULL WIDTH MARBLE THRESHOLDS AT BATHROOM DOORS.
E. ALL HOLLOW METAL FRAMES ARE TO BE FIELD PAINTED. COLOR TO BE SELECTED.
F. ALL GLASS IN INTERIOR WALL FRAMING AND DOORS WILL BE TEMPERED GLASS.
G. REFER TO SPECIFICATIONS FOR DOOR HARDWARE.

DOOR REMARKS

1. SEE CURTAIN WALL/STOREFRONT MANUFACTURER FOR MANUFACTURER DETAILS.
2. DOOR TO HAVE ALARMED EXIT DEVICE W/ CARD READER OVERRIDE.
3. POCKET DOOR HARDWARE TO BE PROVIDED IN HARDWARE ALLOWANCE.
4. POWER ASSIST FOR EGRESS ONLY.
5. VAULT DOOR PER SECTION 083459.
6. AUTOMATIC SPRINKLERS SHALL BE INSTALLED ALONG BOTH SIDES OF THE OPENING, WITHIN 12" MAX OF THE WALL PLANE, AND SPACED AT INTERVALS NOT GREATER THAN 6'-0" O.C (IBC2012, SECTION 404.6, EXCEPTION #1)
7. POCKET DOOR TO HAVE LOCKING HARDWARE; KEYED ON BOTH SIDES; DOOR TO BE METAL.
8. OMITTED
9. DOOR AND FRAME TO PROVIDE LEVEL 3 SECURITY PROTECTION UTILIZING HEAVY GAUGE METAL COMPONENTS PER SECTION 081113.
10. ALL GLASS ENTRANCE MODEL NO. 51GSF BY OLDCASTLE OR EQUAL; RE: WINDOW SCHEDULE FOR ADDITIONAL INFORMATION.
11. ALL HARDWARE ON DOOR TO BE PROVIDED BY DOOR MFR EXCEPT CYLINDER LOCK. TYP.
12. PROVIDE FIRE DEPARTMENT KNOX BOX NEXT TO DOOR; COORDINATE DOOR HARDWARE.
13. HIGH SPEED ROLL-DOWN DOOR "ULTRA SECURE" BY ALBANY DOOR SYSTEMS OR EQUAL w/RFID/AVI READER AND AUTOMATIC OPENER.
14. OMITTED.
15. 1-HOUR FIRE RATED DOOR AND FRAME BY SAFTIFIRST OR EQUAL; RE: SECTION 088500.
16. SILL AT 6" A.F.F.; SEE BUILDING SECTIONS.

CITY OF HATTIESBURG MISSISSIPPI 1884

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

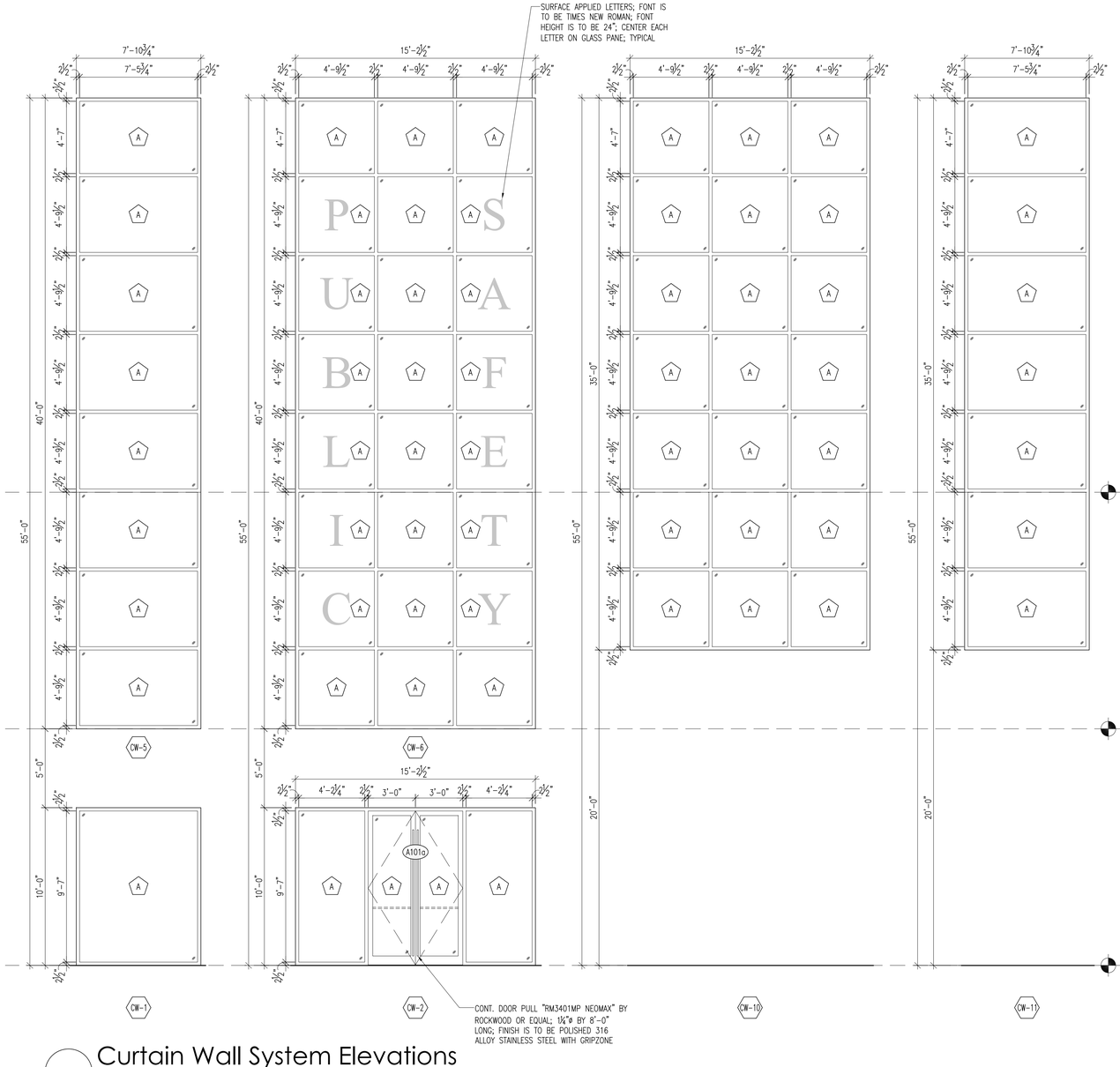
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Drawn By: CR,CP,AS,RB
Checked By: CR,LA,CP
Client No: ------
Albert & Associates: 12575

REGISTERED ARCHITECT Larry A. Albert Hattiesburg, MS STATE OF MISSISSIPPI

A8.1c



Curtain Wall System Elevations

SCALE: 1/4" = 1'-0"

Window Schedule

TAG	TYPE	# REQ.	SIZE (WxH)	HEAD	JAMB	SILL	#'D NOTES
CW-1	CW-A	1	SEE ELEVATION	------	------	------	NOTE(S): 1
CW-2	CW-A	1	SEE ELEVATION	------	------	------	NOTE(S): 1
CW-3	CW-A	1	SEE ELEVATION	------	------	------	NOTE(S): 1
CW-4	CW-A	1	SEE ELEVATION	------	------	------	NOTE(S): ------
CW-5	CW-A	1	SEE ELEVATION	------	------	------	NOTE(S): 1
CW-6	CW-A	1	SEE ELEVATION	------	------	------	NOTE(S): 1
CW-7	CW-A	1	SEE ELEVATION	------	------	------	NOTE(S): 1
CW-8	CW-A	1	SEE ELEVATION	------	------	------	NOTE(S): 1
CW-9	CW-A	1	SEE ELEVATION	------	------	------	NOTE(S): 1
CW-10	CW-A	1	SEE ELEVATION	------	------	------	NOTE(S): 1
CW-11	CW-A	1	SEE ELEVATION	------	------	------	NOTE(S): 1
CW-12	CW-B	1	SEE ELEVATION	------	------	------	NOTE(S): 1,4
CW-13	CW-B	1	SEE ELEVATION	------	------	------	NOTE(S): 1,4,5
CW-14	CW-C	1	SEE ELEVATION	------	------	------	NOTE(S): 1,4,5
CW-15	CW-C	1	SEE ELEVATION	------	------	------	NOTE(S): 1,3,4,5,6
CW-16	CW-A	1	SEE ELEVATION	------	------	------	NOTE(S): 1
CW-17	CW-A	1	SEE ELEVATION	------	------	------	NOTE(S): 1
CW-18	CW-A	1	SEE ELEVATION	------	------	------	NOTE(S): 1
CW-19	CW-A	1	SEE ELEVATION	------	------	------	NOTE(S): 1
CW-20	CW-A	1	SEE ELEVATION	------	------	------	NOTE(S): 1
CW-22	CW-A	1	SEE ELEVATION	------	------	------	NOTE(S): 1
CW-23	CW-A	1	SEE ELEVATION	------	------	------	NOTE(S): 1
CW-24	CW-D	1	SEE ELEVATION	------	------	------	NOTE(S): 1,4,6
CW-25	CW-D	1	SEE ELEVATION	------	------	------	NOTE(S): 1,4,6
CW-26	CW-D	1	SEE ELEVATION	------	------	------	NOTE(S): 1,4,6
CW-27	CW-D	1	SEE ELEVATION	------	------	------	NOTE(S): 1,4,6
CW-28a	CW-D	1	SEE ELEVATION	------	------	------	NOTE(S): 1,4,6
CW-29a	CW-D	1	SEE ELEVATION	------	------	------	NOTE(S): 1,4,6
CW-28b	CW-D	1	SEE ELEVATION	------	------	------	NOTE(S): 1,4,6
CW-29b	CW-D	1	SEE ELEVATION	------	------	------	NOTE(S): 1,4,6
SF-1	SF-B	1	SEE ELEVATION	------	------	------	NOTE(S): ------
SF-2	SF-B	1	SEE ELEVATION	------	------	------	NOTE(S): ------
SF-3	SF-B	1	SEE ELEVATION	------	------	------	NOTE(S): ------
SF-4	SF-B	1	SEE ELEVATION	------	------	------	NOTE(S): ------
SF-5	SF-B	1	SEE ELEVATION	------	------	------	NOTE(S): ------
SF-6	SF-B	1	SEE ELEVATION	------	------	------	NOTE(S): ------
SF-7	SF-A	2	SEE ELEVATION	------	------	------	NOTE(S): ------
SF-8	SF-A	17	SEE ELEVATION	------	------	------	NOTE(S): ------
SF-9	NOT USED						
SF-10	NOT USED						
SF-11	NOT USED						
SF-12	SF-D	1	SEE ELEVATION	------	------	------	NOTE(S): 7,8
SF-13	SF-C	1	SEE ELEVATION	------	------	------	NOTE(S): 6,8
SF-14	SF-C	1	SEE ELEVATION	------	------	------	NOTE(S): 6,8
SF-15	SF-C	1	SEE ELEVATION	------	------	------	NOTE(S): 6,8
SF-16	SF-C	1	SEE ELEVATION	------	------	------	NOTE(S): 6,8
SF-17	SF-C	1	SEE ELEVATION	------	------	------	NOTE(S): 6,8
SF-18	NOT USED		SEE ELEVATION				
SF-19	SF-C	1	SEE ELEVATION	------	------	------	NOTE(S): 6,8
SF-20	SF-C	1	SEE ELEVATION	------	------	------	NOTE(S): 6,8
SF-21	SF-B	1	SEE ELEVATION	------	------	------	NOTE(S): ------
SF-22	SF-E	1	SEE ELEVATION	------	------	------	NOTE(S): 1
SF-23	SF-A	2	SEE ELEVATION	------	------	------	NOTE(S): 1
SF-24	SF-A	1	SEE ELEVATION	------	------	------	NOTE(S): 1
SF-25	SF-A	14	SEE ELEVATION	------	------	------	NOTE(S): 1
SF-26	SF-A	1	SEE ELEVATION	------	------	------	NOTE(S): 1
SF-27	SF-A	1	SEE ELEVATION	------	------	------	NOTE(S): 1
SF-28	SF-A	1	SEE ELEVATION	------	------	------	NOTE(S): 1
SF-29	SF-A	1	SEE ELEVATION	------	------	------	NOTE(S): 1
SF-30	SF-A	1	SEE ELEVATION	------	------	------	NOTE(S): 1
SF-31	SF-C	1	SEE ELEVATION	------	------	------	NOTE(S): 6
SF-32	SF-C	1	SEE ELEVATION	------	------	------	NOTE(S): 6
SF-33	SF-C	1	SEE ELEVATION	------	------	------	NOTE(S): 6
SF-34	SF-B	1	SEE ELEVATION	------	------	------	NOTE(S): ------
SF-35	SF-C	1	SEE ELEVATION	------	------	------	NOTE(S): 6
SF-36	SF-C	1	SEE ELEVATION	------	------	------	NOTE(S): 6
SF-37	SF-B	1	SEE ELEVATION	------	------	------	NOTE(S): ------
SF-40	SF-B	1	SEE ELEVATION	------	------	------	NOTE(S): 9
FW-1	FW-A	1	SEE ELEVATION	------	------	------	NOTE(S): 2
FW-2	FW-A	1	SEE ELEVATION	------	------	------	NOTE(S): 2

NUMBERED WINDOW NOTES:

1. PROVIDE FLASHING @ HEAD, JAMBS, & SILL OF WINDOW.
2. FIRE-RESISTANCE RATED FRAME & GLAZING.
3. PROVIDE LEVEL 3 BULLET RESISTANT GLAZING MOUNTED BETWEEN VERTICAL CURTAIN WALL MULLIONS; MOUNT TO MULLIONS USING STAINLESS STEEL CHANNELS; LEAVE 2" GAP BETWEEN BOTTOM OF BULLET RESISTANT GLAZING AND TOP OF CURTAIN WALL SILL MULLION AND BETWEEN TOP OF BULLET RESISTANT GLAZING AND ADJACENT CEILING ELEVATION FOR AIR MOVEMENT BETWEEN EXTERIOR GLAZING AND BULLET RESISTANT GLAZING (PANELS WILL BE APPROXIMATELY 7'-8" TALL).
4. PROVIDE INTEGRATED ALUMINUM PARAPET CAP; CAP FINISH IS TO EXACTLY MATCH WINDOW SYSTEM FRAMING AND IS TO BE PROVIDED BY THE WINDOW SYSTEM MANUFACTURER.
5. GLAZING IS TO BE TRANSLUCENT FOR PRIVACY.
6. STRUCTURAL SILICON GLAZED WINDOW SYSTEM.
7. ALL GLASS WINDOW SYSTEM.
8. PROVIDE ¾" SURFACE APPLIED ETCHED SIGNAGE THREAD AS INDICATED ON WINDOW ELEVATIONS; ETCHED THREADS ARE TO ALIGN WITH WALL REVEALS.
9. STOREFRONT SYSTEM IS TO BE INSTALLED IN A HORIZONTAL ORIENTATION AS A INTERIOR CEILING; SEE REFLECTED CEILING PLANS.

Glass Schedule

- (A) 1" CLEAR INSULATED GLAZING [088000]
- (B) OMITTED
- (C) 1" TRANSLUCENT GLAZING [088000]
- (D) 1/4" CLEAR GLAZING [088000]
- (E) OMITTED
- (F) 3/4" CLEAR LAMINATED GLAZING [102215]
- (G) LEVEL 3 BULLET RESISTANT GLAZING [085500]
- (H) 1-HOUR FIRE RESISTIVE CLEAR GLAZING [088500]
- (J1) 1/4" TRANSLUCENT GLAZING [088000]
- (J2) 1/4" TRANSLUCENT LAMINATED GLAZING [088000]
- (K) OMITTED
- (L) 1/4" ONE-WAY REFLECTIVE GLAZING [088000]
- (M) 1/4" CLEAR LAMINATED SAFETY GLASS [088000]
- (N) 1/4" DETENTION GLAZING [088000]

Window Type Legend

CW-A 1600 WALL SERIES I BY KAWNEER OR EQUAL (EXTERIOR APPLICATION)
2½" SIGHT LINE; 7½" FRAME DEPTH; ANODIZED ALUMINUM FINISH
FRONT PLANE, OUTSIDE GLAZED

CW-B 1600 WALL SERIES I BY KAWNEER OR EQUAL (EXTERIOR APPLICATION)
2½" SIGHT LINE; 6" FRAME DEPTH; ANODIZED ALUMINUM FINISH
FRONT PLANE, OUTSIDE GLAZED
INTEGRATED ALUMINUM PARAPET CAP PROVIDED BY WINDOW MANUFACTURER

CW-C 1620 SSG CURTAIN WALL SYSTEM BY KAWNEER OR EQUAL (EXTERIOR APPLICATION)
2" SIGHT LINE; 6" FRAME DEPTH; ANODIZED ALUMINUM FINISH
FRONT PLANE, OUTSIDE GLAZED
INTEGRATED ALUMINUM PARAPET CAP PROVIDED BY WINDOW MANUFACTURER

CW-D 1620 SSG CURTAIN WALL SYSTEM BY KAWNEER OR EQUAL (EXTERIOR APPLICATION)
2" SIGHT LINE; 7½" FRAME DEPTH; ANODIZED ALUMINUM FINISH
FRONT PLANE, OUTSIDE GLAZED
INTEGRATED ALUMINUM PARAPET CAP PROVIDED BY WINDOW MANUFACTURER

SF-A TRIFAB VG 451 BY KAWNEER OR EQUAL (EXTERIOR APPLICATION)
2" SIGHT LINE; 4½" FRAME DEPTH; ANODIZED ALUMINUM FINISH
FRONT PLANE, OUTSIDE GLAZED

SF-B TRIFAB VG 450 BY KAWNEER OR EQUAL (INTERIOR APPLICATION)
1¾" SIGHT LINE; 4½" FRAME DEPTH; ANODIZED ALUMINUM FINISH
FRONT PLANE, OUTSIDE GLAZED

SF-C TRIFAB VG 450 SSG BY KAWNEER OR EQUAL (INTERIOR APPLICATION)
1¾" SIGHT LINE; 4½" FRAME DEPTH; ANODIZED ALUMINUM FINISH
FRONT PLANE, OUTSIDE GLAZED

SF-D ALL GLASS ENTRANCE MODEL NO. 51GSF BY OLDCASTLE OR EQUAL (INTERIOR APPLICATION)
¾" GLASS FOR VERTICAL GLASS PANELS AND DOORS; BOTTOM PATCH LOCK AT EACH DOOR; PATCH FITTINGS AT TOP AND BOTTOM PIVOT POINTS WITH CONCEALED FLOOR CLOSER

SF-E ENCORE BY KAWNEER OR EQUAL (EXTERIOR APPLICATION)
1¾" SIGHT LINE; 4½" FRAME DEPTH; ANODIZED ALUMINUM FINISH
FRONT PLANE, OUTSIDE GLAZED

FW-A GPX ARCHITECTURAL SERIES BY SAFTIFIRST OR EQUAL (INTERIOR APPLICATION)
2½" SIGHT LINE; 4" FRAME DEPTH; ANODIZED ALUMINUM FINISH; SUPERLITE II-XL GLAZING
60-MINUTE FRAME; 60-MINUTE DOOR; 60-MINUTE GLAZING

** SUBSTITUTIONS BY OTHER MANUFACTURERS ARE ACCEPTABLE AND MUST BE SUBMITTED TO ARCHITECT FOR APPROVAL. WINDOW SYSTEMS ARE TO BE INSTALLED PER MANUFACTURER'S RECOMMENDATIONS. ALL FRAME DEPTHS ARE TO BE VERIFIED BY WINDOW MANUFACTURER ENGINEER'S BASED ON LOADS PROVIDED IN STRUCTURAL DRAWINGS. CONTRACTOR SHALL PROVIDE ROUGH OPENINGS AS REQUIRED BY MANUFACTURER DOCUMENTATION. SUBMIT SHOP DRAWINGS OF ALL FRAMES FOR APPROVAL BY ARCHITECT.

CITY OF HATTIESBURG MISSISSIPPI 1884

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

Drawing Issued:

Date	Rev.	Description
08-31-2015		DD Check Set
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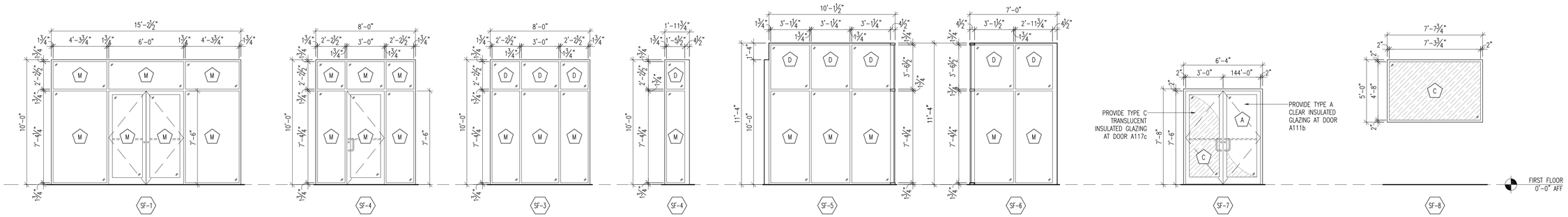
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Client No: ------
Albert & Associates: 12575

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A8.2

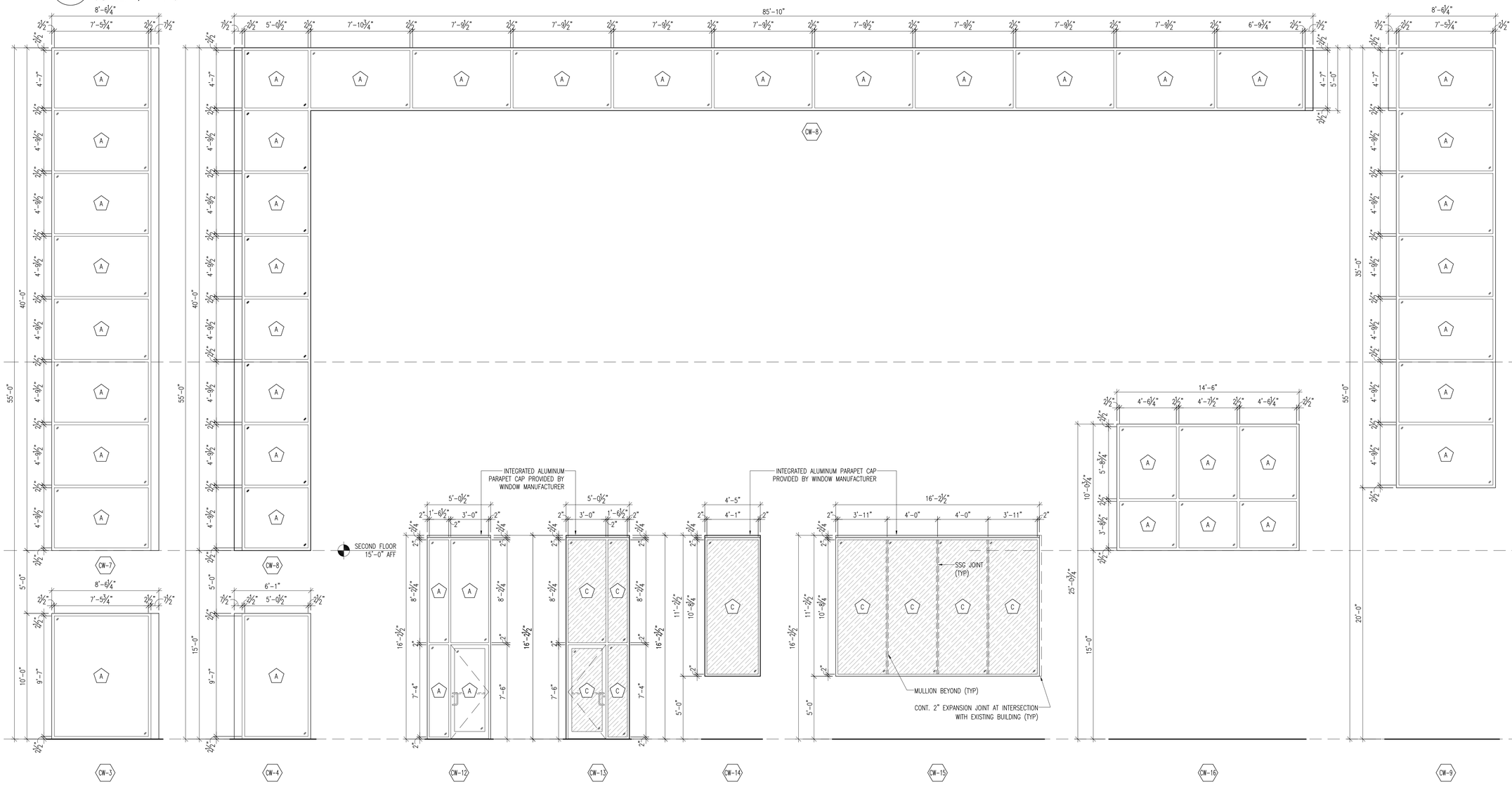
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Albert & McCleskey Associates Architects

WINDOW SCHEDULE & ELEVATIONS



Storefront System Elevations

SCALE: 1/4" = 1'-0"



Curtain Wall System Elevations

SCALE: 1/4" = 1'-0"

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

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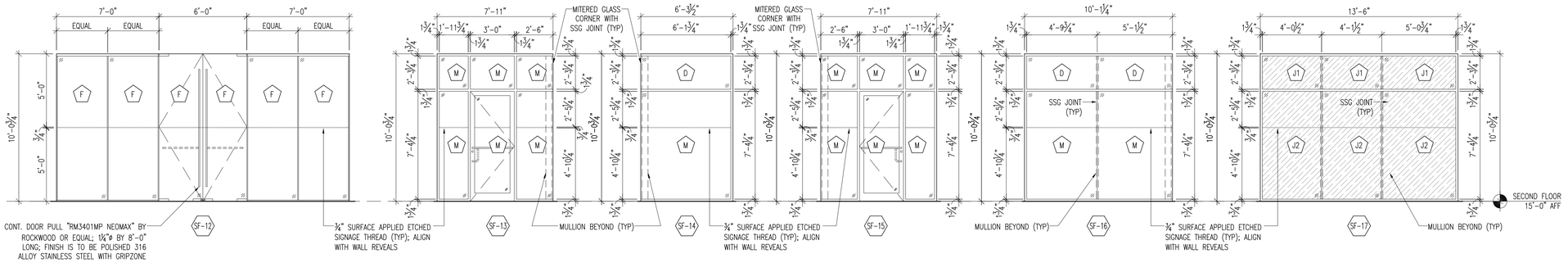
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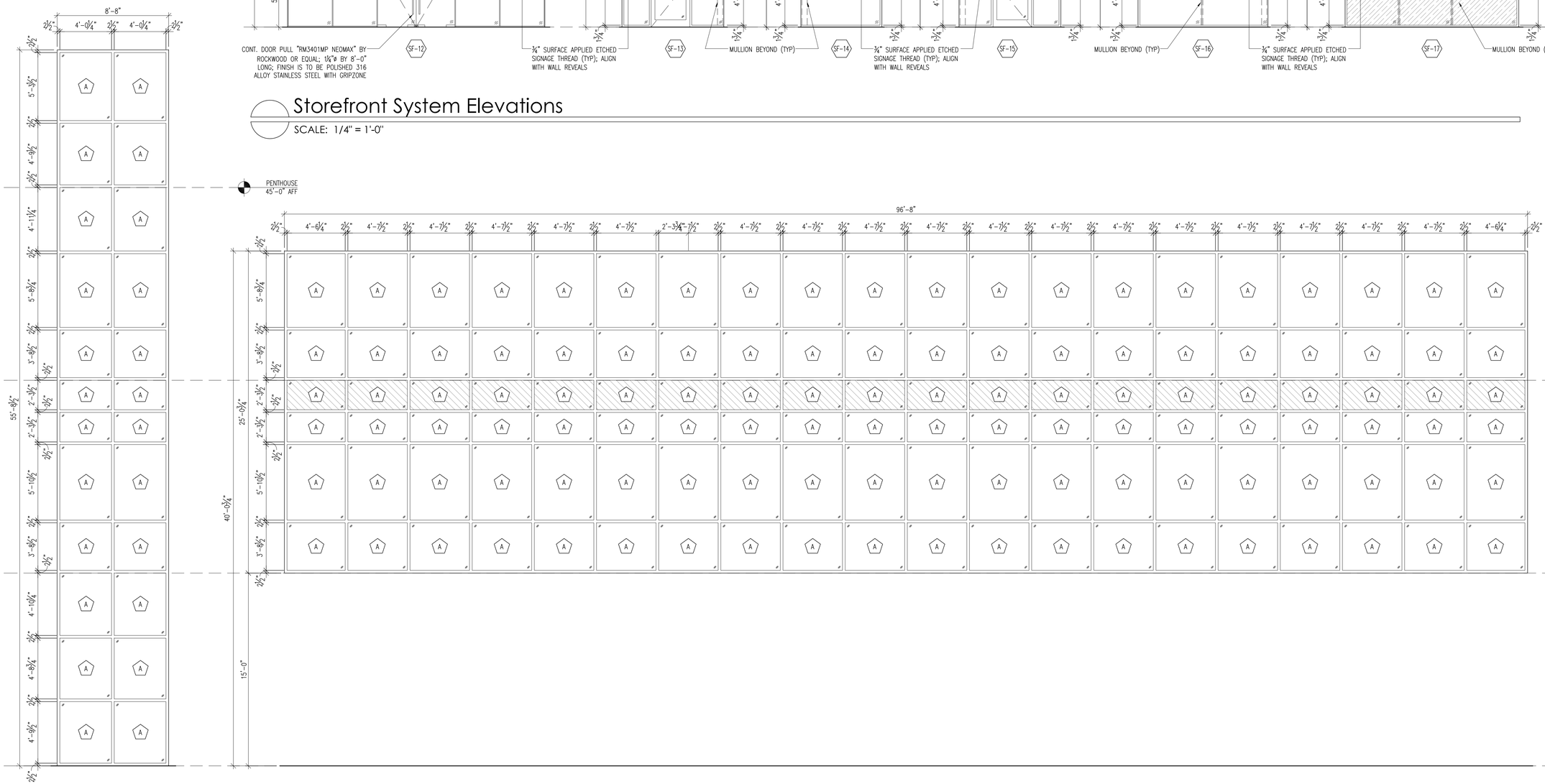
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Storefront System Elevations

SCALE: 1/4" = 1'-0"



Curtain Wall System Elevations

SCALE: 1/4" = 1'-0"

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

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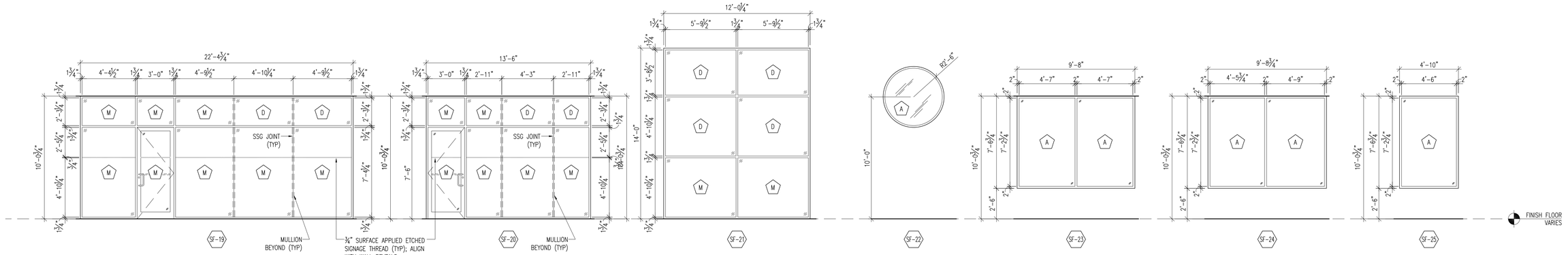
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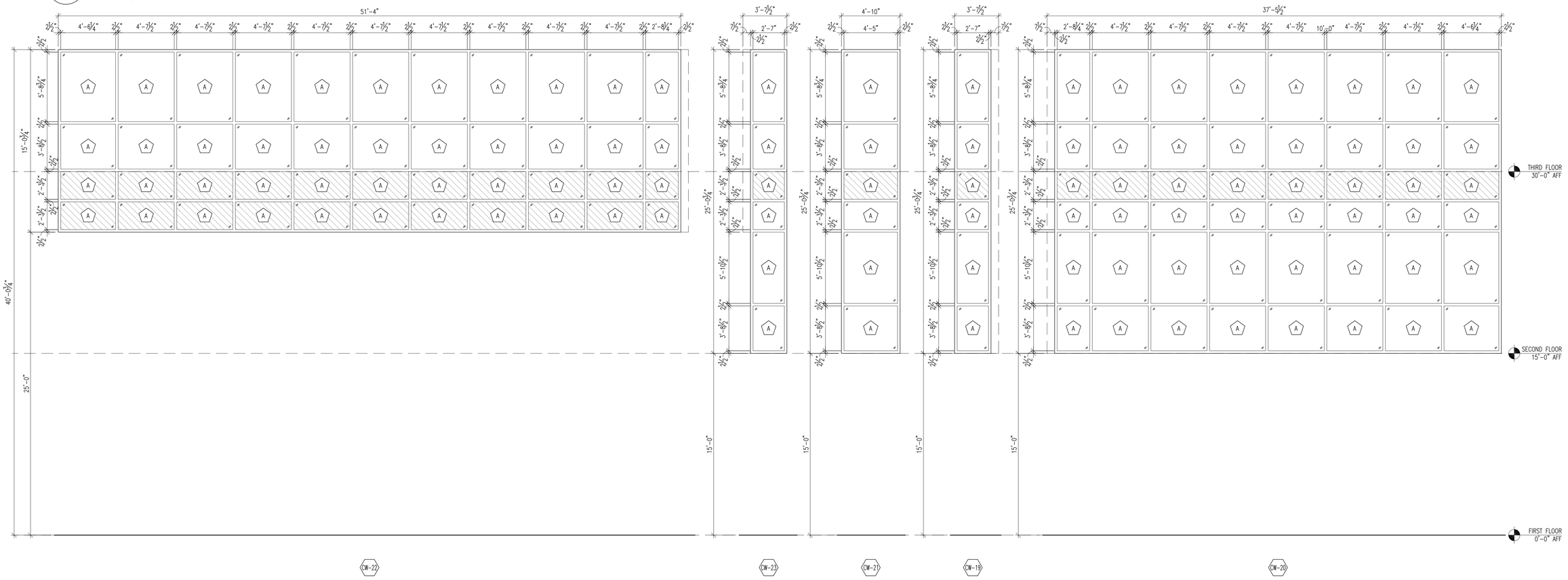
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Storefront System Elevations

SCALE: 1/4" = 1'-0"



Curtain Wall System Elevations

SCALE: 1/4" = 1'-0"

HATTIESBURG PUBLIC SAFETY COMPLEX

POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

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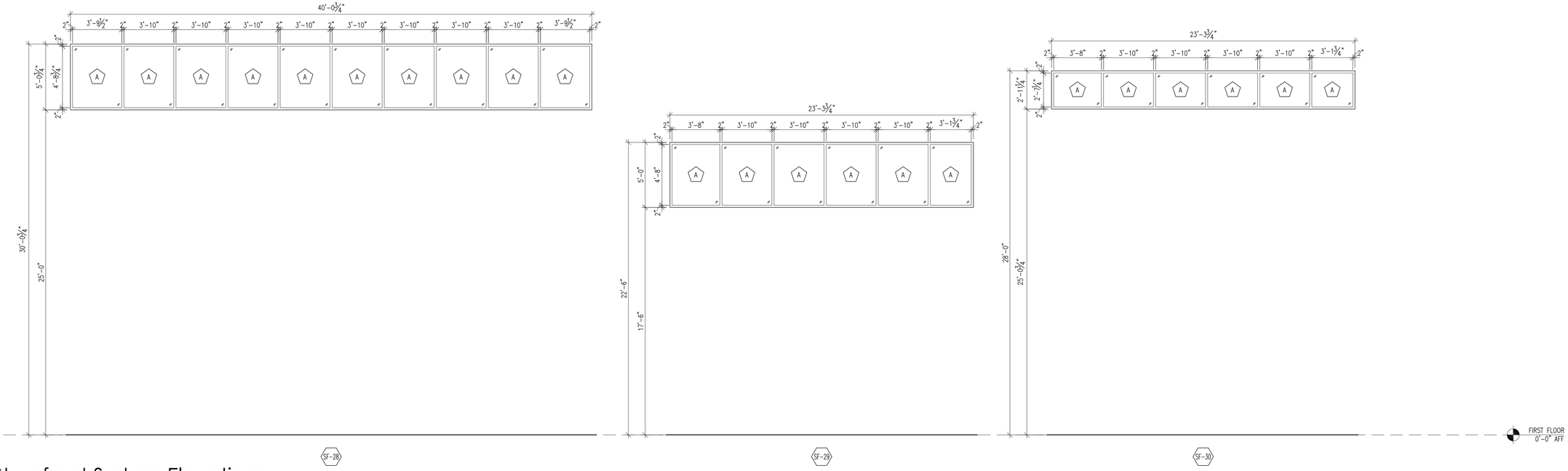
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Albert & Associates: 12575

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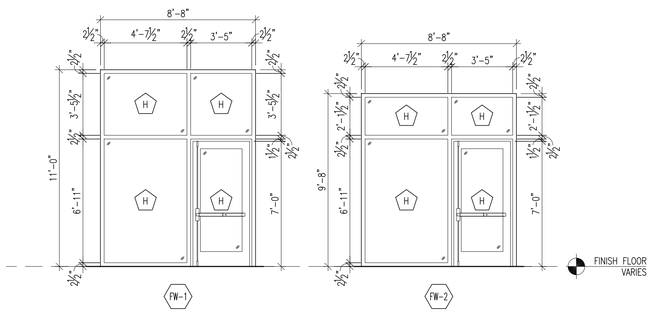
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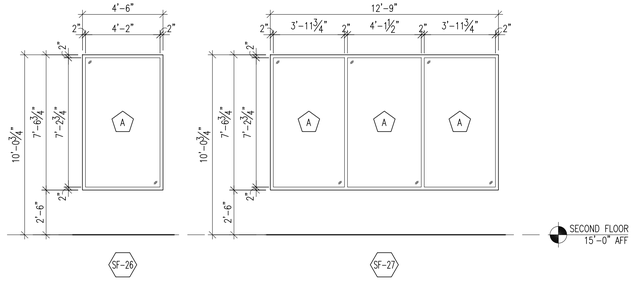
Storefront System Elevations

SCALE: 1/4" = 1'-0"



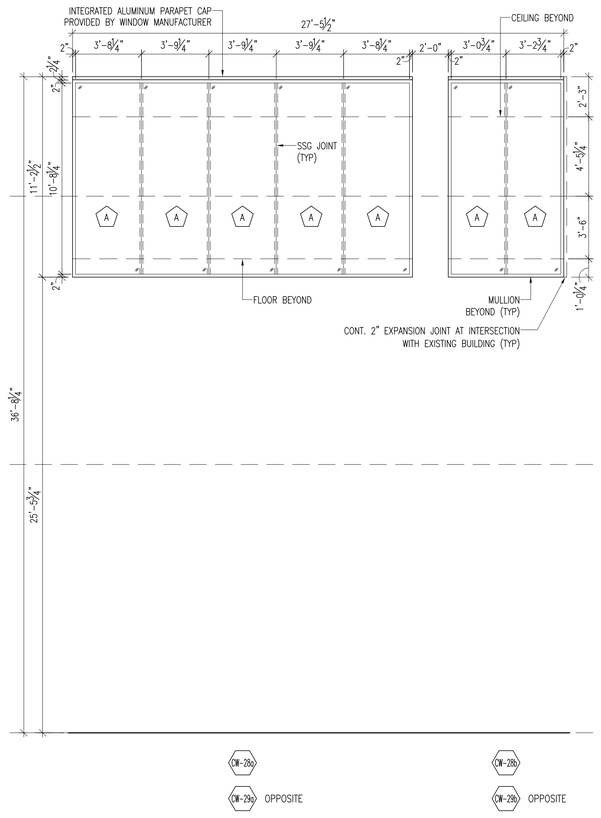
Fire Frame System Elevations

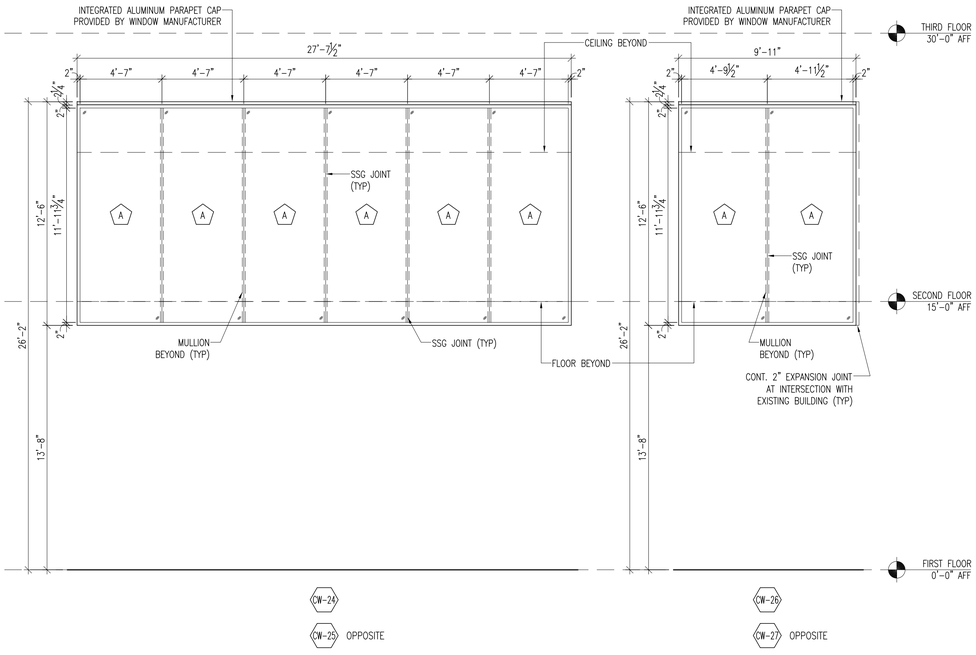
SCALE: 1/4" = 1'-0"



Storefront System Elevations

SCALE: 1/4" = 1'-0"





Curtain Wall System Elevations

SCALE: 1/4" = 1'-0"

CITY OF HATTIESBURG
MISSISSIPPI
1884

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

Drawing Issued:

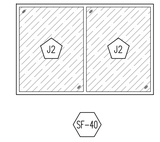
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REGISTERED ARCHITECT
Larry A. Albert
Hattiesburg, MS
STATE OF MISSISSIPPI

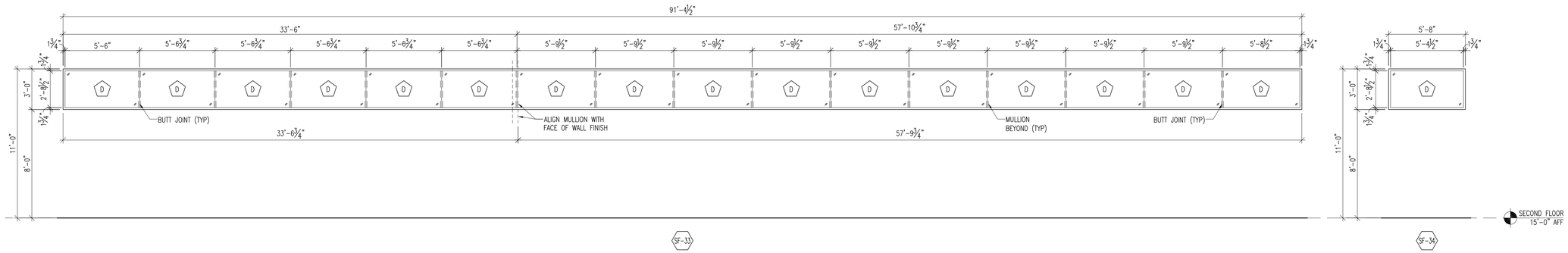
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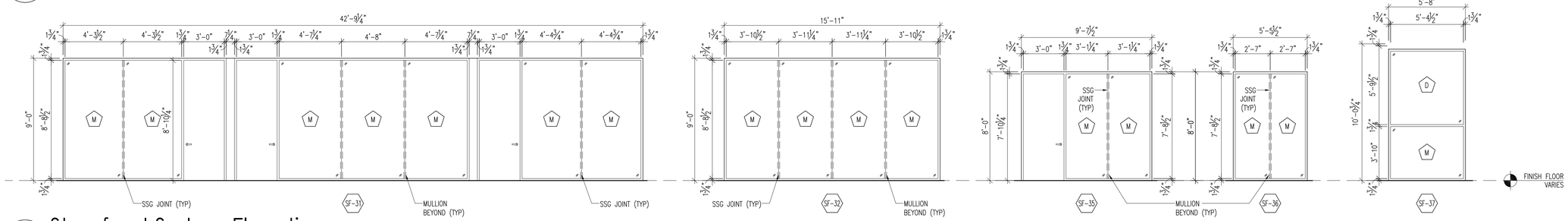
Storefront System Elevations

SCALE: 1/4" = 1'-0"



Storefront System Elevations

SCALE: 1/4" = 1'-0"



Storefront System Elevations

SCALE: 1/4" = 1'-0"

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

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Albert & Associates: 12575

REGISTERED ARCHITECT Larry M Albert Hattiesburg, MS STATE OF MISSISSIPPI

A8.7

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Room Finish Schedule

ROOM #	ROOM NAME	FLOORS	BASE	WALLS	CEILINGS	CEILING HGT	CABINETS	NOTE(S)
A101	VESTIBULE	RF-1,5	MTL-1	MLAM-1	PT-4	10'-0"	-----	NOTE(S): 1
A102	SECURITY QUEUE	RF-2	----	MLAM-1,PT-1	PT-4	VARIES	-----	NOTE(S): 2,9
A103	SECURITY	RF-3,4	MTL-1	PT-1	PT-4	12'-6"	QTZ-1,PLAM-4	NOTE(S): 1,4
A104	POLICE LOBBY	RF-1,2,4,5	MTL-1	VP-1,VP-2,PT-1,SWS-1,WD-11,WD-13	PT-4,LAT-7	VARIES	QTZ-1,MLAM-1	NOTE(S): 1,2,3,4,9,23
A105	RECEPTION	RF-1,5	MTL-1	VP-1,VP-2,PT-1,SWS-1,WD-11,WD-13	-----	VARIES	QTZ-1,WD-4,PLAM-5	NOTE(S): 1,2,4
A106	COURT LOBBY	RF-1,2,5	MTL-1	VP-1,VP-2,PT-1,SWS-1,WD-11,WD-13	PT-4,LAT-3,PLAM-3	VARIES	QTZ-1,MLAM-1	NOTE(S): 1,2,3,4,9,22
A107	VESTIBULE	RF-2	RB-3	PT-1	LAT-3	9'-0"	-----	NOTE(S): -----
A108	WOMEN	PCT-1	----	PCT-6	LAT-3	9'-0"	QTZ-1,PLAM-1	NOTE(S): 2,4
A109	MEN	PCT-1	----	PCT-6	LAT-3	9'-0"	QTZ-1,PLAM-1	NOTE(S): 2,4
A110	JANITOR	SC-1	RB-3	EPT-1	EPT-1	EXPOSED	-----	NOTE(S): 6,14
A111	COMMUNITY ROOM	VCT-1	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
A112	COMMUNICATIONS	SC-1	RB-3	PT-1	-----	9'-0"	-----	NOTE(S): -----
A113	KITCHEN	VCT-1	RB-3	PT-1	LAT-1	9'-0"	PLAM-1,PLAM-2	NOTE(S): 4
A114	STORAGE	SC-1	RB-3	PT-1	LAT-3	9'-0"	-----	NOTE(S): -----
A115	ELECTRICAL	SC-1	RB-3	PT-1	PT-4	EXPOSED	-----	NOTE(S): 14
A116	CORRIDOR	LVT-2	RB-3	PT-1	LAT-3	9'-0"	-----	NOTE(S): -----
A117	DEPUTY COURT CLERK AREA	CPT-2	RB-3	PT-1	LAT-3	VARIES	PLAM-1,PLAM-2	NOTE(S): 4,9
A118	COURT CLERK DESK	CPT-2	RB-3	PT-1	PT-4	10'-6"	QTZ-1,MLAM-1	NOTE(S): 2,4
A119	COURT BREAK ROOM	LVT-2	RB-3	PT-1	LAT-3	10'-0"	PLAM-1,PLAM-2	NOTE(S): 4
A120	WOMEN	PCT-1	PCTB-1	EPT-1	LAT-3	10'-0"	PLAM-1,PLAM-2	NOTE(S): 4,15
A121	MEN	PCT-1	PCTB-1	EPT-1	LAT-3	10'-0"	PLAM-1,PLAM-2	NOTE(S): 4,15
A122	FELONY/MISD CLERK OFFICE	CPT-2	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
A123	VESTIBULE	RF-5	RB-3	PT-1	PT-4	10'-0"	-----	NOTE(S): -----
A124	VESTIBULE	RF-5	RB-3	PT-1	WD-11,SF-40	15'-0"	-----	NOTE(S): 3,7,9
A125	VESTIBULE	RF-5	RB-3	PT-1	PT-4	10'-0"	-----	NOTE(S): -----
A126	COURTROOM	CPT-4	MTL-1	PT-1,WD-11	AP-1(PT-4),LAT-3	VARIES	QTZ-1,WD-4	NOTE(S): 2,3,4,9
A127	CORRIDOR	CPT-2	RB-3	PT-1	LAT-3	VARIES	-----	NOTE(S): 9
A128	CLERK MANAGER OFFICE	CPT-2	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
A129	COURT ACCOUNTING OFFICE	CPT-2	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
A130	OFFICE (ATTORNEY)	CPT-2	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
A131	COURT ACCOUNTING OFFICE	CPT-2	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
A132	CORRIDOR	CPT-2	RB-3	PT-1	LAT-3	8'-6"	-----	NOTE(S): -----
A133	COMMUNICATIONS	SC-1	RB-3	PT-1	PT-4	EXPOSED	-----	NOTE(S): 14
A134	COMMUNICATIONS	SC-1	RB-3	PT-1	PT-4	EXPOSED	-----	NOTE(S): 14
A135	CORRIDOR	CPT-2	RB-3	PT-1	LAT-3	8'-6"	-----	NOTE(S): -----
A136	CORRIDOR	CPT-2	RB-3	PT-1	LAT-3	8'-6"	-----	NOTE(S): -----
A137	CORRIDOR	CPT-2	RB-3	PT-1	LAT-3	8'-6"	-----	NOTE(S): -----
A138	COURT FILE ROOM/WORK AREA	LVT-2	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
A139	JUDGE'S CHAMBER	CPT-2	----	PT-1,WD-12	PT-4	VARIES	-----	NOTE(S): 2,3,4,9
A140	RESTROOM	PCT-1	PCTB-1	EPT-1	LAT-3	10'-0"	PLAM-1,PLAM-2	NOTE(S): 4,15
A141	CLOSET	CPT-2	RB-3	PT-1	LAT-3	8'-6"	-----	NOTE(S): -----
A142	MEETING ROOM	CPT-2	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
A143	ADMIN ASST OFFICE	CPT-2	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
A144	PROSECUTOR ATTORNEY OFFICE	CPT-2	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
A145	WARRANTS	CPT-2	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
A146	COMMUNITY SERVICE OFFICE	CPT-2	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
A147	CORRIDOR	LVT-2	RB-3	PT-1	LAT-3	8'-6"	-----	NOTE(S): -----
A148	CORRIDOR	CPT-1	RB-3	PT-1	LAT-3	8'-6"	-----	NOTE(S): -----
A149	RECORD CLERK AREA	CPT-1	RB-3	PT-1	LAT-3	9'-6"	-----	NOTE(S): -----
A150	FRONT DESK AREA	CPT-1	RB-3	PT-1	PT-4	9'-4"	QTZ-1,MLAM-1	NOTE(S): 2,4,9
A151	WORK AREA	CPT-1	RB-3	PT-1	LAT-3	9'-6"	PLAM-1,PLAM-2	NOTE(S): 4
A152	FINGERPRINT/ID ROOM	LVT-2	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
A153	RECORD CLERK MANAGER	CPT-1	RB-3	PT-1	LAT-3	9'-6"	-----	NOTE(S): -----
A154	TELESERVICE OFFICE	CPT-1	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
A155	PUBLIC INFO OFFICE	CPT-1	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
A156	CORRIDOR	CPT-1	RB-3	PT-1	LAT-3	8'-6"	-----	NOTE(S): -----
A157	NCIC	CPT-1	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
A158	ELECTRICAL	SC-1	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
A159	TELESERVICE OFFICE	CPT-1	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
A160	STORAGE/SUPPLY ROOM	SC-1	RB-3	PT-1	LAT-3	10'-0"	PLAM-1	NOTE(S): 4
A161	MEN	PCT-1	PCTB-1	EPT-1	LAT-3	10'-0"	PLAM-1,PLAM-2	NOTE(S): 4,15
A162	WOMEN	PCT-1	PCTB-1	PCT-1,EPT-1	LAT-3	10'-0"	PLAM-1,PLAM-2	NOTE(S): 2,4,16
A163	POLICE ACCOUNTING	CPT-1	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
A164	BREAKROOM	LVT-2	RB-3	PT-1	LAT-3	10'-0"	PLAM-1,PLAM-2	NOTE(S): 4
A165	VICTIM ADVOCATES OFFICE	CPT-1	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
A166	VICTIM ADVOCATES OFFICE	CPT-1	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
A167	PROBATION ROOM	CPT-1	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
A168	CORRIDOR	LVT-2	RB-3	PT-1	PT-4	13'-2"	-----	NOTE(S): 10
A169	CORRIDOR	LVT-2	RB-3	PT-1	PT-4	13'-2"	-----	NOTE(S): 10
A201	POLICE LOBBY	RF-2	MTL-1	VP-1,VP-2,PT-1,SWS-1,WD-11,WD-13	PT-4	VARIES	-----	NOTE(S): 2,3,4,9
A202	PRESS/BRIEFING ROOM	RF-2,WD-13	MTL-1	PT-1,WD-11	LAT-8,PLAM-3,PT-5	VARIES	WD-11	NOTE(S): 1,2,3,4,8,9
A301	POLICE LOBBY	RF-2,SGF-1	MTL-1	VP-1,VP-2,PT-1,SWS-1,WD-11,WD-13	LAT-3,LAT-7,PT-4	VARIES	-----	NOTE(S): 1,2,3,4,9
----	STAIR A	RF-2,TERR-3	----	----	------	VARIES	-----	NOTE(S): 18
----	ELEVATOR A	RF-1	BY ELEVATOR MANUFACTURER			8'-0"	-----	NOTE(S): -----

NUMBERED FINISH NOTES:

1. MULTIPLE FLOOR FINISHES ARE USED IN THIS SPACE; SEE FINISH FLOOR PLANS FOR PATTERNS AND LOCATIONS OF FINISHES.
2. MULTIPLE WALL FINISHES ARE USED IN THIS SPACE; SEE INTERIOR ELEVATIONS FOR PATTERNS AND LOCATIONS OF FINISHES (INCLUDING REVEALS WHERE APPLICABLE).
3. MULTIPLE CEILING FINISHES ARE USED IN THIS SPACE; SEE REFLECTED CEILING PLANS FOR PATTERNS AND LOCATIONS OF FINISHES.
4. THIS SPACE CONTAINS FINISHED MILLWORK; SEE INTERIOR ELEVATIONS AND MILLWORK DETAILS FOR WOOD FINISHES.
5. THERE ARE MULTIPLE TYPES OF FLOOR FINISHES AND RAILING TYPES AT SPANNING BRIDGE INCLUDING STRUCTURAL GLASS FLOORING AND LAMINATED GLASS RAILINGS; SEE INTERIOR ELEVATIONS AND FINISH FLOOR PLANS FOR LOCATIONS OF EACH.
6. PROVIDE PLEXIGLASS WALL COVERING TO A HEIGHT OF 4'-0" AFF AND HORIZONTALLY 4'-0" FROM THE EDGE OF THE NEAREST WATER SOURCE.
7. A PORTION OF THE CEILING IS STOREFRONT SYSTEM WITH TRANSLUCENT GLAZING; RE: WINDOW SCHEDULE AND ELEVATIONS.
8. PRESS BRIEFING ROOM HAS AN ELEVATED PRESENTATION STAGE AND PODIUM; SEE INTERIOR ELEVATIONS; WOOD FINISHES ARE TO MATCH WD-11.
9. MULTIPLE CEILING HEIGHTS EXIST IN THIS SPACE; SEE REFLECTED CEILING PLANS FOR HEIGHTS.
10. FLOOR LEVEL SLOPES DUE TO RAMP; CEILING HEIGHT IS MEASURED FROM FIRST FLOOR ELEVATION.
11. THIS SPACE CONTAINS POWDER COATED STEEL CASEWORK BY MOTT INDUSTRIES OR EQUAL; SEE INTERIOR ELEVATIONS; PROVIDE STAINLESS STEEL COUNTERTOPS.
12. NORTH WALL OF VESTIBULE SHALL BE EXPOSED CMU; PAINT TO MATCH ADJACENT GYPSUM BOARD.
13. PROVIDE EMBEDDED ALUMINUM STAIR NOSING BY BALCO OR EQUAL; TYPE T-213 IN 2 INCH WIDTH WITH TYPE 6 CAST-IN ANCHOR.
14. ALL EXPOSED STRUCTURE AT CEILING IS TO BE PAINTED.
15. SMOOTH, HARD, NONABSORBENT SURFACE NOT REQUIRED IN THIS RESTROOM AT SERVICE SINKS, URINALS, AND WATER CLOSETS PER IBC 2012, 1210.2.2, EXCEPTION #2.
16. SMOOTH, HARD, NONABSORBENT SURFACE REQUIRED AT ALL WALLS AND PARTITIONS WITHIN 2 FEET OF SERVICE SINKS, URINALS, AND WATER CLOSETS TO A HEIGHT NOT LESS THAN 48 INCHES ABOVE FLOOR PER IBC 2012, 1210.2.2.
17. SMOOTH, HARD, NONABSORBENT SURFACE REQUIRED AT ALL SHOWER COMPARTMENTS TO A HEIGHT NOT LESS THAN 70 INCHES ABOVE DRAIN INLET PER IBC 2012, 1210.3.
18. PROVIDE STAINLESS STEEL, SLIP-RESISTANT STAIR NOSING "TREP-E" BY SCHLUTER OR EQUAL; NOSING HEIGHT AT FINISH FLOOR EDGE IS TO BE 2MM (5/32") FOR ABUTMENT TO ADJACENT RUBBER FLOORING; SET NOSING IN A CONTINUOUS BED OF STRUCTURAL EPOXY ADHESIVE; PROVIDE END CAP ACCESSORIES AS REQUIRED; TYPICAL AT CAST-IN-PLACE CONCRETE PORTIONS OF STAIR A WITHIN THE POLICE LOBBY.
19. STEEL FLOOR GRATING IN THIS SPACE SERVES AS PART OF THE SMOKE EVACUATION SYSTEM; SEE BUILDING SECTIONS AND STRUCTURAL DRAWINGS FOR ADDITIONAL INFORMATION.
20. SEE INTERIOR ELEVATIONS FOR SURFACE MOUNTED MIRROR LOCATIONS.
21. LIGHT FIXTURES IN STAIR B ARE TO BE RECESSED LINEAR FIXTURES MOUNTED INTO THE SIDE WALLS; SEE INTERIOR ELEVATIONS AND ELECTRICAL DRAWINGS FOR ADDITIONAL INFORMATION.
22. THE EAST END OF THIS SPACE SERVES AS PART OF THE SMOKE EVACUATION SYSTEM; SEE INTERIOR ELEVATIONS AND REFLECTED CEILING PLANS FOR ADDITIONAL INFORMATION AND VENT LOCATIONS.
23. THE PERFORATED METAL CEILING SYSTEM IN THIS SPACE SERVES AS PART OF THE SMOKE EVACUATION SYSTEM; SEE INTERIOR ELEVATIONS AND REFLECTED CEILING PLANS FOR ADDITIONAL INFORMATION AND VENT LOCATIONS.

Finish Schedule Codes

FLOORING

PORCELAIN TILE
- PCT-1 — 12"x12" TILE PER SECTION 093000 - COLOR: AV203 PENNSYLVANIA BLUE UPS BLUESTONE SERIES BY CROSSVILLE OR EQUAL
- PCT-8 — 2"x2" MOSAIC TILE PER SECTION 09300 - COLOR: AV203 PENNSYLVANIA BLUE UPS WITH CROSS-SHEEN FINISH; BLUESTONE SERIES BY CROSSVILLE OR EQUAL

RUBBER FLOORING
- RF-1 — NORAPLAN SENTIKA - COLOR: 6522 EXPEDITION 3MM (DARK GREY) NORA SYSTEMS, INC. OR EQUAL
- RF-2 — NORAPLAN SENTIKA - COLOR: 6520 SNOW DAY 3MM (LIGHT GREY) NORA SYSTEMS INC. OR EQUAL
- RF-3 — NORAPLAN SENTIKA - COLOR: 6505 SILK 3MM (WHITE) NORA SYSTEMS INC. OR EQUAL
- RF-4 — NORAPLAN SENTIKA - COLOR: 6531 REGATTA 3MM (BLUE) NORA SYSTEMS INC. OR EQUAL
- RF-5 — NORAPLAN SENTIKA - COLOR: 6537 CAMP FIRE 3MM (BROWN) NORA SYSTEMS INC. OR EQUAL
- RF-6 — NORAMENT ROUND STAIRTREADS - COLOR: TBD NORA SYSTEMS INC. OR EQUAL
- RB-2 — 24"x24" ATHLETIC FLOORING - COLOR: JET BLUE 6MM REZTEC SERIES BY EXPANKO RESILIENT FLOORING OR EQUAL

LUXURY VINYL TILE
- LVT-1 — 4"x36" LUXURY VINYL FLOORING - COLOR: VERMONT CHERRY 3408 VENUE WOOD SERIES BY TANDUS CENTIVA OR EQUAL
- LVT-2 — 18"x18" LUXURY VINYL FLOORING - COLOR: NIMBUS SP113 OPUS SERIES BY KARNDEAN DESIGN FLOORING OR EQUAL

CARPET
- CPT-1 — 24x24 CARPET TILE PER SECTION 096813 - STYLE: T502 RESONATE; COLOR: 50208 AZORES; SPEAK COLLECTION BY MASLAND CONTRACT OR EQUAL
- CPT-2 — 24x24 CARPET TILE PER SECTION 096813 - STYLE: BRILLIANCE TILE 59259; COLOR: BLACK FOREST 29500; SHADE COLLECTION BY SHAW CONTRACT OR EQUAL
- CPT-3 — 24x24 CARPET TILE PER SECTION 096813 - STYLE: FORM 5T136; COLOR: CORNERSTONE COPPER 33555; NOBLE MATERIALS COLLECTION BY SHAW CONTRACT OR EQUAL
- CPT-4 — 12' ROLL CARPET - STYLE: TWINE 60748; COLOR: GOOD LIFE 50220 SILK COLLECTION BY SHAW CONTRACT OR EQUAL

SEALED CONCRETE
- SC-1 — SEALED CONCRETE SURFACE PER SECTION 099123 - COLOR: CLEAR H&C SOLVENT BASED STAIN BY SHERWIN WILLIAMS OR EQUAL; SUBMIT COLOR SAMPLES TO ARCHITECT FOR APPROVAL

ACCESS FLOORING
- AX-1 — 24"x24" ACCESS FLOORING PANELS PER SECTION 096900 - CONCORE 1250 BY TATE ACCESS FLOORS, INC.; PROVIDE RF-2 FINISH ON PANELS

STRUCTURAL GLASS FLOORING
- SGF-1 — 1" LAMINATED STRUCTURAL GLASS FLOORING SYSTEM WITH ALUMINUM SUPPORT BEAMS; SUBMIT COLORS AND FRIT PATTERNS FOR APPROVAL; GLASS WALK SG BY INNOVATIVE BUILDING PRODUCTS OR EQUAL

WALLS

PAINT
- VP-1 — FIELD COLOR - COLOR: COUNTERPOINT PFX-5205 (BLUE) ZOLATONE INTERIOR COATINGS OR EQUAL
- PT-1 — FIELD COLOR - COLOR: TBD, EGG SHELL SHERWIN-WILLIAMS OR EQUAL PER SECTION 099123
- PT-2 — ACCENT COLOR - COLOR: TBD, EGG SHELL SHERWIN-WILLIAMS OR EQUAL PER SECTION 099123
- PT-3 — TRIM COLOR - COLOR: TBD, GLOSS SHERWIN-WILLIAMS OR EQUAL PER SECTION 099123
- PT-4 — STANDARD WHITE, FLAT (CEILINGS) SHERWIN-WILLIAMS OR EQUAL PER SECTION 099123
- PT-5 — FIELD COLOR - COLOR: EXACTLY MATCHING EXTERIOR STUCCO, EGG SHELL SHERWIN-WILLIAMS OR EQUAL PER SECTION 099123
- EPT-1 — EPOXY - COLOR: TBD SHERWIN-WILLIAMS OR EQUAL PER SECTION 099123

CERAMIC TILE
- CT-2 — OMITTED

PORCELAIN TILE
- PCT-6 — 12"x12" TILE PER SECTION 09300 - COLOR: VS75 CADET WHITE POLISHED TO CEILING EMPIRE SERIES BY CROSSVILLE OR EQUAL

SCULPTED WALL SURFACE
- SWS-1 — ART DIFFUSION STYLE SOT002X4 - SANDED AND PRIMED; FIELD PAINT WITH PT-1; INTERLAM OR EQUAL

WOOD
- WD-11 — ¾" STAIN GRADE WOOD SHEATHING MILLWORK - COLOR: CHERRY (SHALL MATCH LVT-1 FLOORING); SUBMIT SAMPLES FOR APPROVAL
- WD-12 — STAIN GRADE WOOD WAINSCOTING - COLOR: CHERRY (SHALL MATCH LVT-1 FLOORING); SUBMIT SAMPLES FOR APPROVAL
- WD-13 — 1x6 STAIN GRADE TONGUE-AND-GROOVE WOOD PLANKS - COLOR: CHERRY (SHALL MATCH LVT-1 FLOORING); SUBMIT SAMPLES FOR APPROVAL

CEILINGS

ACOUSTIC TILE
- LAT-2 — 24"x24" MOISTURE RESISTANT LAY-IN ACOUSTICAL TILE PER SECTION 095100 - CERAMAGUARD 605 UNPERFORATED SQUARE EDGE W/ 15/16 PRELUDE SUSPENSION SYSTEM BY ARMSTRONG OR EQUAL
- LAT-3 — 24"x24" LAY-IN ACOUSTICAL TILE PER SECTION 095100 - DUNE 1775 BEVELED TEGULAR EDGE (24X24) W/ 9/16" SUPRAFINE SUSPENSION SYSTEM BY ARMSTRONG OR EQUAL
- LAT-6 — 22"x94"x2" VERTICAL ACOUSTICAL PANEL - SOUNDSCAPES BLADES 3923-WH W/ FOUR POINT HANGING KIT BY ARMSTRONG OR EQUAL
- LAT-7 — 24"x24"6%" PERFORATED ALUMINUM CEILING TILES - METALWORKS 6464-M2-WH MIRCROPERFORATED SQUARE TEGULAR EDGE W/ 9/16" SUPRAFINE SUSPENSION SYSTEM; NO ACOUSTICAL FLEECE REQUIRED; ARMSTRONG OR EQUAL
- LAT-8 — 24"x48" LAY-IN ACOUSTICAL TILE PER SECTION 095100 - DUNE 1777 BEVELED TEGULAR EDGE W/ 9/16" SUPRAFINE SUSPENSION SYSTEM BY ARMSTRONG OR EQUAL

ACOUSTICAL PLASTER
- AP-1 — 1½" ACOUSTICAL PLASTER ASSEMBLY - BASWAPHON SOUND ABSORBING PLASTER SYSTEM BY BASWA ACOUSTIC NORTH AMERICA, LLC OR EQUAL

PAINT
- PT-4 — FIELD COLOR - COLOR: WHITE, FLAT SHERWIN-WILLIAMS OR EQUAL PER SECTION 099123
- PT-5 — FIELD COLOR - COLOR: BLACK, FLAT SHERWIN-WILLIAMS OR EQUAL PER SECTION 099123

CERAMIC TILE
- CT-2 — SEE CT-2 UNDER WALL TILE

BASE

PORCELAIN TILE BASE
- PCTB-1 — 4x12 BULLNOSE COVE BASE TO CORRESPOND WITH PCT-1. SEE FLOOR TILE.

METAL
- MTL-1 — 4" REVEAL BASE - COLOR: BLACK; DRMB-625-400 BY FRY REGLET OR EQUAL

RUBBER BASE
- RB-3 — 4" RUBBER BASE - COLOR: 078 UMBER FLEXCO OR EQUAL
- RB-4 — 4" RUBBER BASE - COLOR: 067 TRUE BLUE FLEXCO OR EQUAL (TO BE USED WITH RB-2)

MISCELLANEOUS

- QTZ-1 — QUARTZ COUNTERTOP PER SECTION 123600 - MYSTIC BLUE CT407 HANSTONE OR EQUAL
- SS-1 — STAINLESS STEEL COUNTERTOP BY SECTION 123600
- SOS-1 — SOLID SURFACE COUNTERTOP BY SECTION 123600 COLOR: AS SELECTED - MATTE FINISH CORIAN BY DUPONT OR EQUAL
- PLAM-1 — PLASTIC LAMINATE CABINET FACING SURFACES BY SECTION 064100 COLOR: AS SELECTED - MATTE FINISH BY WILSONART OR EQUAL
- PLAM-2 — PLASTIC LAMINATE COUNTERTOP SURFACES BY SECTION 064100 COLOR: AS SELECTED - MATTE FINISH BY WILSONART OR EQUAL
- PLAM-3 — PLASTIC LAMINATE WALL FACING SURFACES BY SECTION 064100 COLOR: DESIGNER WHITE D354K-01 W/ GLOSS FINISH BY WILSONART OR EQUAL
- PLAM-4 — PLASTIC LAMINATE CABINET FACING SURFACES BY SECTION 064100 COLOR: DOVE GREY D92-60 (SOLID GRAY) - MATTE FINISH BY WILSONART OR EQUAL
- PLAM-5 — PLASTIC LAMINATE CABINET FACING SURFACES BY SECTION 064100 COLOR: COFFEE BEAN D485-60 (SOLID BROWN) - MATTE FINISH BY WILSONART OR EQUAL
- MLAM-1 — METAL LAMINATE - COLOR: MATTE NATURAL ALUMINUM #6252(419); WILSONART OR EQUAL
- MLAM-2 — METAL LAMINATE - COLOR: SATIN BRUSHED GOLD ALUMINUM #6258(419); WILSONART OR EQUAL
- WD-4 — STAIN GRADE WOOD CABINETS - COLOR: CHERRY (SHALL MATCH LVT-1 FLOORING); SUBMIT SAMPLES FOR APPROVAL
- GL-3 — ¾" CLEAR LAMINATED GLASS RAILING WITH 316 STAINLESS STEEL STANDOFFS FOR MOUNTING TO STEEL SUPPORT STRUCTURE; C.R. LAWRENCE CO. OR EQUAL
- GL-4 — ¾" CLEAR LAMINATED GLASS RAILING WITH EMBED SHOE MOUNT FOR FOR CONCRETE SUBTRATES; C.R. LAWRENCE CO. OR EQUAL
- TERR-3 — 1½" PRECAST TERRAZZO STAIR TREADS; SUBMIT COLOR SAMPLES FOR APPROVAL

Finish Sched. Gen. Notes

1. CONTRACTOR TO CONSULT ARCHITECT IMMEDIATELY IF DISCREPANCIES ARE FOUND BETWEEN ARCHITECTURAL AND ENGINEERING DRAWINGS.
2. ALL ANGLES ARE 90° OR 45° UNLESS DIMENSIONED OTHERWISE.
3. SEE A2.x SHEETS FOR FLOOR PLANS.
4. SEE A3.x SHEETS FOR ROOF PLANS.
5. SEE A4.X SHEETS FOR REFLECTED CEILING PLANS.
6. SEE A5.x SHEETS FOR EXTERIOR ELEVATIONS.
7. SEE A6.x SHEETS FOR BUILDING SECTIONS.
8. SEE A8.x SHEETS FOR DOOR SCHEDULE/FRAME ELEVATIONS AND WINDOW SCHEDULE/WINDOW ELEVATIONS.
9. SEE A9.x SHEETS FOR FINISH SCHEDULE AND FINISH FLOOR PLANS.
10. SEE A10.x SHEETS FOR INTERIOR ELEVATIONS.
11. SEE A11.x SHEETS FOR VERTICAL CIRCULATION.

General Finish Notes

1. ALL FLOORS TO BE PROPERLY PREPPED AND FLOATED AS NECESSARY.
2. ALL EXPOSED LOUVERS, REGISTERS, VENTS, ETC. ARE TO BE PAINTED TO MATCH SURROUNDING CONDITIONS.
3. AT ALL FLOORING PRODUCT TRANSITIONS, PROVIDE NECESSARY ACCESSIBLE TRANSITION MATERIALS. RE: SHEET A9.0c FOR THRESHOLD/FLOORING TRANSITION DETAILS.
4. ALL PORCELAIN TILE FLOORING TO MEET OR EXCEED STATIC COEFFICIENT OF FRICTION (SLIP RESISTANCE) A.D.A. STANDARD OF 0.60 FOR ACCESSIBLE ROUTES.
5. APPLY THOROUGH WATERPROOFING MASTIC BEHIND ALL WALL TILE, FLOOR TILE, AND CURB TILE IN RESTROOMS.
6. ALL EXPOSED STEEL COLUMNS, BEAMS, TRUSSES, JOISTS, DECKING, ETC. IS TO BE PRIMED AND PAINTED PER SECTION 9 SPECIFICATIONS.
7. SUBMIT COLOR SAMPLES FOR ALL PRODUCTS TO ARCHITECT FOR APPROVAL.

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

Drawing Issued:

Date	Rev.	Description
08-31-2015		DD Check Set
10-20-2015		75% Progress Set
11-02-2015		90% Pricing Set
11-19-2018		100% Bid Docs

Drawn By: CR,CP,AS,RB
Checked By: CR,LA,CP
Client No: -----
Albert & Associates: 12575

REGISTERED ARCHITECT Larry A. Albert Jr. Hattiesburg, MS STATE OF MISSISSIPPI

A9.0a

Room Finish Schedule

ROOM #	ROOM NAME	FLOORS	BASE	WALLS	CEILINGS	CEILING HGT	CABINETS	NOTE(S)
B101	CORRIDOR	SC-1	RB-3	EPT-1	LAT-3	8'-0"	-----	NOTE(S): -----
B102	FIRE RISER	SC-1	----	EPT-1	-----	10'-0"	-----	NOTE(S): -----
B103	STAIR	SC-1	RB-3	EPT-1	LAT-3	8'-0"	-----	NOTE(S): 13
B104	WEAPONS VAULT	SC-1	----	EPT-1	EPT-1	EXPOSED	-----	NOTE(S): 14
B105	SPECIAL OPS EQUIPMENT	SC-1	----	EPT-1	EPT-1	EXPOSED	-----	NOTE(S): 14
B106	ELECTRICAL ROOM	SC-1	----	EPT-1	EPT-1	EXPOSED	-----	NOTE(S): 14
B201	INVESTIGATIONS LOBBY	CPT-1	RB-3	PT-1	LAT-3,PT-4	VARIES	PLAM-1	NOTE(S): 3,4,9
B202	ADMIN ASST OFFICE	CPT-1	RB-3	PT-1	LAT-3	10'-0"	PLAM-1	NOTE(S): 4
B203	WORK AREA	CPT-1	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B204	CORRIDOR	CPT-1	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B205	CONFERENCE ROOM	CPT-1	RB-3	PT-1	LAT-3	10'-0"	PLAM-1,PLAM-2	NOTE(S): 4
B206	ADMIN ASSISTANT'S OFFICE	CPT-1	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B207	DOMESTIC VIOLENCE OFFICE	CPT-1	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B208	DOMESTIC VIOLENCE OFFICE	CPT-1	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B209	DOMESTIC VIOLENCE OFFICE	CPT-1	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B210	DOMESTIC VIOLENCE OFFICE	CPT-1	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B211	SECURED RECORDS	LVT-2	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B212	BREAK ROOM	LVT-2	RB-3	PT-1	LAT-3	10'-0"	PLAM-1,PLAM-2	NOTE(S): 4
B213	EMPLOYEE TOILET	PCT-1	PCTB-1	EPT-1	LAT-3	10'-0"	PLAM-1,PLAM-2	NOTE(S): 4,15
B214	EMPLOYEE TOILET	PCT-1	PCTB-1	EPT-1	LAT-3	10'-0"	PLAM-1,PLAM-2	NOTE(S): 4,15
B215	CORRIDOR	LVT-2	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B216	FUTURE OFFICE	CPT-1	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B217	FUTURE OFFICE	CPT-1	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B218	STORAGE ROOM	SC-1	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B219	ELECTRICAL	SC-1	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B220	CAPT OFICE	CPT-1	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B221	LT OFICE	CPT-1	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B222	PALS COORDINATOR OFFICE	CPT-1	RB-3	PT-1	LAT-3	10'-0"	PLAM-1	NOTE(S): 4
B223	WAITING	CPT-1	RB-3	PT-1	LAT-3,PT-4	VARIES	PLAM-1	NOTE(S): 4
B224	SMALL MEETING ROOM	CPT-1	RB-3	PT-1	LAT-8,PT-4	VARIES	PLAM-1,PLAM-2	NOTE(S): 2,3,4,9
B225	CUBICLES	CPT-1	RB-3	PT-1	LAT-3,LAT-8,PT-4	VARIES	-----	NOTE(S): 3,9
B226	CORRIDOR	LVT-2	RB-3	PT-1	LAT-3,PT-4	VARIES	-----	NOTE(S): 3,9
B227	CORRIDOR	LVT-2	RB-3	PT-1	LAT-8,PT-4	VARIES	-----	NOTE(S): 3,9
B228	CORRIDOR	LVT-2	RB-3	PT-1	LAT-3,PT-4	VARIES	-----	NOTE(S): 3,9
B229	CRIME ANALYSIS	CPT-1	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B230	DETECTIVE'S CUBICLES	CPT-1	RB-3	PT-1	LAT-3,LAT-8,PT-4	VARIES	-----	NOTE(S): 3,9
B231	SGT OFFICE	CPT-1	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B232	CAPT OFFICE	CPT-1	RB-3	PT-1	LAT-3,PT-4	VARIES	-----	NOTE(S): 3,9
B233	LT OFFICE	CPT-1	RB-3	PT-1	LAT-3,PT-4	VARIES	-----	NOTE(S): 3,9
B234	DETECTIVES BREAK ROOM	LVT-2	RB-3	PT-1	LAT-3	10'-0"	PLAM-1,PLAM-2	NOTE(S): 4
B235	EMPLOYEE TOILET	PCT-1	PCTB-1	EPT-1	LAT-3	9'-0"	PLAM-1,PLAM-2	NOTE(S): 4,15
B236	EMPLOYEE TOILET	PCT-1	PCTB-1	EPT-1	LAT-3	9'-0"	PLAM-1,PLAM-2	NOTE(S): 4,15
B237	CORRIDOR	LVT-2	RB-3	PT-1	LAT-3	9'-0"	-----	NOTE(S): -----
B238	CRIME SCENE LABORATORY	LVT-2	RB-3	EPT-1	LAT-3	9'-0"	METAL CASEWORK,SS-1	NOTE(S): 11
B239	CRIME SCENE UNIT	CPT-1	RB-3	PT-1	LAT-3,LAT-8,PT-4	VARIES	-----	NOTE(S): 3,9
B240	TEMPORARY EVIDENCE STORAGE	LVT-2	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B241	EVIDENCE SUPERVISOR/OFFICE	LVT-2	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B242	SECURE EVIDENCE STORAGE	SC-1	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B243	STORAGE DISPOSAL	SC-1	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B244	REFRIGERATED STORAGE	SC-1	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B245	SECURE VALUABLES STORAGE	SC-1	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B246	SECURE WEAPONS STORAGE	SC-1	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B247	SECURE NARCOTICS STORAGE	SC-1	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B248	ELECTRICAL	SC-1	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B249a	COMMUNICATION	SC-1	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B249b	COMMUNICATION	SC-1	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B250	FIRE RISER	SC-1	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B251	INTERNAL AFFAIRS	CPT-1	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B252	FILES/STORAGE	LVT-2	RB-3	PT-1	LAT-3	10'-0"	PLAM-1	NOTE(S): 4
B253	BREAKROOM	LVT-2	RB-3	PT-1	LAT-3	10'-0"	PLAM-1,PLAM-2	NOTE(S): 4
B254	CORRIDOR	CPT-1	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B255	SMALL INTERVIEW ROOM	CPT-1	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B256	SMALL INTERVIEW ROOM	CPT-1	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B257	WORK ROOM	LVT-2	RB-3	PT-1	LAT-3	10'-0"	PLAM-1,PLAM-2	NOTE(S): 4
B258	MECH SPACE	METAL GRATE	----	EPT-1	EPT-1	EXPOSED	-----	NOTE(S): 14,19
B259	JANITOR'S CLOSET	SC-1	RB-3	EPT-1	EPT-1	EXPOSED	-----	NOTE(S): 6,14

Room Finish Schedule

ROOM #	ROOM NAME	FLOORS	BASE	WALLS	CEILINGS	CEILING HGT	CABINETS	NOTE(S)
B301	ADMINISTRATIVE ASSISTANTS	CPT-3	RB-3	PT-1	LAT-3,PT-4	VARIES	-----	NOTE(S): 3,9
B302	SUPPLY ROOM	CPT-3	RB-3	PT-1	LAT-3	9'-0"	-----	NOTE(S): -----
B303	WORK ROOM/MAIL	CPT-3	RB-3	PT-1	LAT-3	9'-0"	PLAM-1,PLAM-2	NOTE(S): 4
B304	CONFERENCE ROOM	LVT-1	WD-12	PT-1,WD-12	LAT-3,PT-4	VARIES	-----	NOTE(S): 2,3,4,9
B305	BREAK ROOM	LVT-2	RB-3	PT-1	LAT-3	10'-0"	PLAM-1,PLAM-2	NOTE(S): 4
B306	WOMEN'S RESTROOM	PCT-1, PCT-8	PCTB-1	EPT-1,PCT-1	LAT-3,EPT-1	VARIES	PLAM-1,PLAM-2	NOTE(S): 1,2,3,4,9,15,17
B307	MEN'S RESTROOM	PCT-1, PCT-8	PCTB-1	EPT-1,PCT-1	LAT-3,EPT-1	VARIES	PLAM-1,PLAM-2	NOTE(S): 1,2,3,4,9,16,17
B308	CORRIDOR	CPT-3	RB-3	PT-1	LAT-3	9'-0"	-----	NOTE(S): -----
B309	CORRIDOR	CPT-3	RB-3	PT-1	LAT-3	9'-0"	-----	NOTE(S): -----
B310	POLICE CHIEF OFFICE	CPT-3	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B311	EMPLOYEE TOILET	PCT-1	PCTB-1	EPT-1	LAT-3	10'-0"	PLAM-1,PLAM-2	NOTE(S): 4,15
B312	CLOSET	CPT-3	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B313	CLOSET	CPT-3	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B314	EMPLOYEE TOILET	PCT-1	PCTB-1	EPT-1	LAT-3	10'-0"	PLAM-1,PLAM-2	NOTE(S): 4,15
B315	ASST POLICE CHIEF OFFICE	CPT-3	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B316	OPER BUREAU OFFICE	CPT-3	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B317	DIR SUPPORT BUREAU OFFICE	CPT-3	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B318	CPT OF ADMIN OFFICE	CPT-3	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B319	FUTURE OFFICE	CPT-3	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B320	FUTURE OFFICE	CPT-3	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B321	CORRIDOR	LVT-2	RB-3	PT-1	LAT-8,PT-4	VARIES	-----	NOTE(S): 3,9
B322	ELECTRICAL	SC-1	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B323	STORAGE ROOM	SC-1	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B324	GRANT COORDINATOR OFFICE	CPT-3	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B325	COMMUNITY DEV. SPECIALIST	CPT-3	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B326	CORRIDOR	LVT-2,RF-6	RB-3	PT-1	LAT-3,PT-4	VARIES	-----	NOTE(S): 1,3,9
B327	MAIN COMPUTER/EQUIP/NETWORKING RM	AX-1,RF-2	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): 1
B328	DISPATCH FLOOR AREA	AX-1	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B329	LOCKER ROOM	LVT-2	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B330	DISPATCH MANAGER'S OFFICE	CPT-3	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B331	LOUNGE/BREAK ROOM	LVT-2	RB-3	PT-1	LAT-3	10'-0"	PLAM-1,PLAM-2	NOTE(S): 4
B332	CORRIDOR	LVT-2	RB-3	PT-1	LAT-3,PT-4	VARIES	-----	NOTE(S): 3,9
B333	COMPUTER MAINTENANCE ROOM	AX-1,RF-2	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): 1
B334	EXERCISE ROOM	RB-2	RB-4	PT-1	LAT-3,LAT-8,PT-4	VARIES	-----	NOTE(S): 3,9,20
B335	SPACE OMITTED							
B336	WOMEN'S SHOWERS/LOCKERS	PCT-1,PCT-8	PCTB-1	PCT-1,EPT-1	LAT-2,LAT-3,EPT-1	VARIES	PLAM-1,PLAM-2	NOTE(S): 1,2,3,4,9,16,17
B337	VESTIBULE	PCT-1	PCTB-1	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B338	VESTIBULE	PCT-1	PCTB-1	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B339	MEN'S SHOWERS/LOCKERS	PCT-1,PCT-8	PCTB-1	PCT-1,EPT-1	LAT-2,LAT-3,EPT-1	VARIES	PLAM-1,PLAM-2	NOTE(S): 1,2,3,4,9,16,17
B340	VESTIBULE	PCT-1	PCTB-1	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B341	COMMUNICATION	SC-1	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B342	ELECTRICAL	SC-1	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B343	FIRE RISER	SC-1	RB-3	PT-1	LAT-3	10'-0"	-----	NOTE(S): -----
B344	EMPLOYEE TOILET	PCT-1	PCTB-1	EPT-1	LAT-3	10'-0"	PLAM-1,PLAM-2	NOTE(S): 4,15
B345	EMPLOYEE TOILET	PCT-1	PCTB-1	EPT-1	LAT-3	10'-0"	PLAM-1,PLAM-2	NOTE(S): 4,15
B346	JANITOR'S CLOSET	SC-1	RB-3	EPT-1	LAT-3	10'-0"	-----	NOTE(S): 6
B401	MECHANICAL	SC-1	----	EPT-1	EPT-1	VARIES	EXPOSED	NOTE(S): 14
B402	VESTIBULE	SC-1	----	EPT-1	EPT-1	VARIES	EXPOSED	NOTE(S): 12,14
----	STAIR B	RF-2,RF-6	RB-3	PT-1	PT-4	VARIES	-----	NOTE(S): 1,21
----	ELEVATOR B	LVT-2	BY ELEVATOR MANUFACTURER			8'-0"	-----	NOTE(S): -----

NUMBERED FINISH NOTES:

1. MULTIPLE FLOOR FINISHES ARE USED IN THIS SPACE; SEE FINISH FLOOR PLANS FOR PATTERNS AND LOCATIONS OF FINISHES.
2. MULTIPLE WALL FINISHES ARE USED IN THIS SPACE; SEE INTERIOR ELEVATIONS FOR PATTERNS AND LOCATIONS OF FINISHES (INCLUDING REVEALS WHERE APPLICABLE).
3. MULTIPLE CEILING FINISHES ARE USED IN THIS SPACE; SEE REFLECTED CEILING PLANS FOR PATTERNS AND LOCATIONS OF FINISHES.
4. THIS SPACE CONTAINS FINISHED MILLWORK; SEE INTERIOR ELEVATIONS AND MILLWORK DETAILS FOR WOOD FINISHES.
5. THERE ARE MULTIPLE TYPES OF FLOOR FINISHES AND RAILING TYPES AT SPANNING BRIDGE INCLUDING STRUCTURAL GLASS FLOORING AND LAMINATED GLASS RAILINGS; SEE INTERIOR ELEVATIONS AND FINISH FLOOR PLANS FOR LOCATIONS OF EACH.
6. PROVIDE PLEXIGLASS WALL COVERING TO A HEIGHT OF 4'-0" AFF AND HORIZONTALLY 4'-0" FROM THE EDGE OF THE NEAREST WATER SOURCE.
7. A PORTION OF THE CEILING IS STOREFRONT SYSTEM WITH TRANSLUCENT GLAZING; RE: WINDOW SCHEDULE AND ELEVATIONS.
8. PRESS BRIEFING ROOM HAS AN ELEVATED PRESENTATION STAGE AND PODIUM; SEE INTERIOR ELEVATIONS; WOOD FINISHES ARE TO MATCH WD-11.
9. MULTIPLE CEILING HEIGHTS EXIST IN THIS SPACE; SEE REFLECTED CEILING PLANS FOR HEIGHTS.
10. FLOOR LEVEL SLOPES DUE TO RAMP; CEILING HEIGHT IS MEASURED FROM FIRST FLOOR ELEVATION.
11. THIS SPACE CONTAINS POWDER COATED STEEL CASEWORK BY MOTT INDUSTRIES OR EQUAL; SEE INTERIOR ELEVATIONS; PROVIDE STAINLESS STEEL COUNTERTOPS.
12. NORTH WALL OF VESTIBULE SHALL BE EXPOSED CMU; PAINT TO MATCH ADJACENT GYPSUM BOARD.
13. PROVIDE EMBEDDED ALUMINUM STAIR NOSING BY BALCO OR EQUAL; TYPE T-213 IN 2 INCH WIDTH WITH TYPE 6 CAST-IN ANCHOR.
14. ALL EXPOSED STRUCTURE AT CEILING IS TO BE PAINTED.
15. SMOOTH, HARD, NONABSORBENT SURFACE NOT REQUIRED IN THIS RESTROOM AT SERVICE SINKS, URINALS, AND WATER CLOSETS PER IBC 2012, 1210.2.2, EXCEPTION #2.
16. SMOOTH, HARD, NONABSORBENT SURFACE REQUIRED AT ALL WALLS AND PARTITIONS WITHIN 2 FEET OF SERVICE SINKS, URINALS, AND WATER CLOSETS TO A HEIGHT NOT LESS THAN 48 INCHES ABOVE FLOOR PER IBC 2012, 1210.2.2.
17. SMOOTH, HARD, NONABSORBENT SURFACE REQUIRED AT ALL SHOWER COMPARTMENTS TO A HEIGHT NOT LESS THAN 70 INCHES ABOVE DRAIN INLET PER IBC 2012, 1210.3.
18. PROVIDE STAINLESS STEEL, SLIP-RESISTANT STAIR NOSING 'TREP-E' BY SCHLUTER OR EQUAL; NOSING HEIGHT AT FINISH FLOOR EDGE IS TO BE 2MM (5/32") FOR ABUTMENT TO ADJACENT RUBBER FLOORING; SET NOSING IN A CONTINUOUS BED OF STRUCTURAL EPOXY ADHESIVE; PROVIDE END CAP ACCESSORIES AS REQUIRED; TYPICAL AT CAST-IN-PLACE CONCRETE PORTIONS OF STAIR A WITHIN THE POLICE LOBBY.
19. STEEL FLOOR GRATING IN THIS SPACE SERVES AS PART OF THE SMOKE EVACUATION SYSTEM; SEE BUILDING SECTIONS AND STRUCTURAL DRAWINGS FOR ADDITIONAL INFORMATION.
20. SEE INTERIOR ELEVATIONS FOR SURFACE MOUNTED MIRROR LOCATIONS.
21. LIGHT FIXTURES IN STAIR B ARE TO BE RECESSED LINEAR FIXTURES MOUNTED INTO THE SIDE WALLS; SEE INTERIOR ELEVATIONS AND ELECTRICAL DRAWINGS FOR ADDITIONAL INFORMATION.
22. THE EAST END OF THIS SPACE SERVES AS PART OF THE SMOKE EVACUATION SYSTEM; SEE INTERIOR ELEVATIONS AND REFLECTED CEILING PLANS FOR ADDITIONAL INFORMATION AND VENT LOCATIONS.
23. THE PERFORATED METAL CEILING SYSTEM IN THIS SPACE SERVES AS PART OF THE SMOKE EVACUATION SYSTEM; SEE INTERIOR ELEVATIONS AND REFLECTED CEILING PLANS FOR ADDITIONAL INFORMATION AND VENT LOCATIONS.

CITY OF HATTIESBURG MISSISSIPPI 1884

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

Drawing Issued:

Date	Rev.	Description
08-31-2015		DD Check Set
10-20-2015		75% Progress Set
11-02-2015		90% Pricing Set
11-19-2018		100% Bid Docs

Drawn By: CR,CP,AS,RB

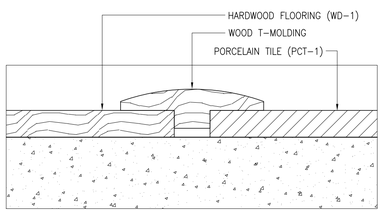
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Client No: -----

Albert & Associates: 12575

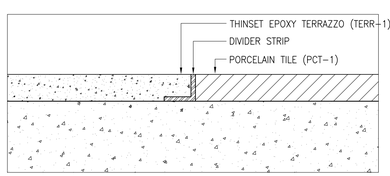
REGISTERED ARCHITECT Larry A. Albert Hattiesburg, MS STATE OF MISSISSIPPI

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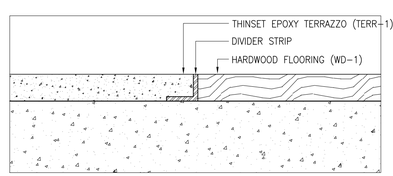
1 Threshold Detail

SCALE: FULL SCALE WOOD - TILE



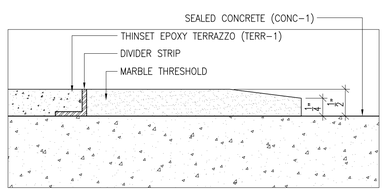
2 Threshold Detail

SCALE: FULL SCALE TERRAZZO - TILE



3 Threshold Detail

SCALE: FULL SCALE TERRAZZO - WOOD



4 Threshold Detail

SCALE: FULL SCALE TERRAZZO - CONCRETE

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Client No: ——

Albert & Associates: 12575

REGISTERED ARCHITECT Larry M Albert Hattiesburg, MS STATE OF MISSISSIPPI

A9.0c

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com

Finish Floor Plan Legend

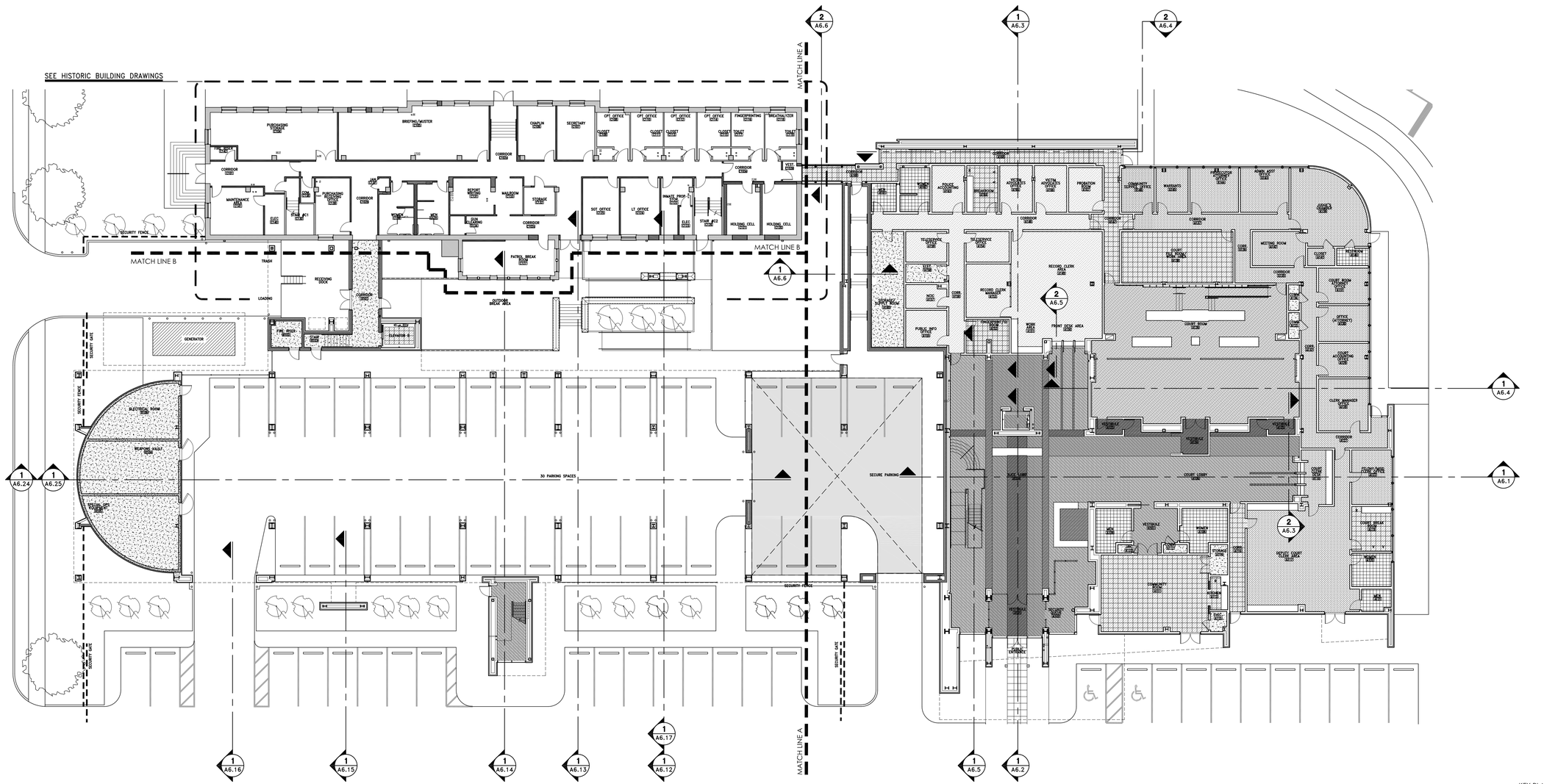
- PCT-1 – 12x12 PORCELAIN TILE
- PCT-8 – 2x2 MOSAIC TILE
- TERR-3 – PRECAST TERRAZZO STAIR TREAD
- RF-1 – RUBBER FLOORING (DARK GRAY)
- RF-2 – RUBBER FLOORING (LIGHT GRAY)
- RF-3 – RUBBER FLOORING (WHITE GRAY)
- RF-4 – RUBBER FLOORING (BLUE)
- RF-5 – RUBBER FLOORING (BROWN)
- RF-6 – RUBBER STAIR TREADS
- RB-2 – RUBBER ATHLETIC FLOORING
- LVT-1 – 4x36 PLANK (VERMONT CHERRY)
- LVT-2 – 18x18 TILE (NIMBUS)
- CPT-1 – CARPET
- CPT-2 – CARPET
- CPT-3 – CARPET
- CPT-4 – CARPET
- SC-1 – SEALED CONCRETE
- AX-1 – ACCESS FLOORING
- SGF-1 – STRUCTURAL GLASS FLOORING

Finish Plan General Notes

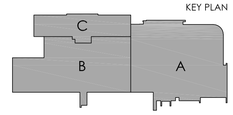
1. ALL FLOORS TO BE PROPERLY PREPPED AND FLOATED AS NECESSARY.
2. ALL EXPOSED LOUVERS, REGISTERS, VENTS, ETC. ARE TO BE PAINTED TO MATCH SURROUNDING CONDITIONS.
3. AT ALL FLOORING PRODUCT TRANSITIONS, PROVIDE NECESSARY ACCESSIBLE TRANSITION MATERIALS; RE: SHEET A9.0c FOR THRESHOLD/FLOORING TRANSITION DETAILS.
4. ALL PORCELAIN TILE FLOORING TO MEET OR EXCEED STATIC COEFFICIENT OF FRICTION (SLIP RESISTANCE) A.D.A. STANDARD OF 0.60 FOR ACCESSIBLE ROUTES.
5. APPLY THOROUGH WATERPROOFING MASTIC BEHIND ALL WALL TILE, FLOOR TILE, AND CURB TILE IN RESTROOMS.
6. ALL EXPOSED STEEL COLUMNS, BEAMS, TRUSSES, JOISTS, DECKING, ECT. ARE TO BE PRIMED AND PAINTED PER SECTION 9 SPECIFICATIONS.
7. SUBMIT COLOR SAMPLES FOR ALL PRODUCTS TO ARCHITECT FOR APPROVAL.

General Plan Notes

1. ALL DIMENSIONS ARE TO THE FACE OF FINISH OR FACE OF BLOCK UNLESS NOTED OTHERWISE.
2. IN MASONRY WALL CONSTRUCTION DIMENSIONS ARE TO ROUGH OPENINGS.
3. IN STUD WALL CONSTRUCTION DIMENSIONS ARE TO CENTERLINE OF OPENINGS.
4. ALL DOORS ARE 6" FROM FACE OF STUD OR 8" FROM FACE OF CMU UNLESS DIMENSIONED OTHERWISE.
5. CONTRACTOR TO CONSULT ARCHITECT IMMEDIATELY IF DISCREPANCIES ARE FOUND BETWEEN ARCHITECTURAL AND ENGINEERING DRAWINGS.
6. ALL ANGLES ARE 90° OR 45° UNLESS DIMENSIONED OTHERWISE.
7. SEE A2.x SHEETS FOR FLOOR PLANS.
8. SEE A3.x SHEETS FOR ROOF PLANS.
9. SEE A4.X SHEETS FOR REFLECTED CEILING PLANS.
10. SEE A5.x SHEETS FOR EXTERIOR ELEVATIONS.
11. SEE A6.x SHEETS FOR BUILDING SECTIONS.
12. SEE A8.x SHEETS FOR DOOR SCHEDULE/FRAME ELEVATIONS AND WINDOW SCHEDULE/WINDOW ELEVATIONS.
13. SEE A10.x SHEETS FOR INTERIOR ELEVATIONS.
14. SEE A11.x SHEETS FOR VERTICAL CIRCULATION.



KEY PLAN



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First Floor Finish Floor Plan Composite

SCALE: 1/16" = 1'-0"

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10-20-2015		75% Progress Set
11-02-2015		90% Prticing Set
11-19-2018		100% Bid Docs

Drawn By: CR,CP,AS,RB

Checked By: CR,LA,CP

Client No: ------

Albert & Associates: 12575

REGISTERED ARCHITECT Larry M Albert Jr. Hattiesburg, MS STATE OF MISSISSIPPI

A9.0d

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com **Albert & McCleskey Associates Architects**

FIRST FLOOR FFP COMPOSITE

Finish Floor Plan Legend

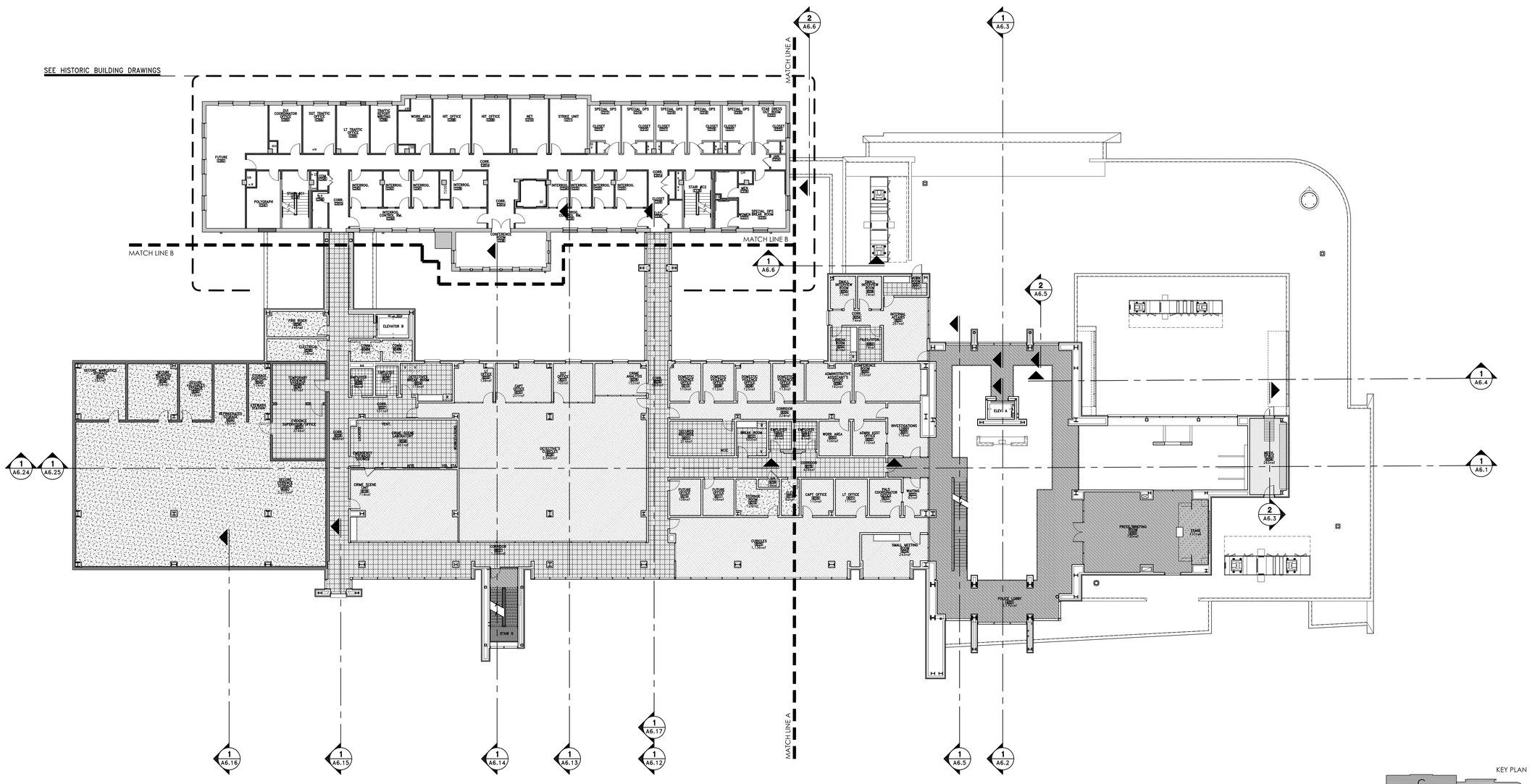
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- PCT-8 – 2x2 MOSAIC TILE
- TERR-3 – PRECAST TERRAZZO STAIR TREAD
- RF-1 – RUBBER FLOORING (DARK GRAY)
- RF-2 – RUBBER FLOORING (LIGHT GRAY)
- RF-3 – RUBBER FLOORING (WHITE GRAY)
- RF-4 – RUBBER FLOORING (BLUE)
- RF-5 – RUBBER FLOORING (BROWN)
- RF-6 – RUBBER STAIR TREADS
- RB-2 – RUBBER ATHLETIC FLOORING
- LVT-1 – 4x36 PLANK (VERMONT CHERRY)
- LVT-2 – 18x18 TILE (NIMBUS)
- CPT-1 – CARPET
- CPT-2 – CARPET
- CPT-3 – CARPET
- CPT-4 – CARPET
- SC-1 – SEALED CONCRETE
- AX-1 – ACCESS FLOORING
- SGF-1 – STRUCTURAL GLASS FLOORING

Finish Plan General Notes

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4. ALL PORCELAIN TILE FLOORING TO MEET OR EXCEED STATIC COEFFICIENT OF FRICTION (SLIP RESISTANCE) A.D.A. STANDARD OF 0.60 FOR ACCESSIBLE ROUTES.
5. APPLY THOROUGH WATERPROOFING MASTIC BEHIND ALL WALL TILE, FLOOR TILE, AND CURB TILE IN RESTROOMS.
6. ALL EXPOSED STEEL COLUMNS, BEAMS, TRUSSES, JOISTS, DECKING, ECT. ARE TO BE PRIMED AND PAINTED PER SECTION 9 SPECIFICATIONS.
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General Plan Notes

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11. SEE A6.x SHEETS FOR BUILDING SECTIONS.
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13. SEE A10.x SHEETS FOR INTERIOR ELEVATIONS.
14. SEE A11.x SHEETS FOR VERTICAL CIRCUMLATION.



N

Second Floor Finish Floor Plan Composite

SCALE: 1/16" = 1'-0"

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

Drawing Issued:

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11-19-2018		100% Bid Docs

Drawn By: CR,CP,AS,RB

Checked By: CR,LA,CP

Client No: ---------

Albert & Associates: 12575

REGISTERED ARCHITECT Larry M Albert Hattiesburg, MS STATE OF MISSISSIPPI

A9.0e

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com **Albert & McCleskey Associates Architects**

SECOND FLOOR FFP COMPOSITE

Finish Floor Plan Legend

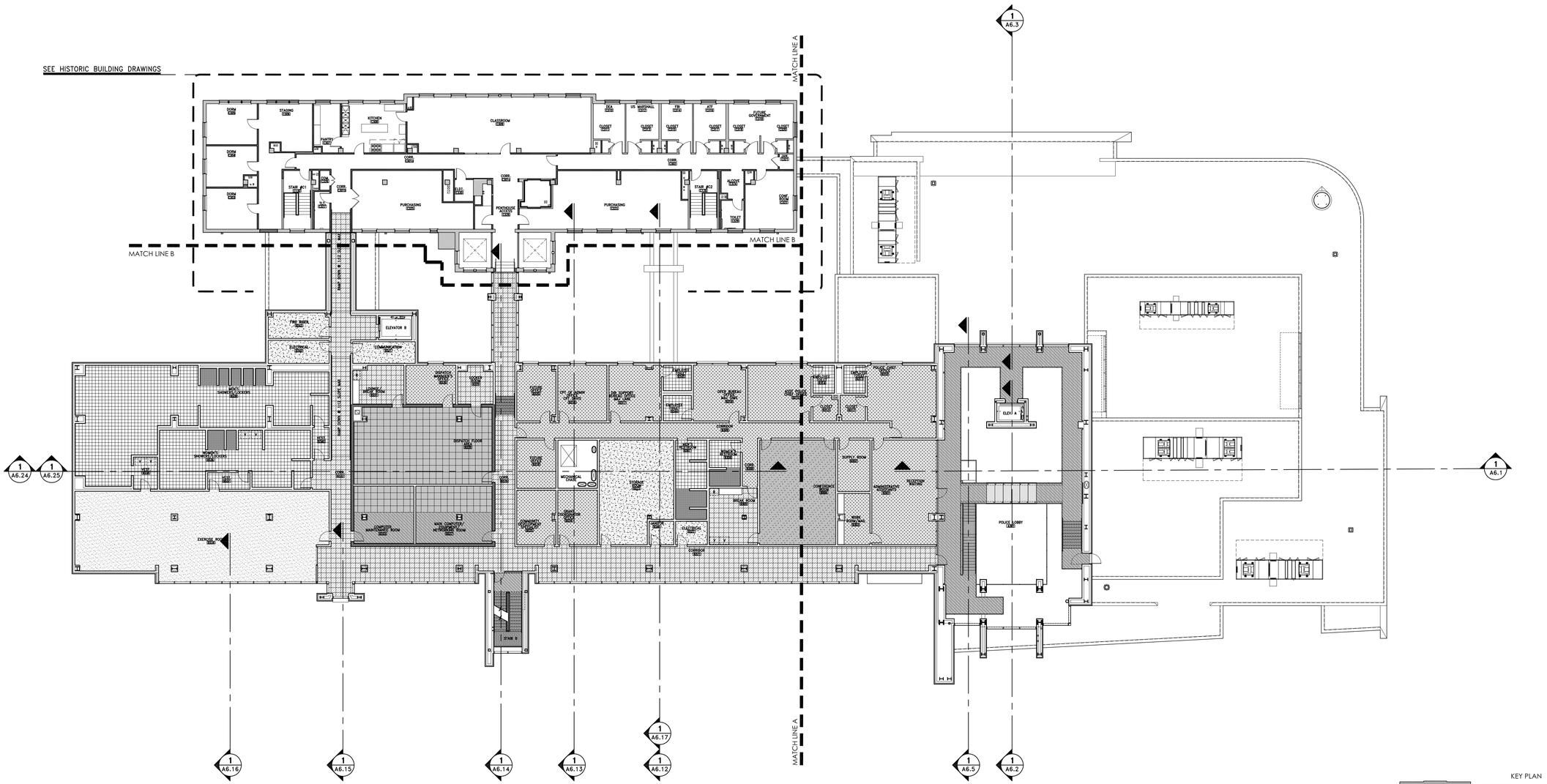
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- CPT-2 – CARPET
- CPT-3 – CARPET
- CPT-4 – CARPET
- SC-1 – SEALED CONCRETE
- AX-1 – ACCESS FLOORING
- SGF-1 – STRUCTURAL GLASS FLOORING

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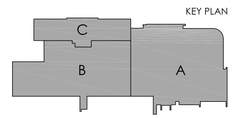


N

Third Floor Finish Floor Plan Composite

SCALE: 1/16" = 1'-0"

KEY PLAN



HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

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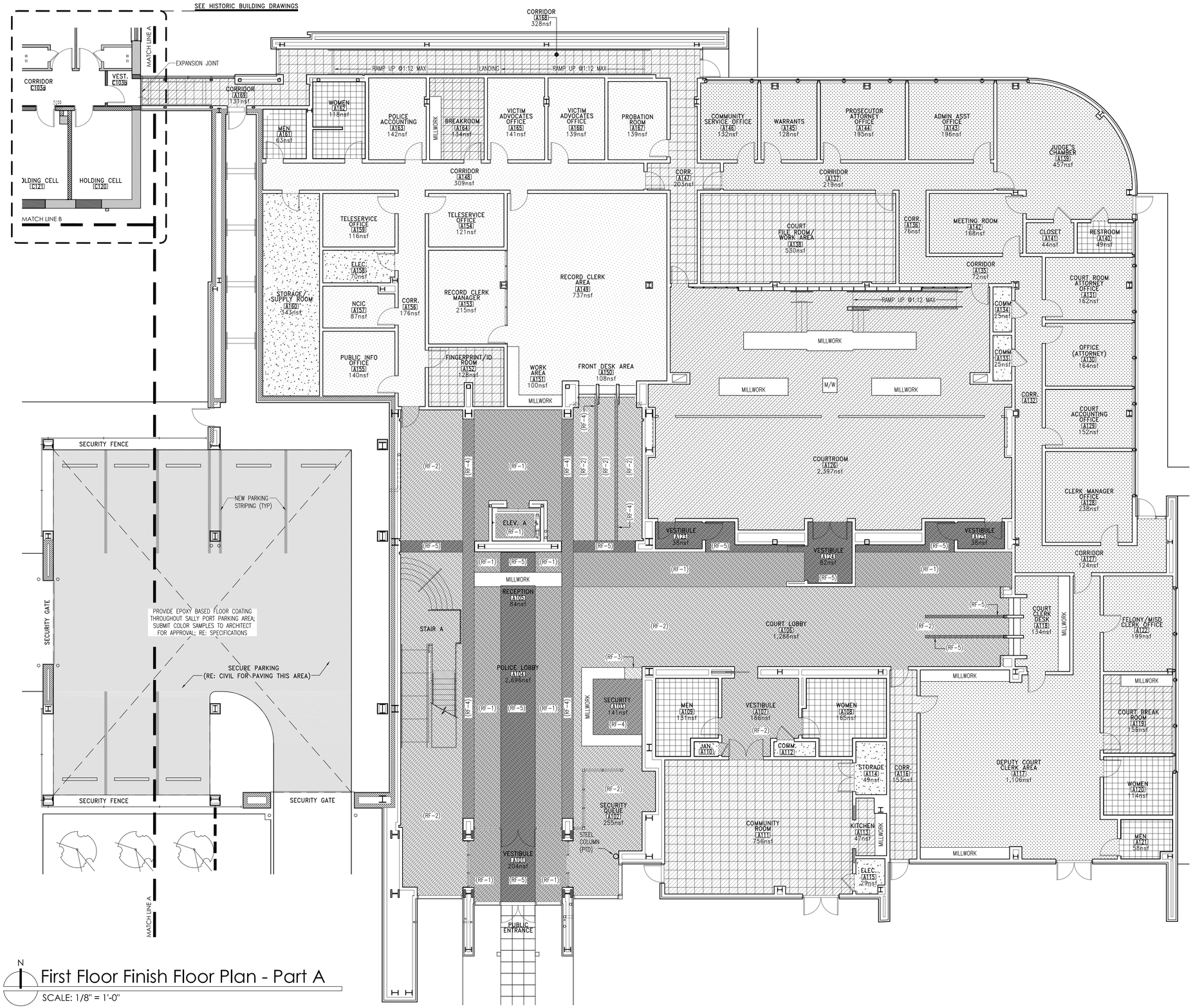
Client No: ——

Albert & Associates: 12575

Larry M Albert, Hattiesburg, MS

A9.0f

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com **Albert & McCleskey Associates Architects**



First Floor Finish Floor Plan - Part A

SCALE: 1/8" = 1'-0"

Finish Floor Plan Legend

- PCT-1 – 12x12 PORCELAIN TILE
- PCT-8 – 2x2 MOSAIC TILE
- TERR-3 – PRECAST TERRAZZO STAIR TREAD
- RF-1 – RUBBER FLOORING (DARK GRAY)
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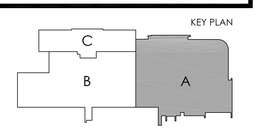
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KEY PLAN



CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

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Checked By: CR,LA,CP

Client No: ------

Albert & Associates: 12575

REGISTERED ARCHITECT Larry A. Albert Hattiesburg, MS STATE OF MISSISSIPPI

A9.1a

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com **Albert & McCleskey Associates Architects**

Finish Floor Plan Legend

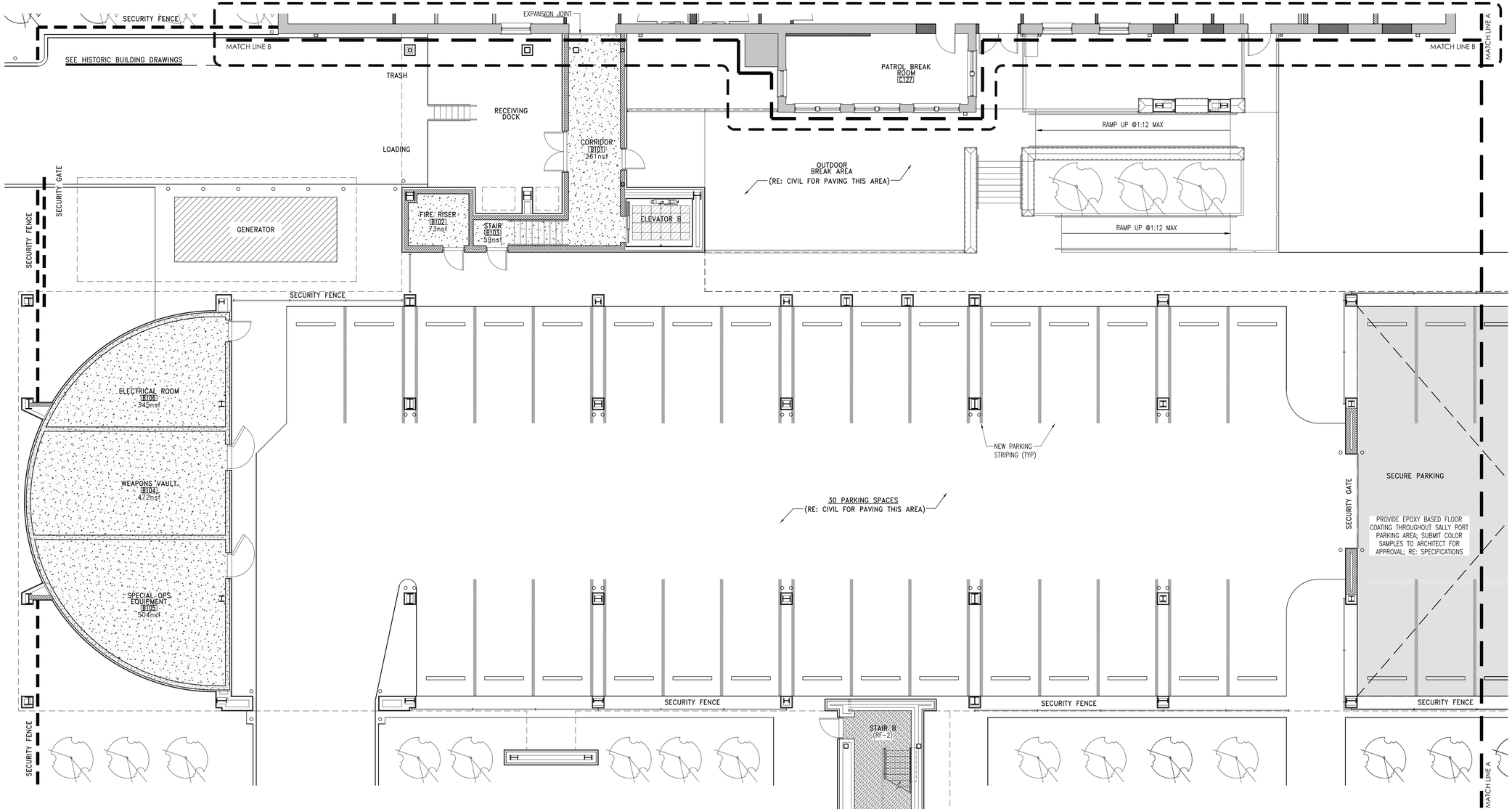
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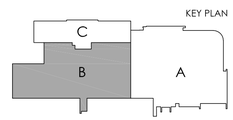


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First Floor Finish Floor Plan - Part B

SCALE: 1/8" = 1'-0"

KEY PLAN



CITY OF HATTIESBURG MISSISSIPPI 1884

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT

HPSC Police and Court Building

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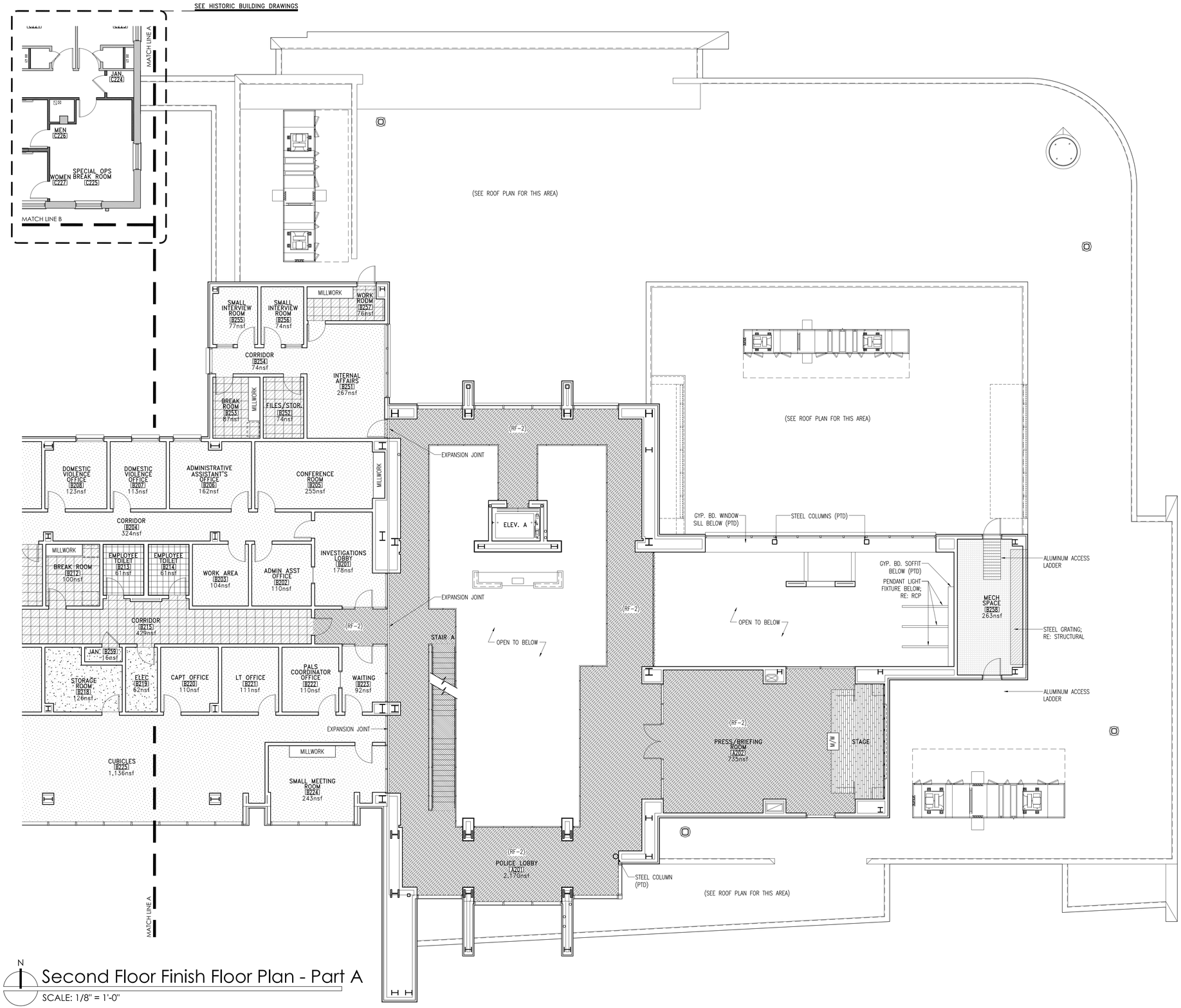
Client No: ——

Albert & Associates: 12575

REGISTERED ARCHITECT Larry M Albert Hattiesburg, MS STATE OF MISSISSIPPI

A9.1b

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com **Albert & McCleskey Associates Architects**



Second Floor Finish Floor Plan - Part A

SCALE: 1/8" = 1'-0"

Finish Floor Plan Legend

- PCT-1 – 12x12 PORCELAIN TILE
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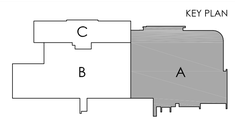
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KEY PLAN



CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

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REGISTERED ARCHITECT Larry M Albert Hattiesburg, MS STATE OF MISSISSIPPI

A9.2a

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com **Albert & McCleskey Associates Architects**

Finish Floor Plan Legend

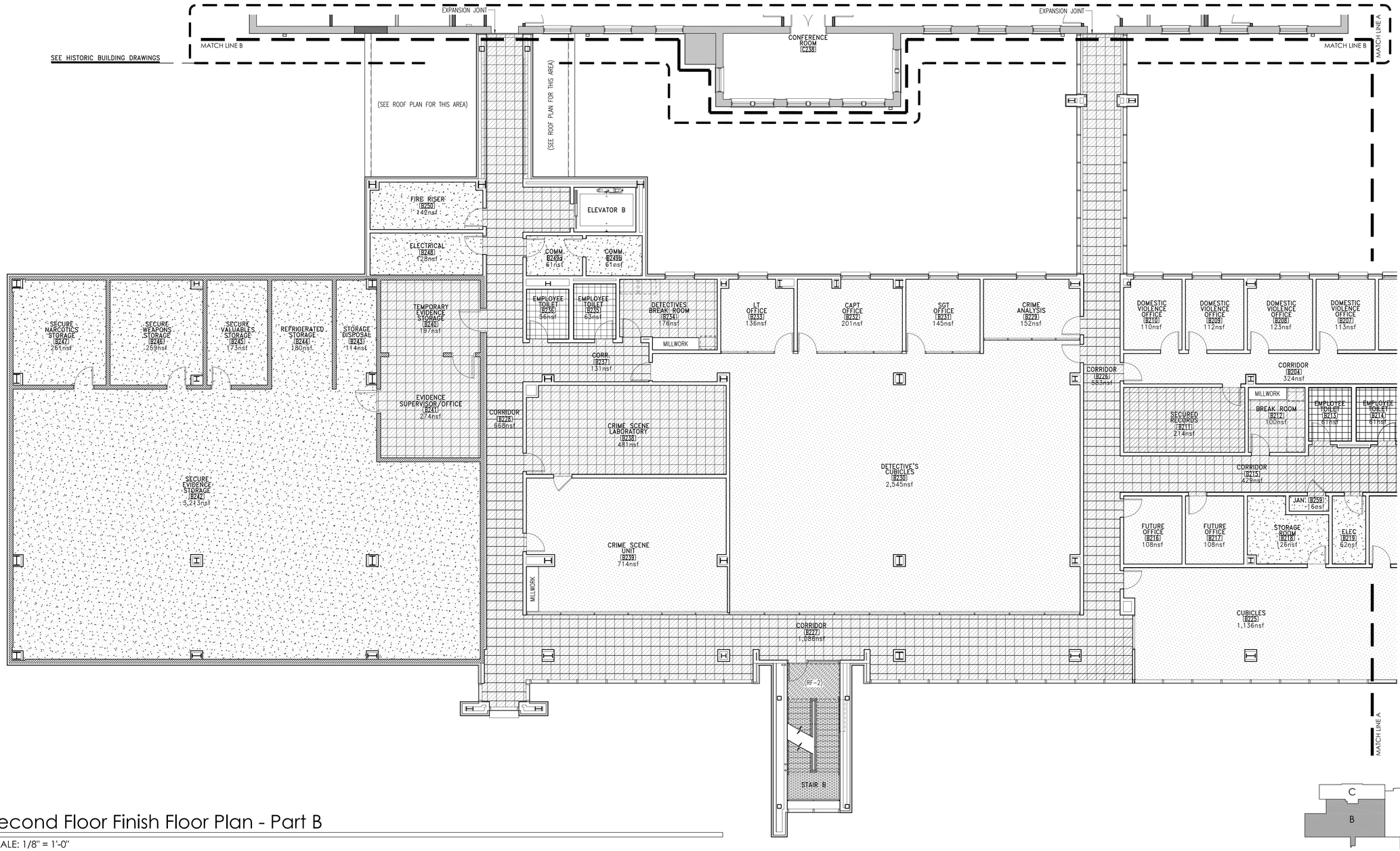
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- RF-5 – RUBBER FLOORING (BROWN)
- RF-6 – RUBBER STAIR TREADS
- RB-2 – RUBBER ATHLETIC FLOORING
- LVT-1 – 4x36 PLANK (VERMONT CHERRY)
- LVT-2 – 18x18 TILE (NIMBUS)
- CPT-1 – CARPET
- CPT-2 – CARPET
- CPT-3 – CARPET
- CPT-4 – CARPET
- SC-1 – SEALED CONCRETE
- AX-1 – ACCESS FLOORING
- SGF-1 – STRUCTURAL GLASS FLOORING

Finish Plan General Notes

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8. SEE A3.x SHEETS FOR ROOF PLANS.
9. SEE A4.X SHEETS FOR REFLECTED CEILING PLANS.
10. SEE A5.x SHEETS FOR EXTERIOR ELEVATIONS.
11. SEE A6.x SHEETS FOR BUILDING SECTIONS.
12. SEE A8.x SHEETS FOR DOOR SCHEDULE/FRAME ELEVATIONS AND WINDOW SCHEDULE/WINDOW ELEVATIONS.
13. SEE A10.x SHEETS FOR INTERIOR ELEVATIONS.
14. SEE A11.x SHEETS FOR VERTICAL CIRCULATION.



KEY PLAN

N

Second Floor Finish Floor Plan - Part B

SCALE: 1/8" = 1'-0"

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

Drawing Issued:

Date	Rev.	Description
08-31-2015		DD Check Set
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11-19-2018		100% Bid Docs

Drawn By: CR,CP,AS,RB

Checked By: CR,LA,CP

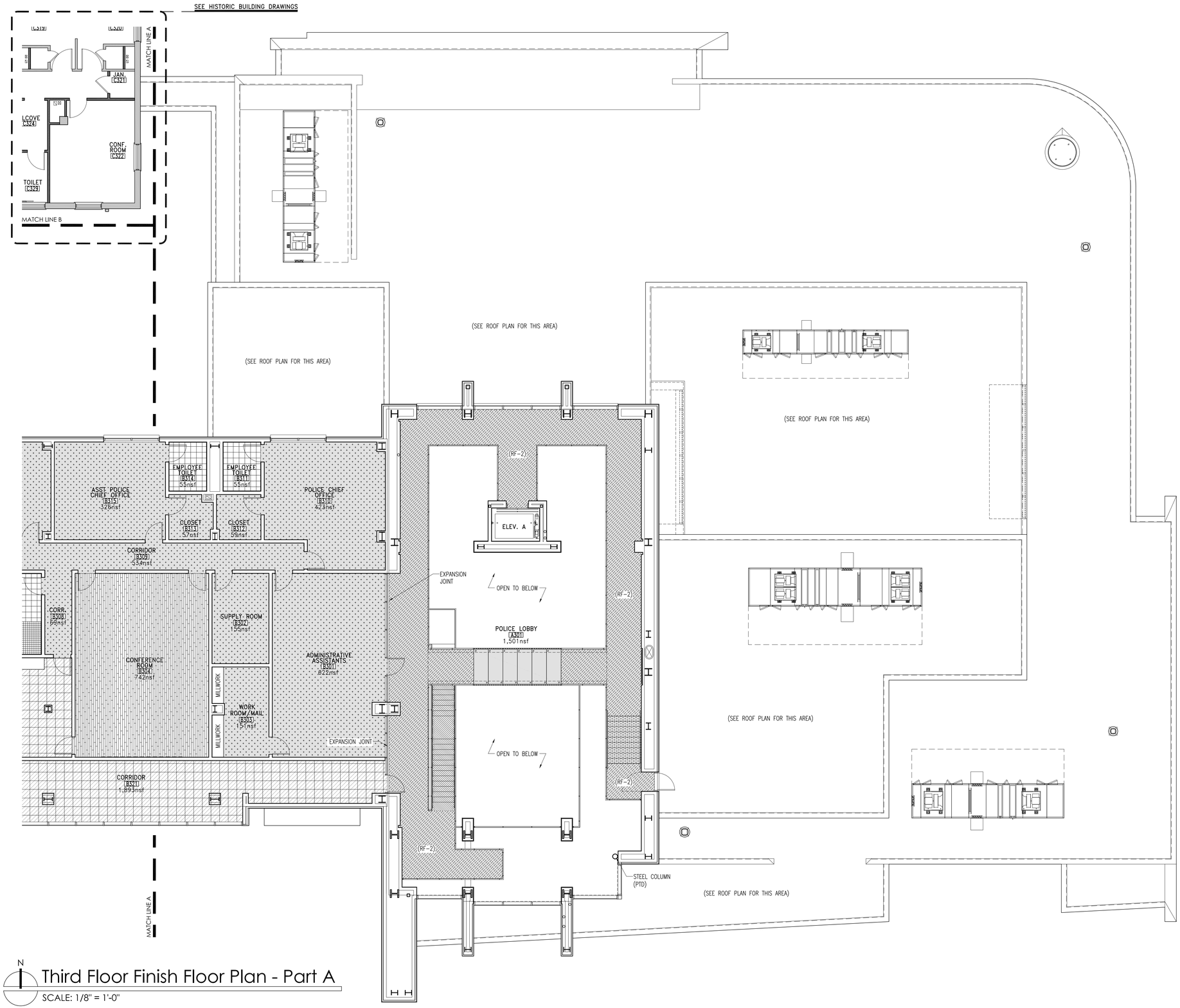
Client No: ------

Albert & Associates: 12575

REGISTERED ARCHITECT Larry M Albert Hattiesburg, MS STATE OF MISSISSIPPI

A9.2b

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com **Albert & McCleskey Associates Architects**



Third Floor Finish Floor Plan - Part A

SCALE: 1/8" = 1'-0"

Finish Floor Plan Legend

- PCT-1 – 12x12 PORCELAIN TILE
- PCT-8 – 2x2 MOSAIC TILE
- TERR-3 – PRECAST TERRAZZO STAIR TREAD
- RF-1 – RUBBER FLOORING (DARK GRAY)
- RF-2 – RUBBER FLOORING (LIGHT GRAY)
- RF-3 – RUBBER FLOORING (WHITE GRAY)
- RF-4 – RUBBER FLOORING (BLUE)
- RF-5 – RUBBER FLOORING (BROWN)
- RF-6 – RUBBER STAIR TREADS
- RB-2 – RUBBER ATHLETIC FLOORING
- LVT-1 – 4x36 PLANK (VERMONT CHERRY)
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- CPT-1 – CARPET
- CPT-2 – CARPET
- CPT-3 – CARPET
- CPT-4 – CARPET
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- AX-1 – ACCESS FLOORING
- SGF-1 – STRUCTURAL GLASS FLOORING

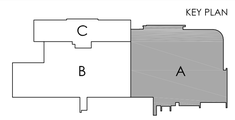
Finish Plan General Notes

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12. SEE A8.x SHEETS FOR DOOR SCHEDULE/FRAME ELEVATIONS AND WINDOW SCHEDULE/WINDOW ELEVATIONS.
13. SEE A10.x SHEETS FOR INTERIOR ELEVATIONS.
14. SEE A11.x SHEETS FOR VERTICAL CIRCULATION.

KEY PLAN



CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

Drawing Issued:

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Drawn By: CR,CP,AS,RB

Checked By: CR,LA,CP

Client No: ----

Albert & Associates: 12575

REGISTERED ARCHITECT Larry A Albert Hattiesburg, MS STATE OF MISSISSIPPI

A9.3a

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com **Albert & McCleskey Associates Architects**

Finish Floor Plan Legend

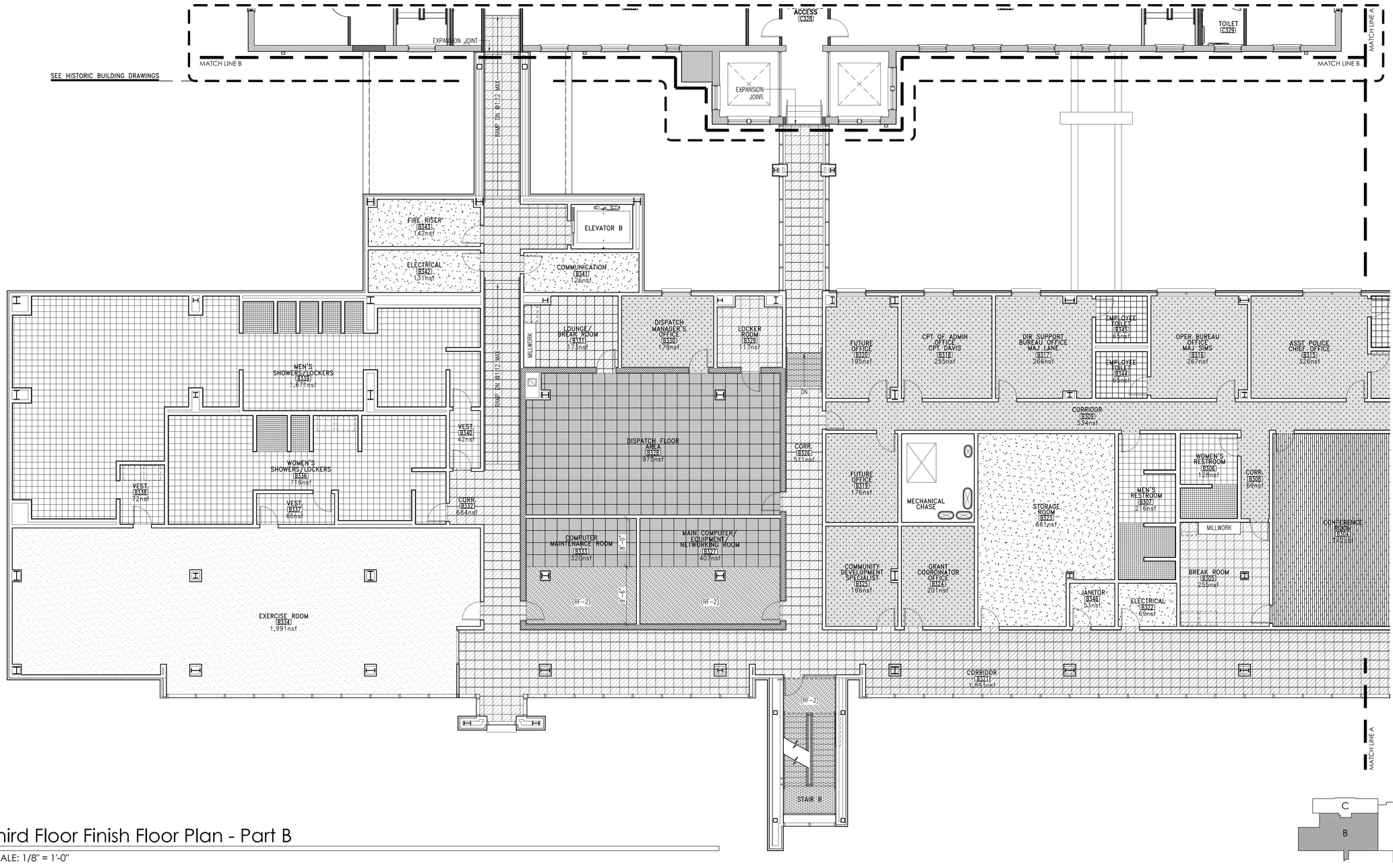
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14. SEE A11.x SHEETS FOR VERTICAL CIRCULATION.



KEY PLAN

N

Third Floor Finish Floor Plan - Part B

SCALE: 1/8" = 1'-0"

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

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Checked By: CR,LA,CP

Client No: ------

Albert & Associates: 12575

REGISTERED ARCHITECT Larry M. Albert Hattiesburg, MS STATE OF MISSISSIPPI

A9.3b

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com **Albert & McCleskey Associates Architects**

Finish Floor Plan Legend

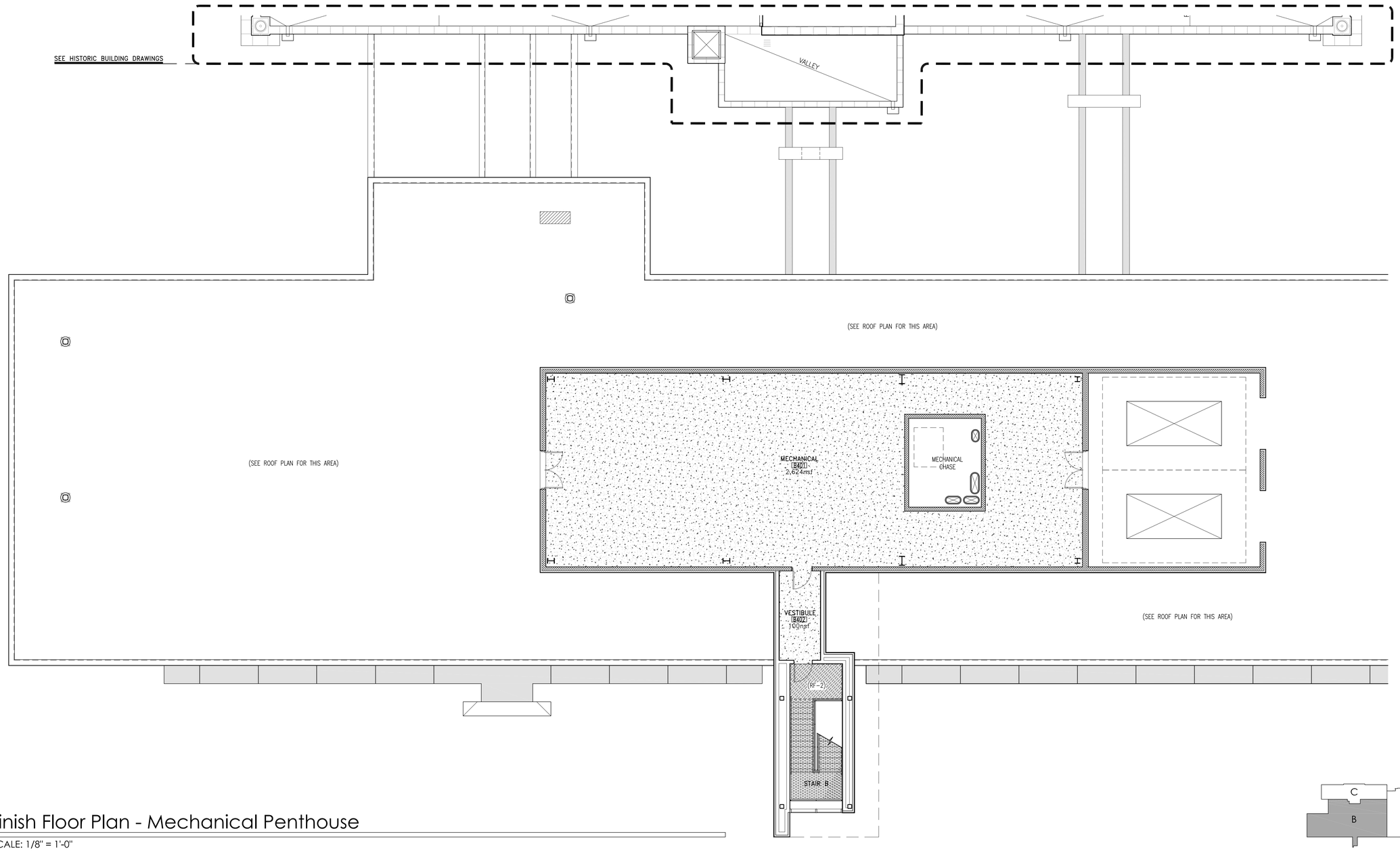
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KEY PLAN

N

Finish Floor Plan - Mechanical Penthouse

SCALE: 1/8" = 1'-0"

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

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Checked By: CR,LA,CP

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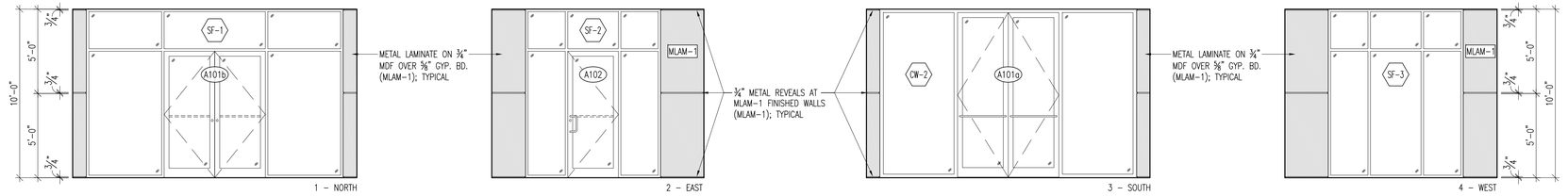
Albert & Associates: 12575

REGISTERED ARCHITECT Larry A. Albert Hattiesburg, MS STATE OF MISSISSIPPI

A9.4

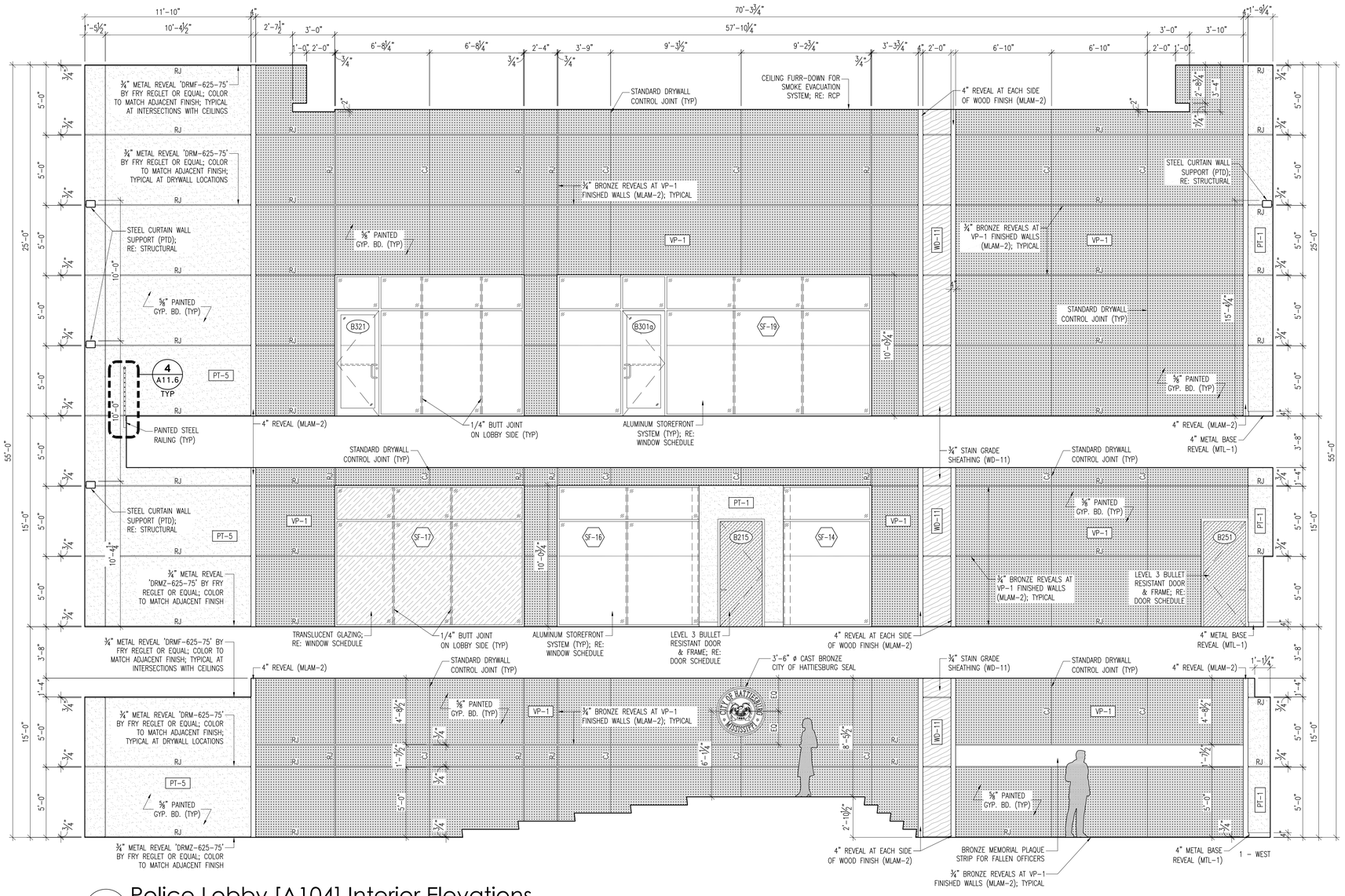
514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com **Albert & McCleskey Associates Architects**

FFP
MECHANICAL PENTHOUSE



2 Vestibule [A101] Interior Elevation

SCALE: 1/4" = 1'-0"



1 Police Lobby [A104] Interior Elevations

SCALE: 1/4" = 1'-0"

Interior Elevations Note

REFER TO SHEET A9.0a AND A9.0b FOR FINISH SCHEDULES AND CODES

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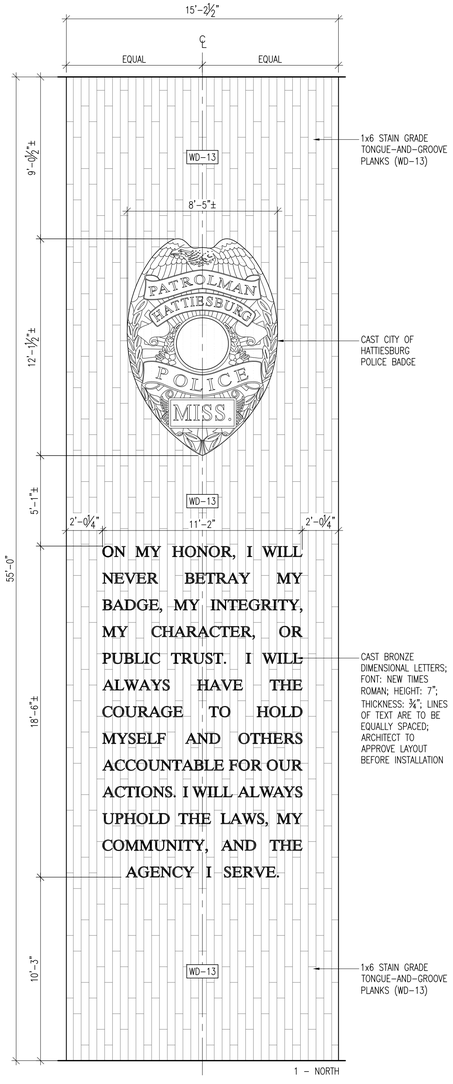
Larry M. Albert, Hattiesburg, MS

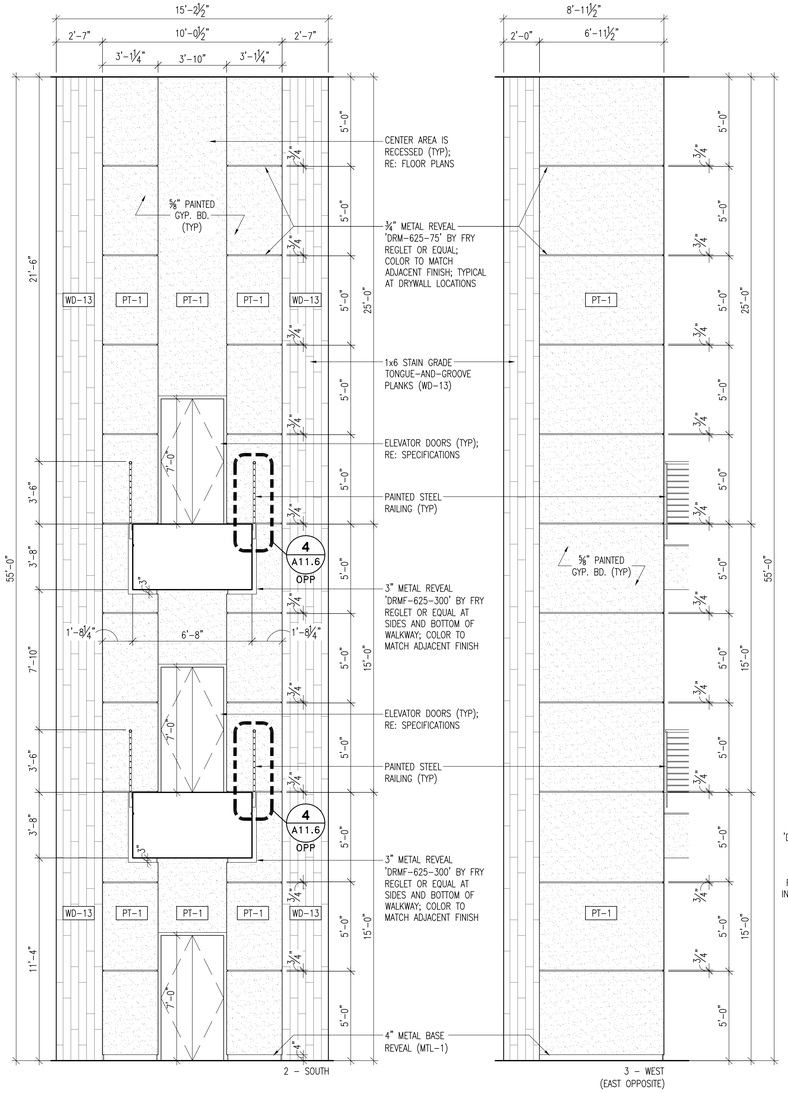
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Interior Elevations Note

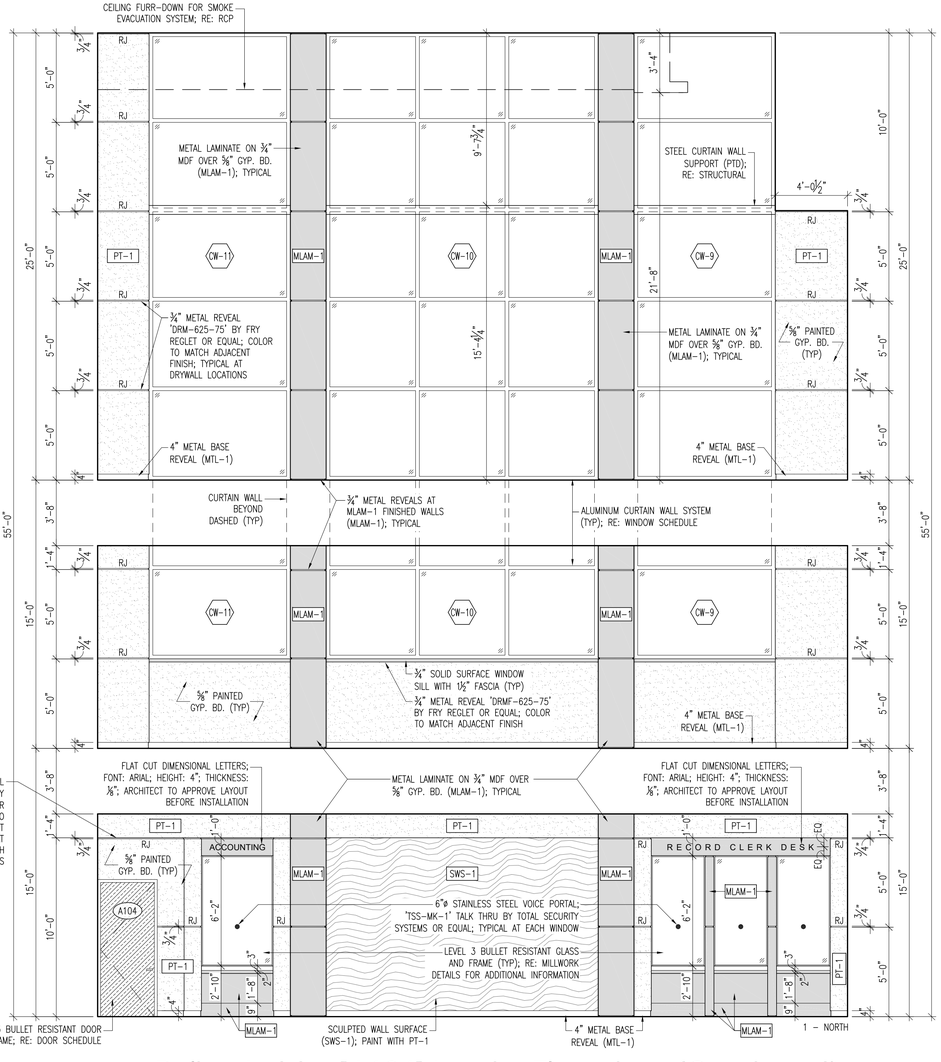
REFER TO SHEET A9.0a AND A9.0b FOR FINISH SCHEDULES AND CODES





2 Elevator A Interior Elevations

SCALE: 1/4" = 1'-0"



1 Police Lobby [A104] Interior Elevations (Continued)

SCALE: 1/4" = 1'-0"

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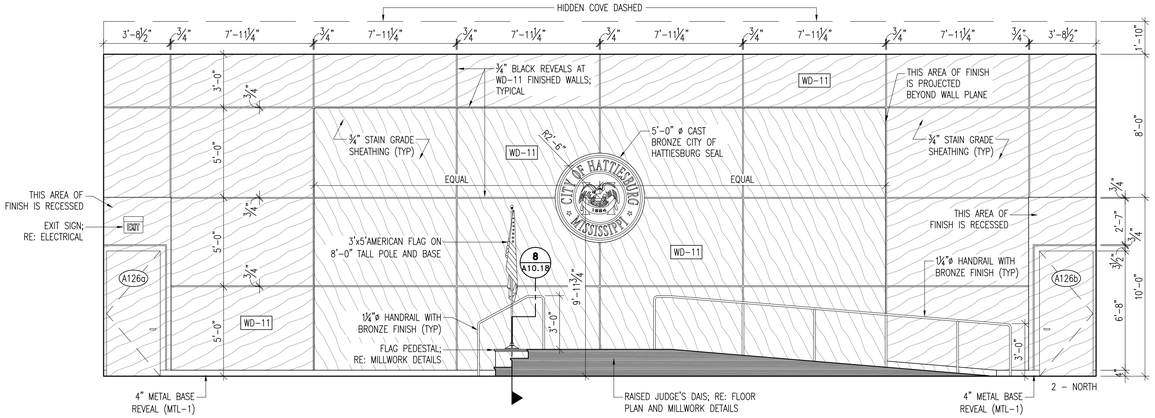
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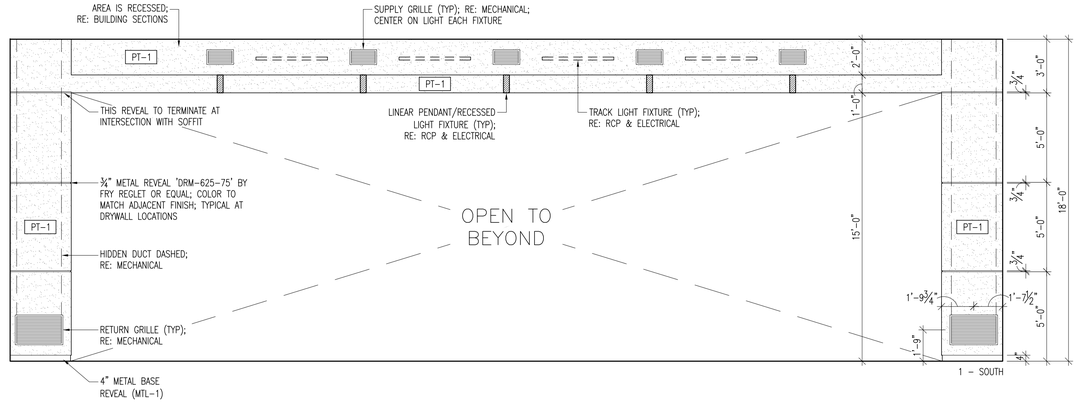
Albert & Associates: 1257t

REGISTERED ARCHITECT Larry A. Albert Hattiesburg, MS STATE OF MISSISSIPPI

A10.2

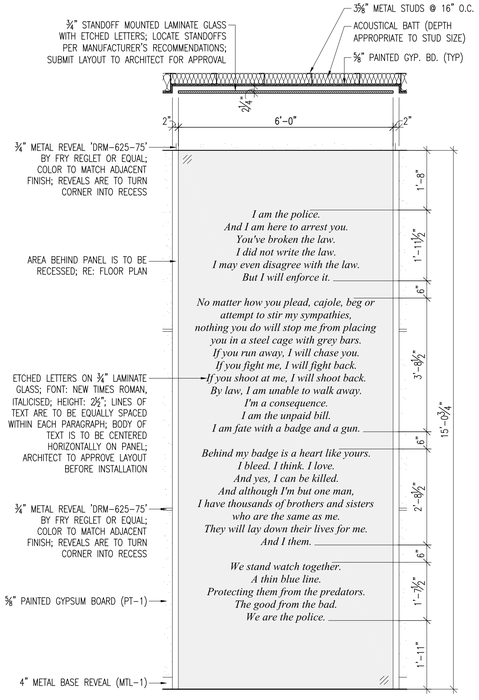
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2 Courtroom [A126] Interior Elevations

SCALE: 1/4" = 1'-0"



3 Police Motto Panel

SCALE: 1/2" = 1'-0"

1 Police Lobby [A104] Interior Elevations (Continued)

SCALE: 1/4" = 1'-0"

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INTERIOR ELEVATIONS

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HPSC Police and Court Building

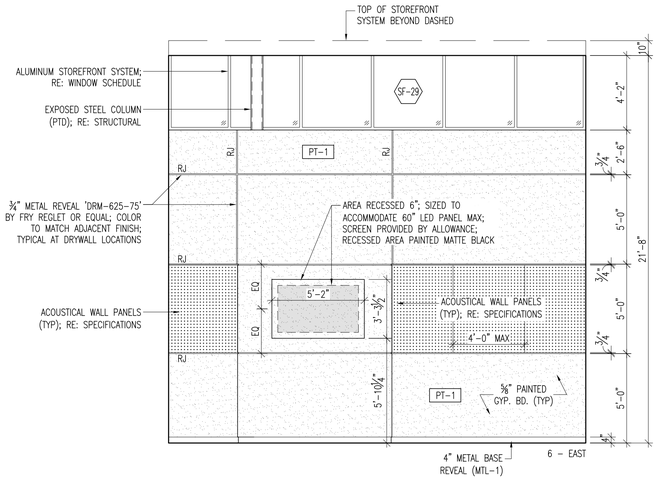
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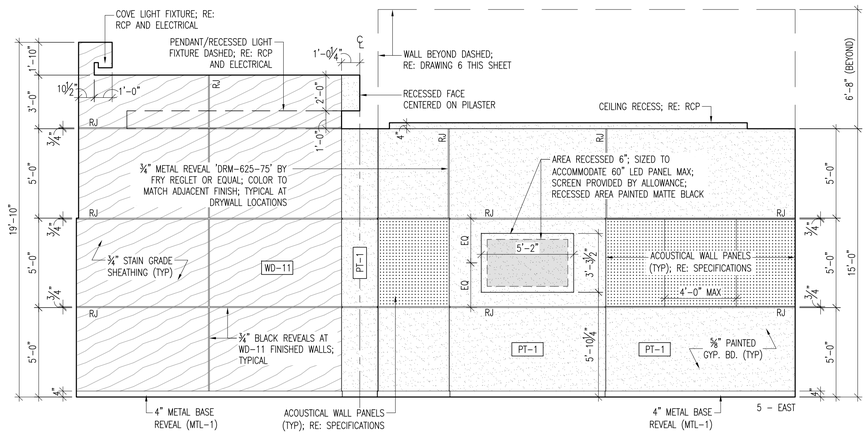
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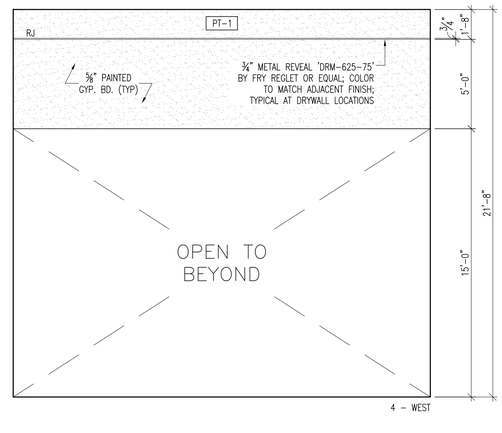
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Client No: ------
Albert & Associates: 12575

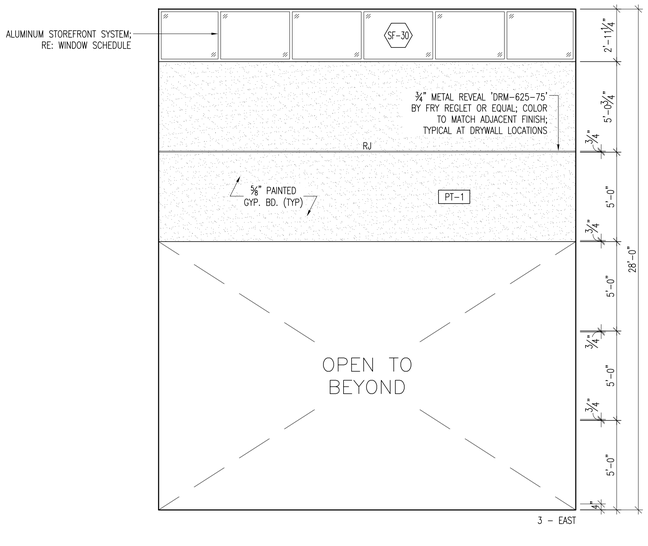
Larry A. Albert, Hattiesburg, MS

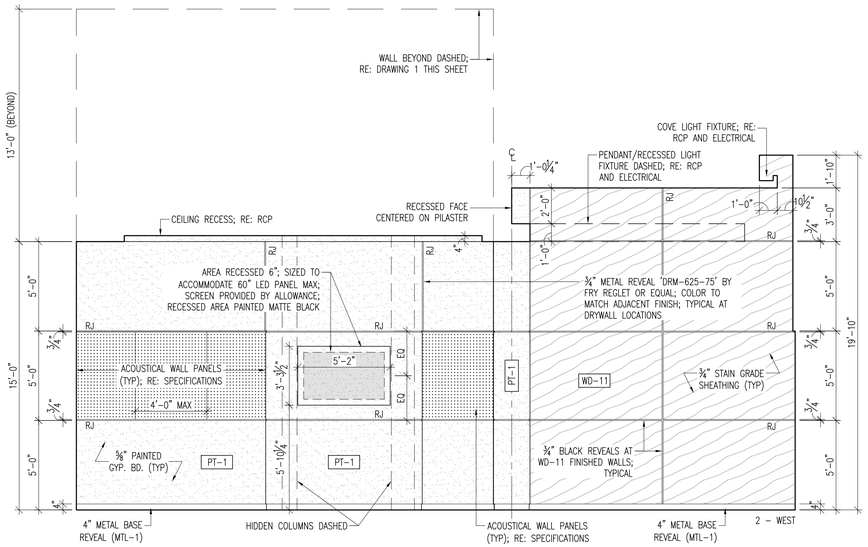
A10.3

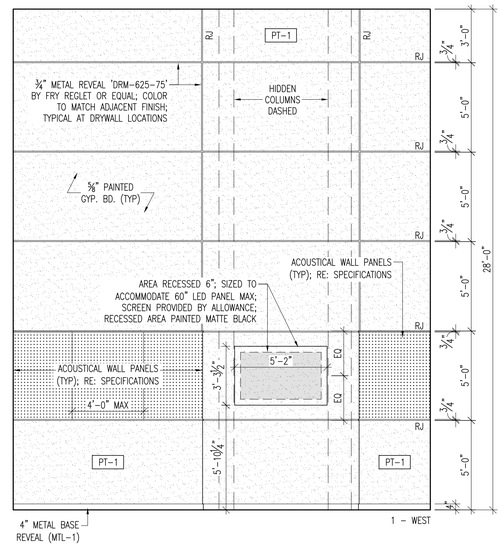












1 Courtroom [A126] Interior Elevations (Continued)

SCALE: 1/4" = 1'-0"

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com

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INTERIOR ELEVATIONS

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

Drawing Issued:

Date	Rev.	Description
08-31-2015		DD Check Set
10-20-2015		75% Progress Set
11-02-2015		90% Pricing Set
11-19-2018		100% Bid Docs

Drawn By: CR,CP,AS,RB

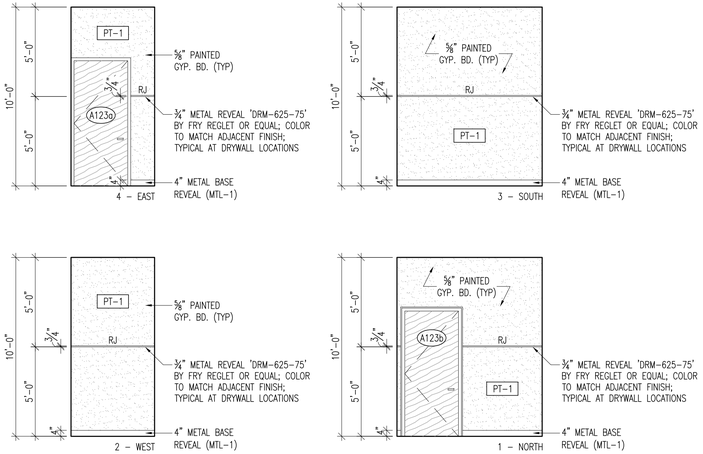
Checked By: CR,LA,CP

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Albert & Associates: 12575

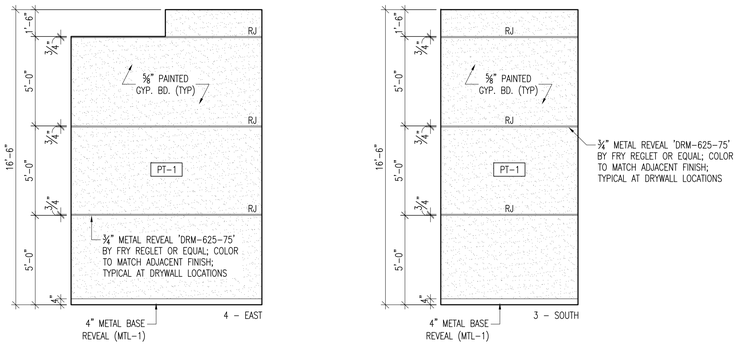
REGISTERED ARCHITECT Larry A. Albert Jr. Hattiesburg, MS STATE OF MISSISSIPPI

A10.4



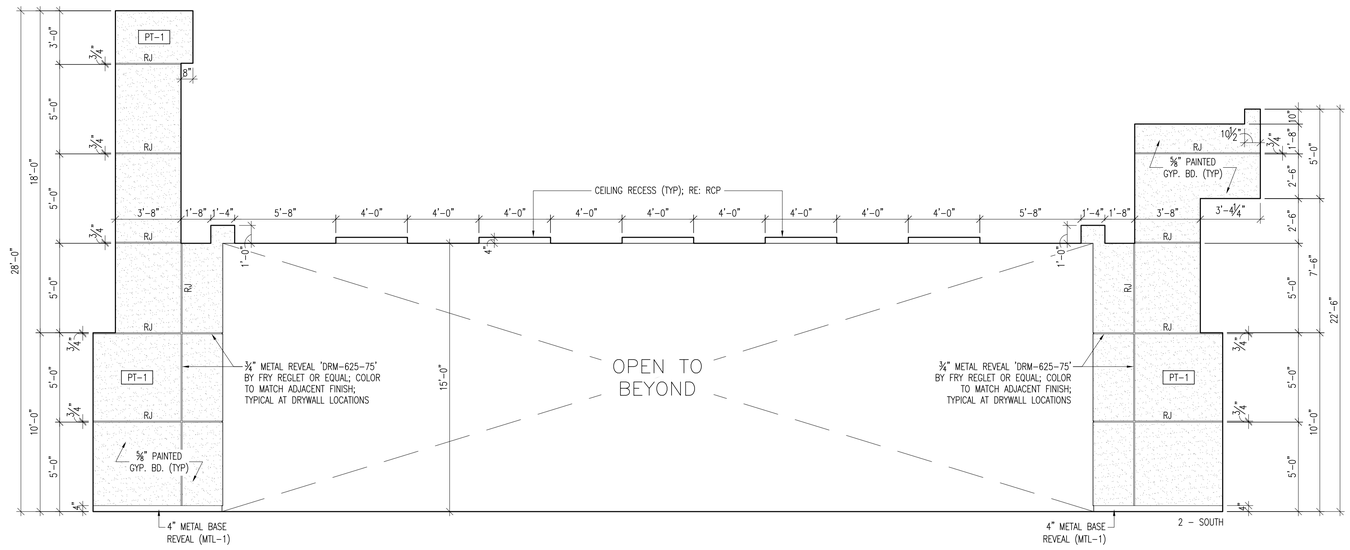
3 Vestibule [A123/A125(opp.)]

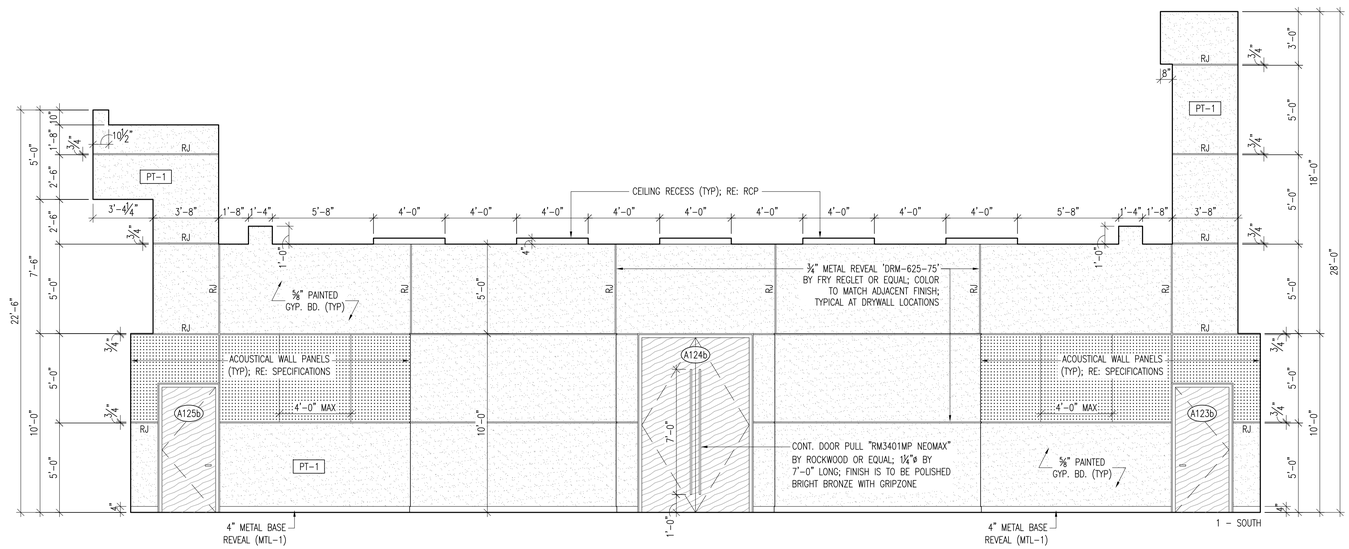
SCALE: 1/4" = 1'-0"



2 Vestibule [A124]

SCALE: 1/4" = 1'-0"





1 Courtroom [A126] Interior Elevations (Continued)

SCALE: 1/4" = 1'-0"

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

Drawing Issued:

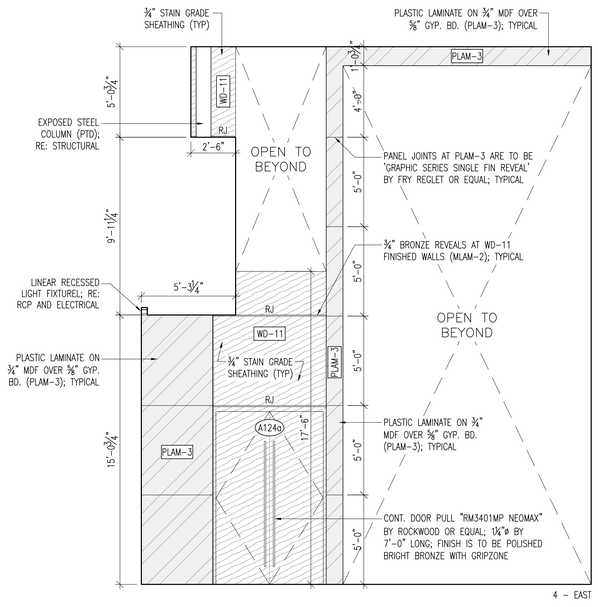
Date	Rev.	Description
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11-02-2015		90% Pricing Set
11-19-2018		100% Bid Docs

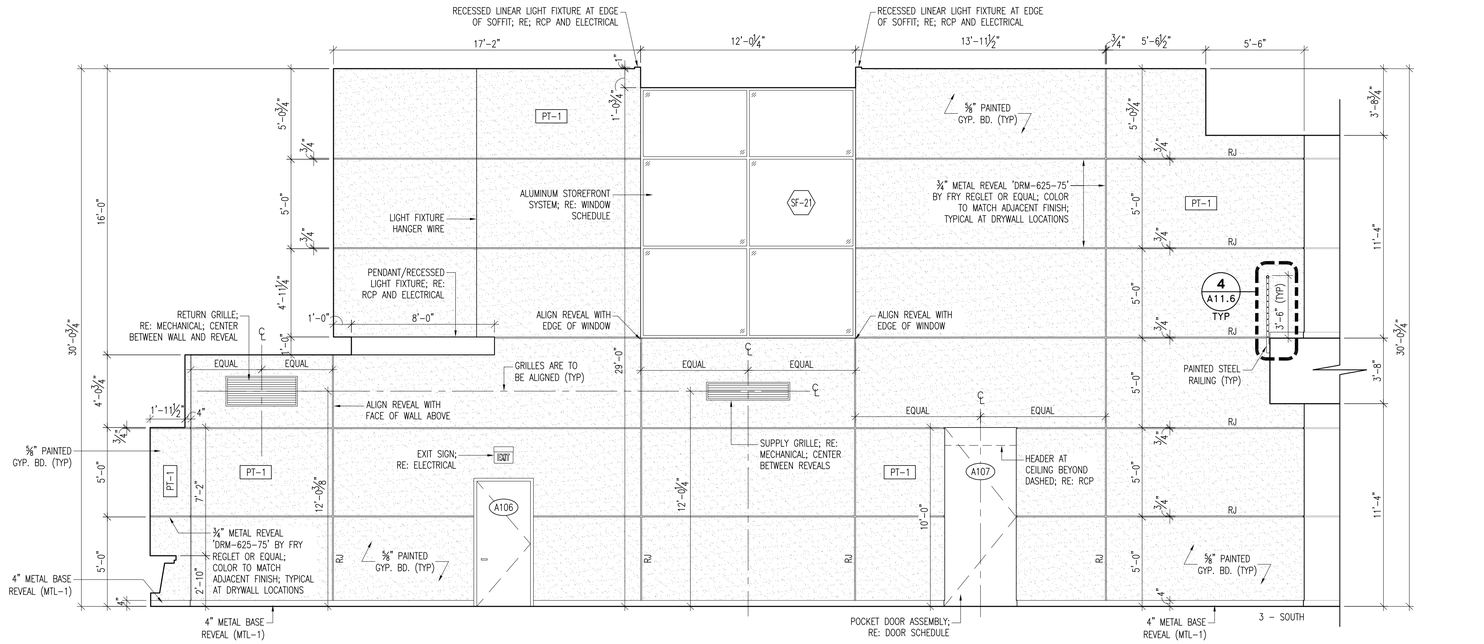
Drawn By:	CR,CP,AS,RB
Checked By:	CR,LA,CP
Client No:	------
Albert & Associates:	12575

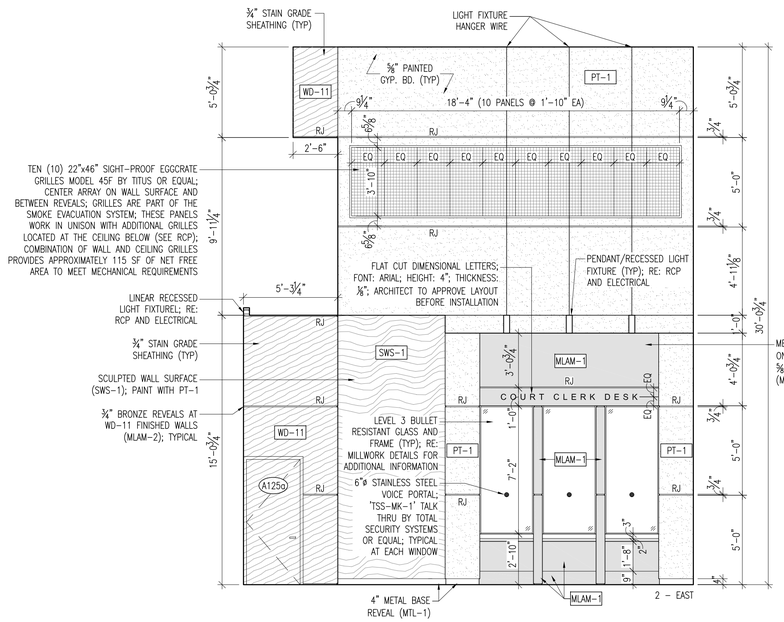
REGISTERED ARCHITECT Larry M Albert Hattiesburg, MS STATE OF MISSISSIPPI

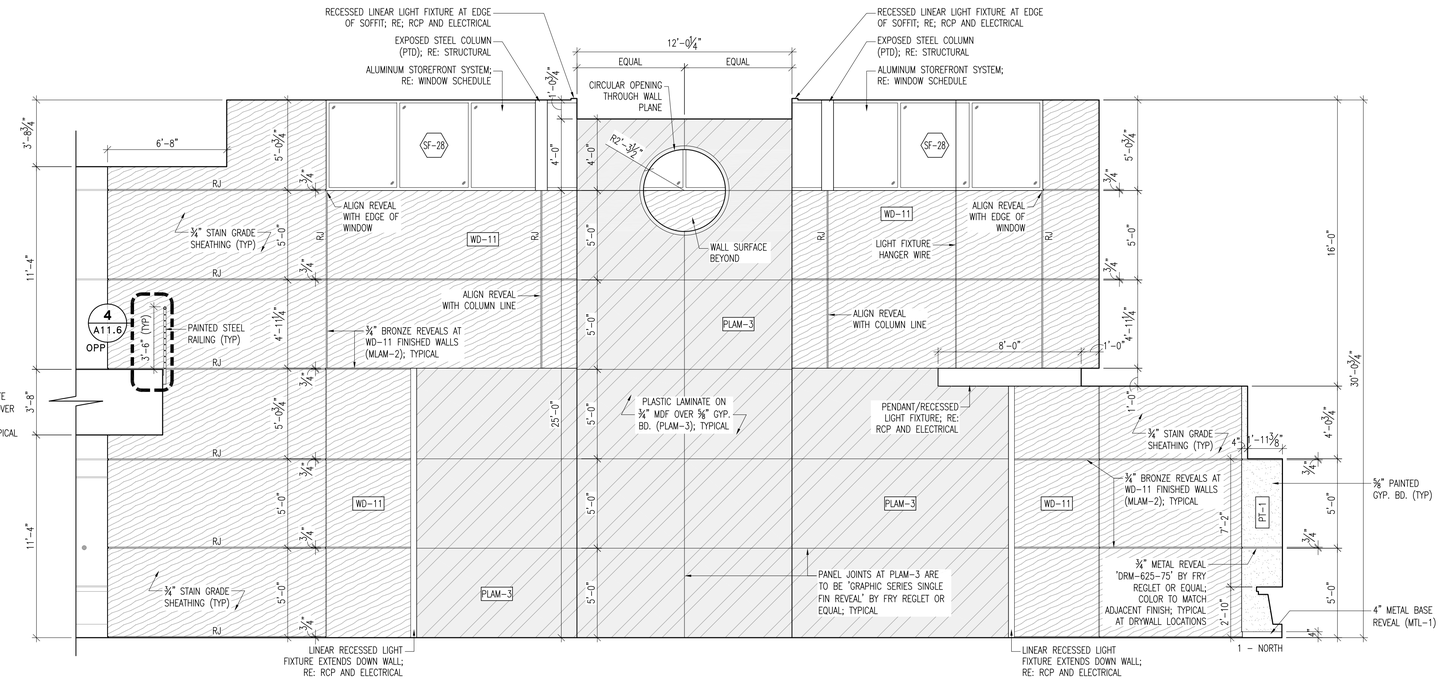
A10.5

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1 Court Lobby [A106] Interior Elevations

SCALE: 1/4" = 1'-0"

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

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11-02-2015	-	90% Pricing Set
11-19-2018	-	100% Bid Docs

Drawn By: CR,CP,AS,RB

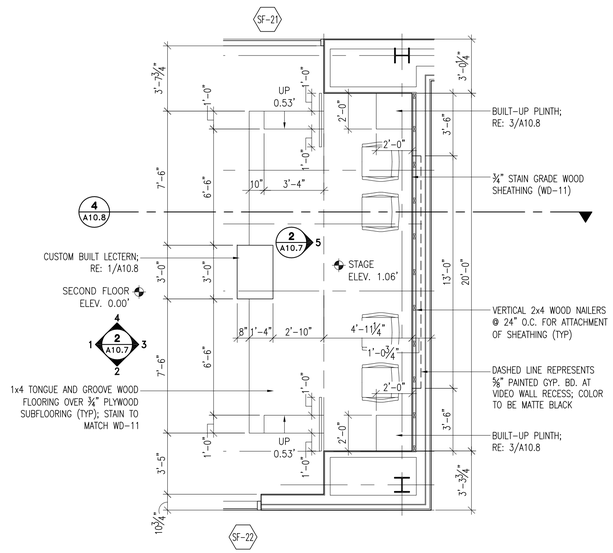
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Client No: ——

Albert & Associates: 12575

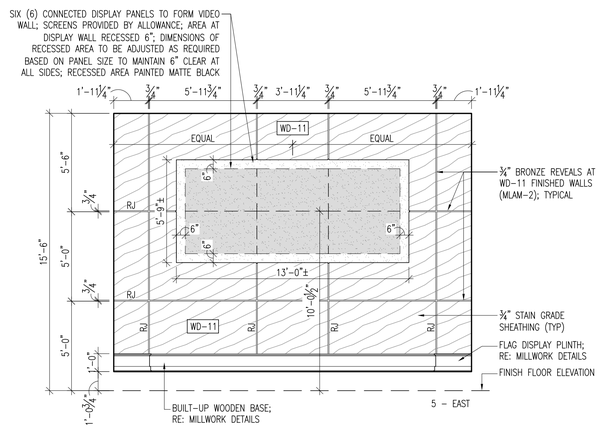
Larry M Albert, Registered Architect, Hattiesburg, MS, State of Mississippi

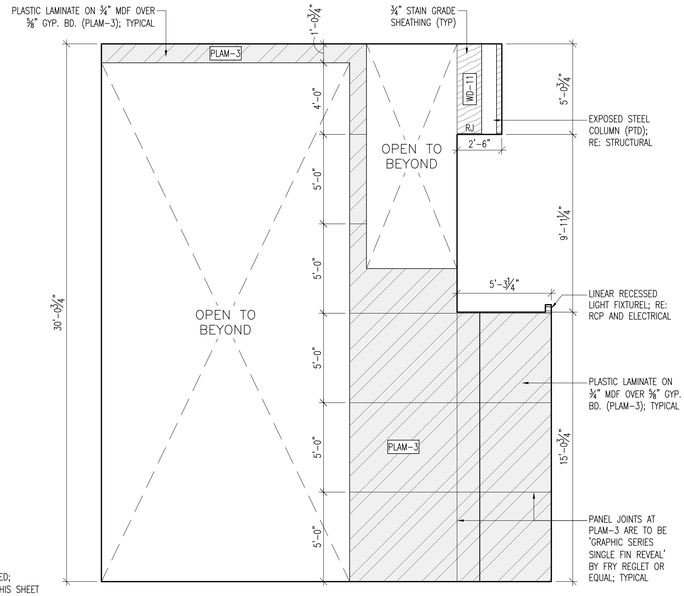
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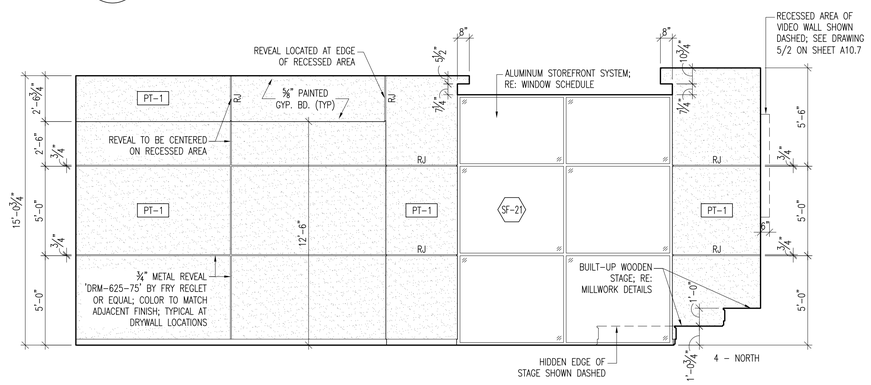


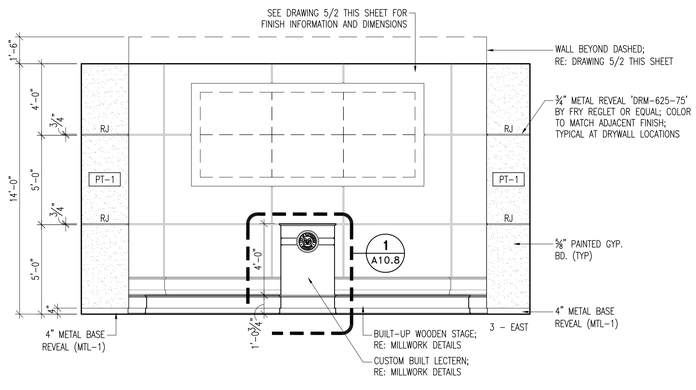
3 Enlarged Stage Plan @ Press/Breifing Room [A202]

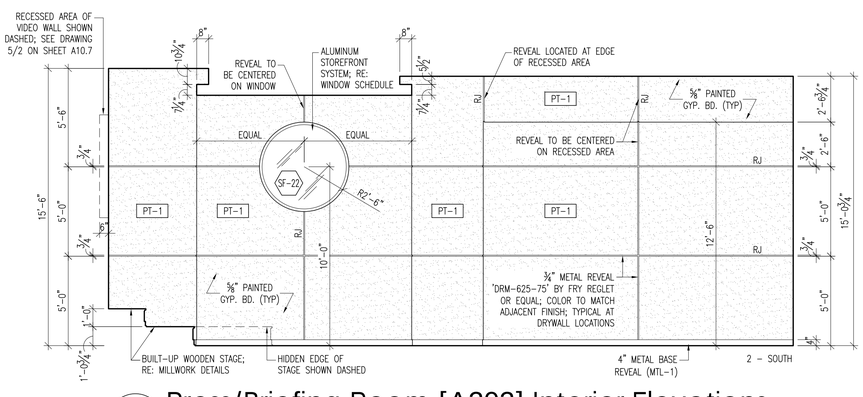
SCALE: 1/4" = 1'-0"

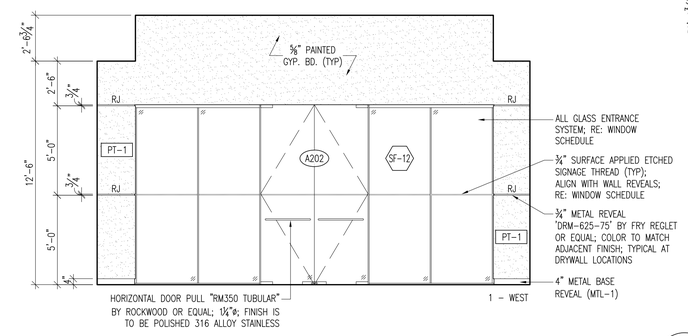


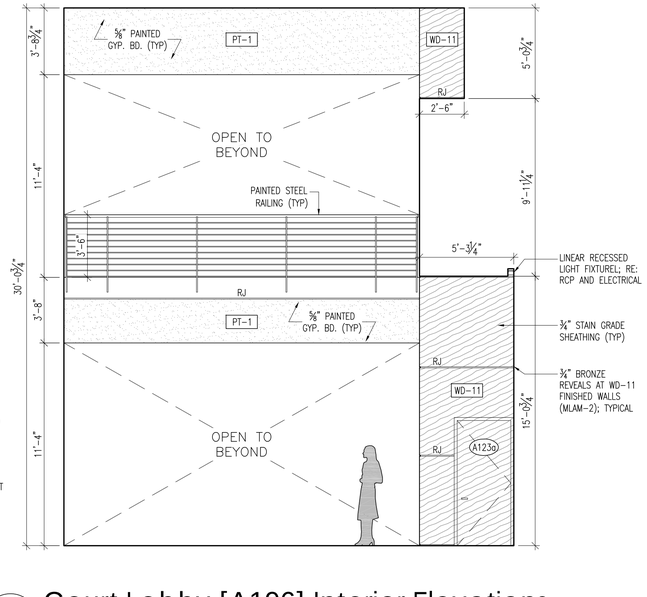












2 Press/Briefing Room [A202] Interior Elevations

SCALE: 1/4" = 1'-0"

1 Court Lobby [A106] Interior Elevations

SCALE: 1/4" = 1'-0"

CITY OF HATTIESBURG MISSISSIPPI 1884

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

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11-19-2018		100% Bid Docs

Drawn By: CR,CP,AS,RE

Checked By: CR,LA,CP

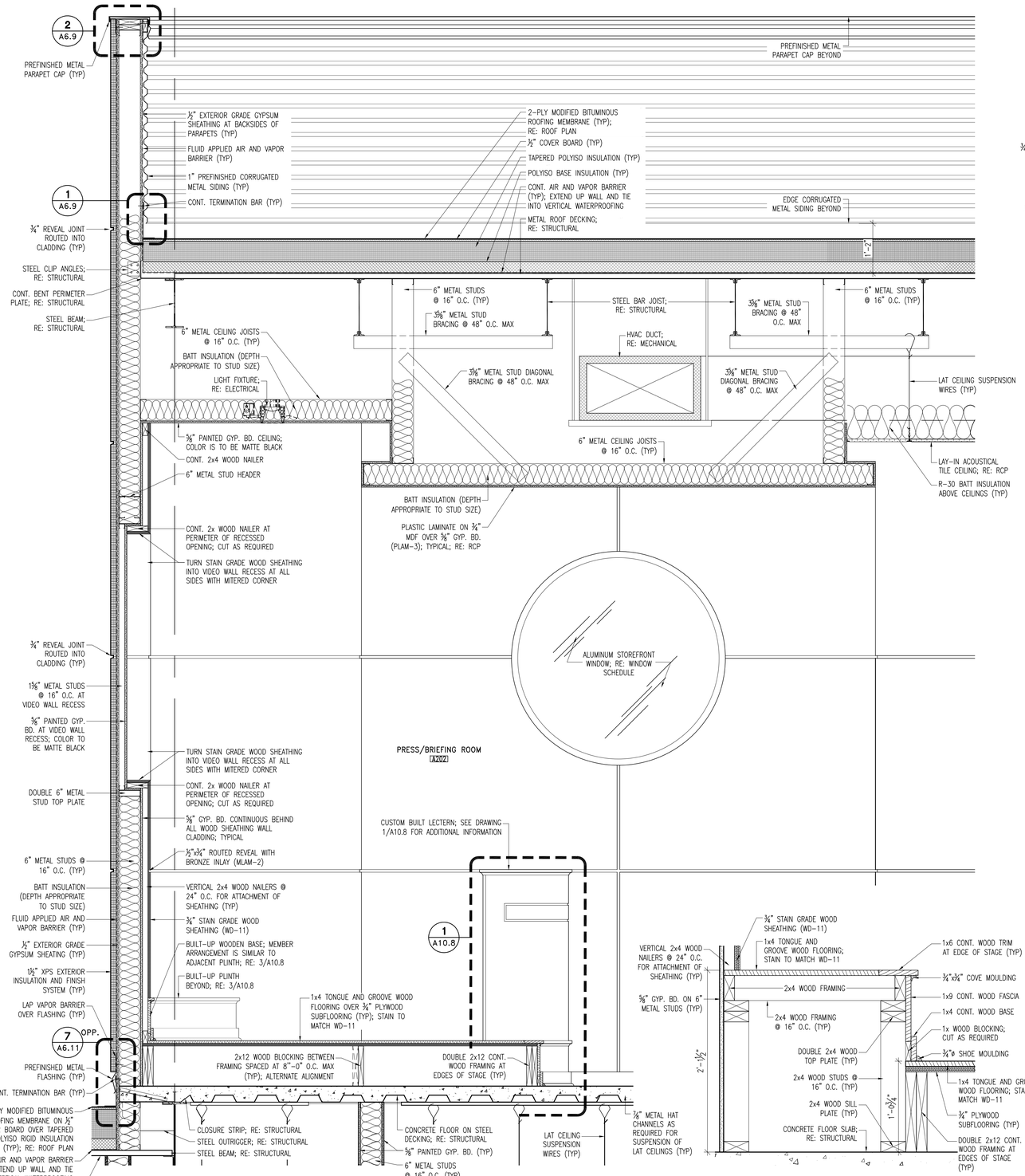
Client No: ------

Albert & Associates: 12576

REGISTERED ARCHITECT Larry M Albert Hattiesburg, MS STATE OF MISSISSIPPI

A10.7

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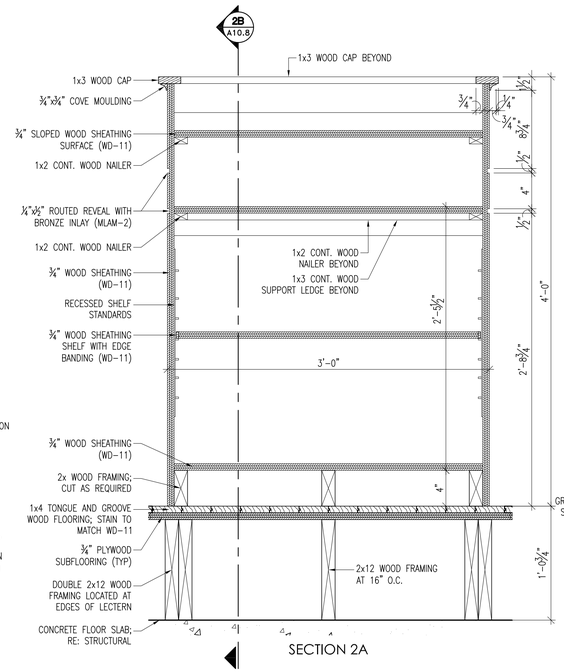
4 Section @ Stage

SCALE: 3/4" = 1'-0"

NOTE: INTERIOR ELEVATIONS IN BUILDING SECTIONS ARE ILLUSTRATIONAL ONLY AND MAY NOT FULLY DEPICT THE DESIGN OF THE SPACE. SEE INTERIOR ELEVATIONS SHEETS FOR INTENDED DESIGN OF SPACES.

3 Plinth Detail

SCALE: 1 1/2" = 1'-0"

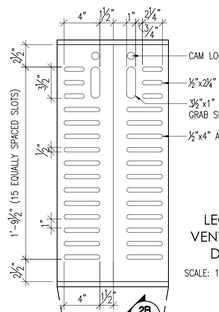


2 Sections @ Lectern

SCALE: 1 1/2" = 1'-0"

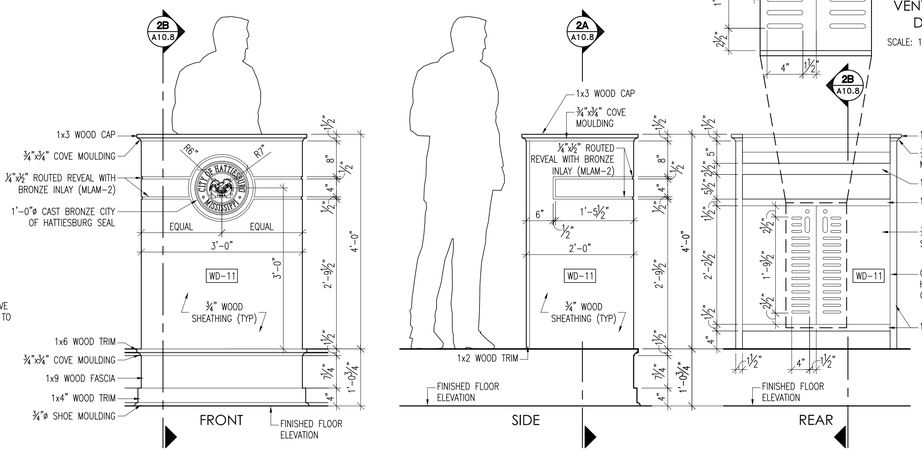
Finished Wood

ALL FINISHED WOOD MEMBERS AT STAGE AND LECTERN ARE TO BE STAIN GRADE; STAIN IS TO MATCH FINISH CODE WD-11; SUBMIT COLOR SAMPLES TO ARCHITECT FOR APPROVAL.



LECTERN VENTILATION DETAIL

SCALE: 1 1/2" = 1'-0"



1 Lectern Elevations

SCALE: 3/4" = 1'-0"

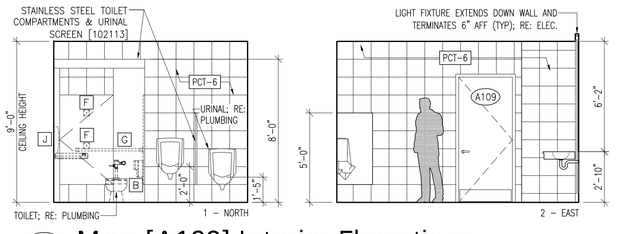
HATTIESBURG PUBLIC SAFETY COMPLEX
HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■
HPSC Police and Court Building

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Drawn By: CR,CP,AS,RB
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Client No: ——
Albert & Associates: 12575

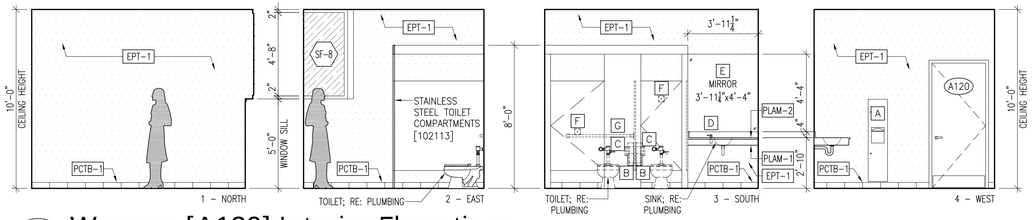
Larry M Albert, Registered Architect, Hattiesburg, MS, State of Mississippi

A10.8



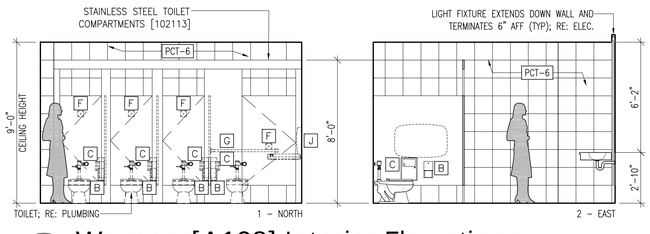
5 Men [A109] Interior Elevations

SCALE: 1/4" = 1'-0"



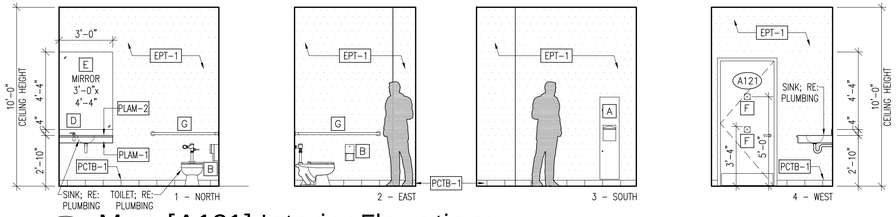
6 Women [A120] Interior Elevations

SCALE: 1/4" = 1'-0"



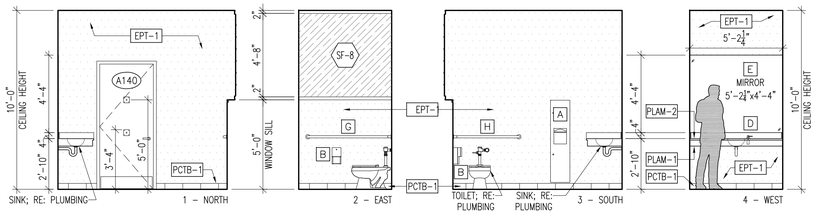
7 Women [A108] Interior Elevations

SCALE: 1/4" = 1'-0"



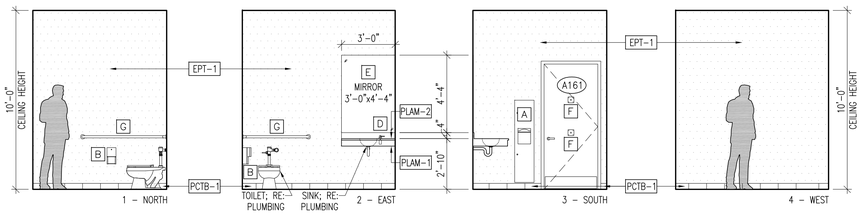
8 Men [A121] Interior Elevations

SCALE: 1/4" = 1'-0"



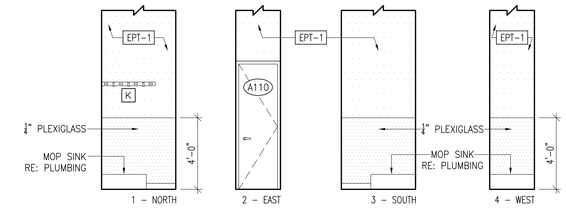
9 Restroom [A140] Interior Elevations

SCALE: 1/4" = 1'-0"



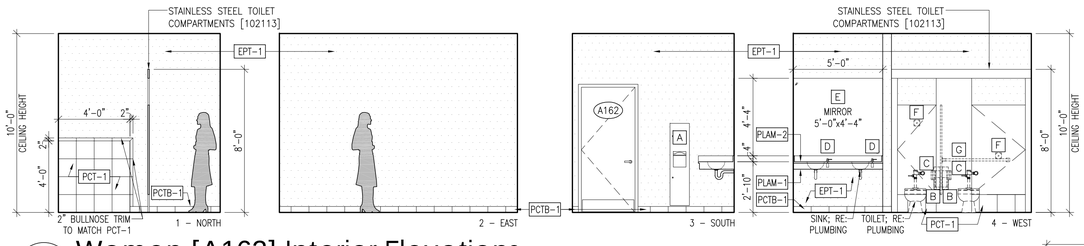
10 Men [A161] Interior Elevations

SCALE: 1/4" = 1'-0"



11 Janitor's Closet [A110]

SCALE: 1/4"=1'-0"



12 Women [A162] Interior Elevations

SCALE: 1/4" = 1'-0"

Restroom Accessory Key and Notes

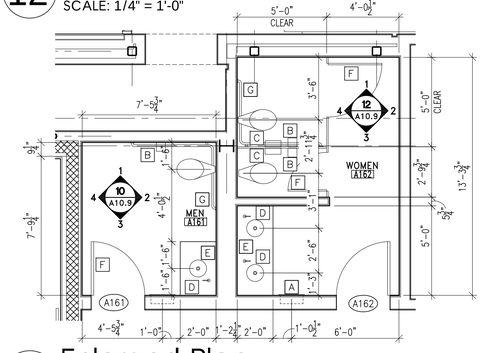
A	RECESSED PAPER TOWEL DISPENSER AND WASTE RECEPTACLE (B-3803) BY BOBRICK OR EQUAL	F	VANDAL-RESISTANT CLOTHES HOOK (B-983) BY BOBRICK OR EQUAL
B	SURFACE-MOUNTED-MULTI ROLL TOILET TISSUE DISPENSER (B-4288) BY BOBRICK OR EQUAL	G	TWO-WALL TOILET COMPARTMENT GRAB BARS 42"x54" BY BOBRICK OR EQUAL
C	SANITARY NAPKIN DISPOSAL (B-254) BY BOBRICK OR EQUAL	J	WALL-MOUNTED BABY CHANGING STATION (KB200-SS) BY KOALA OR EQUAL
D	VANITY-MOUNTED SOAP DISPENSER (B-822) BY BOBRICK OR EQUAL	K	MOP AND BROOM HOLDER (B-223) BY BOBRICK OR EQUAL
E	MIRROR (WALL MOUNT, BEVELED EDGES) – SEE INTERIOR ELEVS. FOR SIZES.		

GENERAL NOTES:

1. PROVIDE CUTSHEETS PRIOR TO ORDERING ACCESSORIES.
2. VERIFY ADA COMPLIANT MOUNTING HEIGHTS AND INSTALL ALL BATHROOM ACCESSORIES IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.
3. PROVIDE ALL NECESSARY BLOCKING AND PARTS FOR COMPLETE INSTALLATION.
4. ALL ACCESSORIES SHALL BE BRAND NEW AND OUT OF THE BOX, AND PROVIDED WITH THE MANUFACTURER'S MANUALS.
5. COORDINATE ACCESSORIES INSTALLATION WITH PLUMBING FIXTURES (RE: PLUMBING).

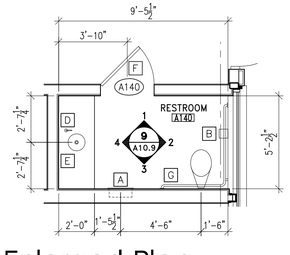
Interior Elevations Note

REFER TO SHEET A9.0a AND A9.0b FOR FINISH SCHEDULES AND CODES



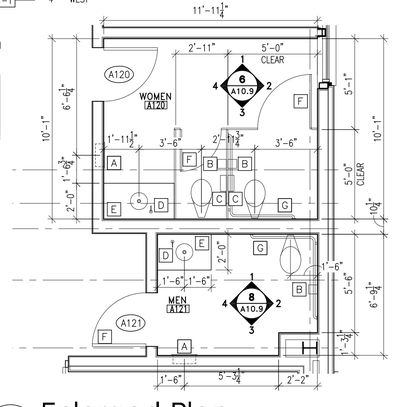
4 Enlarged Plan

SCALE: 1/4" = 1'-0" MEN A161 & WOMEN A162



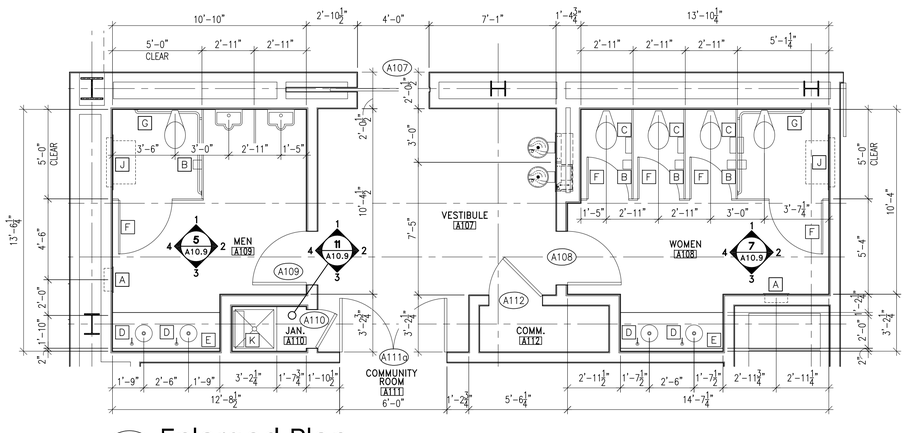
3 Enlarged Plan

SCALE: 1/4" = 1'-0" RESTROOM A140



2 Enlarged Plan

SCALE: 1/4" = 1'-0" WOMEN A120 & MEN A121



1 Enlarged Plan

SCALE: 1/4" = 1'-0" MEN A109 & WOMEN A108

CITY OF HATTIESBURG MISSISSIPPI 1884

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Checked By: CR,LA,CF

Client No: ------

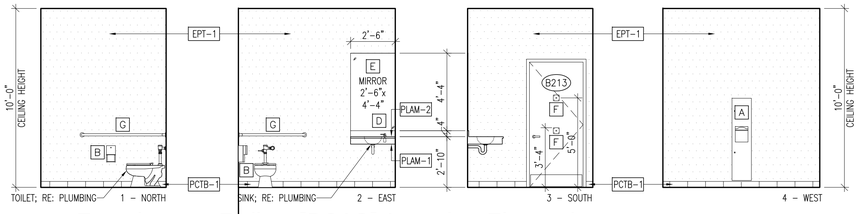
Albert & Associates: 1257!

REGISTERED ARCHITECT Larry M Albert Hattiesburg, MS STATE OF MISSISSIPPI

A10.9

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com **Albert & McCleskey Associates Architects**

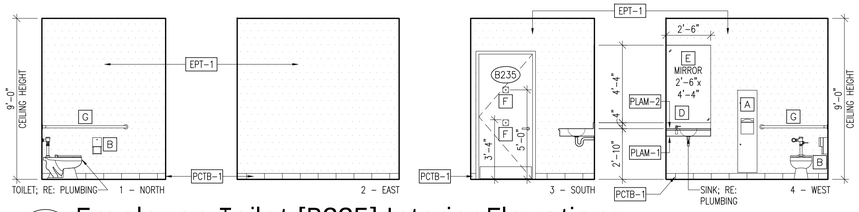
ENLARGED RESTROOM PLANS & ELEVATIONS



5 Employee Toilet [B213] Interior Elevations

SCALE: 1/4" = 1'-0"

EMPLOYEE TOILET B214 (OPP. HAND)



6 Employee Toilet [B235] Interior Elevations

SCALE: 1/4" = 1'-0"

Shower Accessory Key and Notes

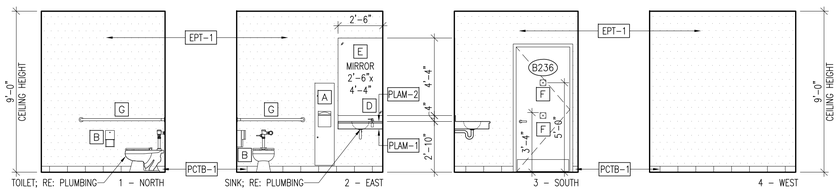
(a) WALL MOUNTED FOLDING SHOWER SEAT BY BOBRICK OR EQUAL

(b) RECESSED SOAP SOAP DISH W/ BAR BY BOBRICK OR EQUAL

(c) 24" TOWEL BAR BY BOBRICK OR EQUAL

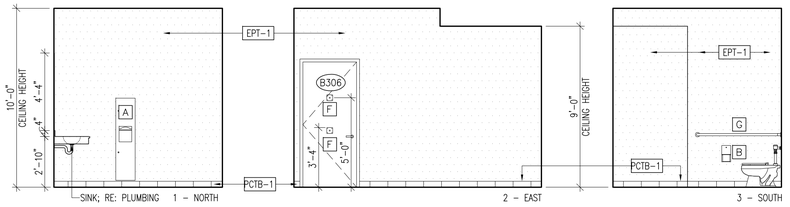
GENERAL NOTES:

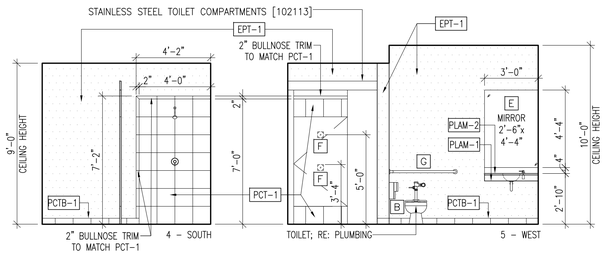
1. PROVIDE CUTSHEETS PRIOR TO ORDERING ACCESSORIES.
2. VERIFY ADA COMPLIANT MOUNTING HEIGHTS AND INSTALL ALL BATHROOM ACCESSORIES IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.
3. PROVIDE ALL NECESSARY BLOCKING AND PARTS FOR COMPLETE INSTALLATION.
4. ALL ACCESSORIES SHALL BE BRAND NEW AND OUT OF THE BOX, AND PROVIDED WITH THE MANUFACTURER'S MANUALS.
5. COORDINATE ACCESSORIES INSTALLATION WITH PLUMBING FIXTURES (RE: PLUMB).



7 Employee Toilet [B236] Interior Elevations

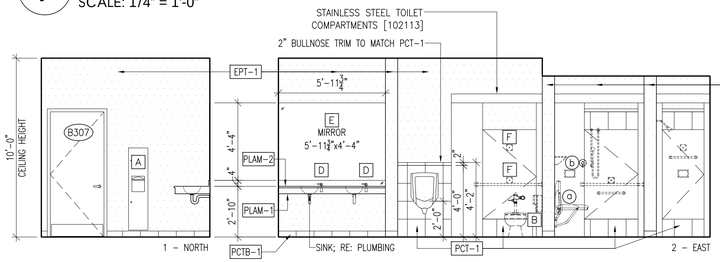
SCALE: 1/4" = 1'-0"

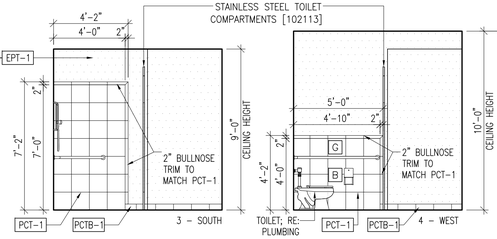


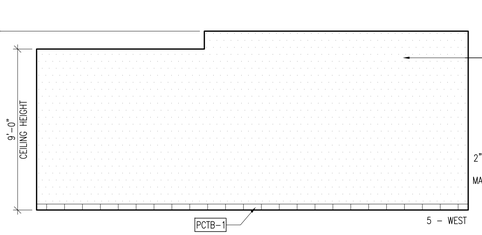


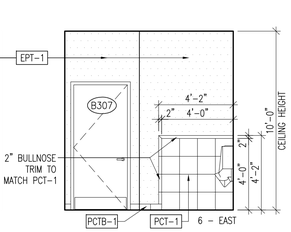
8 Restroom w/ Shower [B306] Interior Elevations

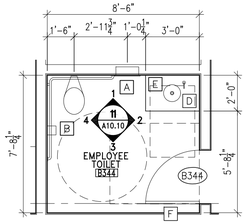
SCALE: 1/4" = 1'-0"









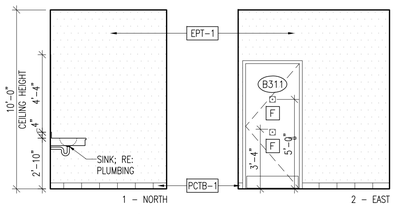


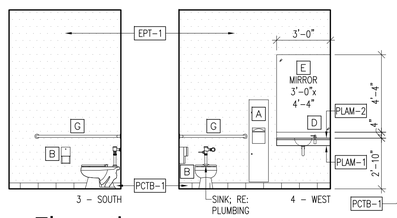
9 Restroom w/ Showers [B307] Interior Elevations

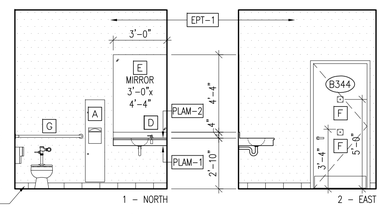
SCALE: 1/4" = 1'-0"

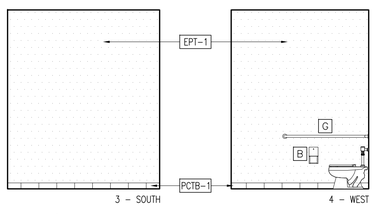
12 Enlarged Plan

SCALE: 1/4" = 1'-0" EMPLOYEE TLT B344









10 Employee Toilet [B311] Interior Elevations

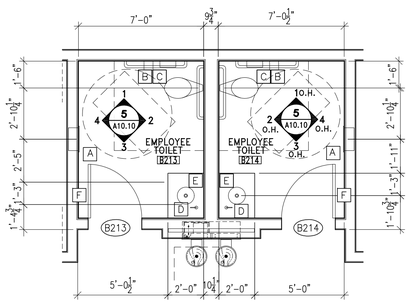
SCALE: 1/4" = 1'-0"

EMPLOYEE TOILET B314 (OPP. HAND)

11 Employee Toilet [B344] Interior Elevations

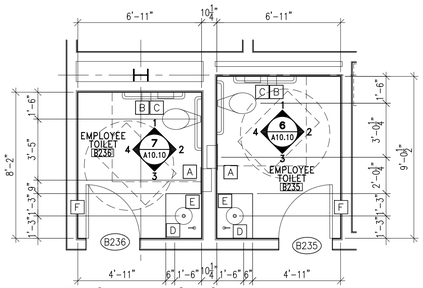
SCALE: 1/4" = 1'-0"

EMPLOYEE TOILET B345 (SIM.)



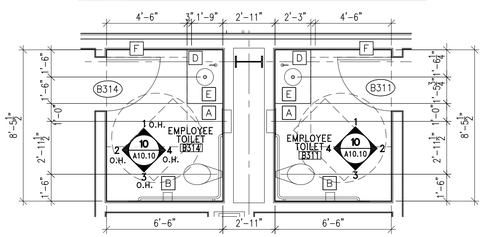
4 Enlarged Plan

SCALE: 1/4" = 1'-0" EMPLOYEE TOILET B213 & B214



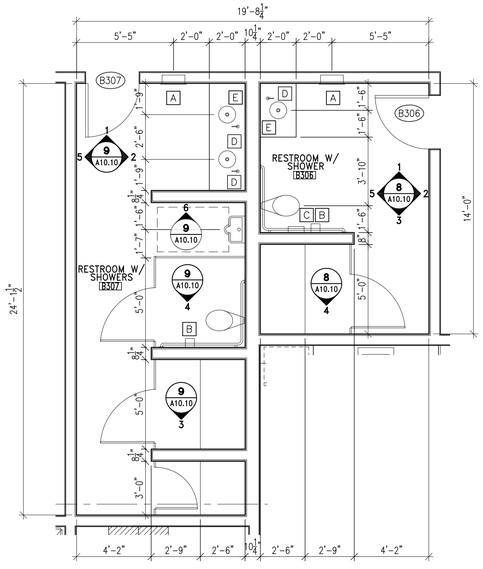
3 Enlarged Plan

SCALE: 1/4" = 1'-0" EMPLOYEE TOILET B235 & B236



2 Enlarged Plan

SCALE: 1/4" = 1'-0" EMPLOYEE TOILET B311 & B314



1 Enlarged Plan

SCALE: 1/4" = 1'-0" RESTROOM w/SHOWERS B306 & B307

Interior Elevations Note

REFER TO SHEET A9.0a AND A9.0b FOR FINISH SCHEDULES AND CODES

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT

HPSC Police and Court Building

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Date	Rev.	Description
08-31-2015		DD Check Set
10-20-2015		75% Progress Set
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11-19-2018		100% Bid Docs

Drawn By: CR,CP,AS,RE

Checked By: CR,LA,CF

Client No: ------

Albert & Associates: 1257

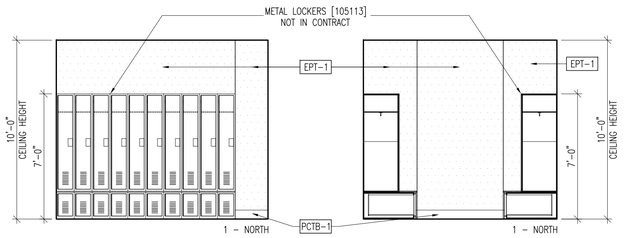
Lorry W. Albert, P.E. Hattiesburg, MS

A10.10

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com

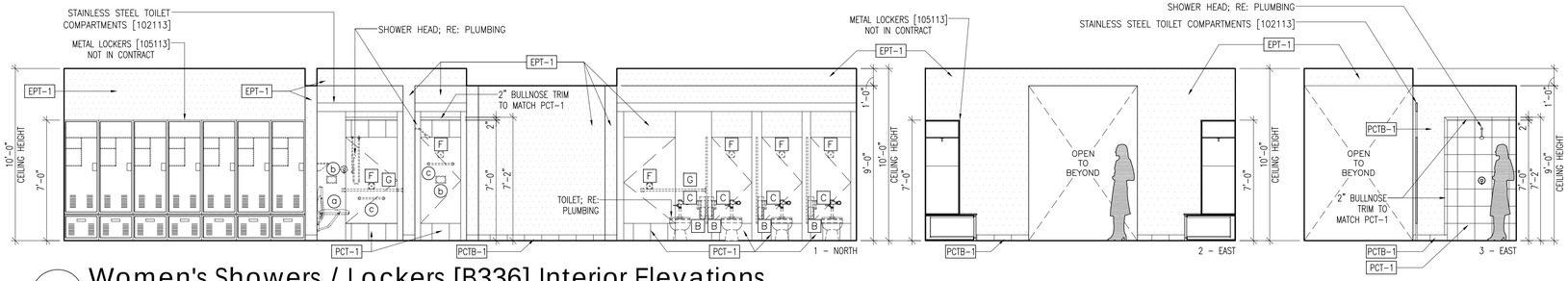
Albert & McCleskey Associates Architects

ENLARGED RESTROOM PLANS & ELEVATIONS



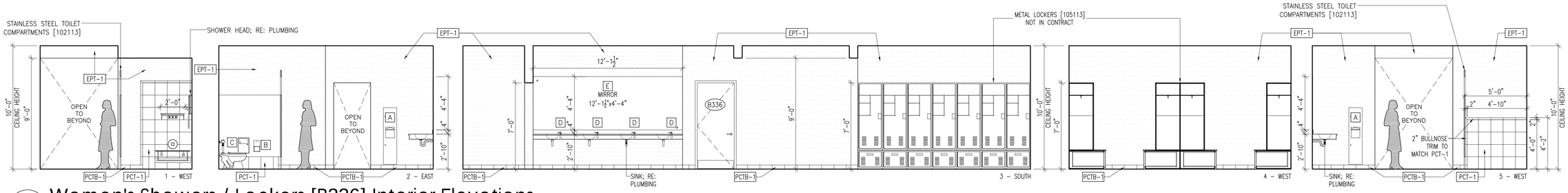
2 Locker Room [B337] Interior Elevations

SCALE: 1/4" = 1'-0"



3 Women's Showers / Lockers [B336] Interior Elevations

SCALE: 1/4" = 1'-0"



4 Women's Showers / Lockers [B336] Interior Elevations

SCALE: 1/4" = 1'-0"

Interior Elevations Note

REFER TO SHEET A9.0a AND A9.0b FOR FINISH SCHEDULES AND CODES

Restroom Accessory Key and Notes

- A — RECESSED PAPER TOWEL DISPENSER AND WASTE RECEPTACLE (B-3803) BY BOBRICK OR EQUAL
- B — SURFACE-MOUNTED-MULTI ROLL TOILET TISSUE DISPENSER (B-4288) BY BOBRICK OR EQUAL
- C — SANITARY NAPKIN DISPOSAL (B-254) BY BOBRICK OR EQUAL
- D — VANITY-MOUNTED SOAP DISPENSER (B-822) BY BOBRICK OR EQUAL
- E — MIRROR (WALL MOUNT, BEVELED EDGES) - SEE INTERIOR ELEVS. FOR SIZES.
- F — VANDAL-RESISTANT CLOTHES HOOK (B-983) BY BOBRICK OR EQUAL
- G — TWO-WALL TOILET COMPARTMENT GRAB BARS 42"x54" BY BOBRICK OR EQUAL
- J — WALL-MOUNTED BABY CHANGING STATION (KB200-SS) BY KOALA OR EQUAL
- K — MOP AND BROOM HOLDER (B-223) BY BOBRICK OR EQUAL

GENERAL NOTES:

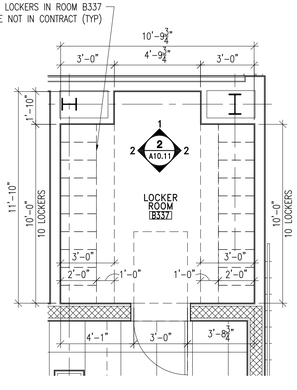
1. PROVIDE CUTSHEETS PRIOR TO ORDERING ACCESSORIES.
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5. COORDINATE ACCESSORIES INSTALLATION WITH PLUMBING FIXTURES (RE: PLUMBING).

Shower Accessory Key & Notes

- (a) WALL MOUNTED FOLDING SHOWER SEAT BY BOBRICK OR EQUAL
- (b) RECESSED SOAP SOAP DISH W/ BAR BY BOBRICK OR EQUAL
- (c) 24" TOWEL BAR BY BOBRICK OR EQUAL

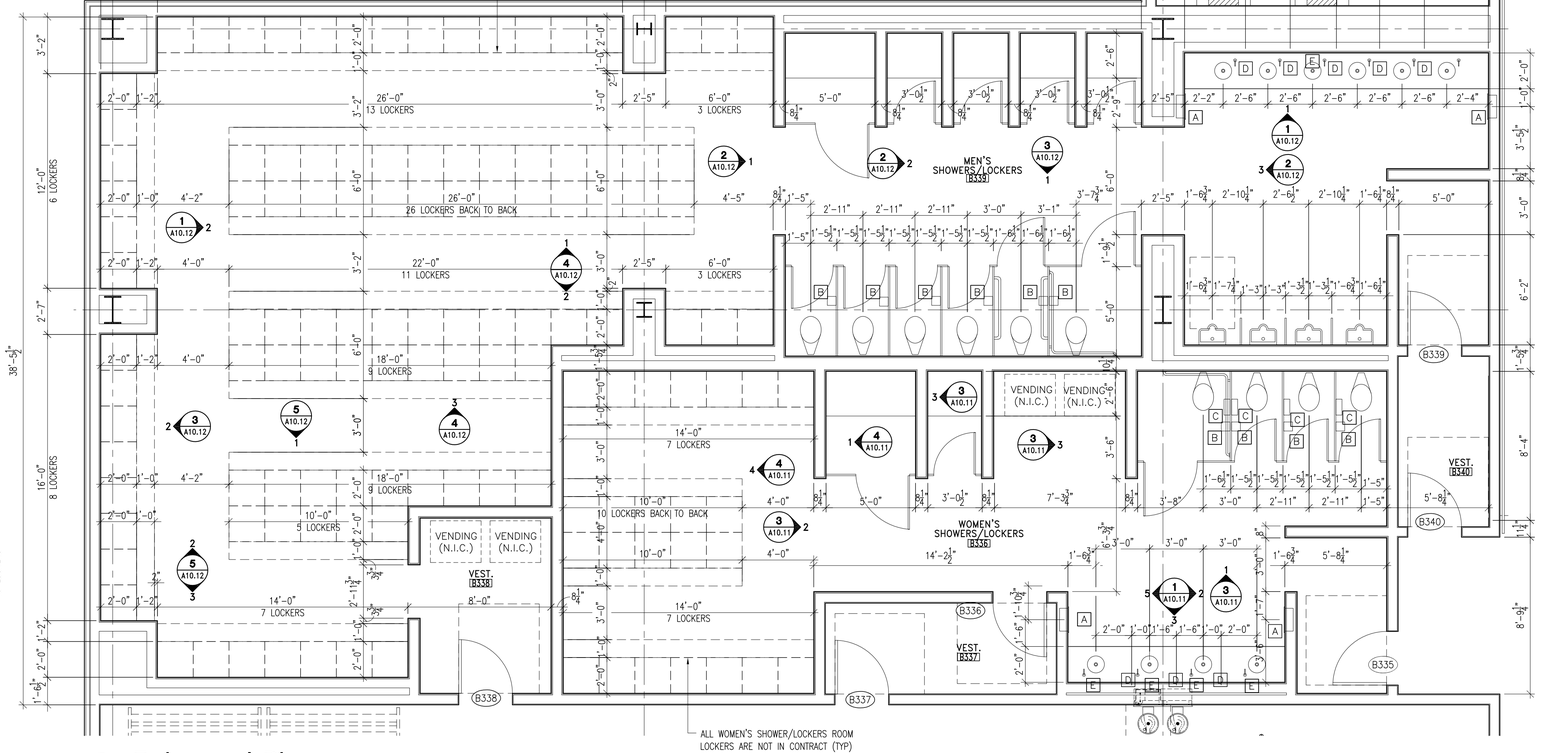
GENERAL NOTES:

1. PROVIDE CUTSHEETS PRIOR TO ORDERING ACCESSORIES.
2. VERIFY ADA COMPLIANT MOUNTING HEIGHTS AND INSTALL ALL BATHROOM ACCESSORIES IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.
3. PROVIDE ALL NECESSARY BLOCKING AND PARTS FOR COMPLETE INSTALLATION.
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5. COORDINATE ACCESSORIES INSTALLATION WITH PLUMBING FIXTURES (RE: PLUMB).



2 Enlarged Plan

SCALE: 1/4" = 1'-0" LOCKER R00M B337



1 Enlarged Plan

SCALE: 1/4" = 1'-0"

MEN'S / WOMEN'S SHOWERS LOCKERS B336-B340

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

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Drawn By: CR,CP,AS,RB

Checked By: CR,LA,CP

Client No: ------

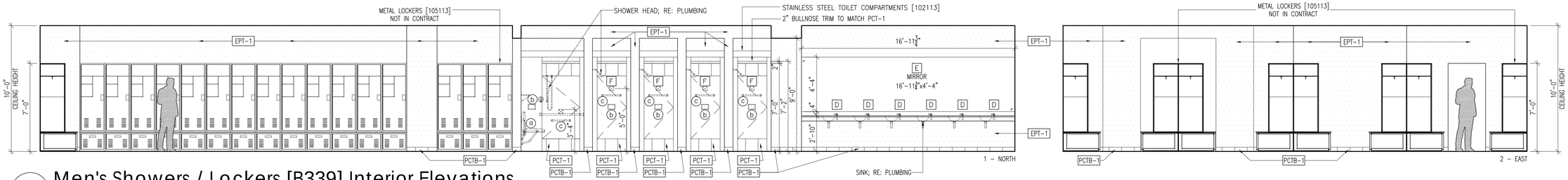
Albert & Associates: 12575

Larry M. Albert — Registered Architect — Hattiesburg, MS — State of Mississippi

A10.11

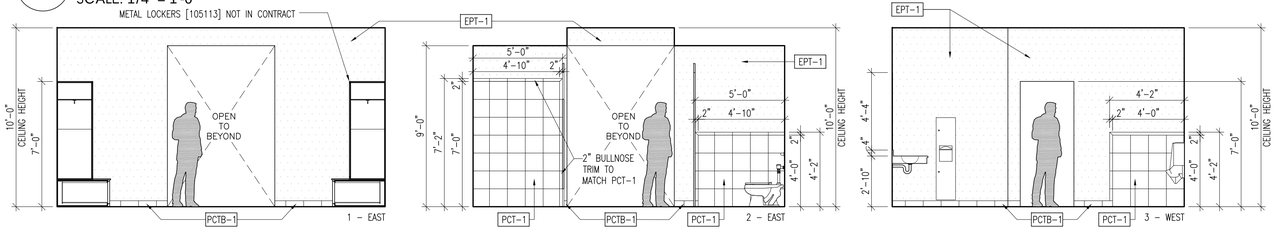
514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com **Albert & McCleskey Associates Architects**

ENLARGED RESTROOM PLANS & ELEVATIONS



1 Men's Shower / Lockers [B339] Interior Elevations

SCALE: 1/4" = 1'-0"



2 Men's Showers / Lockers [B339] Interior Elevations

SCALE: 1/4" = 1'-0"

Shower Accessory Key & Notes

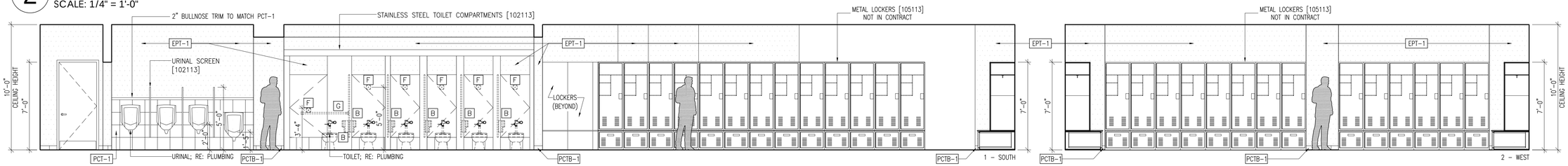
(a) WALL MOUNTED FOLDING SHOWER SEAT BY BOBRICK OR EQUAL

(b) RECESSED SOAP SOAP DISH W/ BAR BY BOBRICK OR EQUAL

(c) 24" TOWEL BAR BY BOBRICK OR EQUAL

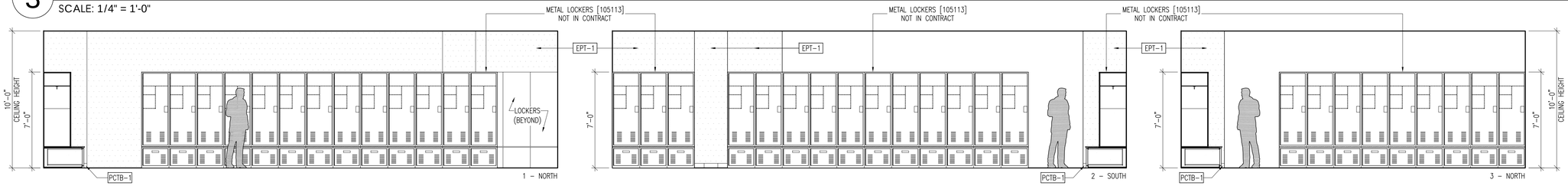
GENERAL NOTES:

1. PROVIDE CUTSHEETS PRIOR TO ORDERING ACCESSORIES.
2. VERIFY ADA COMPLIANT MOUNTING HEIGHTS AND INSTALL ALL BATHROOM ACCESSORIES IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.
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5. COORDINATE ACCESSORIES INSTALLATION WITH PLUMBING FIXTURES (RE: PLUMB).



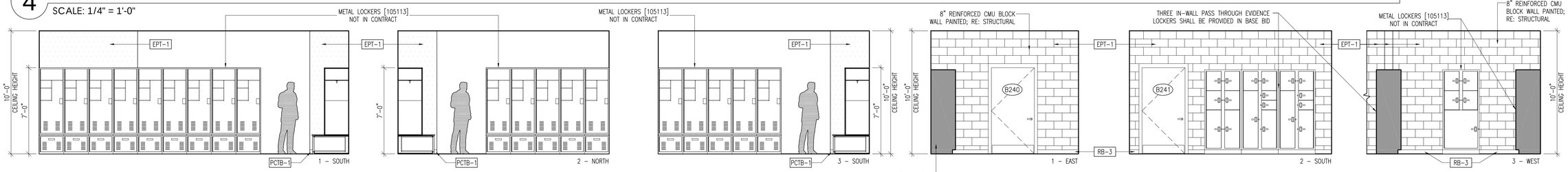
3 Men's Showers / Lockers [B339] Interior Elevations

SCALE: 1/4" = 1'-0"



4 Men's Showers / Lockers [B339] Interior Elevations

SCALE: 1/4" = 1'-0"



5 Men's Showers / Lockers [B339] Interior Elevations

SCALE: 1/4" = 1'-0"

6 Temporary Evidence Storage [B240] Interior Elevations

SCALE: 1/4" = 1'-0"

Restroom Accessory Key and Notes

A RECESSED PAPER TOWEL DISPENSER AND WASTE RECEPTACLE (B-3803) BY BOBRICK OR EQUAL.

B SURFACE-MOUNTED-MULTI ROLL TOILET TISSUE DISPENSER (B-4288) BY BOBRICK OR EQUAL.

C SANITARY NAPKIN DISPOSAL (B-254) BY BOBRICK OR EQUAL.

D VANITY-MOUNTED SOAP DISPENSER (B-822) BY BOBRICK OR EQUAL.

E MIRROR (WALL MOUNT, BEVELED EDGES) - SEE INTERIOR ELEVS. FOR SIZES.

F VANDAL-RESISTANT CLOTHES HOOK (B-983) BY BOBRICK OR EQUAL.

G TWO-WALL TOILET COMPARTMENT GRAB BARS 42"x54" BY BOBRICK OR EQUAL

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GENERAL NOTES:

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4. ALL ACCESSORIES SHALL BE BRAND NEW AND OUT OF THE BOX, AND PROVIDED WITH THE MANUFACTURER'S MANUALS.
5. COORDINATE ACCESSORIES INSTALLATION WITH PLUMBING FIXTURES (RE: PLUMBING).

Interior Elevations Note

REFER TO SHEET A9.0a AND A9.0b FOR FINISH SCHEDULES AND CODES

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Checked By: CR,LA,CF

Client No: ------

Albert & Associates: 1257

REGISTERED ARCHITECT Larry A. Albert Hattiesburg, MS STATE OF MISSISSIPPI

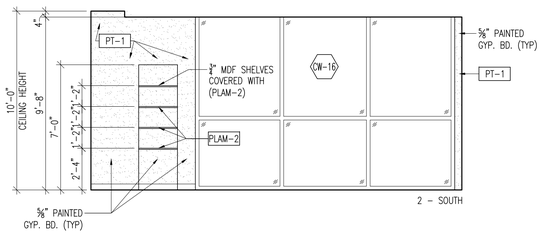
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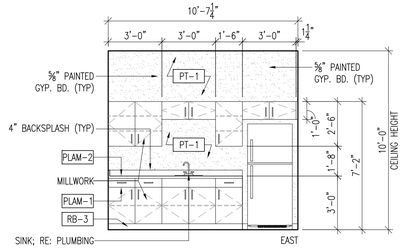
ENLARGED RESTROOM PLANS & ELEVATIONS

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com **Albert & McCleskey Associates Architects**

Interior Elevations Note

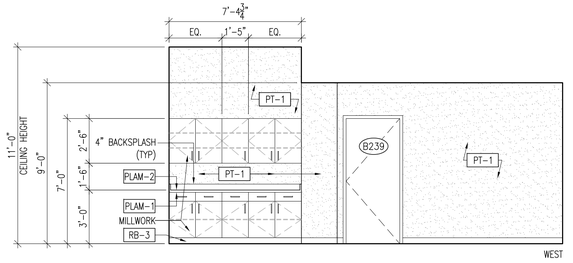
REFER TO SHEET A9.0a AND A9.0b FOR FINISH SCHEDULES AND CODES





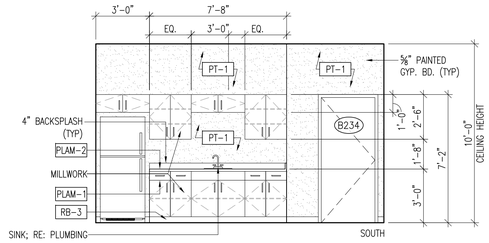
13 Break Room [A253] Int. Elev.

SCALE: 1/4" = 1'-0"



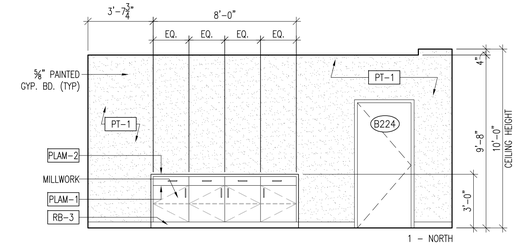
12 Crime Scene Unit [B239] Int. Elev.

SCALE: 1/4" = 1'-0"



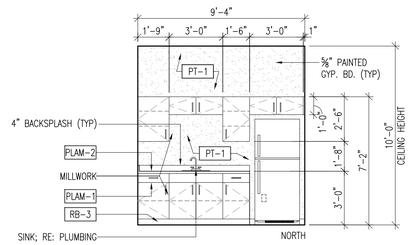
11 Detectives Break Room [B234] Int. Elev.

SCALE: 1/4" = 1'-0"



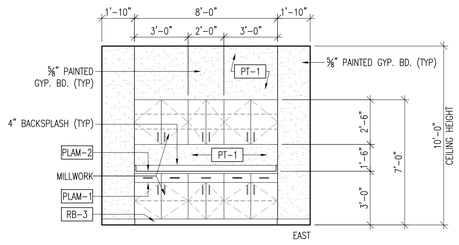
10 Small Meeting Room [B224] Int. Elevations

SCALE: 1/4" = 1'-0"



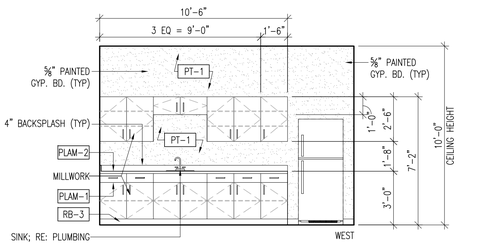
9 Break Room [B212] Int. Elev.

SCALE: 1/4" = 1'-0"



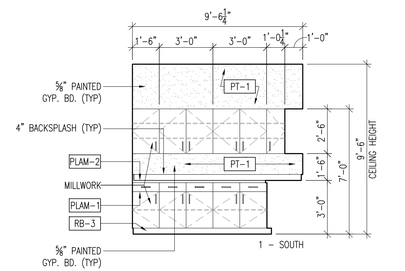
8 Conference Room [B205] Int. Elev.

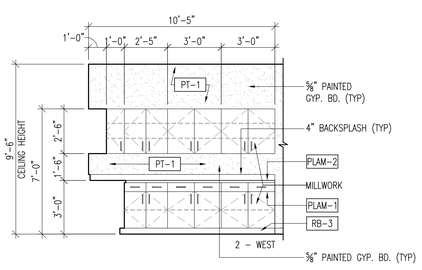
SCALE: 1/4" = 1'-0"



7 Break Room [A164] Int. Elev.

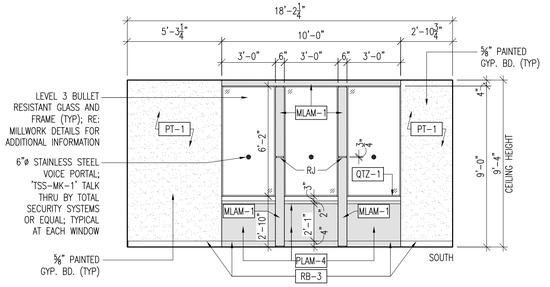
SCALE: 1/4" = 1'-0"





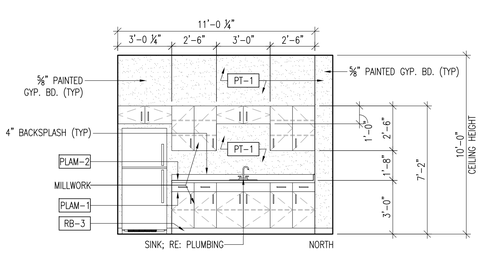
6 Work Area [A151] Interior Elevations

SCALE: 1/4" = 1'-0"



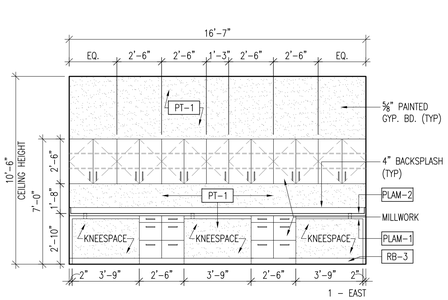
5 Front Desk Area [A150] Int. Elev.

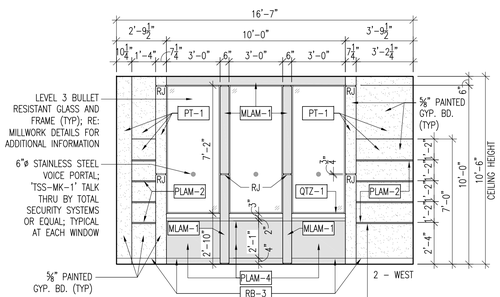
SCALE: 1/4" = 1'-0"



4 Court Break Room [A119] Int. Elev.

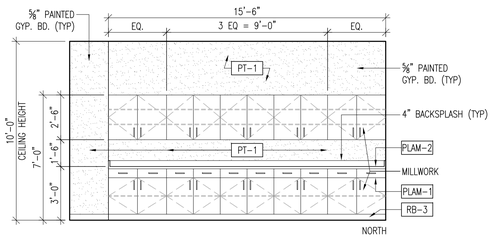
SCALE: 1/4" = 1'-0"





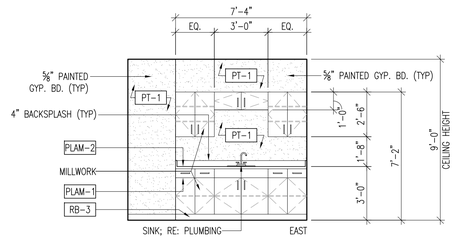
3 Court Clerk Desk [A118] Interior Elevations

SCALE: 1/4" = 1'-0"



2 Deputy Court Clerk Area [A117] Interior Elevation

SCALE: 1/4" = 1'-0"



1 Kitchen [A113] Interior Elevation

SCALE: 1/4" = 1'-0"

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

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11-19-2018		100% Bid Docs

Drawn By: CR,CP,AS,RB

Checked By: CR,LA,CP

Client No: ------

Albert & Associates: 12575

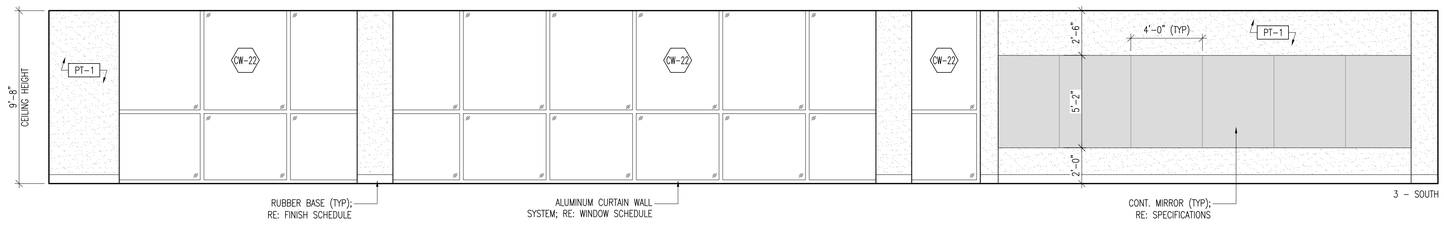
REGISTERED ARCHITECT Larry Albert Hattiesburg, MS STATE OF MISSISSIPPI

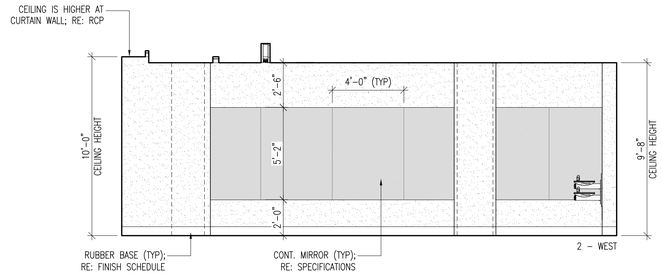
A10.13

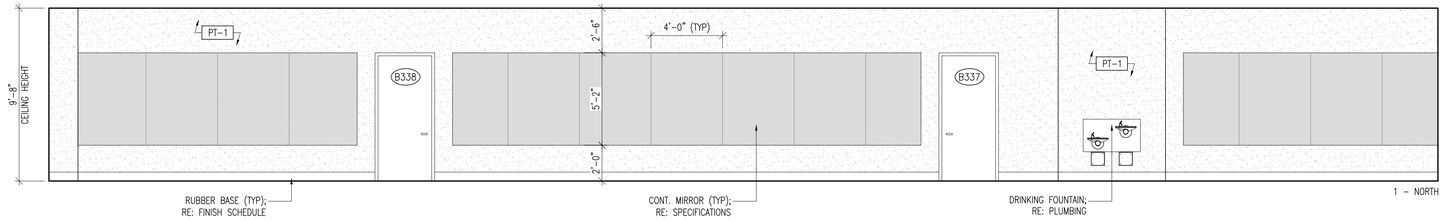
514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com **Albert & McCleskey Associates Architects**

Interior Elevations Note

REFER TO SHEET A9.0a AND A9.0b FOR FINISH SCHEDULES AND CODES



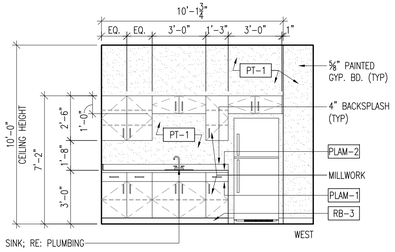




OMITTED

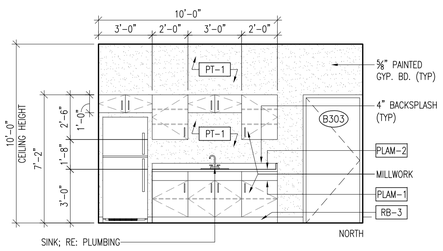
6 Exercise Room [B334] Interior Elevations

SCALE: 1/4" = 1'-0"



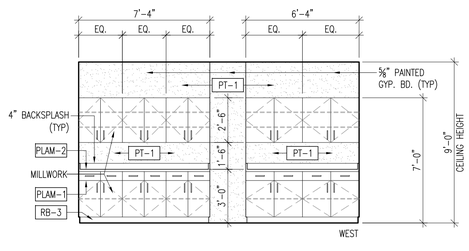
5 Break Room [B331] Int. Elev.

SCALE: 1/4" = 1'-0"



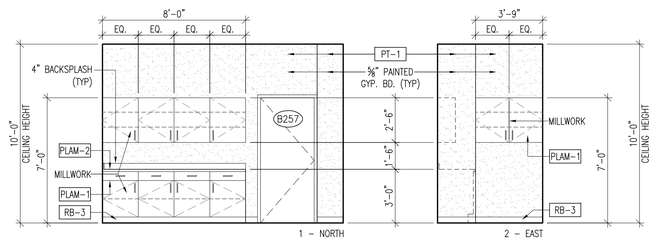
4 Break Room [B305] Int. Elev.

SCALE: 1/4" = 1'-0"



3 Work Room /Mail [B303] Int. Elev.

SCALE: 1/4" = 1'-0"



2 Work Room [B257] Interior Elevations

SCALE: 1/4" = 1'-0"

OMITTED

1 – NORTH

OMITTED

2 – EAST

OMITTED

3 – SOUTH

OMITTED

4 – WEST

1 Crime Scene Laboratory [B238] Interior Elevations - OMITTED

SCALE: 1/4"=1'-0"

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com **Albert & McCleskey Associates Architects**

CITY OF HATTIESBURG MISSISSIPPI 1884

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

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11-19-2018		100% Bid Docs

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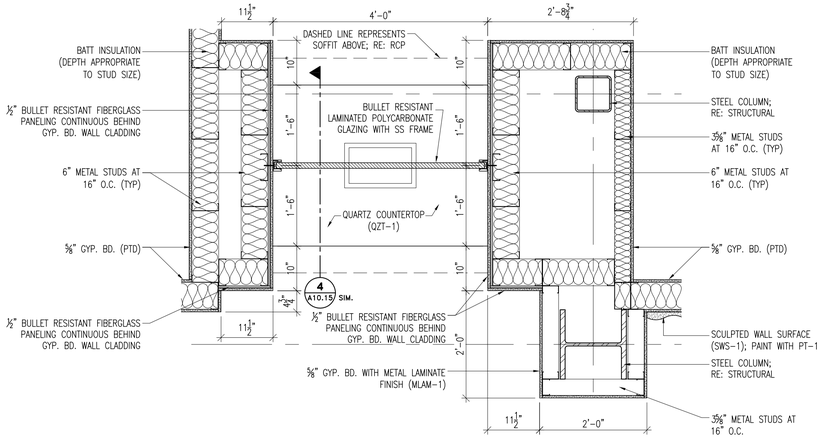
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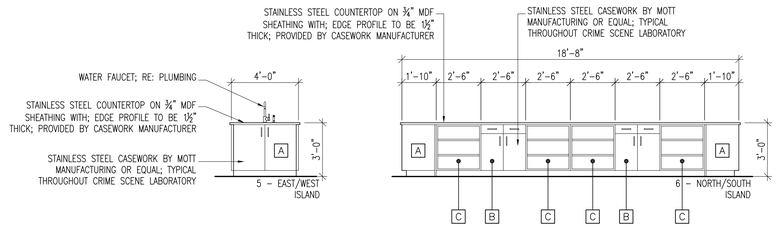
Client No: ------

Albert & Associates: 1257

REGISTERED ARCHITECT Larry A. Albert Hattiesburg, MS STATE OF MISSISSIPPI

A10.14





Stainless Steel Casework Schedule

TAG	# REQ.	TYPE	PRODUCT NUMBER	#'D NOTES
A	2	BASE	1513011–23–62–30–51–70	NOTE(S): 1,2,3,4,5
B	4	BASE	1310022–23–62–30–51–70	NOTE(S): 1,2,3,4,5
C	8	BASE	1310000–51–70	NOTE(S): 2

** ALL STAINLESS STEEL CASEWORK PRODUCT NUMBERS ARE BASED ON MOTT MANUFACTURING LTD. SUBSTITUTIONS BY OTHER MANUFACTURER'S ARE ACCEPTABLE AND MUST BE SUBMITTED TO THE ARCHITECT FOR APPROVAL. ALL CABINETS ARE TO BE INSTALLED PER MANUFACTURER'S RECOMMENDATIONS. CONTRACTOR SHALL PROVIDE ALL BLOCKING AS REQUIRED FOR PROPER INSTALLATION OF CABINETRY.

CASEWORK NUMBERED NOTES:

1. DOORS/DRAWERS ARE TO BE LOCKABLE.
2. ENTIRE CABINET IS TO BE 304 STAINLESS STEEL.
3. DOORS/DRAWERS ARE TO HAVE 4" STAINLESS STEEL WIRE PULL.
4. DOORS ARE TO HAVE STAINLESS STEEL HINGES.
5. LOCKSET #1

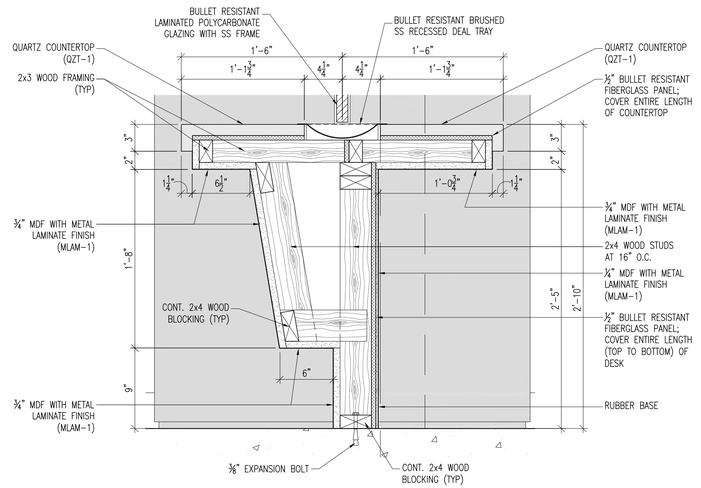
XXXXXXX–XX–XX–XX
BASE PRODUCT / OPTION CODES

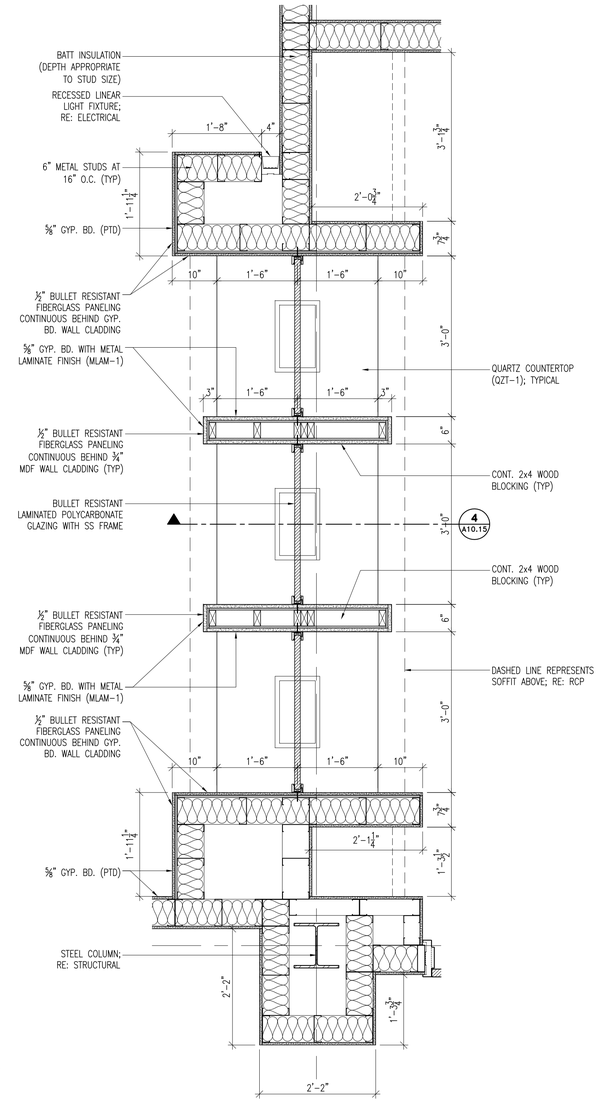
PRODUCT NUMBER OPTION CODES:

23 STAINLESS STEEL HINGE
62 4" STANDARD BRUSHED ALUMINUM WIRE PULL
30 STANDARD LOCKS ON DOORS/DRAWERS
51 ENTIRE 304 STAINLESS STEEL COMPONENT
70 FRONT TOE KICK

6 Crime Scene Laboratory [B238] Interior Elevations Cont.

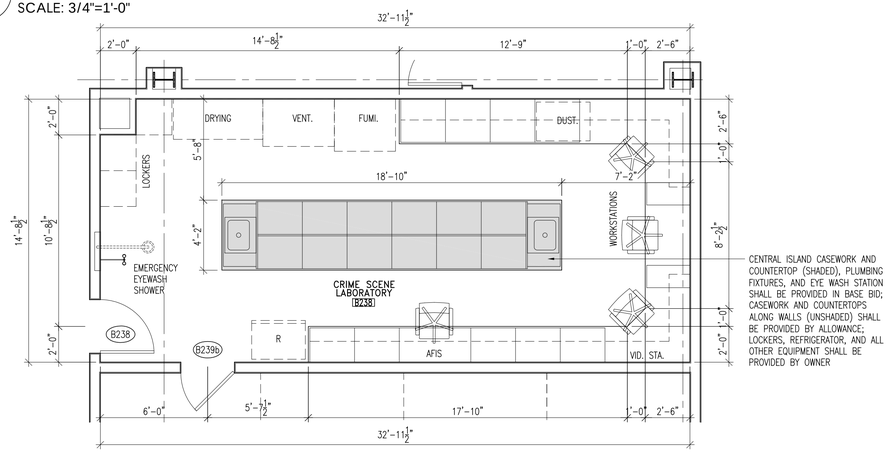
SCALE: 1/4"=1'-0"





7 Enlarged Plan @ Police Accounting [A152]

SCALE: 3/4"=1'-0"



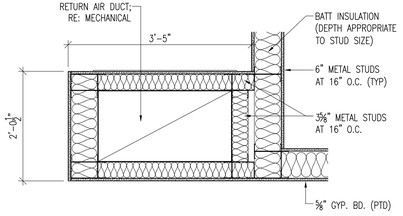
CENTRAL ISLAND CASEWORK AND COUNTERTOP (SHADED), PLUMBING FIXTURES, AND EYE WASH STATION SHALL BE PROVIDED IN BASE BID; CASEWORK AND COUNTERTOPS ALONG WALLS (UNSHADED) SHALL BE PROVIDED BY ALLOWANCE; LOCKERS, REFRIGERATOR, AND ALL OTHER EQUIPMENT SHALL BE PROVIDED BY OWNER

5 Crime Scene Laboratory [B238] Enlarged Floor Plan

SCALE: 1/4"=1'-0"

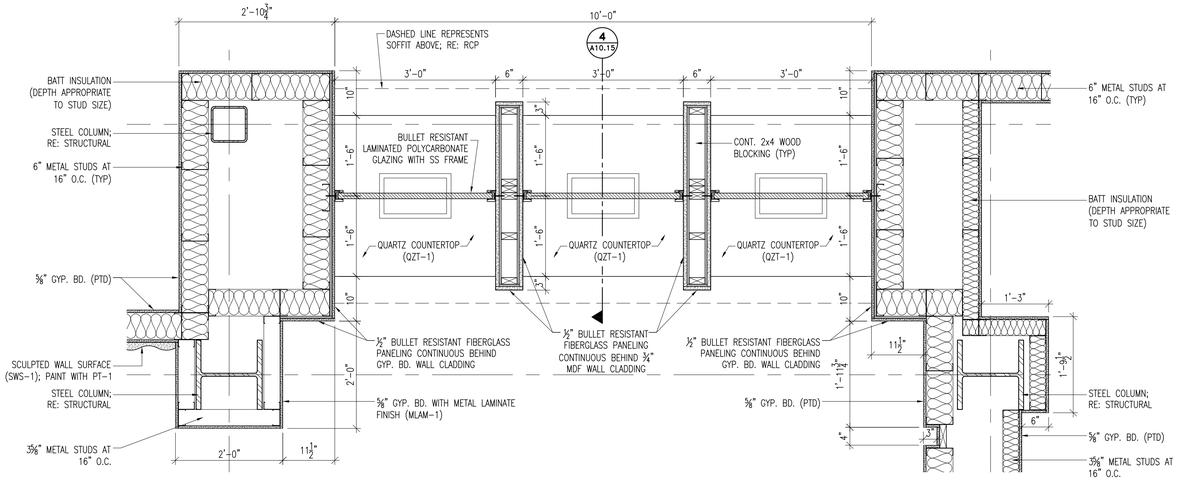
4 Clerk Desk Section Detail

SCALE: 1 1/2" = 1'-0"



3 Enlarged Plan Detail

SCALE: 3/4" = 1'-0"



2 Enlarged Plan @ Record Clerk Desk [A150]

SCALE: 3/4" = 1'-0"

1 Enlarged Plan @ Court Clerk [A118]

SCALE: 3/4" = 1'-0"

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

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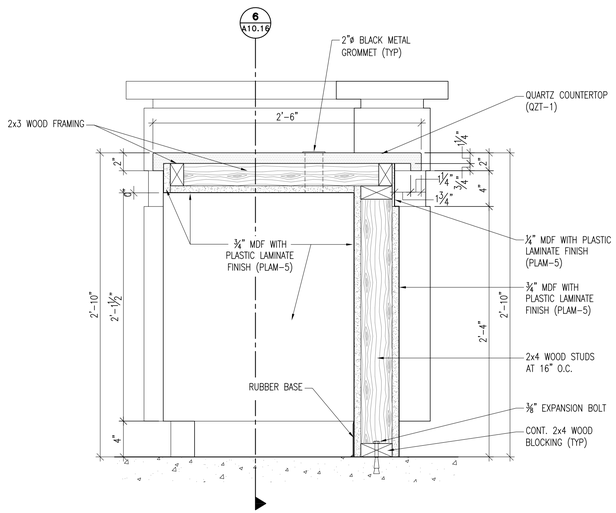
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11-02-2015		90% Pricing Set
11-19-2018		100% Bid Docs

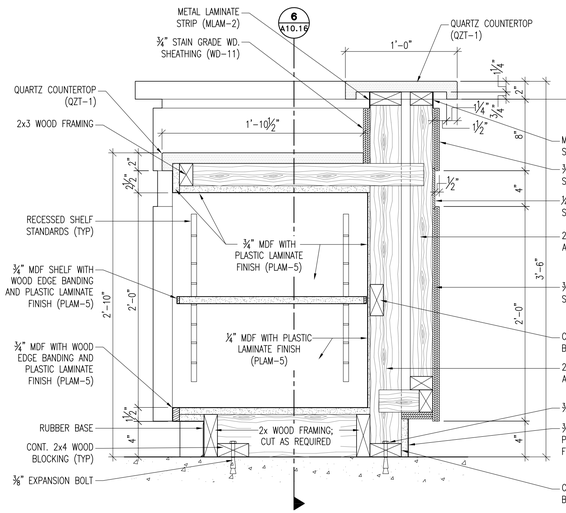
Drawn By: CR,CP,AS,RE
Checked By: CR,LA,CF
Client No: ------
Albert & Associates: 1257

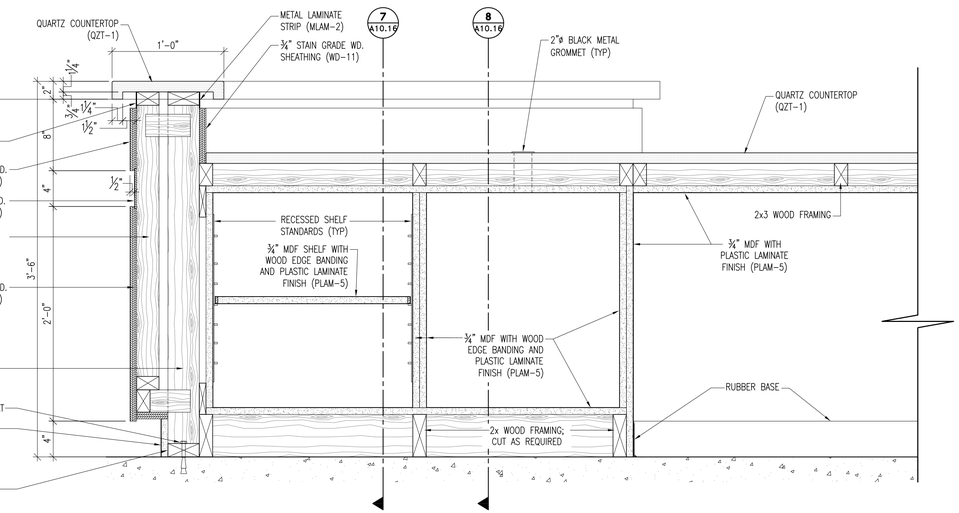
REGISTERED ARCHITECT Larry M. Albert, Jr. Hattiesburg, MS STATE OF MISSISSIPPI

A10.15

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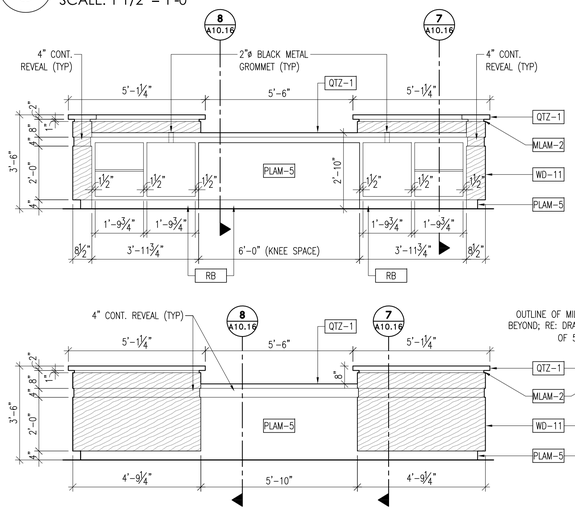






8 Section @ Reception Desk

SCALE: 1 1/2" = 1'-0"

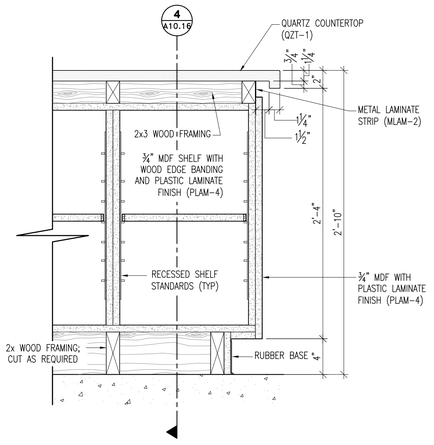


2 Reception Desk Elevations

SCALE: 3/8" = 1'-0"

7 Section @ Reception Desk

SCALE: 1 1/2" = 1'-0"

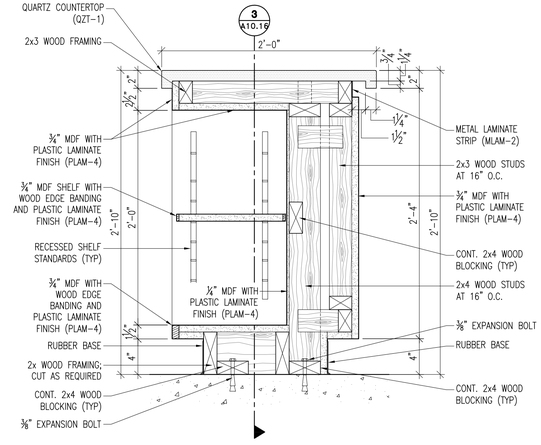


3 Section @ Security

SCALE: 1 1/2" = 1'-0"

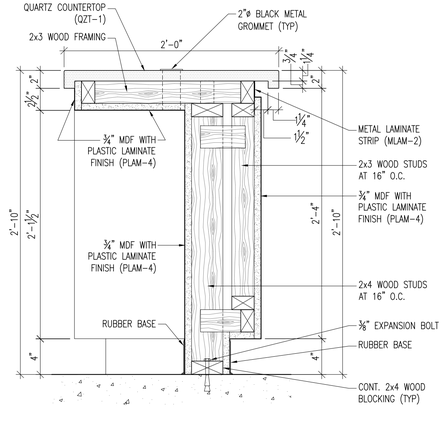
6 Section @ Reception Desk

SCALE: 1 1/2" = 1'-0"



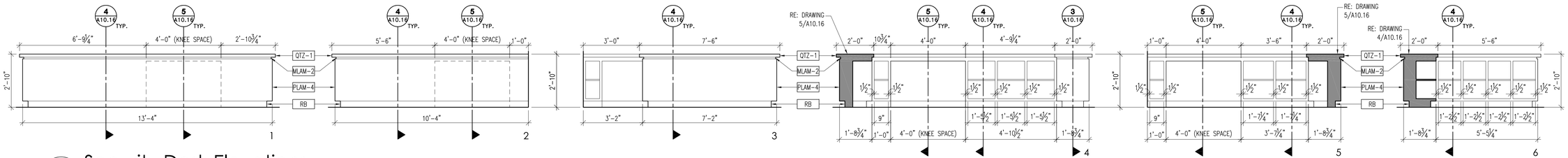
4 Section @ Security

SCALE: 1 1/2" = 1'-0"



5 Section @ Security

SCALE: 1 1/2" = 1'-0"



1 Security Desk Elevations

SCALE: 3/8" = 1'-0"

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MILLWORK DETAILS

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HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

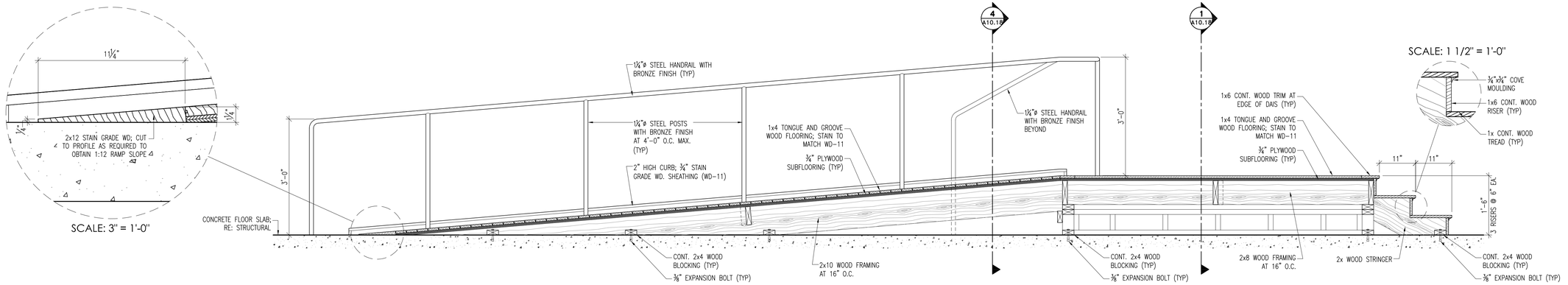
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Checked By: CR,LA,CP
Client No: ------
Albert & Associates: 12575

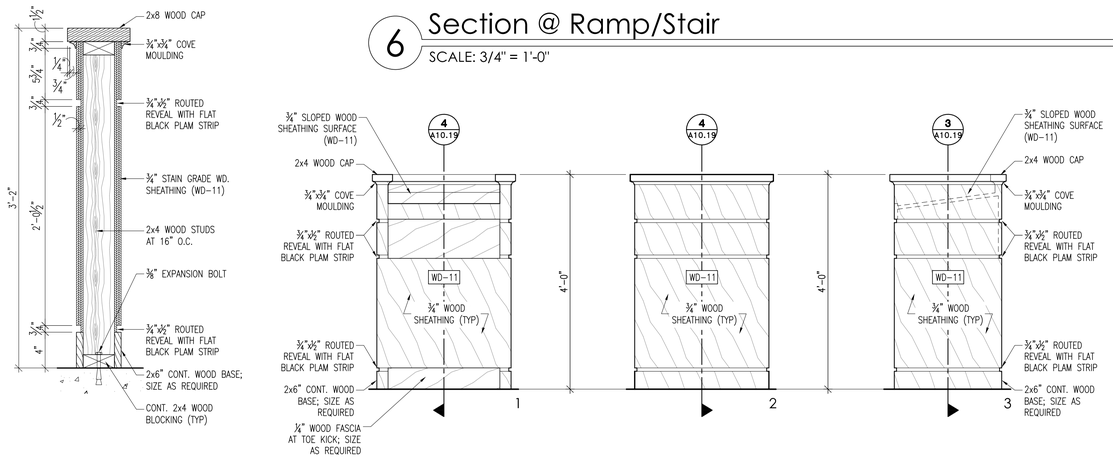
REGISTERED ARCHITECT Larry M Albert Hattiesburg, MS STATE OF MISSISSIPPI

A10.16



6 Section @ Ramp/Stair

SCALE: 3/4" = 1'-0"

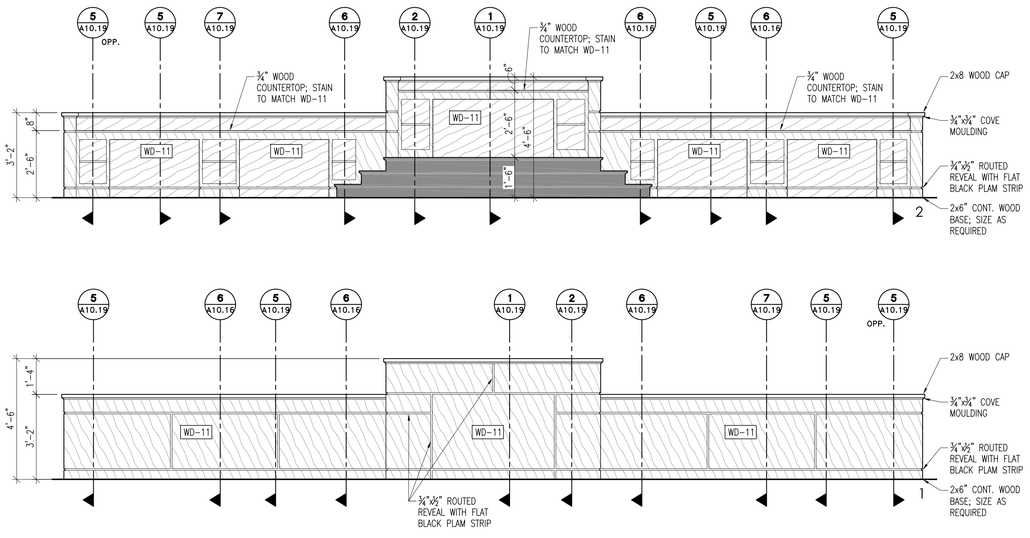


5 Section @ Rail

SCALE: 1 1/2" = 1'-0"

4 Podium Elevations

SCALE: 3/4" = 1'-0"

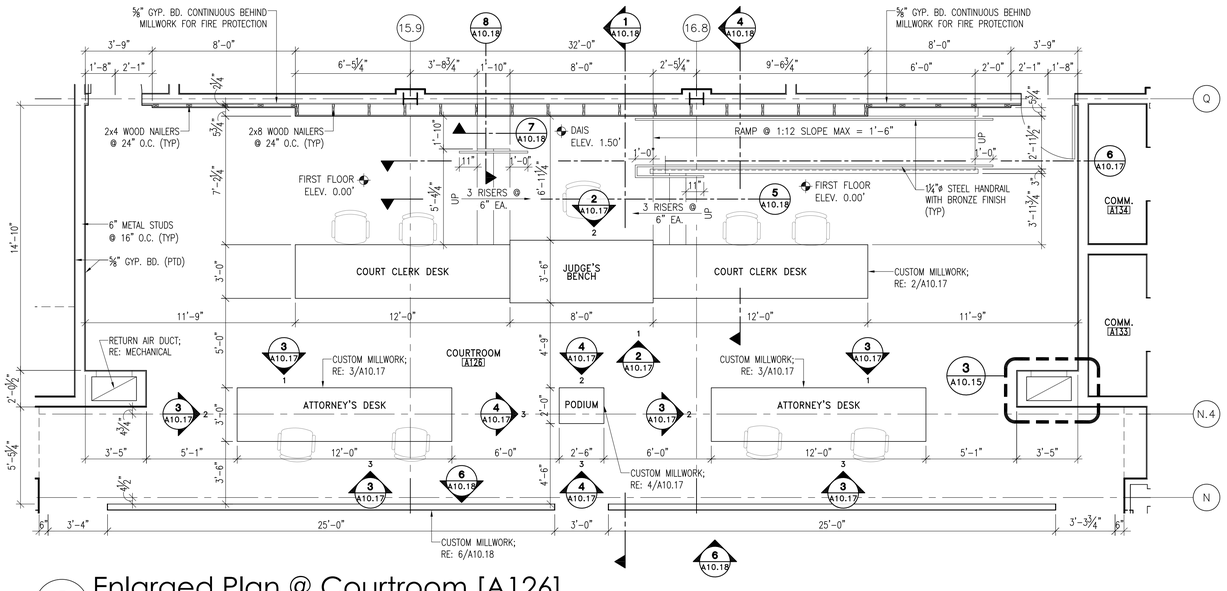


2 Judge's Bench/Court Clerk Desk Elevations

SCALE: 3/8" = 1'-0"

3 Attorney's Desk Elevations

SCALE: 3/8" = 1'-0"



1 Enlarged Plan @ Courtroom [A126]

SCALE: 1/4" = 1'-0"

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CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

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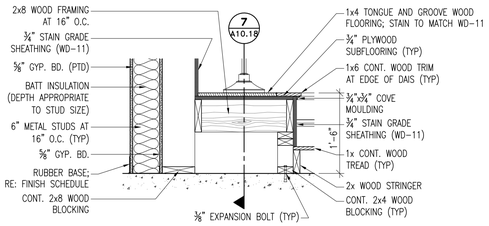
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Date	Rev. Description
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10-20-2015	75% Progress Set
11-02-2015	90% Pricing Set
11-19-2018	100% Bid Docs

Drawn By:	CR,CP,AS,RB
Checked By:	CR,LA,CP
Client No:	------
Albert & Associates:	12575

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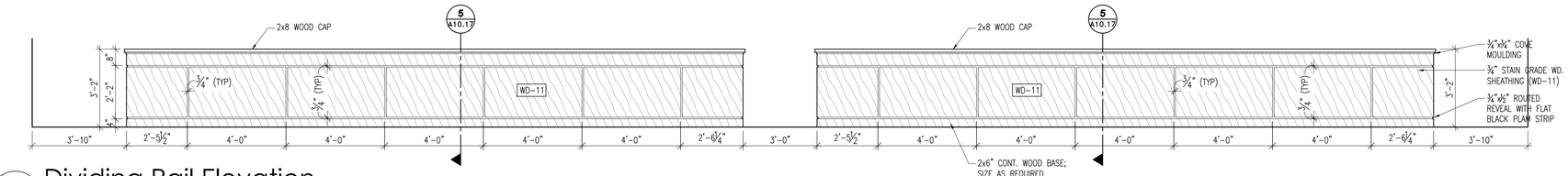
A10.17

MILLWORK DETAILS



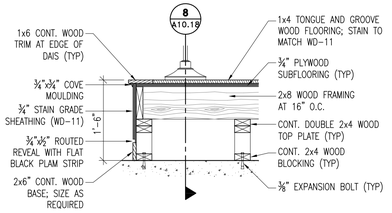
8 Flag Pedestal Detail

SCALE: 3/4" = 1'-0"



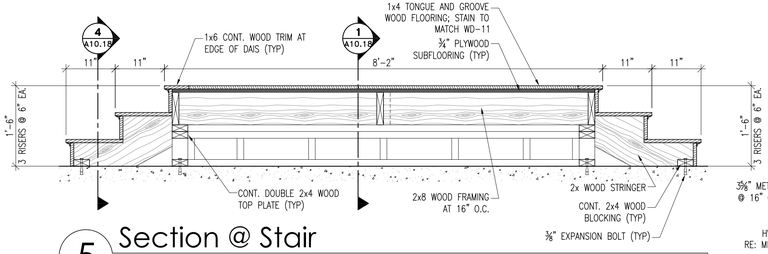
6 Dividing Rail Elevation

SCALE: 3/8" = 1'-0"



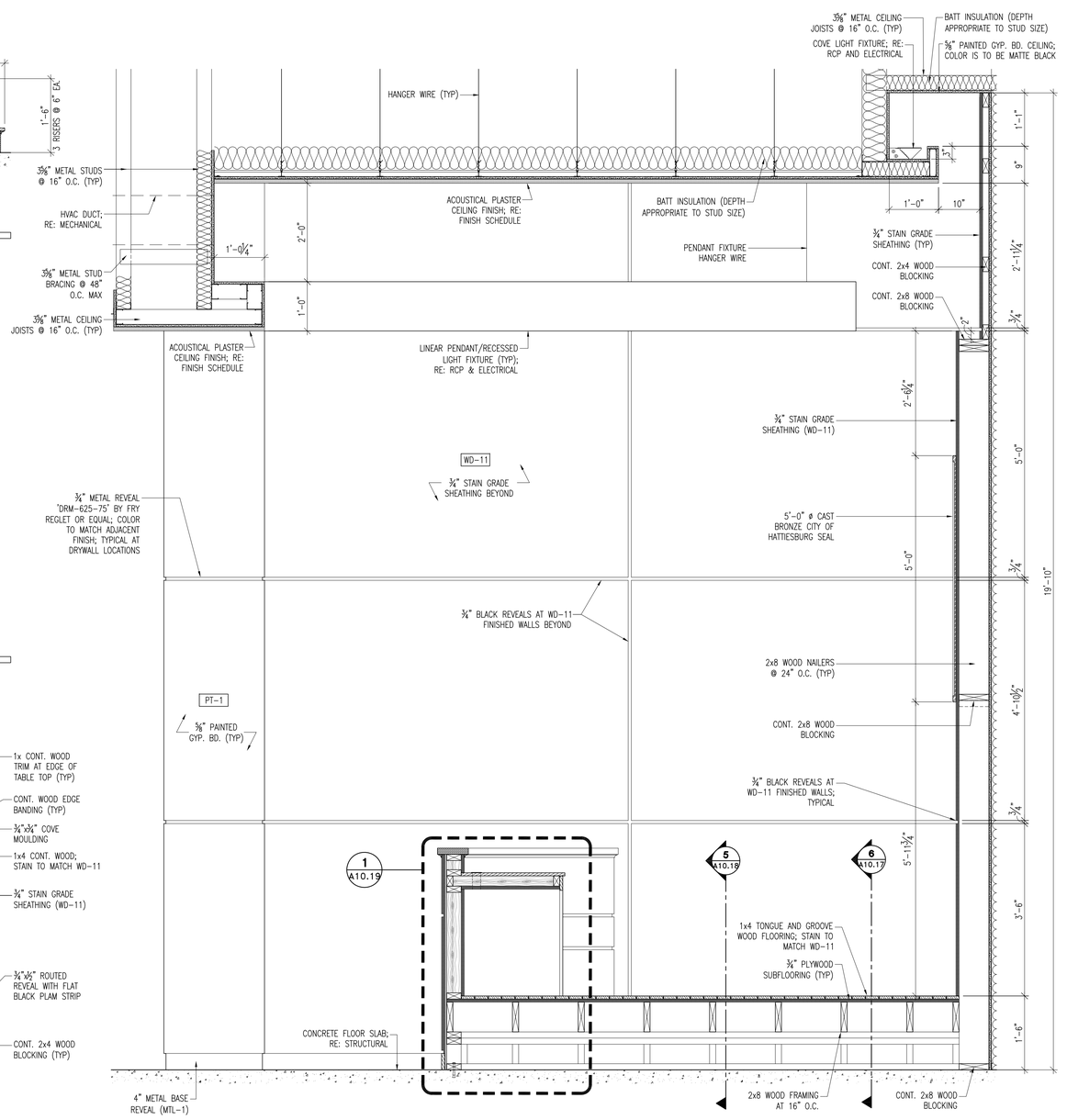
7 Flag Pedestal Detail

SCALE: 3/4" = 1'-0"



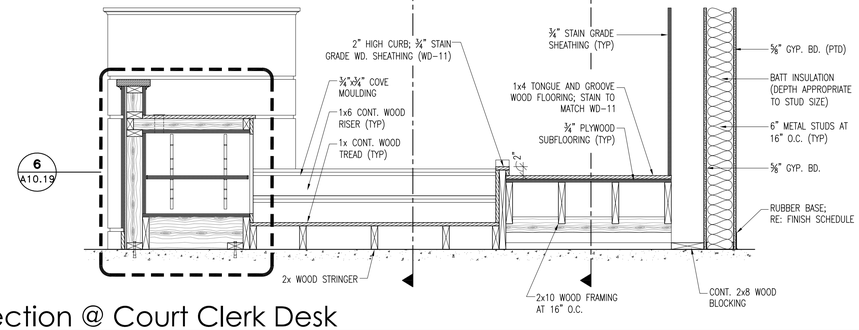
5 Section @ Stair

SCALE: 3/4" = 1'-0"



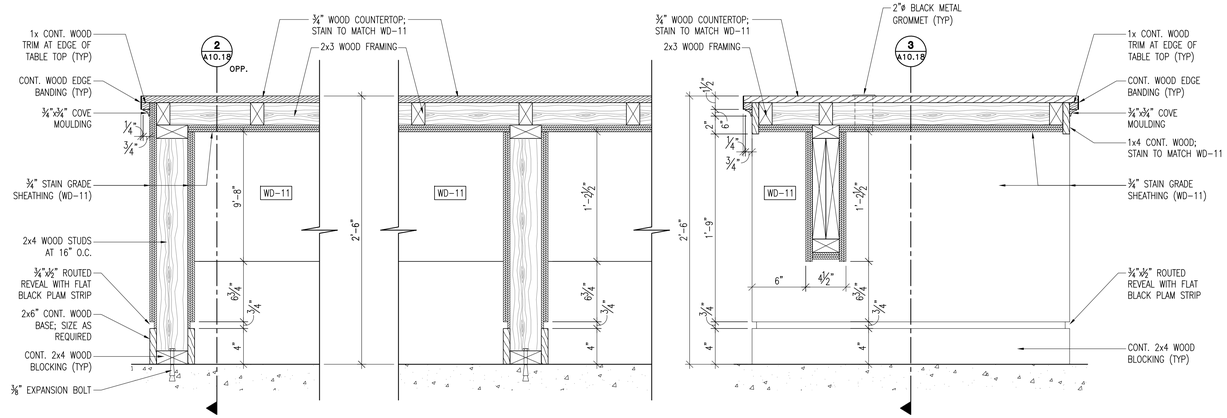
1 Section @ Judge's Bench

SCALE: 3/4" = 1'-0"



4 Section @ Court Clerk Desk

SCALE: 3/4" = 1'-0"



3 Section @ Attorney's Desk

SCALE: 1 1/2" = 1'-0"

2 Section @ Attorney's Desk

SCALE: 1 1/2" = 1'-0"

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT

HATTIESBURG MUNICIPAL COURT ■ HATTIESBURG PUBLIC SAFETY COMPLEX

HPSC Police and Court Building

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11-19-2018		100% Bid Docs

Drawn By: CR,CP,AS,RB

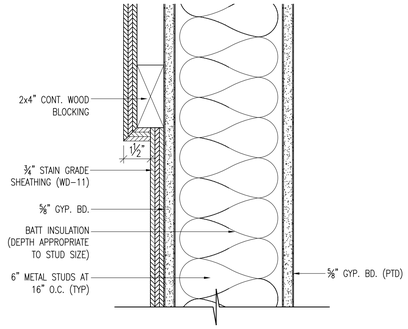
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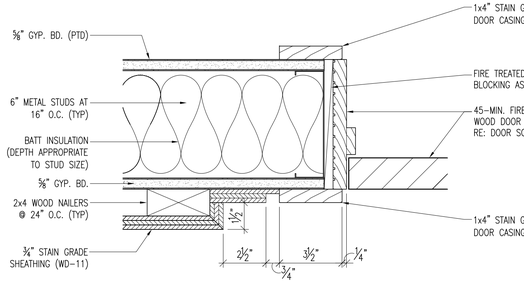
Client No: ------

Albert & Associates: 12575

REGISTERED ARCHITECT Larry A. Albert Hattiesburg, MS STATE OF MISSISSIPPI

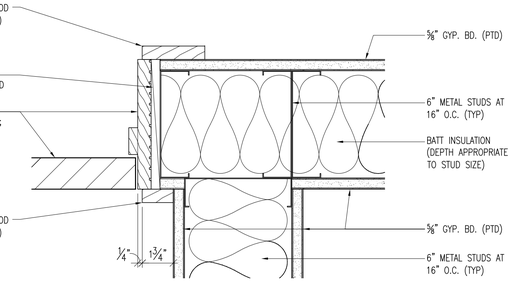
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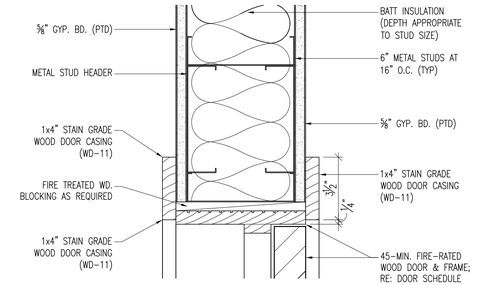
9 Door Jamb Detail

SCALE: 3" = 1'-0"



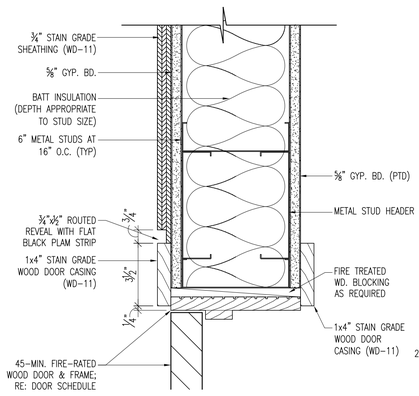
8 Door Jamb Detail

SCALE: 3" = 1'-0"



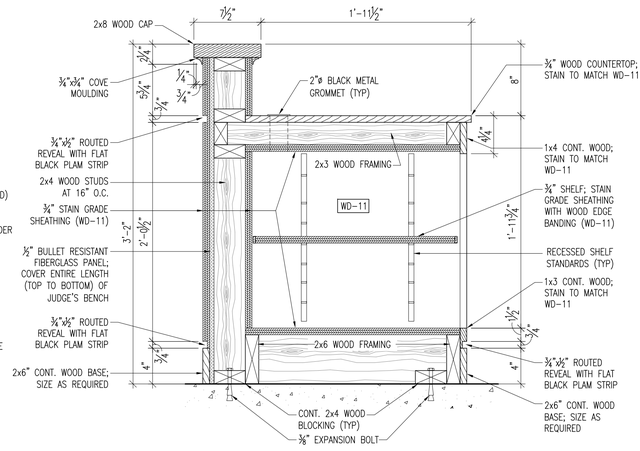
11 Door Head Detail

SCALE: 3" = 1'-0"



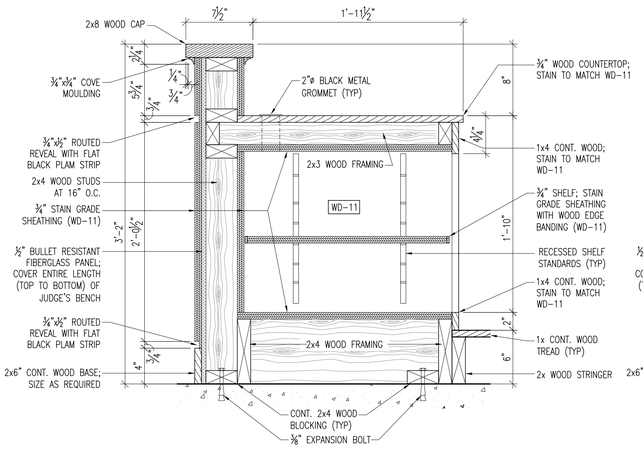
10 Door Head Detail

SCALE: 3" = 1'-0"



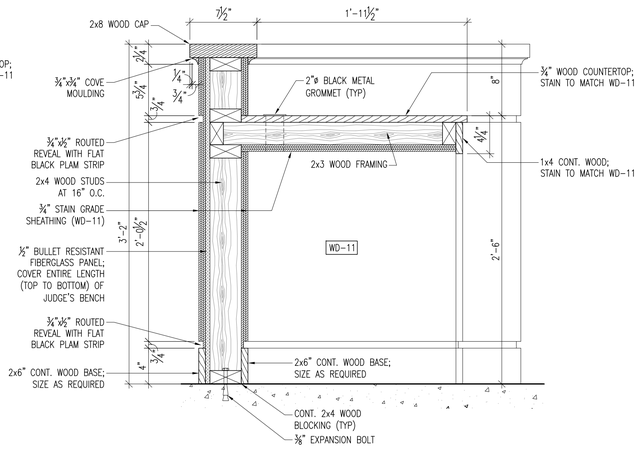
7 Section @ Court Clerk Desk

SCALE: 3/4" = 1'-0"



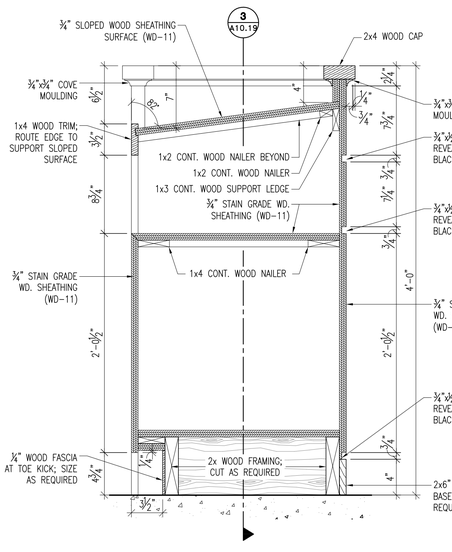
6 Section @ Court Clerk Desk

SCALE: 3/4" = 1'-0"



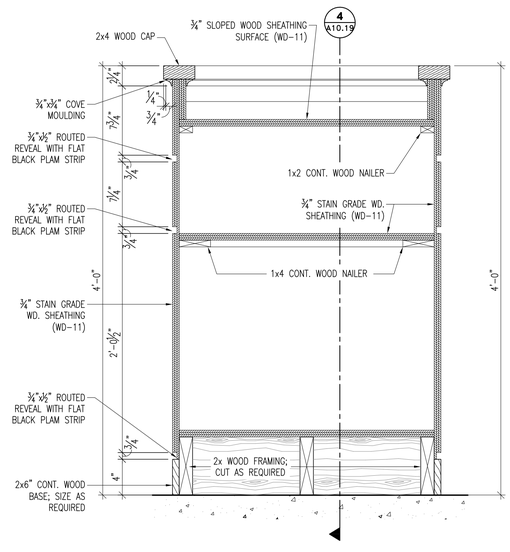
5 Section @ Court Clerk Desk

SCALE: 3/4" = 1'-0"



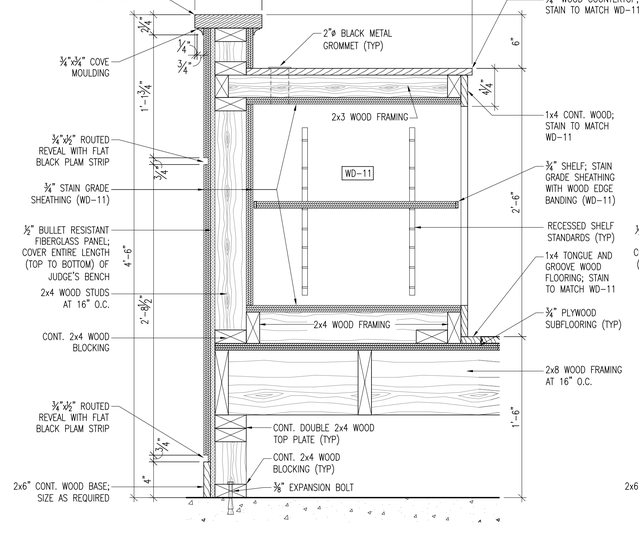
4 Section Details @ Podium

SCALE: 3/4" = 1'-0"



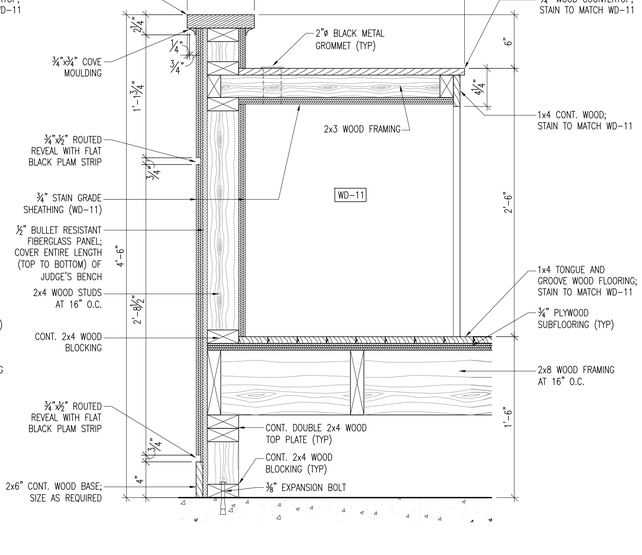
3 Section Details @ Podium

SCALE: 3/4" = 1'-0"



2 Section @ Judge's Bench

SCALE: 3/4" = 1'-0"



1 Section @ Judge's Bench

SCALE: 3/4" = 1'-0"

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MILLWORK DETAILS

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■ HATTIESBURG

HPSC Police and Court Building

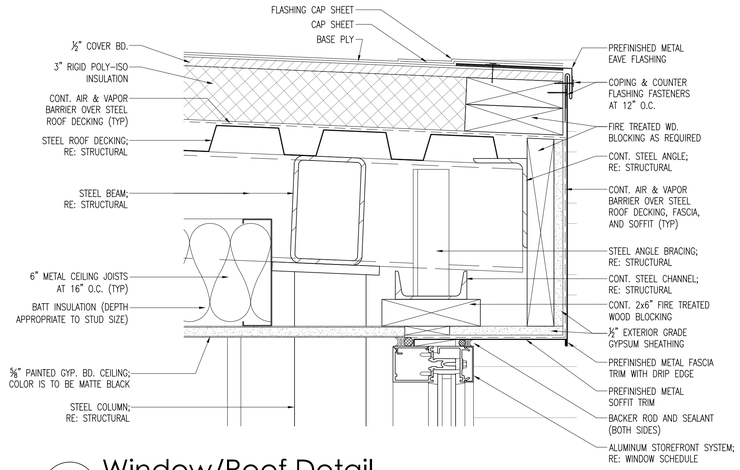
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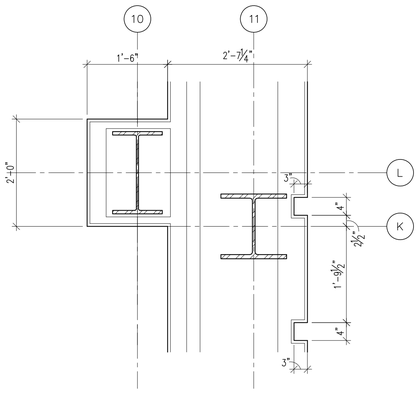
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Client No: ——
Albert & Associates: 12575

REGISTERED ARCHITECT Larry M Albert 16 Hattiesburg, MS STATE OF MISSISSIPPI

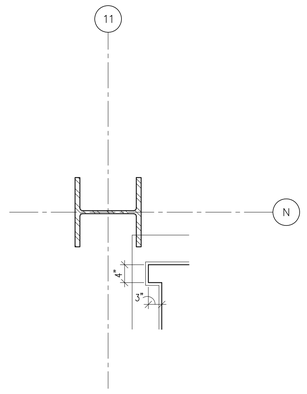
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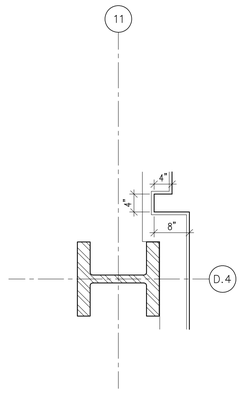
10 Window/Roof Detail
SCALE: 3" = 1'-0"



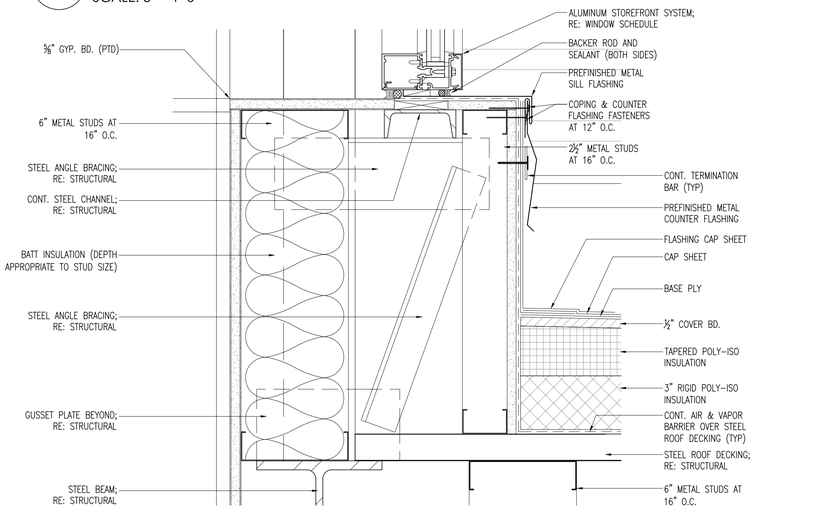
9 Enlarged Plan Detail
SCALE: 3/4" = 1'-0"



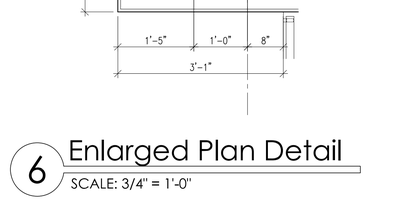
8 Enlarged Plan Detail
SCALE: 3/4" = 1'-0"



7 Enlarged Plan Detail
SCALE: 3/4" = 1'-0"



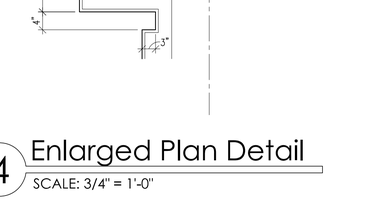
11 Window/Roof Detail
SCALE: 3" = 1'-0"



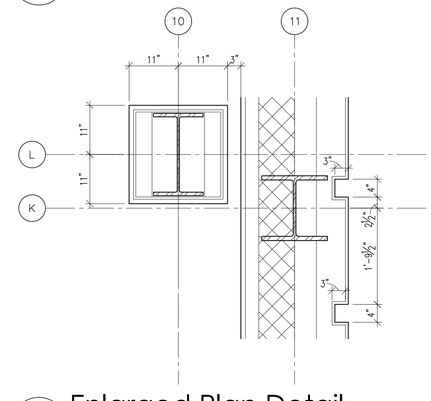
6 Enlarged Plan Detail
SCALE: 3/4" = 1'-0"



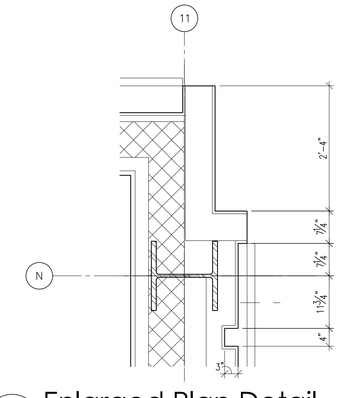
5 Enlarged Plan Detail
SCALE: 3/4" = 1'-0"



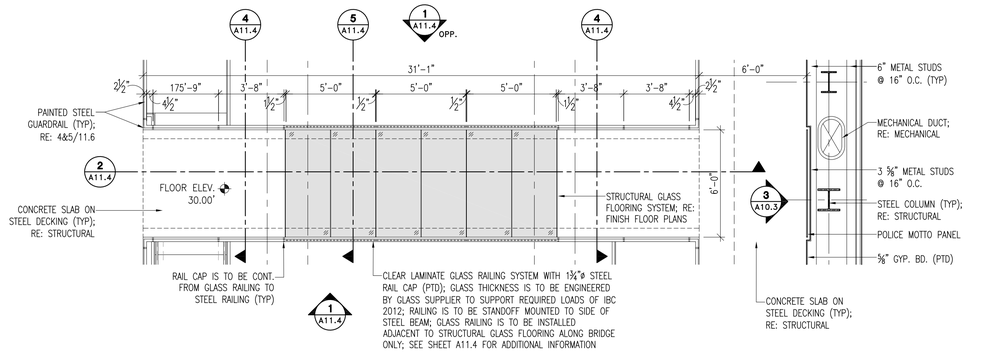
4 Enlarged Plan Detail
SCALE: 3/4" = 1'-0"



3 Enlarged Plan Detail
SCALE: 3/4" = 1'-0"



2 Enlarged Plan Detail
SCALE: 3/4" = 1'-0"



1 Enlarged Plan @ Police Lobby Bridge
SCALE: 1/4" = 1'-0"

HATTIESBURG PUBLIC SAFETY COMPLEX
HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

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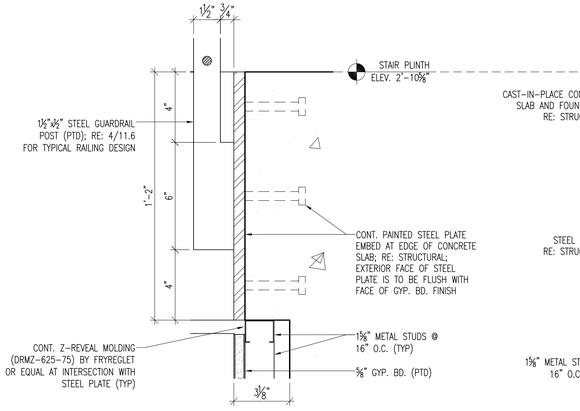
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Checked By: CR,LA,CP
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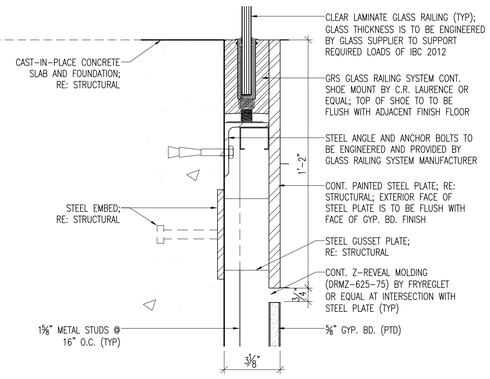
A10.20

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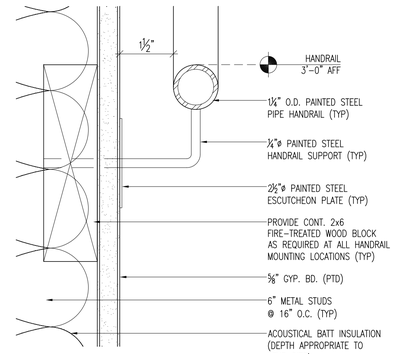
6 Plinth Edge/Railing Detail

SCALE: 3" = 1'-0"



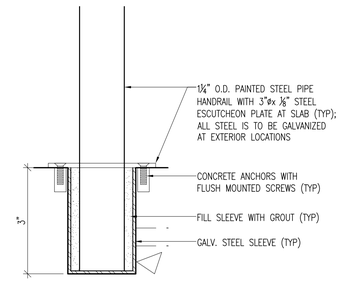
7 Plinth Edge/Railing Detail

SCALE: 3" = 1'-0"



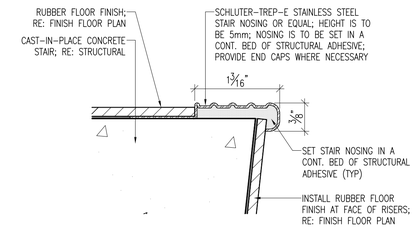
8 Handrail Detail

SCALE: 6" = 1'-0" TYPICAL



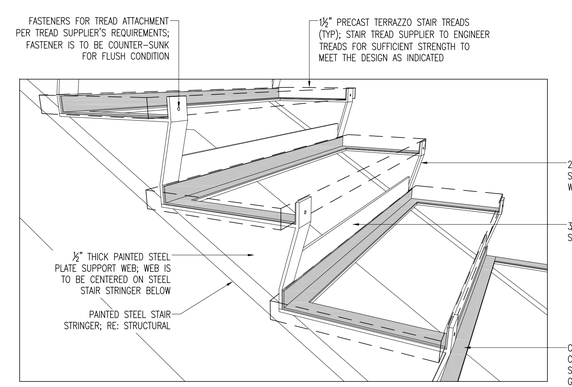
9 Handrail Detail

SCALE: 6" = 1'-0" TYPICAL



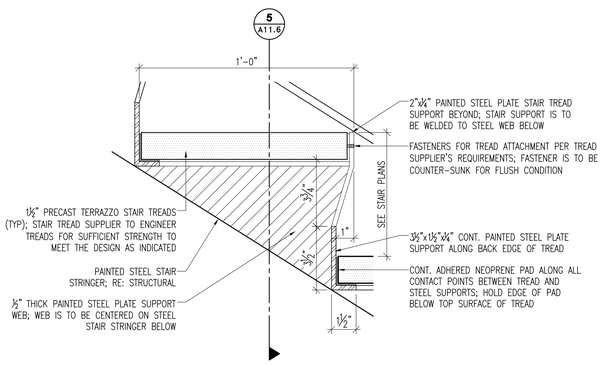
10 Nosing Detail

SCALE: 1'-0" = 1'-0" TYPICAL



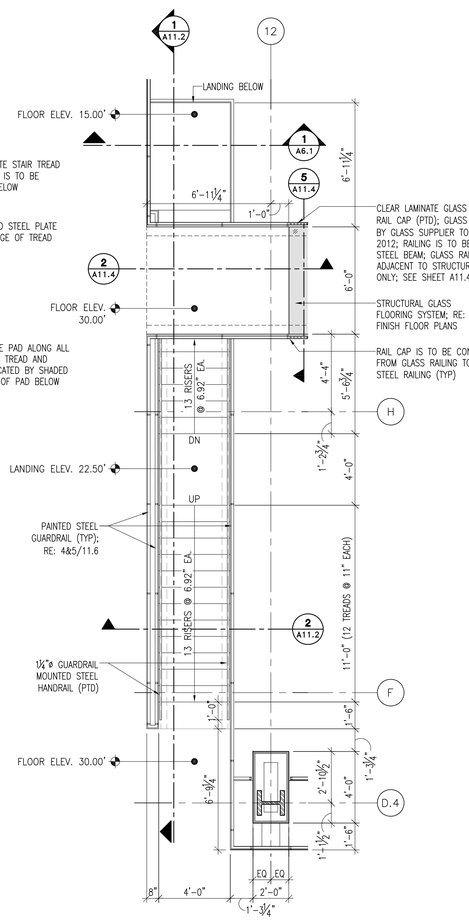
5 Stair "A" Tread/Riser Perspective

SCALE: NTS TYPICAL



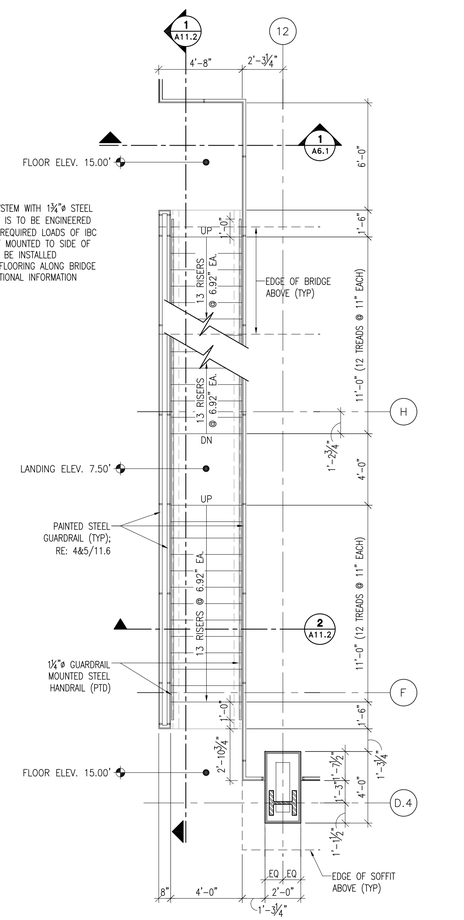
4 Stair "A" Tread/Riser Detail

SCALE: 3" = 1'-0" TYPICAL



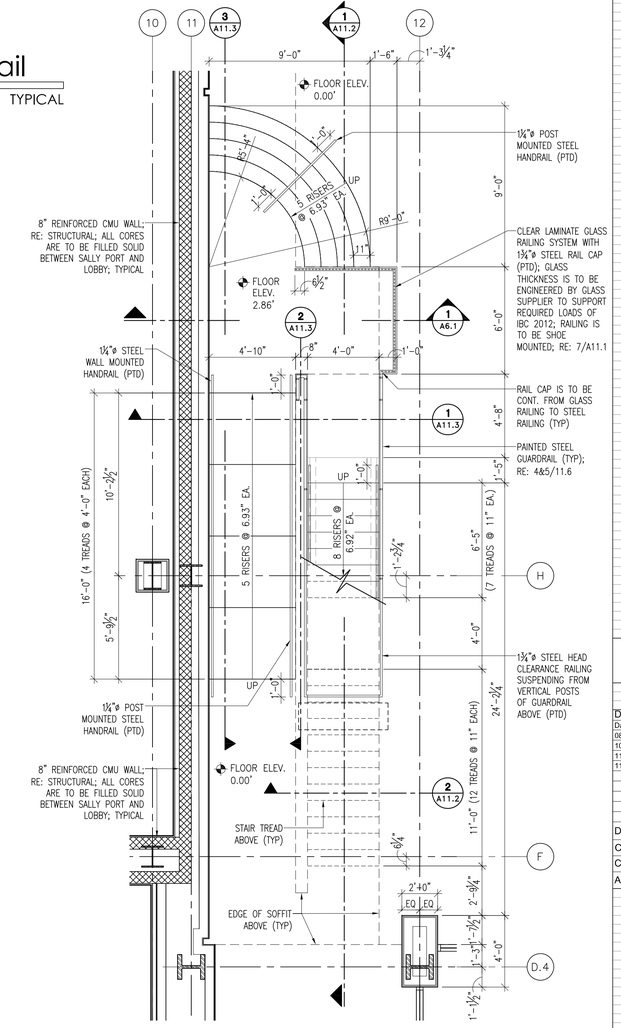
3 Stair "A" Third Floor Plan

SCALE: 1/4" = 1'-0"



2 Stair "A" Second Floor Plan

SCALE: 1/4" = 1'-0"



1 Stair "A" First Floor Plan

SCALE: 1/4" = 1'-0"

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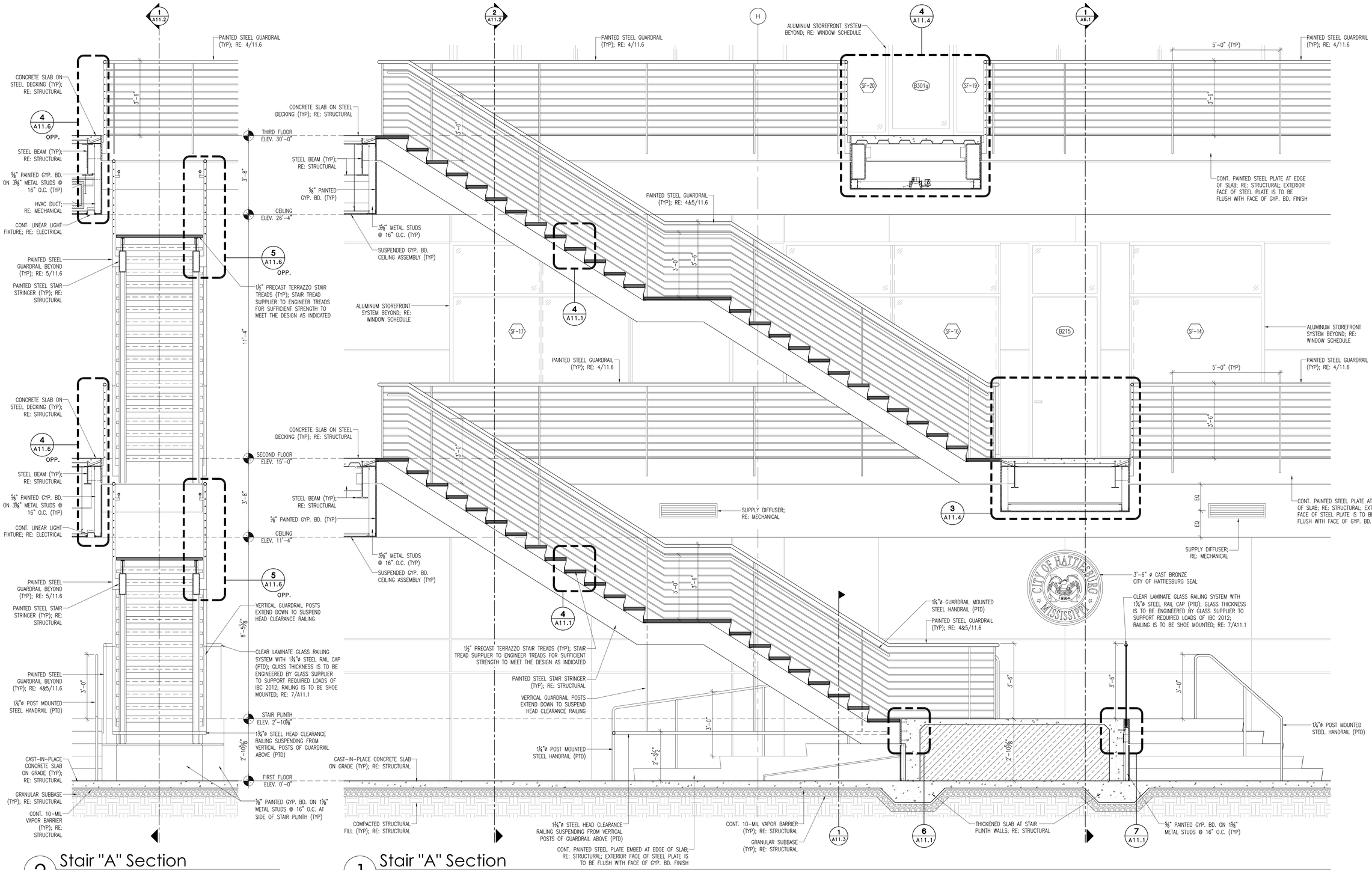
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Albert & Associates: 12575

REGISTERED ARCHITECT Larry M. Albert Hattiesburg, MS STATE OF MISSISSIPPI

A11.1

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2 Stair "A" Section

SCALE: 1/2" = 1'-0"

1 Stair "A" Section

SCALE: 1/2" = 1'-0"

NOTE: INTERIOR ELEVATIONS IN BUILDING SECTIONS ARE ILLUSTRATIONAL ONLY AND MAY NOT FULLY DEPICT THE DESIGN OF THE SPACE. SEE INTERIOR ELEVATIONS IN A9.x SHEETS FOR INTENDED DESIGN OF SPACES.

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Client No: ------

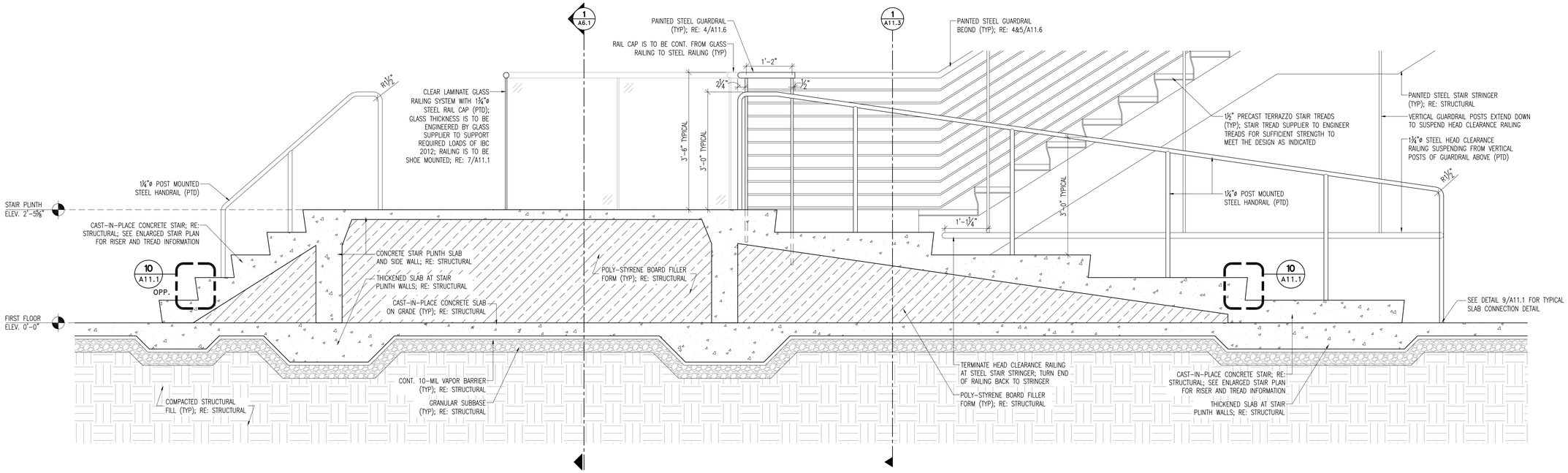
Albert & Associates: 12575

Larry W. Albert, MS 12575, Registered Architect, Hattiesburg, MS, State of Mississippi

A11.2

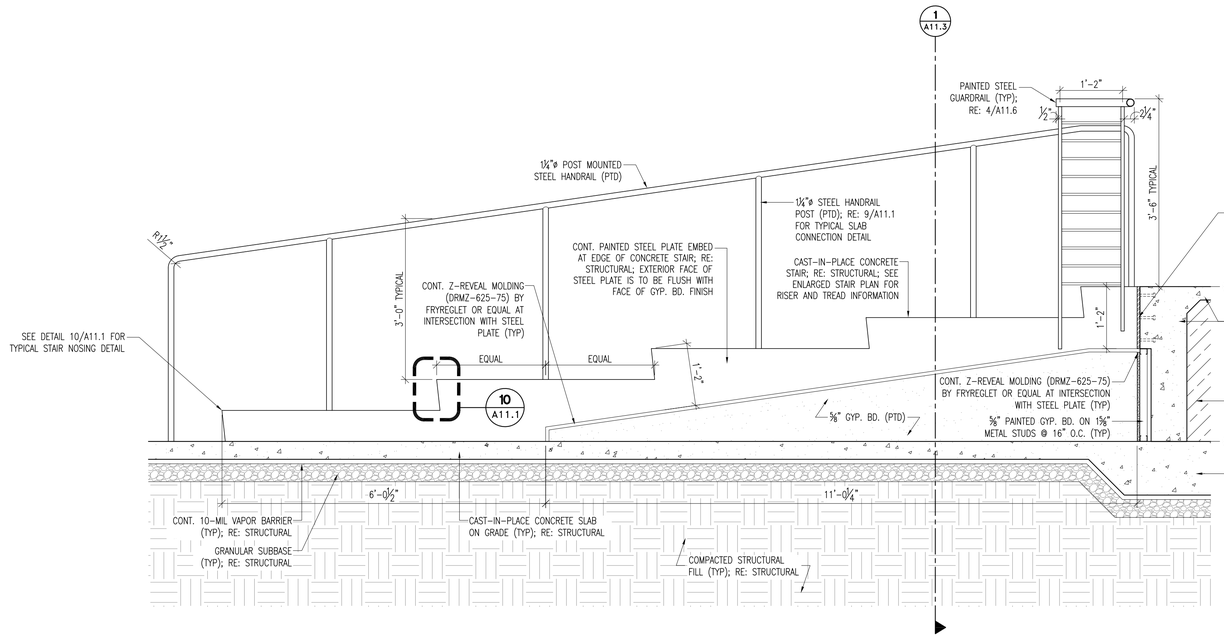
STAIR "A" SECTIONS & DETAILS

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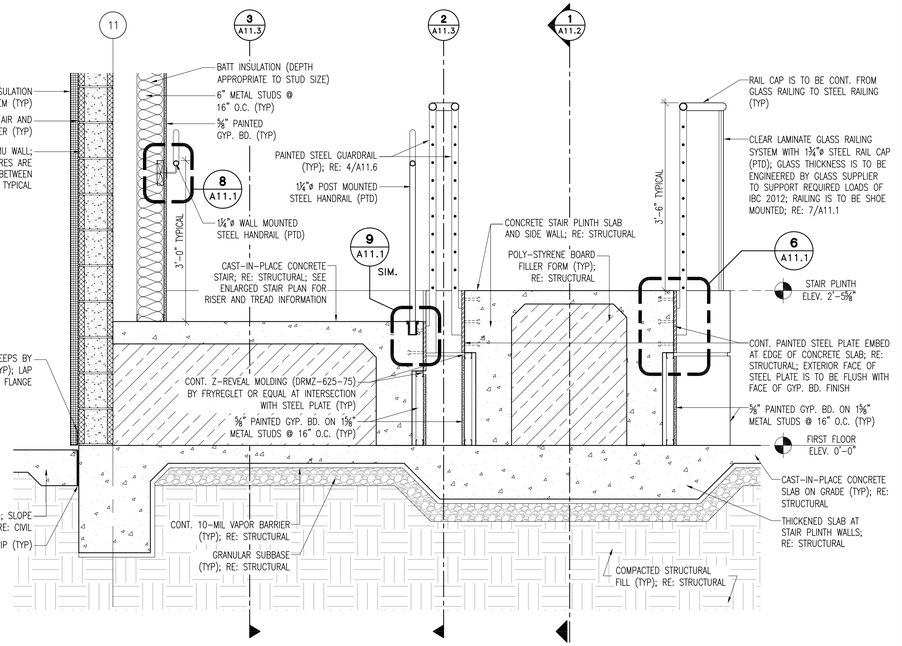
3 Stair "A" Plinth Section Detail

SCALE: 3/4" = 1'-0"



2 Stair "A" Plinth Section Detail

SCALE: 3/4" = 1'-0"



1 Stair "A" Plinth Section Detail

SCALE: 3/4" = 1'-0"

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Drawn By: CR,CP,AS,RB

Checked By: CR,LA,CP

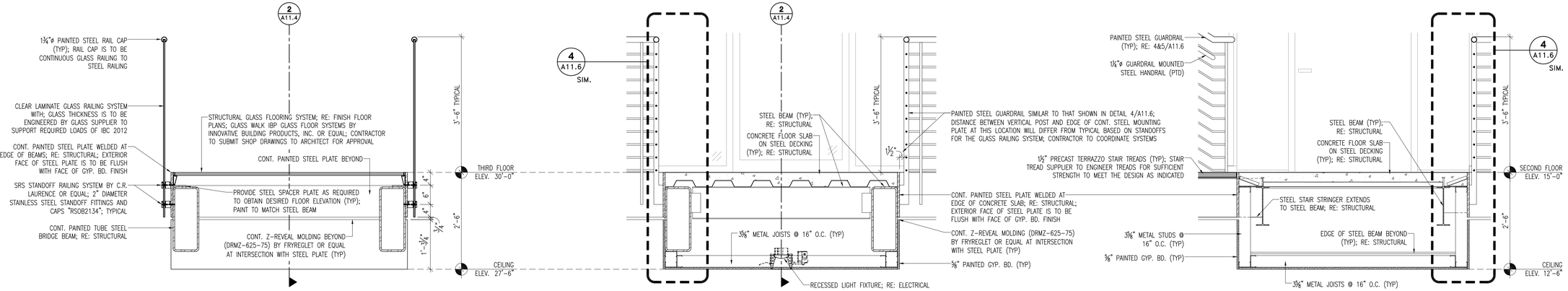
Client No: ——

Albert & Associates: 12575

REGISTERED ARCHITECT Larry M Albert Hattiesburg, MS STATE OF MISSISSIPPI

A11.3

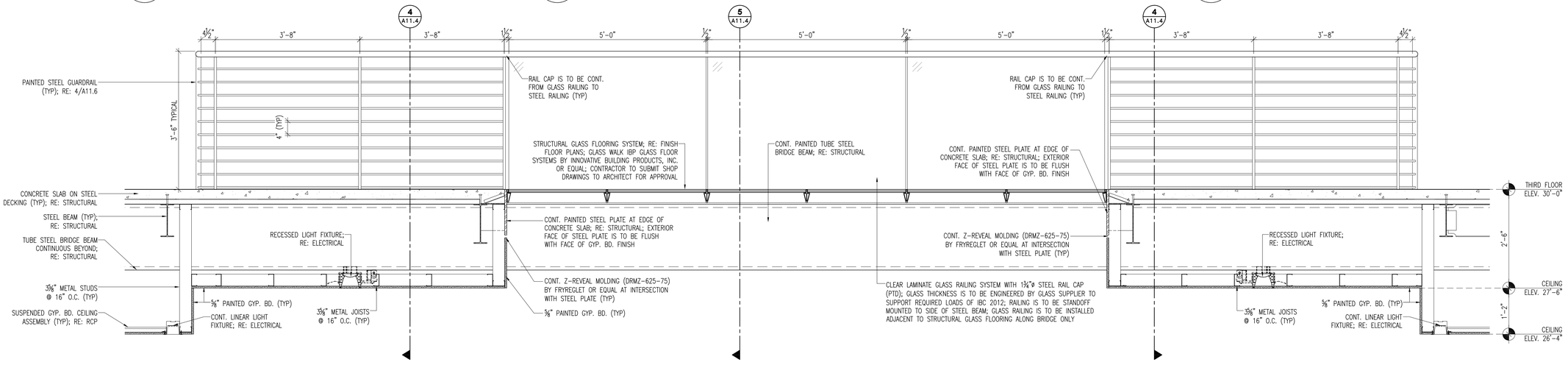
514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com **Albert & McCleskey Associates Architects**



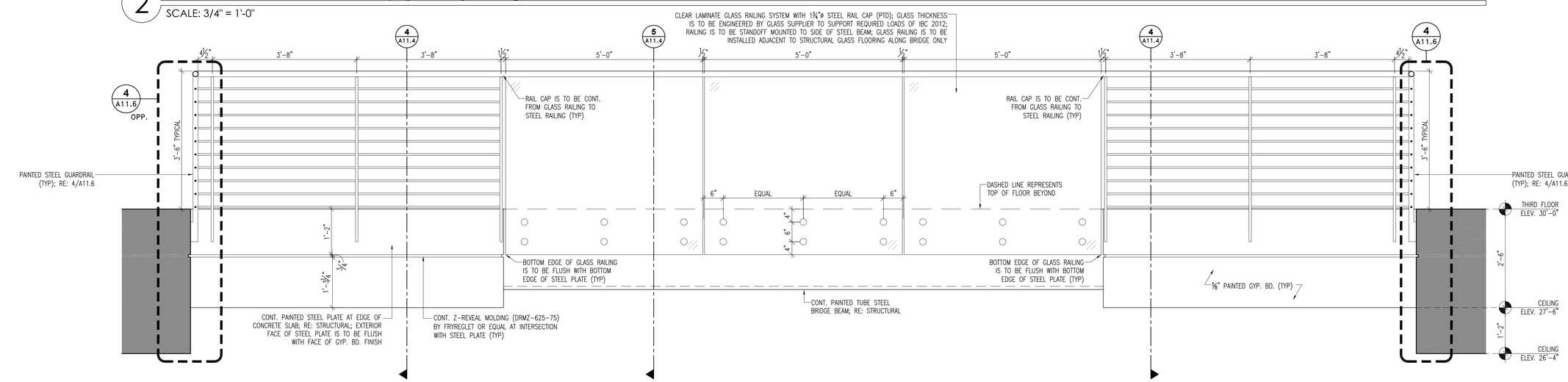
5 Section @ Bridge
SCALE: 3/4" = 1'-0" — THIRD FLOOR

4 Section @ Bridge
SCALE: 3/4" = 1'-0" — THIRD FLOOR

3 Section @ Landing
SCALE: 3/4" = 1'-0" — SECOND FLOOR



2 Section @ Police Lobby [A301] Bridge
SCALE: 3/4" = 1'-0"



1 Elevation @ Police Lobby [A301] Bridge
SCALE: 3/4" = 1'-0"

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POLICE LOBBY BRIDGE SECTIONS & DETAILS

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX
HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

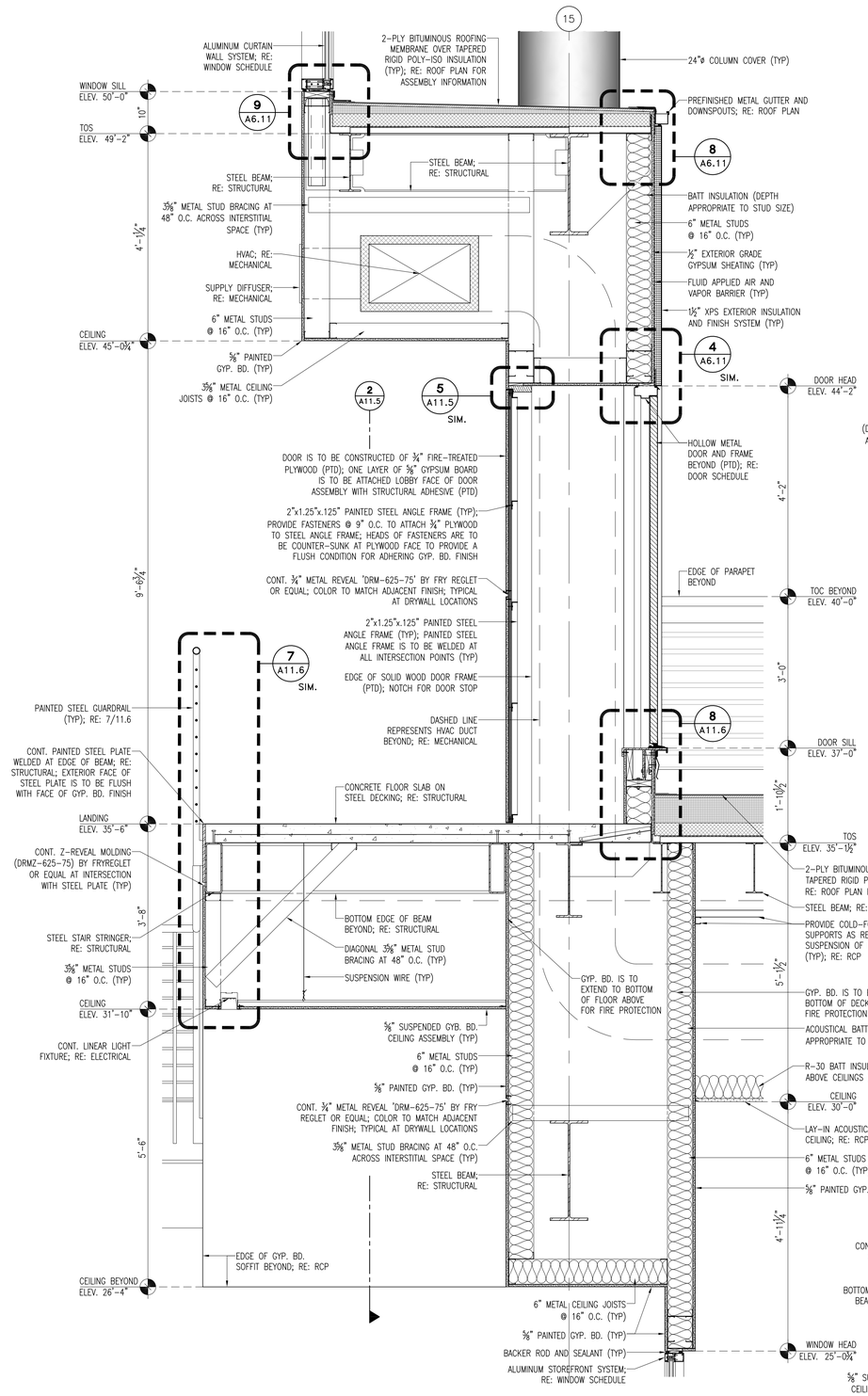
Drawing Issued:

Date	Rev.	Description
08-31-2015		DD Check Set
10-20-2015		75% Progress Set
11-02-2015		90% Pricing Set
11-19-2018		100% Bid Docs

Drawn By: CR,CP,AS,RB
Checked By: CR,LA,CP
Client No: ------
Albert & Associates: 12575

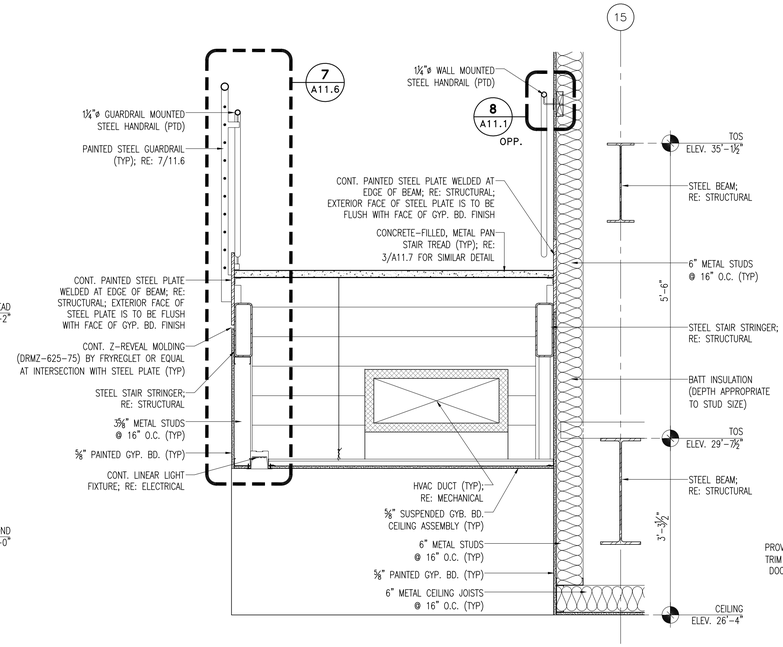
REGISTERED ARCHITECT Larry A. Albert Hattiesburg, MS STATE OF MISSISSIPPI

A11.4



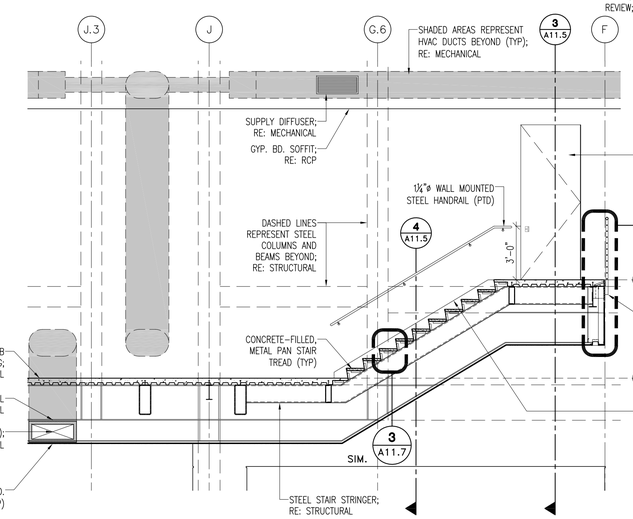
3 Section @ Stair "C"

SCALE: 3/4" = 1'-0"



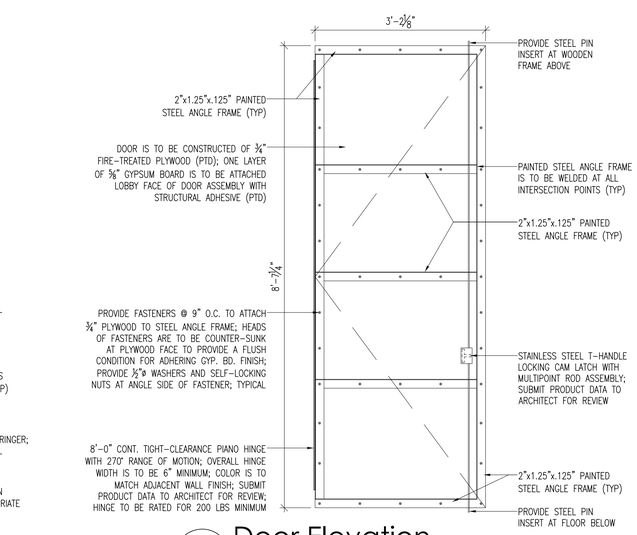
4 Section @ Stair "C"

SCALE: 3/4" = 1'-0"



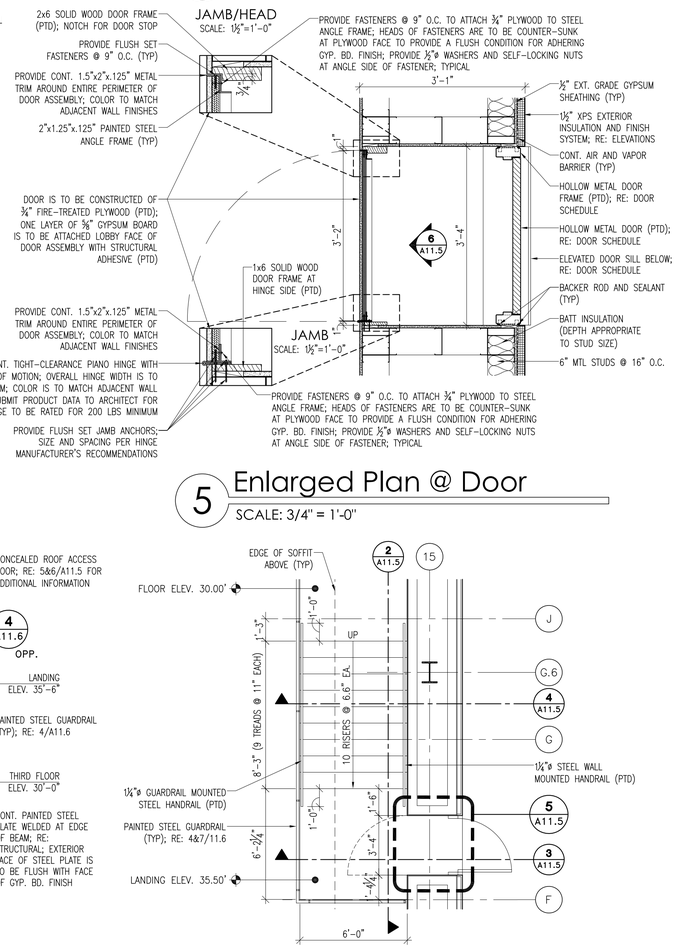
2 Section @ Stair "C"

SCALE: 1/4" = 1'-0"



6 Door Elevation

SCALE: 3/4" = 1'-0"



5 Enlarged Plan @ Door

SCALE: 3/4" = 1'-0"

1 Stair "C" Enlarged Plan

SCALE: 1/4" = 1'-0"

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT

HATTIESBURG PUBLIC SAFETY COMPLEX

HPSC Police and Court Building

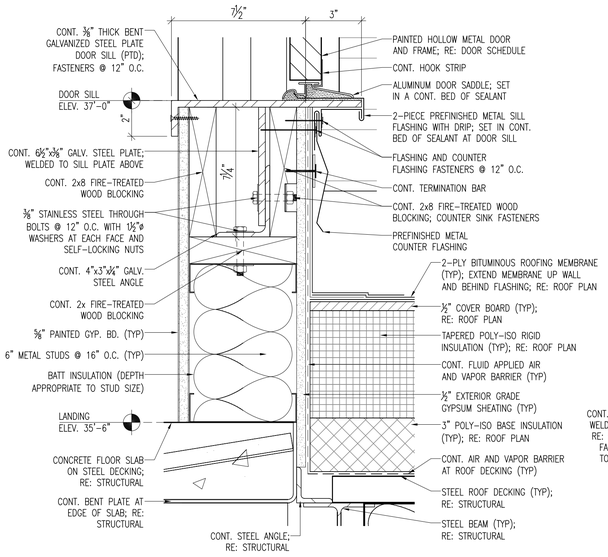
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Date	Rev.	Description
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11-02-2015		90% Pricing Set
11-19-2018		100% Bid Docs

Drawn By: CR,CP,AS,RB
Checked By: CR,LA,CP
Client No: ------
Albert & Associates: 12575

Larry A. Albert, Jr. Registered Architect, Hattiesburg, MS, State of Mississippi

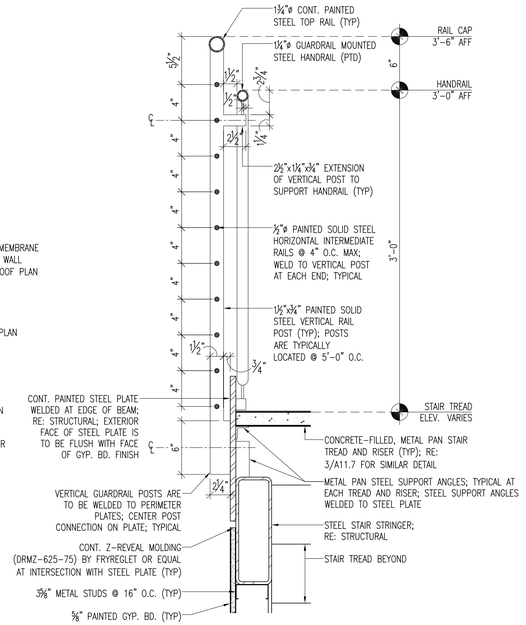
A11.5

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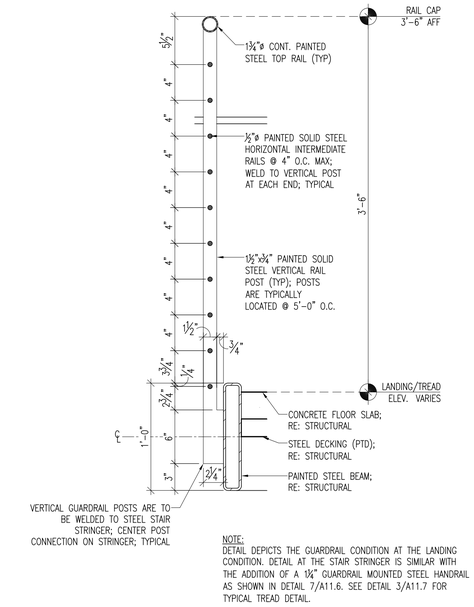
8 Door Sill Detail

SCALE: 3" = 1'-0"



7 Railing Detail @ Stair "C"

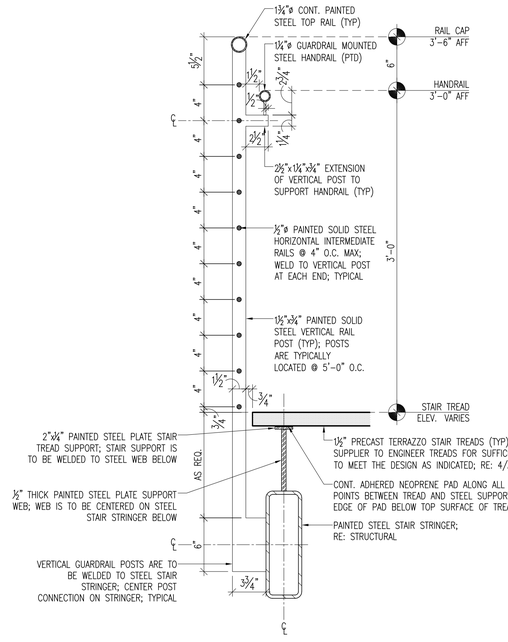
SCALE: 1 1/2" = 1'-0" TYPICAL



NOTE:
DETAIL DEPICTS THE GUARDRAIL CONDITION AT THE LANDING CONDITION. DETAIL AT THE STAIR STRINGER IS SIMILAR WITH THE ADDITION OF A 1¼" GUARDRAIL MOUNTED STEEL HANDRAIL AS SHOWN IN DETAIL 7/A11.6. SEE DETAIL 3/A11.7 FOR TYPICAL TREAD DETAIL.

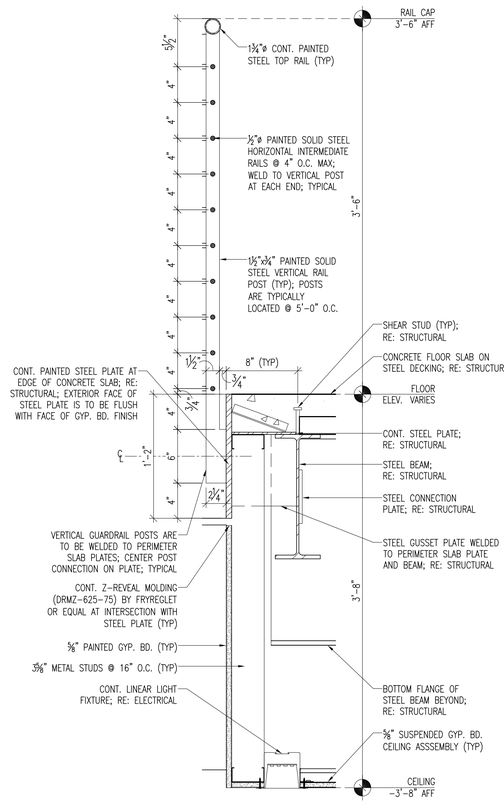
6 Railing Detail @ Stair "B"

SCALE: 1 1/2" = 1'-0" TYPICAL



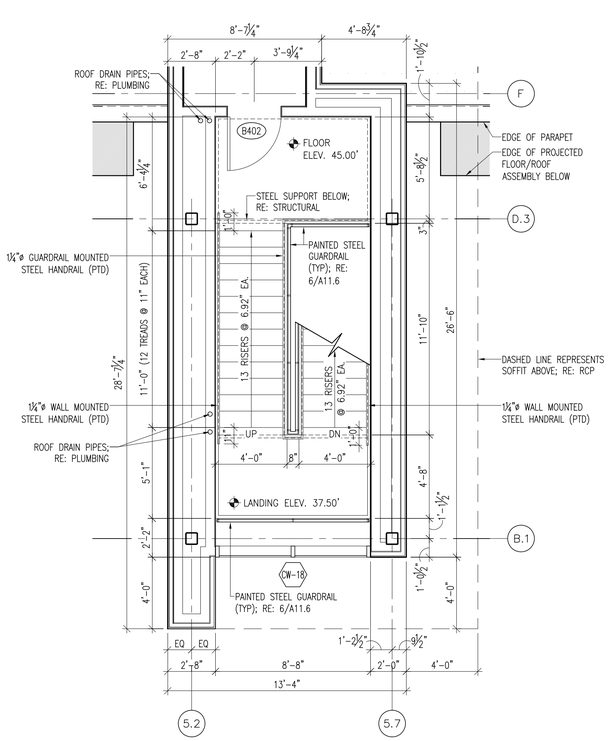
5 Railing Detail @ Stair "A"

SCALE: 1 1/2" = 1'-0" TYPICAL



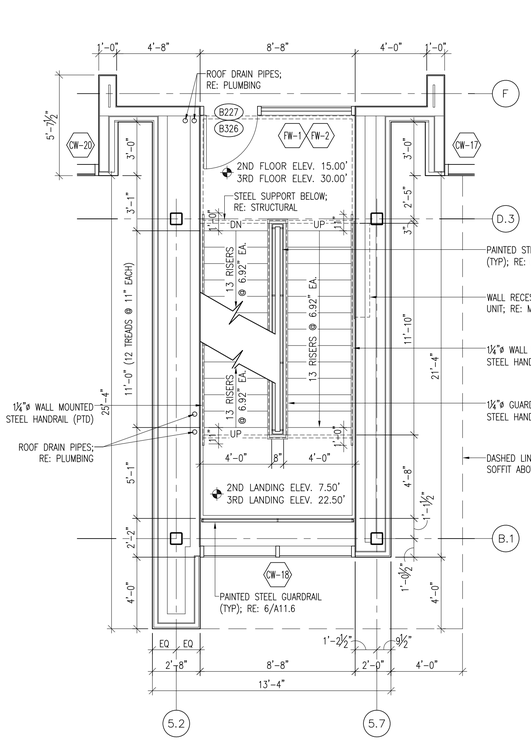
4 Railing Detail @ Walkway

SCALE: 1 1/2" = 1'-0" TYPICAL



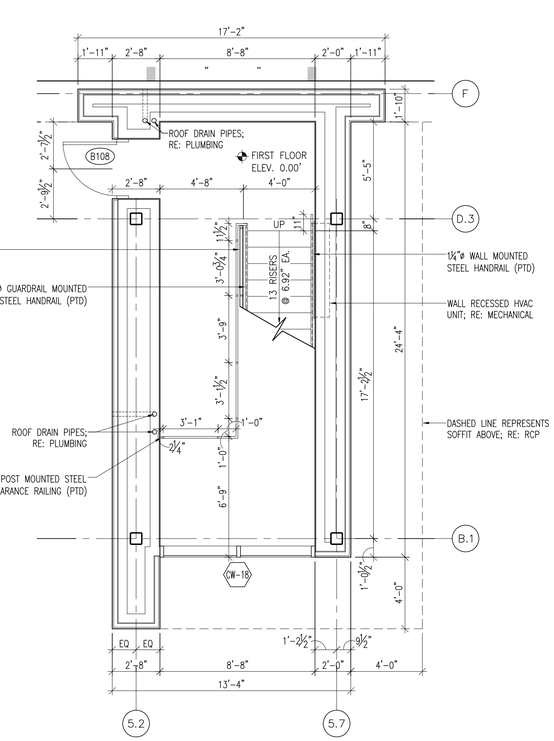
3 Stair "B" Roof Plan

SCALE: 1/4" = 1'-0"



2 Stair "B" Second/Third Floor Plan

SCALE: 1/4" = 1'-0"



1 Stair "B" First Floor Plan

SCALE: 1/4" = 1'-0"

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STAIR "B" PLANS & GUARDRAIL DETAILS

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

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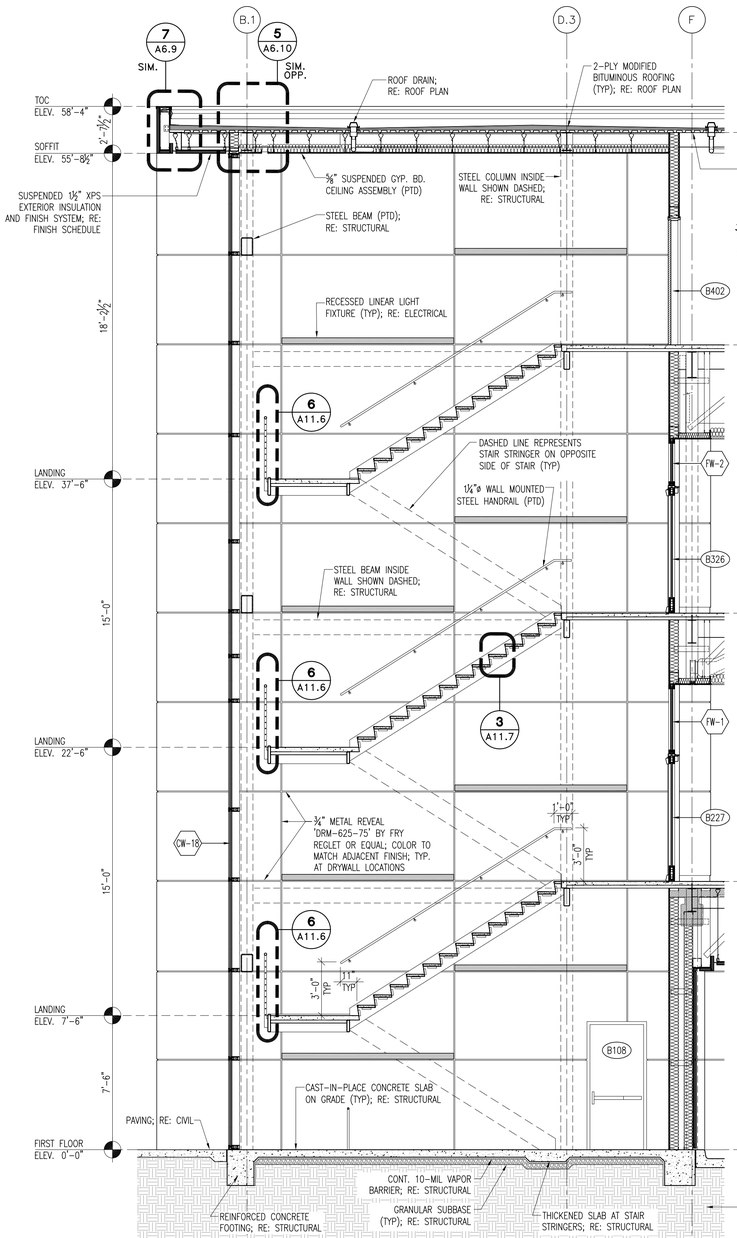
Drawn By: CR,CP,AS,RB
Checked By: CR,LA,CP
Client No: ------
Albert & Associates: 12575

REGISTERED ARCHITECT Larry M Albert Hattiesburg, MS STATE OF MISSISSIPPI

A11.6

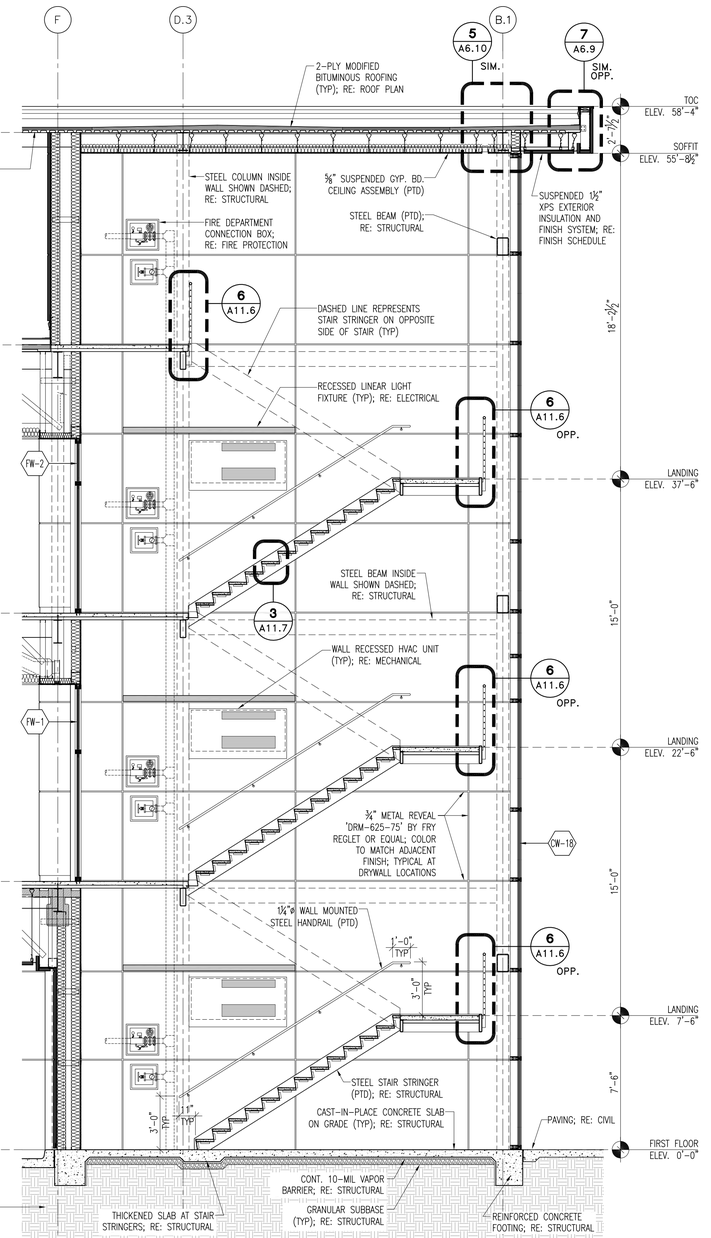
3 Stair "B" Tread/Riser Detail

SCALE: 3" = 1'-0" TYPICAL



2 Stair "B" Section

SCALE: 1/4" = 1'-0"



1 Stair "B" Section

SCALE: 1/4" = 1'-0"

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

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Checked By: CR,LA,CP

Client No: ------

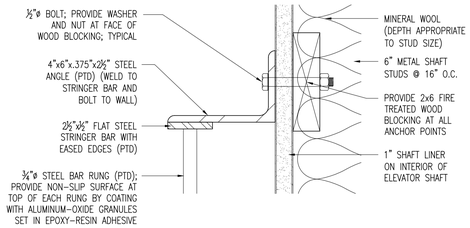
Albert & Associates: 12575

REGISTERED ARCHITECT Larry M Albert Hattiesburg, MS STATE OF MISSISSIPPI

A11.7

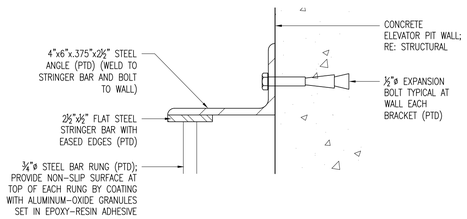
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STAIR "B" SECTIONS & DETAILS



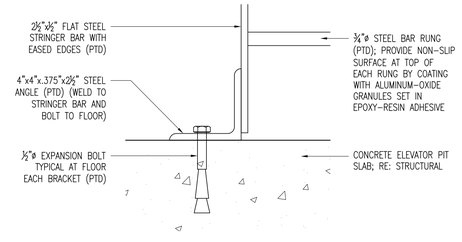
10 Ladder Detail @ Studs

SCALE: 3" = 1'-0"



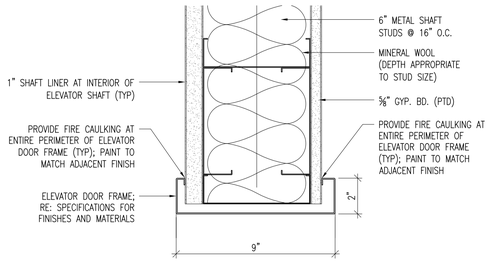
9 Ladder Detail @ Concrete

SCALE: 3" = 1'-0"



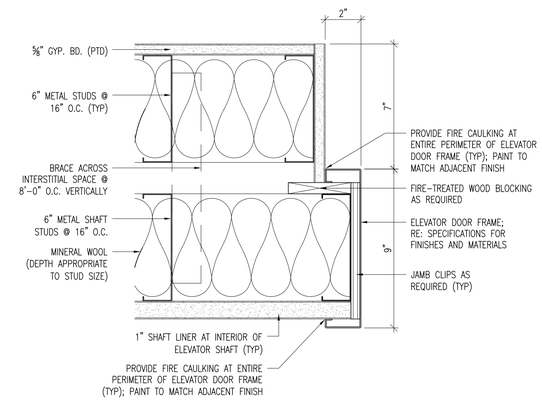
8 Ladder Detail @ Slab

SCALE: 3" = 1'-0"



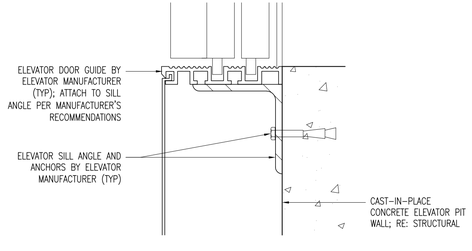
7 Head Detail

SCALE: 3" = 1'-0" TYPICAL



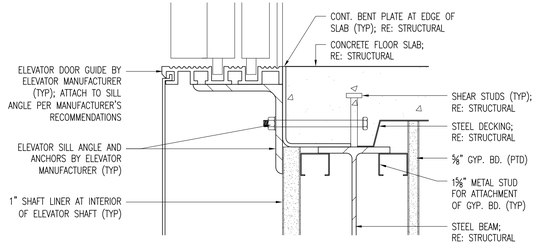
6 Jamb Detail

SCALE: 3" = 1'-0" TYPICAL



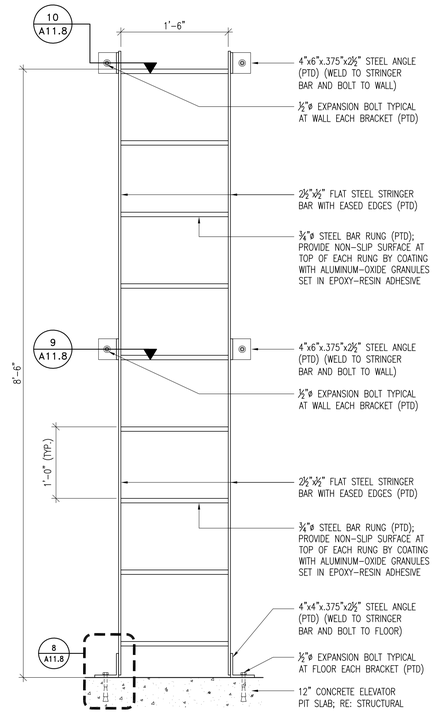
4 Sill Detail @ Elevator Pit

SCALE: 3" = 1'-0"



3 Sill Detail @ Floor Slab

SCALE: 3" = 1'-0" TYPICAL

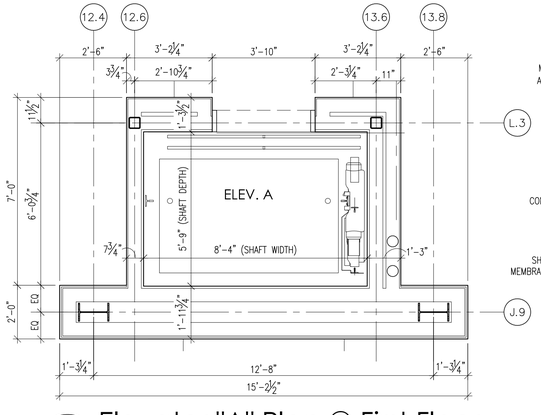


5 Pit Ladder Elevation

SCALE: 1" = 1'-0"

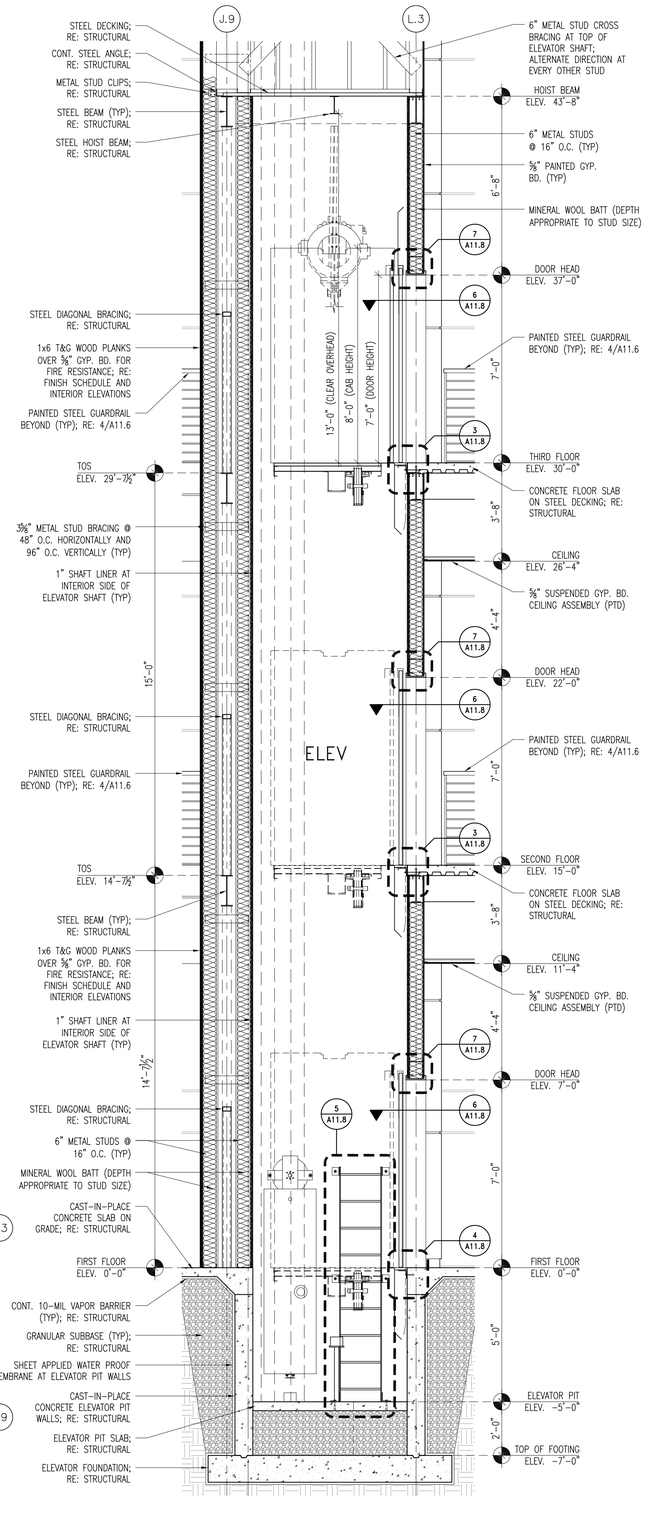
Elevator Plan Note

ELEVATOR PLAN AT SECOND AND THIRD FLOORS ARE SIMILAR TO THE FIRST FLOOR PLAN SHOWN BELOW. SEE FULL BUILDING FLOOR PLANS FOR EACH LOCATION.



2 Elevator "A" Plan @ First Floor

SCALE: 3/8" = 1'-0"



1 Elevator "A" Section

SCALE: 3/8" = 1'-0"

CITY OF HATTIESBURG MISSISSIPPI 1884

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

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Checked By: CR,LA,CP

Client No: ------

Albert & Associates: 12575

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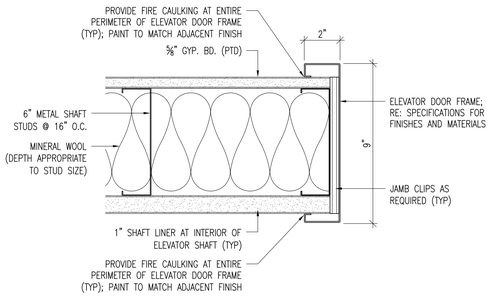
A11.8

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ELEVATOR "A" PLANS & SECTION

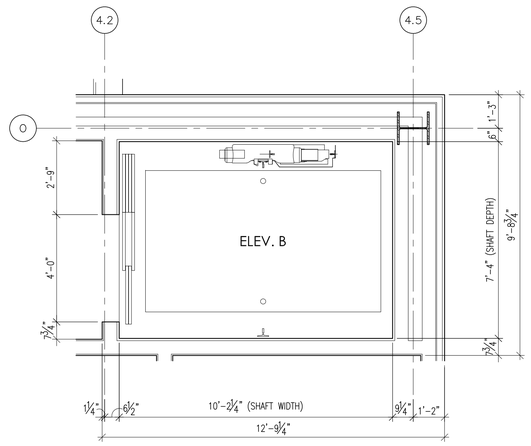
Elevator Plan Note

ELEVATOR PLAN AT THIRD FLOOR IS SIMILAR TO THE SECOND FLOOR PLAN SHOWN BELOW. SEE FULL BUILDING FLOOR PLANS FOR EACH LOCATION.



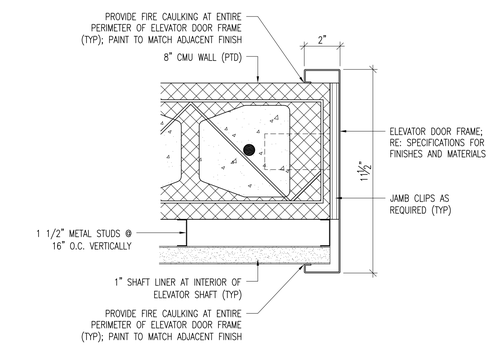
5 Jamb Detail

SCALE: 3" = 1'-0" @ SECOND & THIRD FLOORS



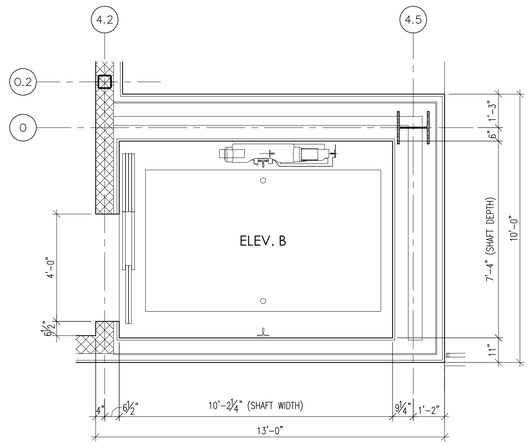
3 Elevator "B" Plan @ Second Floor

SCALE: 3/8" = 1'-0"



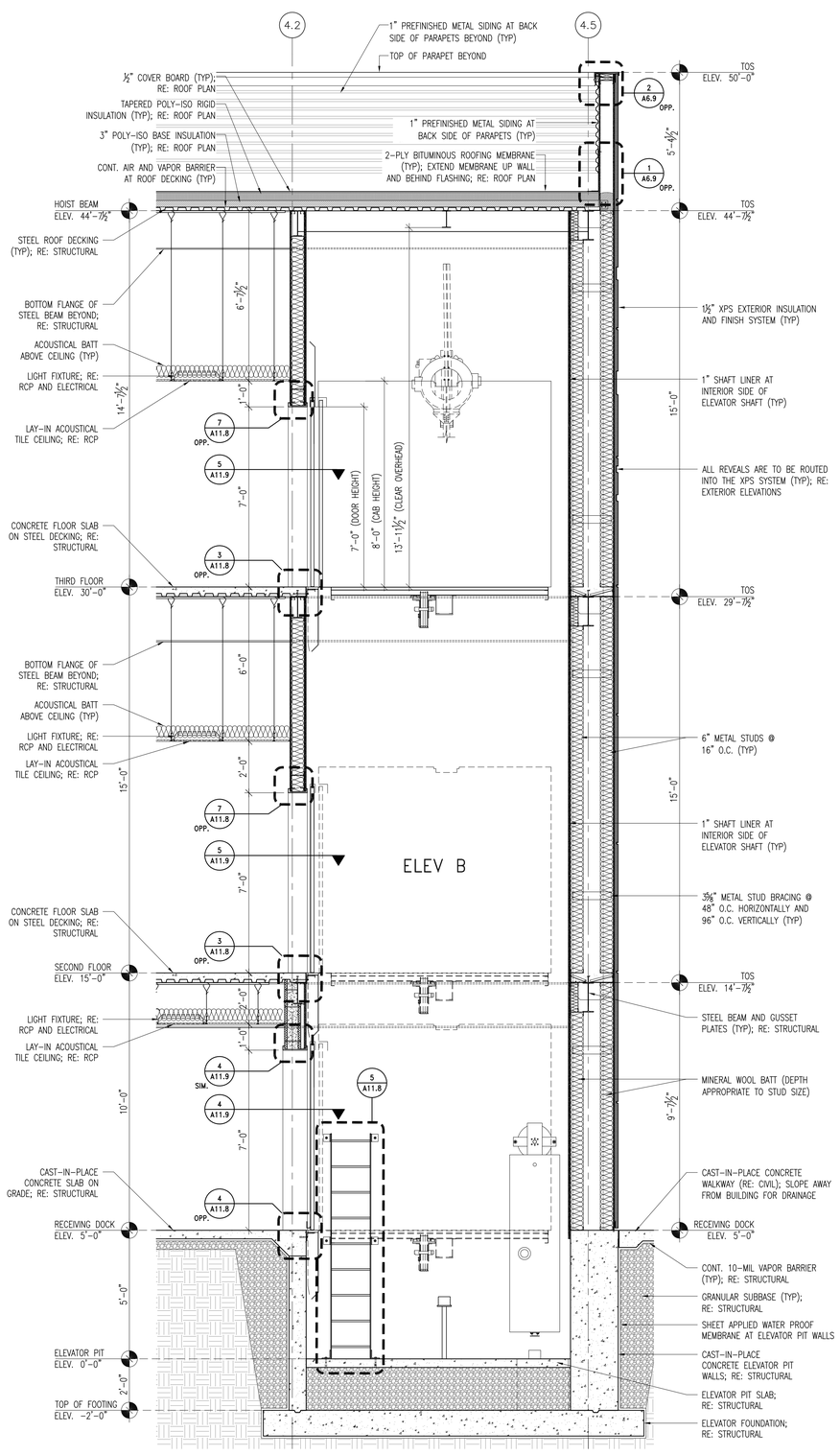
4 Jamb Detail

SCALE: 3" = 1'-0" @ FIRST FLOOR (HEAD SIM.)



2 Elevator "B" Plan @ First Floor

SCALE: 3/8" = 1'-0"



1 Elevator "B" Section

SCALE: 3/8" = 1'-0"

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

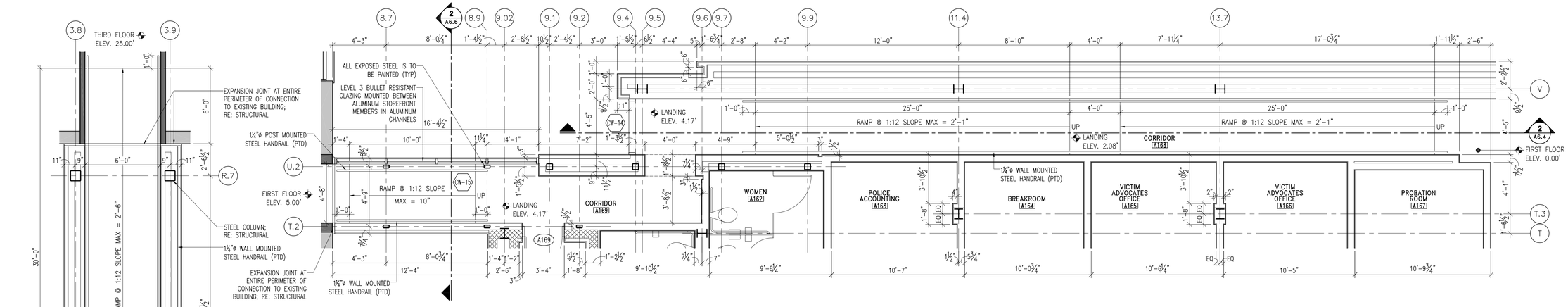
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Drawn By: CR,CP,AS,RB
Checked By: CR,LA,CP
Client No: ------
Albert & Associates: 12575

REGISTERED ARCHITECT Larry M Albert Hattiesburg, MS STATE OF MISSISSIPPI

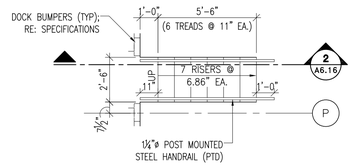
A11.9

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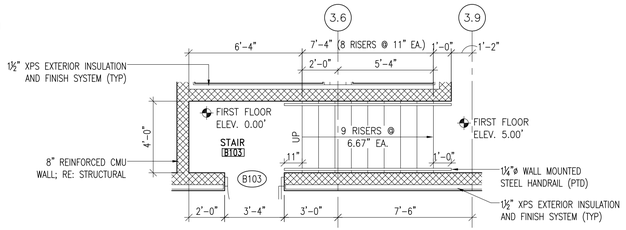
6 Enlarged Ramp Plan @ Corridor [A168] & Corridor [A169]

SCALE: 1/4" = 1'-0"



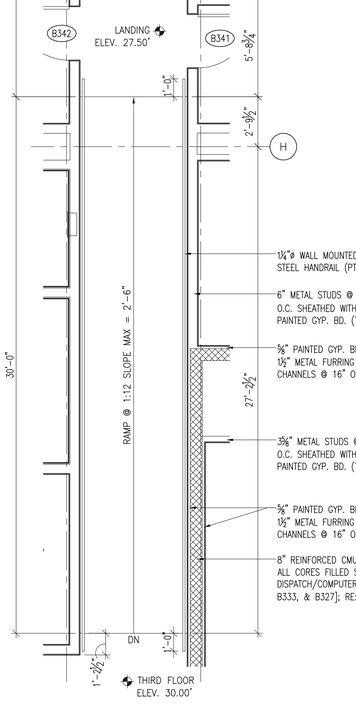
5 Enlarged Plan @ Receiving Dock

SCALE: 1/4" = 1'-0"



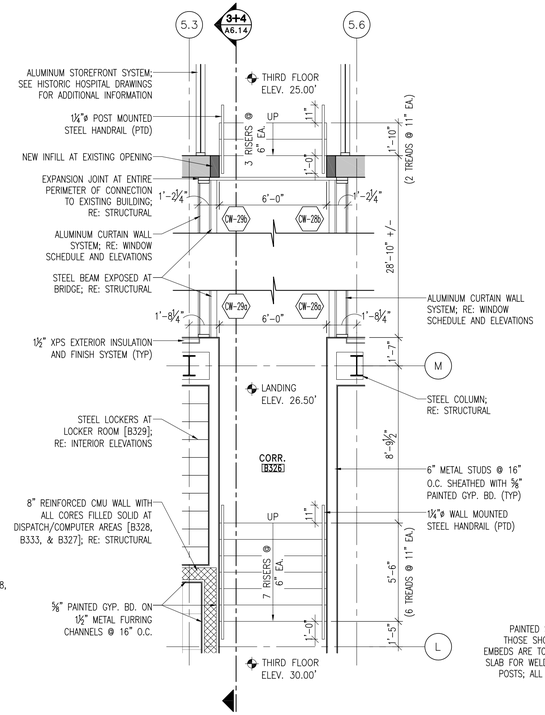
4 Enlarged Plan @ Stair [B103]

SCALE: 1/4" = 1'-0"



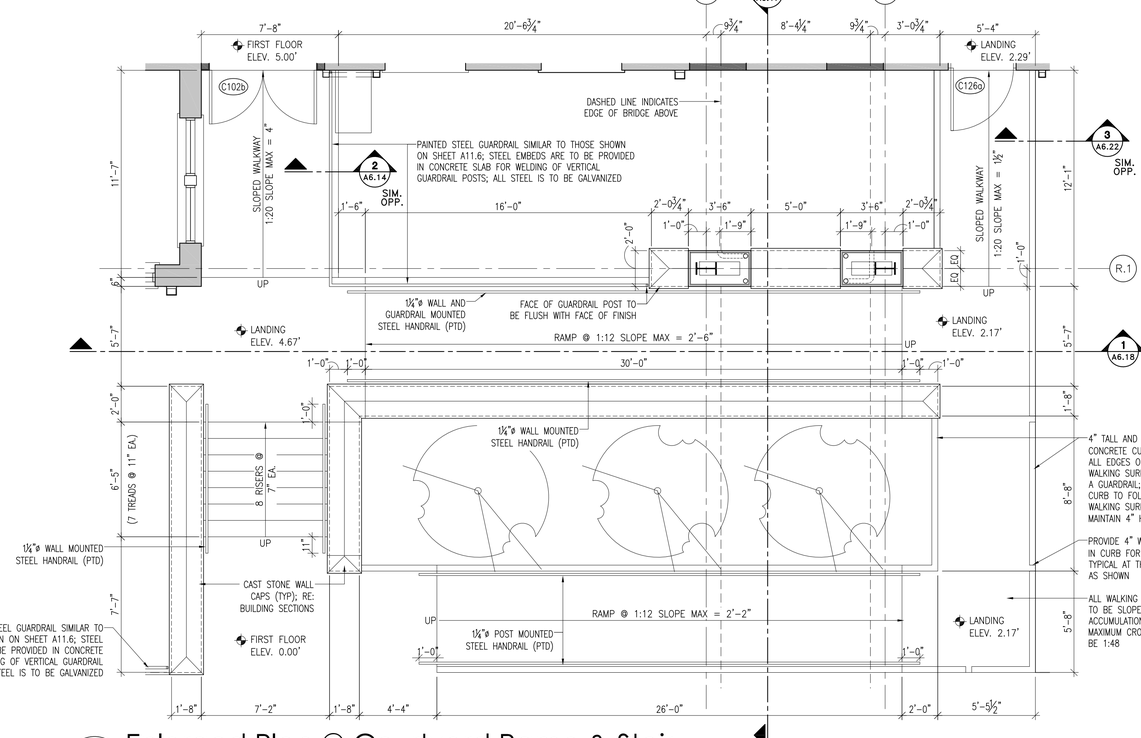
3 Enlarged Plan @ Corr. [B332]

SCALE: 1/4" = 1'-0"



2 Enlarged Plan @ Corr. [B326]

SCALE: 1/4" = 1'-0"



1 Enlarged Plan @ Courtyard Ramp & Stair

SCALE: 1/4" = 1'-0"

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Albert & McCleskey Associates Architects

MISCELLANEOUS STAIRS & RAMPS

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

Drawing Issued:

Date	Rev.	Description
08-31-2015		DD Check Set
10-20-2015		75% Progress Set
11-02-2015		90% Pricing Set
11-19-2018		100% Bid Docs

Drawn By: CR,CP,AS,RB
Checked By: CR,LA,CP
Client No: ------
Albert & Associates: 12575

REGISTERED ARCHITECT Larry M. Albert Hattiesburg, MS STATE OF MISSISSIPPI

A11.10

STRUCTURAL NOTES

THE STRUCTURAL NOTES DEFINE GENERAL DESIGN AND MATERIAL REQUIREMENTS AND ARE INTENDED TO SUPPLEMENT, BUT NOT REPLACE, THE PROJECT SPECIFICATIONS

DESIGN CRITERIA

1. Building Code: 2012 International Building Code and ASCE 7-10 (except Chapter 14 and Appendix 11A)

   1.1. Building Occupancy Category: IV

2. Design Loads

   2.1. Uniform Floor Live Loads (reduced per Building Code, UNO)

Partitions	15 psf	(except when live load > 80 psf)
Offices	50 psf	
Corridors/Lobbies 1st	100 psf	
Corridors/Lobbies 2nd floor and up	80 psf	
Exercise Room	100 psf	
Rooms with Access Floor	100 psf	
Garages (passenger vehicles)	40 psf	
Stairs	100 psf	
Storage	125 psf	
Mass Storage	250 psf	
Penthouse Mechanical	200 psf	

   2.2. Concentrated Floor Live Loads (distributed over 2.5 ft x 2.5 ft, UNO)

Office Buildings	2,000 lbs

   2.3. Roof Loads

2.3.1. Uniform Roof Live Load (reduced per Building Code)	20 psf
Concentrated Roof Live Load	300 lbs

   2.4. Wind Loads: Basic Wind Speed V (ult) = 140 mph; V (asd) = 109 mph
   Wind Exposure B
   Internal Pressure Coefficient = +/-0.18 (Enclosed Building)
   Directionality Factor, Kd = 0.85

   2.4.1. Component and Cladding Pressures (psf)
   2.4.2. Note: Positive Pressures act Toward the Surface; Negative Away.
   Note: Values based on Ultimate Wind Speed, for ASD use Applicable Load Combinations or multiply by 0.6.
   Note: Values based on Kd= 0.85

a = 7 ft	Roof C&C Pressures With Parapets (psf)					
Eff. Area (sq. ft.)	1-10	20	50	100	200	500-1000
Zone 1	+20 / -49	+19 / -48	+17 / -46	+16 / -45	+16 / -45	+16 / -45
Zone 2	+45 / -82	+43 / -73	+40 / -62	+38 / -53	+36 / -53	+34 / -53
Zone 3	+45 / -82	+43 / -73	+40 / -62	+38 / -53	+36 / -53	+34 / -53
a = 7 ft	Roof C&C Pressures With Overhangs (psf)					
Eff. Area (sq. ft.)	1-10	20	50	100	200	500-1000
Zone 1	+20 / -78	+19 / -77	+17 / -75	+16 / -74	+16 / -65	+16 / -53
Zone 2	+20 / -78	+19 / -77	+17 / -75	+16 / -74	+16 / -65	+16 / -53
Zone 3	+20 / -123	+19 / -98	+17 / -65	+16 / -41	+16 / -41	+16 / -41
a = 7 ft	Wall C&C Pressures (psf)					
Eff. Area (sq. ft.)	1-10	20	50	100	200	500-1000
Zone 4	+45 / -48	+43 / -46	+40 / -44	+38 / -42	+36 / -40	+34 / -37
Zone 5	+45 / -60	+43 / -56	+40 / -50	+38 / -46	+36 / -42	+34 / -37
a = 7 ft	Parapet C&C Pressures (psf)					
Eff. Area (sq. ft.)	1-10	20	50	100	200	500-1000
Zone 4	+117 / -82	+106 / -78	+91 / -72	+80 / -68	+78 / -64	+75 / -58
Zone 5	+117 / -94	+106 / -87	+91 / -79	+80 / -73	+78 / -67	+75 / -58

   2.5. Earthquake Loads:
   Seismic Importance Factor, I = 1.50
   Mapped Spectral Response Accelerations, Ss and S1 = 0.119 and 0.068
   Site Class: D
   Spectral Response Coefficients, Sds and Sd1 = 0.127 and 0.109
   Seismic Design Category: C
   Analysis Procedure: Equivalent Lateral Force Procedure
   Slab-on-grade is not designed as a structural diaphragm.

3. Structural Engineer is not responsible for the design of steel stairs, handrails, curtain wall/window wall systems, cold-formed teel framing, or other systems not shown in the Structural Documents. Such systems shall be designed, furnished, and installed as required by other portions of the Construction Documents.

4. Steel floor and roof assemblies and individual beams shall be considered "Restrained" (ASTM E119, Standard Test Methods for Fire Tests of Building Construction and Materials) for determining fireproofing thickness.

5. No explicit provisions have been made for future building expansion.

GENERAL

1. Reference to standards or specifications of technical societies, organizations, or associations means the standard or specification referenced by the governing Building Code shown on the Drawings, unless specifically noted otherwise.
2. Material, workmanship, and design shall conform to the referenced Building Code.
3. For dimensions not shown in the Structural Drawings, see the Architectural Drawings.
4. Contractor responsibilities include, but are not limited to, the following:
   4.1 Coordinate the Structural Documents with the Architectural, Mechanical, Electrical, Plumbing, and Civil Documents. Architect/Structural Engineer shall be notified of any discrepancy or omission.
   4.2 Coordinate Structural Documents with Architectural and MPE Documents for location and quantity of miscellaneous framing for items such as roof drains, suspended or supported mechanical units, etc. Refer to Architectural and MPE Documents for additional miscellaneous structural elements that may not appear in the Structural Documents.
   4.3 Equipment/Framing Verification
      4.3.1 Mechanical Equipment: Submit actual weights of equipment to be used for review at least 3 weeks prior to fabrication and construction. Coordinate opening sizes and locations with Mechanical Contractor.
      4.3.2 Elevator Loads: Submit elevator shop drawings and loads (machine beam/slab, and guide rails) for review prior to detailing, fabrication and installation of elevator system.
      4.3.3 Miscellaneous Framing: Verify framing shown on the Structural Drawings for mechanical equipment, Owner-furnished items, partitions, etc. is consistent with the requirements of such items.
   4.4 The structure is stable only in its completed form. Temporary supports required for stability during all intermediate stages of construction shall be designed, furnished, and installed by the Contractor.
   4.5 Contractor has sole responsibility for jobsite safety and complying with all health and safety precautions as required by any regulatory agency. In performing construction observation visits to the jobsite, the Structural Engineer will have no control over, nor responsibility for, the Contractor's means, methods, sequences, techniques, or Procedures in performing the work.
5. Existing and Unforeseen Conditions
   5.1 Contractor shall field verify all existing conditions, elevations, and site conditions prior to construction and fabrication. Contractor shall immediately notify Structural Engineer of any existing conditions that are in conflict with the Structural Documents.
   5.2 Shop drawing submittals shall be based on field verified dimensions and conditions only. Contractor shall clearly show actual field dimensions on shop drawings.
   5.3 Existing dimensions, elevations, and other information shown in the Structural Drawings are based on the following Documents:

SUBMITTALS

1. Shop Drawings and Submittals
   1.1 Reproduction of Structural Drawings for shop drawings is not permitted.
   1.2 Electronic drawing files will not be provided to the Contractor.
2. Submittals
   2.1 The Structural Quality Assurance Plan and Specifications identify the required submittals. Prior to (or with) the first submittal, Contractor shall submit a list of all required submittals for Engineer's review.
3. Deferred Submittals
   3.1 Deferred Submittals include those portions of the project that are furnished by the Contractor and designed by someone other than the Engineer of Record and are submitted at the time of the application. Deferred Submittals shall be submitted to the Building Official prior to fabrication and installation.
   3.2 Submittal documents for Deferred Submittals:
      3.2.1 Shall be included in the Contractor's scope of services and shall be sealed by an Engineer licensed in the project state. Design of Deferred Submittals shall be in accordance with the governing Building Code indicated above.
      3.2.2 Shall be submitted to the registered design professional in responsible charge who shall review them and forward to the Building Official with a notation indicating the deferred submittal documents have been reviewed and that they have been found in general conformance with the design of the building. Deferred submittal items shall not be installed until the design and submittal documents have been approved by the Building Official.
   3.3 The following shall be considered Deferred Submittals:
      Temporary/Permanent Shoring and Underpinning
      Aggregate Pier Soil Reinforcement
      Steel Connections - See "Structural Steel" Section
      Steel Joists
      Cold-Formed Exterior Steel Stud Framing
      Architectural Precast Concrete
      Steel Stairs and Handrails
      Curtainwall/Window Wall Systems
      Elevators
      Structural Glass Floor

FOUNDATION

1. Geotechnical Report: Public Safety Complex Police and Court Building
   Prepared by: Terracon Consultants, Inc.
   Dated: July 1, 2016
   Report No. EB165058
2. Building Pad Preparation
   2.1 Strip vegetation and topsoil.
   2.2 Proofroll building areas with a minimum of two complete coverages of a loaded dump-truck or scraper in each of two perpendicular directions. Replace soft areas with compacted structural fill.
   2.3 Ground improvement shall be Aggregate Pier Soil Reinforcement.
      2.3.1 Minimum Improved Soil Bearing Capacity:

Isolated Footings	As indicated on Foundation Plans by (#,### psf) at each footing
Retaining wall Footings	3000 psf
Mat footing at Elevator Pit	As indicated on Foundation Plans
Slab-on-Grade	Not Required
Turndown at Slab Edge	3000 psf

      2.3.2 Improved soil settlement limits:

Total	1"
Differential	1/2"

REINFORCEMENT

1. Reinforcing Bars: ASTM A615, Grade 60
   1.1 Reinforcing bars are not to be welded.
2. Welded Wire Reinforcement (WWR) : ASTM A1064, 8" minimum side and end laps
3. Reinforcement Placement (UNO)
   3.1 Concrete Reinforcement Cover

Below Grade:	Unformed	3" clear
	Formed	2" clear
Walls		3/4" clear
Slabs		3/4" clear

   3.2 Masonry reinforcing steel: Place in the center of CMU cells.
4. Reinforcement Splices
   4.1 Reinforcement marked "Continuous" can be spliced at locations determined by Contractor. All other reinforcement shall be spliced only at locations shown or noted, unless approved in writing by Structural Engineer.
   4.2 Splice Lengths (UNO)
   Concrete Reinforcement: Class B Tension Lap
   Masonry Reinforcement: #4 - 24" / #5 - 30" / #6 - 48" / #7 - 60"

CAST-IN-PLACE CONCRETE

1. Concrete Properties

	28-Day, f'c (min.)	w/cm Ratio (max.)	Entrained Air
Footings (Isolated / Continuous)	3,000 psi	----	None Required
Foundation Walls, Pedestals	3,000 psi	----	None Required
Slabs on Grade	3,500 psi	0.48	None Required
Slabs on Composite Steel Deck	3,500 psi	0.48	None Required
Walls	3,000 psi	0.50	None Required
Raised floor and Ribs on Polystyrene	3,500 psi	0.48	None Required
Mechanical Equipment Pads	3,000 psi	----	None Required
All Other Concrete	4,000 psi	0.40	5.0 +/- 1.5%

   Note: All concrete shall be assigned the exposure classes FO, SO, PO, and CO; except concrete in Aggressive Environment shall be assigned the exposure classes F3, SO, P1, and C2 (see ACI 318) .
2. Construction Joint Locations: No horizontal construction joints are permitted except as shown on the Structural Drawings. Obtainteel written consent for additional joints.
3. Pipes or ducts shall not exceed one-third the slab or wall thickness unless specifically detailed. See mechanical and electricalteel drawings for location of sleeves, accessories, etc.
   3.1 Conduit shall not be placed within the slab on grade. Conduit shall be installed below the slab on grade within the granular subbase.
   3.2 It is preferred that conduit not be installed within composite slabs. However, if a limited quantity of conduit must be installed within the composite slab, the conduit outside diameter shall not exceed 1", no crossover can occur, and conduit runs shall be spaced at 18" with a minimum of 3/4" cover. Where possible, conduit should be installed within the low flutes of the composite deck.
4. Concrete floors supported by composite steel deck are to be finished level. The weight of the wet concrete will cause deflectionteel of the steel framing.
   4.1 Concrete overruns of at least 15% should be anticipated and included in the Contractor's Bid.
5. Special Finishes: Refer to Architectural Drawings for molds, grooves, ornaments, clips or grounds required to be encased in concrete and for location of floor finishes and slab depressions.
6. Defect Repair: Honey-combing, spalls, cracks, etc. shall be repaired. Extent of defective area to be determined by the Structura Engineer.

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

Drawing Issued:

Date	Rev.	Description
11-19-2018		100% CD

Drawn By: tw
Checked By: W.G.
Client No: ------
Albert & Associates: 12575

THOMAS C. SCHAEFER REGISTERED PROFESSIONAL ENGINEER 21331 STATE OF MISSISSIPPI

Structural Design Group
220 Great Circle Road, Suite 106
Nashville, Tennessee 37228
p. 615.255.5537
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SDG Project No. 2015-108.20

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STRUCTURAL DESIGN GROUP
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STRUCTURAL NOTES

THE STRUCTURAL NOTES DEFINE GENERAL DESIGN AND MATERIAL REQUIREMENTS AND ARE INTENDED TO SUPPLEMENT, BUT NOT REPLACE, THE PROJECT SPECIFICATIONS

NON-SHRINK GROUTING

1. Non-shrink grout under steel base plates shall be non-metallic with minimum compressive strength of 5000 psi at 28 days.
2. Non-shrink grout used for patching, repair, and other specific applications shall be submitted for review and approval by engineer.

CONCRETE MASONRY

1. CMU Minimum Compressive Strength, f'm = 2,000 psi.
2. Mortar: Walls below grade Type M
   Bearing walls Type M or S
   Partition walls Type N
3. Coarse Grout: 2,500 psi min. compressive strength conforming to ASTM C476.
   3.1 Grout solid bond beams, reinforced CMU cores, and CMU cores and wall cavities below grade.
   3.2 Masonry webs on each side of grouted cells shall be fully mortared. Exterior single wythe CMU walls shall have head joints fully mortared.
4. Horizontal Joint Reinforcement: Two (2) No. 9 gage longitudinal wires at 16" vertically, UNO. Lap wire 6 inches minimum. Provide accessories for corners, intersections, etc. Use ladder type for walls with vertical reinforcing.
5. Provide open bottom beam block units with 3" deep minimum web openings at horizontal reinforcement locations not located over an opening. A minimum clear space of one bar diameter shall be provided between the reinforcing bars and the face of masonry units.
6. CMU has been designed assuming "running bond" placement. Do not use "stack bond" unless approved by Structural Engineer.
7. Contraction Joints: Unless noted otherwise on the Plans, maximum spacing of 1 1/2 times of wall height or 24 feet (whichever is less) in all concrete masonry walls (including partitions) above grade.
8. Dovetail Anchors: At 16" vert., UNO, where CMU walls abut concrete surfaces.
9. Submit written construction procedures prior to the start of masonry construction.

STRUCTURAL STEEL

1. Steel Shapes
   1.1 W-Shapes: ASTM A992 (Grade 50)
   1.2 Angles, Channels, Plates, UNO: ASTM A36
   1.3 Square/Rectangular/Round Hollow Structural Sections (HSS) : ASTM A500
   1.4 Pipe Structural Sections: ASTM A53, Grade B
   1.5 Structural steel exposed to weather shall be galvanized
2. Anchor Rods, Bolts, and Studs
   2.1 Anchor Rods: ASTM F1554, Grade 36. Headed Rods or threaded rods with plate washer and heavy hex nut.
   2.2 Bolts: 3/4" Diameter A325 minimum. All connections may be bearing type, UNO. Design bearing type connections for load values with threads included in the shear plane. Submit proposed bolt tightening procedure for review.
   2.3 The following connections are slip-critical:
   Shear connection in welded moment connections (Moment Frames, etc.)
   Hanger connections
   Any field modified connection
   Connections indicated as slip-critical (SC)
   2.4 Shear Connectors (for Composite Beams) : ASTM A108. 3/4" Diameter, headed
   Length (In-Place After Burn-off) : 3-3/4" (+/- 1/4")
   2.5 Headed Studs: ASTM A108. See Details for Diameter, Length and Spacing. Length given is in-place length after burn-off.
3. Structural steel shall be fabricated and erected according to the "Specification for Structural Steel Buildings" dated June 22, 010 and the AISC "Code of Standard Practice for Steel Buildings and Bridges" Dated April 14, 2010.
4. Connections shall be detailed based on the design information provided in the Structural Documents.
   4.1 Standard Shear Connections: Detail as bolted or welded double-angle, single-plate, single-angle, or tee connections in accordance with the connection tables in the "Manual of Steel Construction", Thirteenth Edition.
   4.1.1 Shear connections not defined in the AISC Manual shall be designed by an Engineer licensed in the project state. This design service shall be included in the Contractor's scope of services. Shop drawings of such connections shall be sealed by the Engineer.
   4.2 Welded Connections: Prequalified welded joints in accordance with AISC and the Structural Welding Code of the American Welding Society; "Non-prequalified joints" shall be qualified prior to fabrication.
   4.3 Factored Design Forces/Reactions: As shown on the Structural Drawings or, if not shown, the factored design reaction shall be half of the "Maximum Total Uniform Load (LRFD) " tabulated in the "Manual of Steel Construction", Thirteenth Edition.
   4.4 Steel connections not specifically detailed in the Structural Drawings shall be designed by the Contractor. This design service shall be included in the Contractor's scope of services. Shop drawings of such connections shall be sealed by an Engineer licensed in the project state.
5. Shop Drawings: Submittal shall adequately depict structural members and connections.
6. Steel Bar Grating: Rectangular type with welded cross bars
   6.1 Steel: ASTM A569
   6.2 Bearing Bars: 1-1/4" deep x 3/16" thick spaced at 1-3/16"
   Cross Bars: Spaced at 4"
   6.3 Grating Surface: Plain
   6.4 Grating Finish: Standard shop coat of red oxide paint
   6.5 Fasten grating to steel supports with saddle clip and self-drilling fastener at every sixth bearing bar along support (min. of 2 clips per panel) .

POST-INSTALLED ANCHORS

1. Post-installed anchors shall only be installed where indicated on the structural drawings, unless approved in writing by engineer of record.
2. The below products are the design basis for this project. Product diameter and embedment shall be as shown in the details. Install products IN ACCORDANCE WITH MANUFACTURER'S PRINTED INSTALLATION INSTRUCTIONS (MPII) . Refer to the project building code and/or evaluation report for special inspections and proof load requirements. Substitution requests for products other than those listed below may be submitted by the contractor to the Engineer-of-Record (EOR) for review. Substitutions will only be considered for products having a research report recognizing the product for the appropriate application under the project building code. Substitution requests shall include calculations that demonstrate the substituted product is capable of achieving the equivalent performance values of the design basis product.
3. For Anchoring into Concrete
   3.1 Expansion Anchors: Hilti Kwik Bolt TZ (ICC-ES ESR-1917) , Simpson Strong-Bolt 2 (ICC-ES ESR-3037) , or Power-Stud+ SD2 (ICC-ES ESR-2502) . Minimum embedment = 6 times anchor diameter, UNO.
   3.2 Screw Anchors: Simpson Titen-HD (Concrete: ICC-ES ESR-2713; Grouted Masonry: ICC-ES ESR-1056) or Powers Wedge-Bolt+ (ICC-ES ESR-2526) Hilti Kwik HUS-EZ (ICC-ES ESR-3027) .Minimum Embedment=6 times anchor diameter, UNO.
4. For Anchorage into Solid Grouted Concrete Masonry
   4.1 Expansion Anchors: Hilti Kwik Bolt 3 (ICC-ES ESR-1385) , Simpson Strong-Bolt 2 (IAPMO-UES ER-240) , Simpson Wedge-All (ICC-ES ESR-1396) or Power-Stud+ SD1 (ICC-ES ESR-2966) . Minimum embedment = 6 times anchor diameter, UNO.
   4.2 Screw Anchors: Simpson Titen-HD (ICC-ES ESR-1056) or Powers Wedge-Bolt+ (ICC-ES ESR-1678) , Hilti Kwik HUS-EZ (ICC-ES ESR-3056) .Minimum Embedment=6 times anchor diameter, UNO.
   4.3 Adhesive Anchors: Adhesive conforming to Simpson Set-XP (IAPMO-UES ER-281) , Simpson SET-XP (ICC-ES ESR-265) , Powers PE1000+ Epoxy Adhesive (ICC-ES ESR-2583) , Powers AC100+ Gold Adhesive (ICC-ES ESR-2582) , Hilti HIT-HY 70 Fast Cure Adhesive (ICC-ES ESR-2682) . Minimum Embedment = 6 times anchor diameter, UNO.
5. Contractor shall arrange for an anchor manufacturer's representative to provide onsite installation training for all of their anchoring products specified. The structural Engineer of record must receive documented confirmation that all of the contractor's personnel who install anchors are trained prior to the commencement of anchor installation.

STEEL JOISTS

1. Steel Joists, Bridging, and Connections: Designed, fabricated, and erected according to Specifications of the Steel Joist Institte (SJI) .
   1.1. Net Uniform Uplift Design Load for Roof Joists = 15 psf
   1.2. Bridging shall be designed to fully brace top chord of joists under service loads for roof joists not braced by steel roof deck.te
   1.3. Top chord extensions or extended ends are to be designed for the same tabulated uniform loads used in the design of the associated joists plus a concentrated load of 300 pounds at the end of the of the extension or extended end, unless noted otherwise on the Drawings.
2. Design of steel joists, bridging, and their connections shall be the sole responsibility of the Contractor. Submit shop drawingste sealed by an Engineer licensed in the project state.
3. Contractor shall coordinate the construction and erection of walls, beam framing, Steel decking, etc. to ensure compatibility ofte roof and wall systems considering pitch and camber of steel joists.

STEEL DECK

1. Composite Steel Deck
   1.1 Composite steel deck shall have the following minimum properties:
   Section Modulus: Positive, Sp = 0.340 in^3
   Negative, Sn = .340 in^3
   Moment of Inertia, I = 0.280 in^4
   Material Yield Strength = 50 ksi
   1.1.1 In no case shall the deck thickness be less than 20 gage regardless of the deck properties provided.
   1.1.2 Deck properties shown above are based on the analysis of two- and three-span deck conditions. The maximum single span of composite deck shall not exceed 7 feet.
   1.2 Composite floor members are designed to be unshored unless noted otherwise.
   1.3 Coordinate embedded items required for Architectural, Structural, and Mechanical elements.
2. Steel Roof Deck: 22 gage, galvanized
3. Submit shop drawings with the manufacturer's catalog demonstrating compliance with the Contract Documents and the Steel Deck Institute.

COLD-FORMED EXTERIOR STEEL STUD FRAMING

1. Design of cold-formed exterior steel non-load bearing studs and their connections shall be the sole responsibility of the Contractor. Design and shop drawing submittals shall comply with the Specifications. Shop drawings shall be sealed by an Engineer licensed in the Project state.
2. Cold-Formed Steel Design, Fabrication and Erection: Conform to AISI S100-07, "North American Specification for Design of Cold-Formed Steel Structural Members".

ELEVATORS

1. Elevator hoistway dimensions, pit depths, sheave beam layout, machine room slabs, hoist beams, and elevator reactions are based on preliminary elevator information only. Final elevator shop drawings were not available during preparation of the Construction Documents.
2. Contractor shall submit final elevator shop drawings to the engineer and architect for review. Elevator shop drawings shall indicate the loads for the machines, counterweights, car buffers, counterweight buffers, and guide rails. Their connections to te structure shall be clearly depicted for verification of the load carrying capacity of the structure.
3. Contractor shall not begin construction or fabrication of any structural elements related to the elevators until final elevator hop drawings have been submitted, reviewed by the Engineer and Architect for coordination purposes, and approved by the Engineer and Architect. These items include elevator pit walls and foundations, separator beams, guide rail support tubes, hoisthop beams, machine room framing, and sheave beams.
4. Where required, Contractor shall coordinate the number and location of elevator guide rail support tubes for elevator guide rail and counterweight rails with the final elevator shop drawings. Miscellaneous steel required to connect elevator guide and counterweight rails to guide rail support tubes shall be furnished by the elevator vendor or contractor.
5. Miscellaneous steel required to support elevator door frames shall be furnished by the elevator vendor or contractor.
6. Elevator Seismic Design and Submittals
   6.1 Design, construction, and installation of elevator systems shall comply with the requirements of the referenced Building Code and ASME A17.1. In case of conflict, the more restrictive requirements shall govern.
   6.2 Elevator cab guide rails and supporting brackets shall be designed to resist the lateral forces specified in the above referenced documents. The lateral forces shall be based on the maximum weight of the car, including one-half the weight of the plunger, plus not less than 40 percent of the rated load capacity of the car. The most critical locations of the lateral forces shall be considered for the design of the elevator cab guide rails. The maximum guide rail deflection shall not exceed 1/2 inches for the design lateral loads. Additional guide rail brackets may be used, if necessary, to reduce the guide rail deflection (tube member supports have been provided at all elevator shafts for this purpose) .
   6.3 Upper and lower position restraints shall be provided as required by the above referenced documents.
   6.4 Structural drawings and engineering calculations of the elevator guide rails, supporting brackets, and all connections shall be stamped and signed by a licensed structural engineer in the project state and submitted to the Structural Engineer of Record.

ANCHORAGE OF MECHANICAL COMPONENTS

1. Roof Top Structures and Equipment
   1.1. Rooftop structures and equipment shall be properly anchored and braced to resist wind and seismic forces. Refer to MPE documents for specific details and additional information.
   1.2. Design of anchorage for rooftop structures, curbs and equipment shall be the sole responsibility of the Contractor. Submit shop drawings sealed by an Engineer licensed in the project state. Shop drawings shall show plan layout, typical elevations, details, and anchorage to the structure.
   1.3. Anchorage of rooftop structures and equipment shall comply with the requirements of Factory Mutual.
2. Piping
   2.1. Pipe loads supported by "C" clamps at the edge of structural steel beam flanges cannot exceed 500 pounds.
   2.2. Total load of mechanical components applied to any one structural steel beam is not to exceed 4000 pounds unless specifically approved by the Structural Engineer.
   2.3. At composite slabs, piping up to and including 6" diameter may be supported by the composite slab. Piping greater than 6" diameter is to be supported from the structural steel beams or supplementary steel supports.
   2.4. At roof decks, piping is to be supported from the structural steel beams or supplementary steel supports, not supported by the roof deck.

DRAWING INDEX

S0.1 ..... STRUCTURAL NOTES
S0.2 ..... STRUCTURAL NOTES & DRAWING INDEX
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SDG Project No. 2015-108.20

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

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Albert & Associates: 12575

THOMAS C. SCHAEFER REGISTERED PROFESSIONAL ENGINEER 21331 STATE OF MISSISSIPPI

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STRUCTURAL QUALITY ASSURANCE PLAN

GENERAL

This Structural Quality Assurance Plan includes:

1. The Statement of Special Inspections which defines the scope of testing and inspection that is required for this project.
2. The responsibilities of the Contractor.

Refer to other portions of the Construction Documents for Special Inspections required of architectural, mechanical, electrical,or other building components.

Special Inspector will be hired by the Owner.

Special Inspector shall maintain records of inspections in accordance with Chapter 17 of the Building Code and shall distribute hese records to the Building Official, Architect, and Structural Engineer on a weekly basis, unless noted otherwise below. Reports shll indicate that work inspected/tested was done in conformance to the Construction Documents. Discrepancies shall be brought to the immediat attention of the Contractor for correction. If the discrepancies are not corrected, they shall be brought to the attention of th Building Official, Architect, and Structural Engineer prior to completion of that phase of the work.

At the conclusion of the project, the Special Inspector shall submit a final report documenting required special inspections andcorrection of any discrepancies noted in the inspections.

STATEMENT OF SPECIAL INSPECTIONS

Special Inspector shall perform the following tests and inspections of all structural elements included within this Statement ofSpecial Inspections.

1. The following elements are part of the Seismic-Force-Resisting （SFR） System. and require additional Special Inspections or Testig for Seismic Resistance:
   a. Moment Frames and their Foundations
   b. Braced Frames and their Foundations
   c. Special Moment Frames and their Foundations
   d. Special Structural Walls, their Foundations, and associated Coupling Beams
   e. Shearwalls and their Foundations
   f. Floor and Roof Diaphragms
2. The followings elements are part of the Main Wind-Force-Resisting （MWFR） System and require additional Special Inspections for Wind Resistance:
   a. Moment Frames and their Foundations
   b. Floor and Roof Diaphragms, including Collectors, Drag Struts, and Boundary Elements
   c. Roof Cladding and Fastening Connections
3. The following tables contain material, components and work that require special inspection or testing:
   a. Inspection Frequency, C - Continuous special inspection. Special inspection by the special inspector who is present when and where the work to be inspected is being performed.
   b. Inspection Frequency, P - Periodic special inspection. Special inspection by the special inspector who is intermittently presen where the work to be inspected has been or is being performed. For structural steel observe the items on a random basis.
   c. See Steel section for additional information for inspection tasks.

SOILS	Inspection Frequency		Remarks
1. Verify materials below shallow foundations are adequate to achieve to design bearing capacity.	-	P	-
2. Verify excavations are extended to proper depth and have reached proper material.	-	P	Inspection is required after excavation is complete and prior to placement of structural fills.
3. Perform classification and testing of controlled fill materials.	-	P	Perform laboratory tests of field samples provided by contractor for verification of in place densities.
4. Verify use of proper materials, densities, and lift thickness during placement and compaction of controlled fill. a. As a minimum, perform one test per lift for every 2500 square feet of fill placed.	C	-	Refer to specification for lift thicknesses and compaction.
5. Prior to placement of controlled fill, observe subgrade and verify that the site has been prepared properly （e.g. proofrolling, etc.） .	-	P	-

AGGREGATE PIER SOIL REINFORCEMENT	Inspection Frequency		Remarks
1. Observe the installation of all aggregate piers maintaining complete and accurate records of each pier.	C	-	Record unusual conditions encountered during installation.
2. Verify placement location and plumbness, confirm pier lengths and drilled diameters.	C	-	-
3. Verify compliance of approved equipment, method, and materials to be used in installing the aggregate piers.	-	P	-
4. Verify performance of modulus test （s） .	-	P	-

CONCRETE CONSTRUCTION	Inspection Frequency		Remarks
1. Inspection of reinforcing steel placement and installation. Grade, size, quantity, quality, location, spacing, clearances.	-	P	ACI 318: 3.5, 7.1 - 7.7 / IBC 1910.4
2. Inspection of reinforcing steel welding: a. Verify weldability of reinforcing steel other than ASTM A 706 b. Reinforcing steel resisting flexural and axial forces in intermediate and special moment frames, and boundary elements of special structural walls of concrete and shear reinforcement. c. Shear reinforcement. d. Other reinforcement.	- C C -	P - - P	ACI 318: 3.5.2 / AWS D1.4 / IBC Table 1705.2.2
3. Inspection of anchors cast in concrete. Verify compliance of the following: diameter, grade, type, length, number, placement, and embedment depth.	C	-	ACI 318: 1.3.2, 8.1.3, 21.1.8 / IBC 1908.5, 1909.1, AISC 360-10 N5.7
4. Inspection of post-installed mechanical anchors installed in hardened concrete members: verify anchor type, anchor dimensions, hole diameter and cleaning procedures, anchor spacing, edge distances, concrete minimum thickness, anchor embedment and tightening torque.	C	-	ACI 318: 3.8.6, 8.1.3, 21.1.8 / IBC 1909.1 Use of post installed anchors must be approved by Structural Engineer
5. Inspection of post-installed adhesive anchors and reinforcing steel installed in hardened concrete members: Verify adhesive type, anchor rod dimensions, hole diameter and cleaning procedures, anchor spacing, edge distances, concrete minimum thickness, anchor embedment and tightening toque.	C	-	ACI App. D9.2.4
6. Verify use of required design mix.	-	P	ACI 318: Ch. 4, 5.2 - 5.4, IBC 1904.2, 1910.2, 1910.3
7. Sampling fresh concrete from concrete discharge. Mold one set of specimens for compressive strength testing for each 150 cubic yards or each 5,000 square feet of slab or wall surface area for each mix design placed in any one day. No fewer than five tests for a given class of concrete for the entire project. a. Mold （5） 4x8-inch compressive strength cylinders, break and report （1） at 7-days, （3） at 28-days, or mold （4） 6x12-inch compressive strength cylinders, break and report （1） at 7-days, （2） at 28-days. b. Remaining specimen （s） shall be broken as directed by the Structural Engineer if compressive strengths do not appear adequate. c. For each set molded, record: i. Slump ii. Air Content iii. Unit Weight iv. Temperature, ambient and concrete v. Batch and discharge times vi. Location and placement vii. Any pertinent information, such as addition of water, addition of admixtures, etc. d. Verify compliance with construction documents	C	-	ACI 318: 5.6, 5.8 ACI （5.a, 5b.i, ii, iii, iv, v, vi） , SDG （5b.vii, 5.c, 5.d) ASTM C 172, ASTM C 31 ACI 318: 5.6.1 Report in writing on the same day as tests are performed. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing agency, concrete design compressive strength, location of concrete placement in structure, concrete mix proportions and materials, compressive breaking strength and type of break.
8. Inspection of concrete conveying and placement for proper application techniques.	C	-	ACI 318: 5.9, 5.10
9. Inspection for maintenance of specified curing temperature and techniques.	-	P	ACI 318: 5.11 - 5.13
10. Erection of Precast concrete members.	-	P	ACI 318: Ch. 16
11. Inspection of formwork for shape, location, and dimensions of the concrete member being formed.	-	P	ACI 318: 6.1.1
12. Perform testing of floor Flatness and Levelness of concrete slab placements in accordance with ASTM E1155. See specification	-	P	ACI 117-10

NON-SHRINK GROUTING	Inspection Frequency		Remarks
1. Compressive strength tests per ASTM C1107. a. Number of Tests: One test for each ten bags of grout used or minimum of one test for each day of grouting. b. Cube Size: 2-inch x 2-inch c. Test Schedule: （1） cube at 3-days, （2） cubes at 7-days, （3） cubes at 28-days.	C	-	
2. Perform one performance evaluation test prior placing grout under base plates. Test shall be performed as outlined in ACI 351.1R-99	-	P	One test shall be performed at the beginning job prior to placement of grout under base plates.

CONCRETE MASONRY	Inspection Frequency		Remarks
1. Verification of f 'm in accordance with Specification TMS 602 Article 1.4 B prior to construction AND for every 5,000 sf during construction	-	-	TMS 602 - Article 1.5
2. Verification of proportions of materials in premixed or preblended mortar and grout other than self-consolidating grout, as delivered to the project site	-	-	
3. Verification of Slump flow and Visual Stability Index （VSI） as delivered to the project site for self-consolidating grout	-	-	TMS 602 - Article 1.5 B.1.b.3
4. Verify compliance with the following approved submittals	-	-	TMS 602 - Article 1.5
a. Mortar mix designs indicating type and proportions of ingredients in compliance with the proportion specification of ASTM C270	-	P	TMS 602 - Article 2.1 and 2.6 A
b. Mortar mix designs and mortar tests performed in accordance with the property specification of ASTM C270.	-	P	TMS 602 - Article 2.1 and 2.6 A
c. Grout mix designs indicating type and proportions of the ingredients according to the proportion requirements of ASTM C476	-	P	TMS 602 - Article 2.2
d. Grout mix designs and grout strength test performed in accordance with ASTM C476	-	P	TMS 602 - Article 2.2
e. Grout compressive strength tests performed in accordance with ASTM C1019, and slump flow and Visual Stability Index （VSI） as determined by ASTM C1611/C1611M.	-	P	TMS 602 - Article 2.2
f. Construction procedures cold weather （temperature below 40°F） or hot weather （temperature above 90°F）	-	P	TMS 602 - Article 1.8 C and 1.8 D
5. Verify that the following are in compliance;	-	-	
a. Proportions of site-mixed mortar and grout	-	P	TMS 602 - Article 2.1, 2.6 A and 2.6 B
b. Grade, type, and size of reinforcement and anchor bolts	-	P	TMS 402 - Sec 1.16 TMS 602 - Article 2.4 and 3.4
c. Placement of masonry units and construction of mortar joints	-	P	TMS 602 - Article 3.3 B
d. Placement of reinforcement and connectors	C	-	TMS 402 - Sec 1.16 TMS 602 - Article 2.4 and 3.4
e. Grout space prior to grouting	C	-	TMS 602 - Article 3.2 D and 3.2 F
f. Placement of grout	C	-	TMS 602 - Article 3.5
g. Size and location of structural elements	-	P	TMS 602 - Article 3.3 F
h. Type, size, and location of anchors including other details of anchorage of masonry to structural members, frames, or other	C	-	TMS 402 - Sec 1.16.4.3 and 1.17.1
i. Preparation, construction, and protection of masonry during cold weather （temperature below 40°F） or hot weather （temperature above 90°F）	-	P	TMS 602 - Article 1.8 C and 1.8 D
6. Observe preparation of grout specimens, mortar specimens, and/or prisms	C	-	TMS 602 - Article 1.4 B.2.b.3, 1.4 B.3, 1.4 B.4

STRUCTURAL STEEL	Inspection Frequency		Remarks AWS D1.1/D1.1M References
Where the following tasks have been be performed by the fabricator's or erector's quality control program in accordance to Chapter N of AISC 360-10 it is permitted that these tasks be coordinated with the Special Inspector so that the inspection functions are performed by only one party. The Special Inspector shall review records of tasked performed by the erector's and fabricator's quality control program to verify completeness.	Obs. - Observe these items on a random basis. Operations need not be delayed pending these inspections. Perf. - Perform these tasks for each welded joint of member.		
1. Inspection of steel framing to verify compliance with details shown on the approved construction documents including member locations, bracing, stiffening application of joint details at each connection, proper fasteners, etc.	-	Obs.	AISC 360-10 N5.7
2. Review the material test reports and certifications as listed below for compliance with the construction documents. a. Main structural steel material test reports b. Anchor rods and threaded rods test reports c. Headed stud anchors - manufacturer's certifications	Perf.	-	AISC 360-10 N5.2 & N3.2
3. Visual Inspection Tasks Prior to Welding	-	-	AISC 360-10 Table N5.4-1
a. Welding procedure specifications （WPSs） available	Perf.	-	AWS D1.1/D1.1M 6.3
b. Manufacturer certifications for welding consumables available.	Perf.	-	
c. Material identification （type/grade）	-	Obs.	AWS D1.1/D1.1M 6.2
d. Welder identification system. The fabricator or erector, as applicable, shall maintain a system by which a welder who has welded a joint or member can be identified. Stamps, if used, shall be the low-stress type.	-	Obs.	AWS D1.1/D1.1M 6.4 （welder qualification) (identification system not required by AWS D1.1/D1.1M)
e. Fit-up of groove welds （including joint geometry) i. Joint preparation ii. Dimensions （alignment, root opening, root face, bevel) iii. Cleanliness （condition of steel surfaces) iv. Tacking （tack weld quality and location) f. Backing type and fit （if applicable)	-	Obs.	AWS D1.1/D1.1M 6.5.2 AWS D1.1/D1.1M 5.22 AWS D1.1/D1.1M 5.15 AWS D1.1/D1.1M 5.18 AWS D1.1/D1.1M 5.10, 5.22.1.1
g. Configuration and finish of access holes	-	Obs.	AWS D1.1/D1.1M 6.5.2, 5.17
h. Fit-up of fillet welds i. Dimensions （alignment, gaps at root) ii. Cleanliness （condition of steel surfaces) iii. Tacking （tack weld quality and location)	-	Obs.	AWS D1.1/D1.1M 5.22.1 AWS D1.1/D1.1M 5.15 AWS D1.1/D1.1M 5.18
i. Check welding equipment		Obs.	Only Required for shop Fabrication.
4. Visual Inspection Tasks During Welding	-	-	AISC 360-10 Table N5.4-2
a. Use of qualified welders	-	Obs.	AWS D1.1/D1.1M 6.4
b. Control and handling of welding consumables i. Packaging ii. Exposure control	-	Obs.	AWS D1.1/D1.1M 6.2 AWS D1.1/D1.1M 5.3.1 AWS D1.1/D1.1M 5.3.2 （for SMAW) , AWS D1.1/D1.1M 5.3.3 （for SAW)
c. No welding over cracked tack welds	-	Obs.	AWS D1.1/D1.1M 5.18
d. Environmental conditions i. Wind speed within limits ii. Precipitation and temperature	-	Obs.	AWS D1.1/D1.1M 5.12.1 AWS D1.1/D1.1M 5.12.2
e. WPS followed I. Settings on welding equipment ii. Travel speed iii. Selected welding materials iv. Shielding gas type/flow rate v. Preheat applied vi. Interpass temperature maintained （min./max.) vii. Proper position （F, V, H, OH) viii. Intermix of filler metals avoided unless approved	-	Obs.	AWS D1.1/D1.1M 6.3.3, 6.5.2, 5.5, 5.21 AWS D1.1/D1.1M 5.6, 5.7
f. Welding techniques i. Interpass and final cleaning ii. Each pass within profile limitations iii. Each pass meets quality requirements	-	Obs.	AWS D1.1/D1.1M 6.5.2, 6.5.3, 5.24 AWS D1.1/D1.1M 5.30.1

STRUCTURAL STEEL	Inspection Frequency		Remarks AWS D1.1/D1.1M References
5. Visual Inspection Tasks After Welding	-	-	AISC 360-10 Table N5.4-3
a. Welds cleaned	-	Obs.	AWS D1.1/D1.1M 5.30.1
b. Size, length and location of welds	Perf.	-	AWS D1.1/D1.1M 6.5.1
c. Welds meet visual acceptance criteria i. Crack prohibition ii. Weld/base-metal fusion iii. Crater cross section iv. Weld profiles v. Weld size vi. Undercut vii. Porosity	Perf.	-	AWS D1.1/D1.1M 6.5.3 AWS D1.1/D1.1M Table 6.1 (1) AWS D1.1/D1.1M Table 6.1 (2) AWS D1.1/D1.1M Table 6.1 (3) AWS D1.1/D1.1M Table 6.1 (4) , 5.24 AWS D1.1/D1.1M Table 6.1 (6) AWS D1.1/D1.1M Table 6.1 (7) AWS D1.1/D1.1M Table 6.1 (8)
d. Arc strikes	Perf.	-	AWS D1.1/D1.1M 5.29
e. k-area. When welding of doubler plates, continuity plates or stiffeners has been performed in the k-area, visually inspect the web k-area for cracks within 3 in. （75mm） of the weld.	Perf.		Not addressed in AWS but see AISC （1997b) . See Commentary Section A3.1c and Section J10.8.
f. Backing removed and weld tabs removed and finished, and fillet welds added （if required)	Perf.	-	AWS D1.1/D1.1M 5.10, 5.31
g. Repair activities	Perf.	-	AWS D1.1/D1.1M 6.5.3, 5.26
h. Document acceptance or rejection of welded joint or member	Perf.	-	AWS D1.1/D1.1M 6.5.4, 6.5.5
6. Nondestructive Testing （NDT） of Welded Joints	Ultrasonic testing （UT) , magnetic particle testing （MT) , penetrant testing （PT） and radiographic testing （RT) , where required, shall be performed by Special Inspector in accordance with AWS D1.1/D1.1M. . NDT of welds completed in a fabricator's shop may be performed by that fabricator when fabricator is AISC Certified or approved by the Building Official where applicable. When the fabricator performs the NDT, the Special inspection agency shall review the fabricator's NDT reports. All NDT of welds completed in the field shall be performed by the Special Inspector. Acceptance criteria shall be in accordance with AWS D1.1/D1.1M for*statically loaded* structures, unless otherwise designated in the*design drawings* or project *specifications*.		
a. UT all complete penetration grove welds subject to transversely applied tension loading in a butt, T- and corner joints in material 5/16" thick or greater.	Perf.	-	AISC 360-10 N5.5b & AISC 341-10 J6.2b
b. Thermally cut surfaces of access holes when material thickness is greater than 2" shall be tested by MT or PT. Any crack shall be deemed unacceptable.	Perf.	-	AISC 360-10 N5.5c
c. Document all NDT performed, identifying tested weld by location in the structure, piece mark and location. Concurrent to submitting NDT reports to EOR or owner submit to contractor.	Perf.	-	AISC 360-10 N5.5g
d. Review NDT test reports performed by fabricator			AISC 360-10 N7
7. Inspection Tasks Prior to Bolting		-	Perform for 10% of all Snug tight joints if task is applicable and all pretension and slip critical joints. AISC 360-10 Table N5.6-1
a. Manufacturer's certifications available for fastener materials	Perf.	-	RCSC 2.1 & 9.1
b. Fasteners marked in accordance with ASTM requirements	Perf.	-	RCSC Figure C-2.1 & 9.1 （Also See ASTM Standards)
c. Proper fasteners selected for the joint detail （grade, type, bolt length if threads are to be excluded from shear plane)	-	Obs.	RCSC 2.3.2, 2.7.2 & 9.1
d. Proper bolting procedure selected for joint detail	-	Obs.	RCSC 4, & 8
e. Connecting elements, Including the appropriate faying surface condition and hole preparation, If specified, meet applicable requirements	-	Obs.	RCSC 3, 9.4 & 9.3
f. Pre-installation verification testing by installation personnel observed and documented for fastener assemblies and methods used, not required for Snug tight bolts	-	Obs.	RCSC 7 & 9.2
g. Proper storage provided for bolts, nuts, washers and other fastener components	-	Obs.	RCSC 2.2.8 & 9.1
8. Inspection Tasks During Bolting		-	Perform for 10% of all Snug tight joints if task is applicable and all pretension and slip critical joints. Special Inspector need not be present during bolt pretensioning procedures. AISC 360-10 Table N5.6-2
a. Fastener assemblies, of suitable condition, placed in all holes and washers （if required） are positioned as required	-	Obs.	RCSC 8.1 & 9.1
b. Joint brought to the snug-tight condition prior to the pretensioning operation	-	Obs.	RCSC 8.1 & 9.1
c. Fastener component not turned by the wrench prevented from rotating	-	Obs.	RCSC 8.2 & 9.2
d. Fasteners are pretensioned in accordance with the RCSC Specification, progressing systematically from the most rigid point toward the free edges	-	Obs.	RCSC 8.2 & 9.2
9. Inspection Tasks After Bolting	-	-	AISC 360-10 Table N5.6-3
a. Document acceptance or rejection of bolted connections	Perf.		
10. Inspection of Steel Elements of Composite Construction Prior to Concrete Placement	-	-	AISC 360-10 Table N6-1
a. Placement and installation of steel headed stud anchors	-	Obs.	Visually inspect and Hammer bend test （1 per 500） .
b. Document acceptance or rejection of steel elements	-	Obs.	
c. Contour and Finish	Perf.	-	
d. Dimensional Tolerances	Perf.	-	

STEEL JOISTS	Inspection Frequency		Remarks
1. Visual inspection of bolted and welded connections.	-	P	-
2. Verify installation of bridging or braces.	-	P	-
3. Verify connections for top and bottom chords.	-	P	-
4. Verify reinforcement of members for concentrated loads.	-	P	-
5. Verify proper bearing.	-	P	-

STEEL DECK	Inspection Frequency		Remarks
1. Material verification of steel deck. a. Identification markings to conform to ASTM standards specified in the approved construction documents b. Manufacturer's certified test reports.	-	P	-
2. Verify general alignment and deck lap.	-	P	-
3. Verify welds for size and pattern.	-	P	
4. Inspection of welding at floor and roof deck	-	P	in accordance with AWS D1.3
5. Verify spacing and type of sidelap attachments.	-	P	-
6. Verify installation of deck closures.	-	P	-
7. Inspect welding operations, screw attachment, bolting, anchoring, and other fastening of components within the lateral force resisting system including shear walls, braces, diaphragms, collectors （drag struts） and hold downs.	-	P	

COLD-FORMED EXTERIOR STEEL STUDS	Inspection Frequency		Remarks
1. Verify that installation of cold-formed members complies with the Construction Documents and the approved shop drawings.	-	P	-

CONTRACTOR RESPONSIBILITIES

1. Contractor shall submit to the Building Official, Owner, and the Architect a written statement of responsibility that contains te following:
   a. Acknowledgment of awareness of the special requirements contained in the Statement of Special Inspections for the main wind- or seismic force-resisting system or a wind- or seismic-resisting component listed in the statement of special inspections.
2. Contractor shall pay for any additional structural testing/inspection required for work or materials not complying with the Consruction Documents due to negligence or nonconformance and shall pay for any additional structural testing/inspection required for his convenience.
3. Contractor is responsible to ensure that the Special Inspector is on site as required to perform all tasks required by Statementof Special Inspection. Any work that requires special inspection and is performed without the Special Inspector being present is suject to being demolished and reconstructed.
4. Contractor has the following responsibilities to the Special Inspector:
   a. Provide copy of Construction Documents to Special Inspector and latest addenda （include change orders and field orders prior to inspection of work contained therein) .
   b. Notify Special Inspector sufficiently in advance of operations to allow assignment of personnel and scheduling of tests.
   c. Cooperate with Special Inspector and provide access to work.
   d. Provide samples of materials to be tested in required quantities.
   e. Provide storage space for Special Inspector's exclusive use, such as for storing and curing concrete testing samples.
   f. Provide labor to assist Special Inspector in performing tests/inspections.
5. Contractor shall perform the following:
   a. SOILS
      i. Identify soils to be used as structural fill.
   b. DRILLED PIERS
      i. Submit reinforcing and concrete material verifications in accordance with Cast-in-Place Concrete requirements below.
   c. CAST-IN-PLACE CONCRETE
      i. Submit manufacturer's certification that reinforcing materials comply with Construction Documents.
         1. For SFR Systems, submit mill test reports for each shipment of reinforcement.
      ii. Establish concrete mix design proportions in accordance with the specifications and ACI 318, Chapter 5.
      iii. Submit manufacturer's certification that concrete materials meet the requirements of the Construction Documents.
      iv. Submit manufacturer's data for tension and compression splicers.
   d. NON-SHRINK GROUTING
      i. Submit product data sheets for non-shrink grout that shows compliance with the Construction Documents and with ASTM C1107 for fluid or flowable grouts, prior to placement of grout.
   e. CONCRETE MASONRY
      i. Submit a certification from each manufacturer or supplier stating that the following materials comply with the Construction Documents:
         1. Concrete masonry units.
         2. Mortar materials: Portland cement, hydrated lime, and aggregates.
         3. Grout materials: Portland cement and aggregates.
         4. Joint reinforcement steel.
         5. Reinforcing steel.
   f. STRUCTURAL STEEL
      i. If steel fabricator and erector are certified by the American Institute of Steel Construction （AISC） Quality Certification Program for Structural Steel Buildings submit certification.
         1. At completion of fabrication, the approved fabricator shall submit a certificate of compliance to the Building Official stating that the materials supplied and work performed by the fabricator are in accordance with the *construction documents*
         2. At completion of erection, the approved erector shall submit a certificate of compliance to the Building Official stating that the materials supplied and work performed by the erector are in accordance with the construction documents.
      ii. If fabricator or erector is not AISC certified, the fabricator and/or erector shall establish and maintain*quality control* procedures and perform inspections to ensure that their work is performed in accordance with the Section N of the Specification for Structural Steel Building, AISC 360-10 and the*construction documents.* Payment of these Quality control tests and inspections shall be by the fabricator and Erector.
         1. Make available the documents listed in AISC 360-10 N3.2 in electronic or printed form for review by the EOR of the EOR's Designee prior to fabrication or erection unless otherwise required by the contract documents to be submitted:
      iii. Provide non-destructive test （NDT） reports performed in shop by fabricator. Fabricator is responsible for cost of NDT performed in shop. Reports shall identify the tested weld by piece mark and location in the piece.
   g. POST-INSTALLED ANCHORS
      i. Contractor shall contact manufacturer's representative for product installation training. Submit a letter indicating that training has taken place.
   h. STEEL JOISTS
      i. Submit manufacturer's certificate of compliance that the steel joists comply with the Construction Documents.
   i. STEEL DECK
      i. Submit manufacturer's certificate of compliance that the supplied steel deck complies with the Construction Documents.
   j. COLD-FORMED EXTERIOR STEEL STUDS
      i. Submit manufacturer's certification that the supplied cold-formed members comply with the Construction Documents.

CITY OF HATTIESBURG MISSISSIPPI

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HATTIESBURG PUBLIC SAFETY COMPLEX

HPSC Police and Court Building

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FOUNDATION PLAN – PART "A"

SCALE : ¼"= 1'-0"

3" CONC. SLAB @ EXT. CORRIDOR w/ WWR 6x6-W1.4xW1.4 & 6" CONC. RIBS SPACED @ 5'-0" MAX. ON POLYSTYRENE BOARD FILLER

3" CONC. RAMP SLAB WITH WWR 6x6-W1.4xW1.4 & 6" CONC. RIBS SPACED @ 5'-0" MAX. ON POLYSTYRENE BOARD FILLER

3" CONC. SLAB @ LANDING, RAMP AND STAIRS WITH WWR 6x6-W1.4xW1.4 AND 6" CONC. RIBS SPACED @ 5'-0" MAX. ON POLYSTYRENE BOARD FILLER

STAIR STRINGERS HSS12x6x¼

4" CONCRETE SLAB WITH WWR 6x6-W1.4xW1.4 TIED TO #4 @ 48" E.W. ON VAPOR BARRIER AND 4" (MIN.) GRANULAR SUB-BASE (TYP.-UNO).

SEE 7/S2.0 FOR TYPICAL SLAB-ON-GRADE DETAILS

T/SLAB EL.= 156.25'

CONTRACTION OR CONSTRUCTION JOINTS - SEE 7/S2.0

SLAB REINF. @ RE-ENTRANT CORNERS SEE DET. 14/S2.6

Guide Rail Support Columns See 7/S2.7

Sump Pit

MOMENT FRAME #1 · #2 · #3 · #4 · #5 · #6 · #7 · #8 · #9 · #10 · #11 · #12 · #13 · #14 · #15 · #16 · #20

BRACED FRAME #1

MATCH LINE

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514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com

Albert & McCleskey Associates Architects

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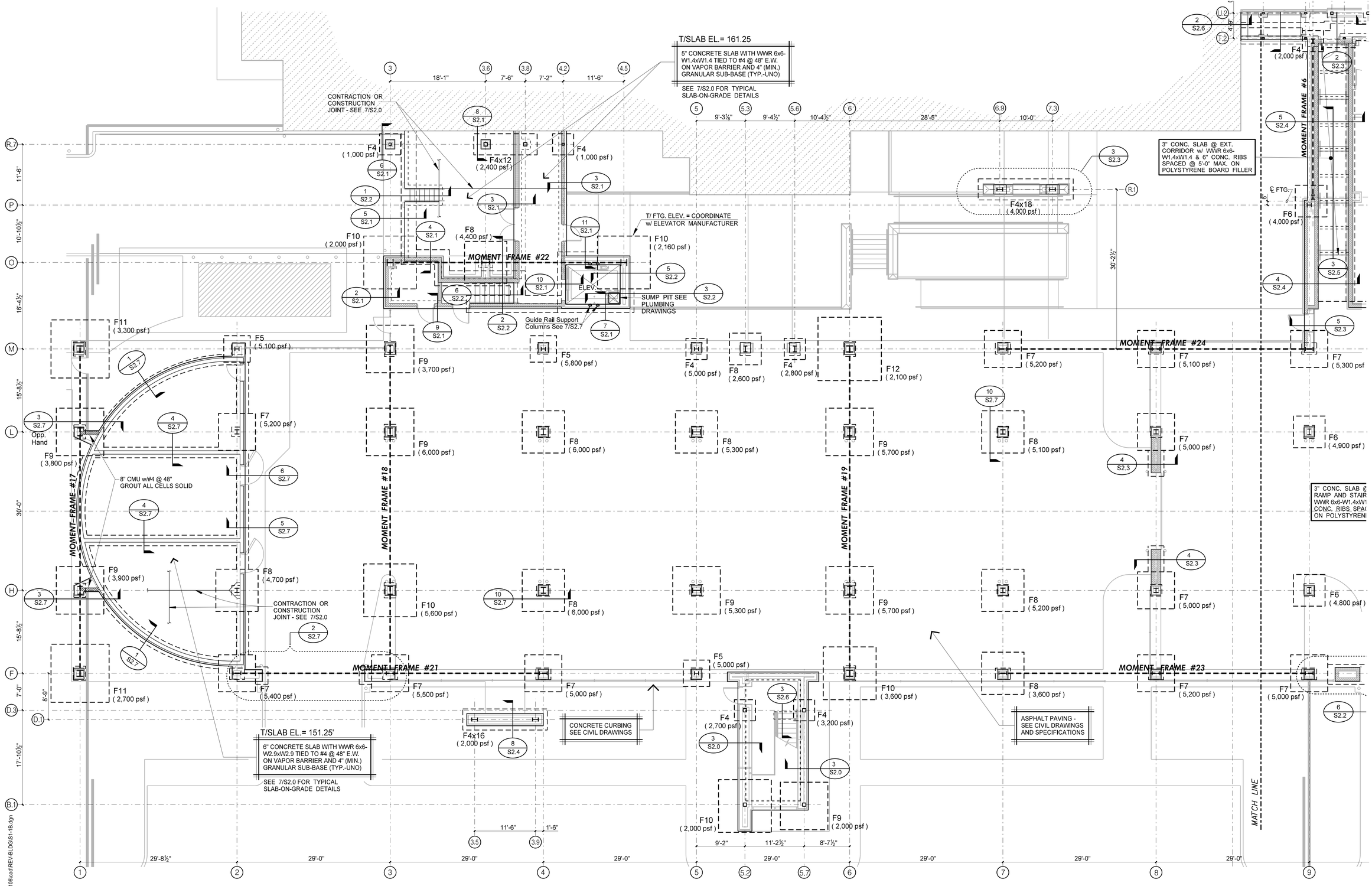
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B A

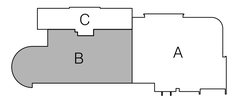
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S1.1A



FOUNDATION PLAN – PART "B"

SCALE : ⅛"= 1'-0"



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COMPOSITE BEAM LEGEND

BEAM SIZE — W24x55 (20) R=50k — BEAM (FACTORED) REACTION

STUD QUANTITY

1. STUDS TO BE UNIFORMLY SPACED ALONG BEAM.
2. FOR BEAMS SUPPORT COMPOSITE SLAB AND WITH NO STUDS INDICATED, PROVIDE STUDS AT 24" TYPICAL.

B1 = W10x12 (4) R=15k

T/STEEL ELEV. = +14'-6½"
TYPE "B" - 1½"x 20 gage STEEL ROOF DECK (GALVANIZED)
SEE 1/S3.0 FOR DECK ATTACHMENT

T/SLAB ELEV. = + 15'-0"
4½" NORMAL WT. STRUCTURAL CONCRETE SLAB w/ 6x6-W1.4xW1.4 WWR AND 2" COMPOSITE METAL DECK GALV. (4½" TOTAL THK.)
SEE 1/S3.1 FOR DECK ATTACHMENT

JOIST BRG. ELEV. = +13'-2"
TYPE "B" - 1½"x 20 gage STEEL ROOF DECK (GALVANIZED)
SEE 1/S3.0 FOR DECK ATTACHMENT

T/SLAB ELEV. = + 17'-0"
4½" NORMAL WT. STRUCTURAL CONCRETE SLAB w/ 6x6-W1.4xW1.4 WWR AND 2" COMPOSITE METAL DECK GALV. (4½" TOTAL THK.)

JOIST BRG. ELEV. = +23'-2"
TYPE "B" - 1½"x 20 gage STEEL ROOF DECK (GALVANIZED)
SEE 1/S3.0 FOR DECK ATTACHMENT

MOMENT FRAME #15 · MOMENT FRAME #14 · MOMENT FRAME #13 · MOMENT FRAME #16 · MOMENT FRAME #9 · MOMENT FRAME #12 · MOMENT FRAME #8 · MOMENT FRAME #11 · MOMENT FRAME #10 · MOMENT FRAME #7 · MOMENT FRAME #6 · MOMENT FRAME #5 · MOMENT FRAME #4 · MOMENT FRAME #20 · MOMENT FRAME #3 · MOMENT FRAME #2 · BRACED FRAME #1

SECOND FLOOR FRAMING PLAN – PART "A" SCALE : ⅛"= 1'-0"

MATCH LINE

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T/BRIDGE SLAB ELEV. = + 15'-0"
4½" NORMAL WT. STRUCTURAL CONCRETE SLAB w/ 6x6-W1.4xW1.4 WWR AND 2" COMPOSITE METAL DECK GALV. (4½" TOTAL THICK.)
SEE 1/S3.1 FOR DECK ATTACHMENT

T/STEEL EL.=+16'-10"
TYPE "B" - 1½"x 20 gage STEEL ROOF DECK (GALVANIZED)
SEE 1/S3.0 FOR DECK ATTACHMENT

T/STEEL ELEV. = +14'-6½"
TYPE "B" - 1½"x 20 gage STEEL ROOF DECK (GALVANIZED)
SEE 1/S3.0 FOR DECK ATTACHMENT

T/STEEL = MATCH EXISTING ELEVATION FIELD VERIFY BEFORE STEEL FABRICATION AND ERECTION

JOIST BRG. ELEV. = +13'-2"
TYPE "B" - 1½"x 20 gage STEEL ROOF DECK (GALVANIZED)
SEE 1/S3.0 FOR DECK ATTACHMENT

T/SLAB ELEV. = + 15'-0"
4½" NORMAL WT. STRUCTURAL CONCRETE SLAB w/ 6x6-W1.4xW1.4 WWR AND 2" COMPOSITE METAL DECK GALV. (4½" TOTAL THK.)
SEE 1/S3.1 FOR DECK ATTACHMENT

MOMENT FRAME #22
MOMENT FRAME #24
MOMENT FRAME #17
MOMENT FRAME #18
MOMENT FRAME #19
MOMENT FRAME #21
MOMENT FRAME #23
MOMENT FRAME #6

Guide Rail Support Cols. See 8/S2.7

HSS 6x6x5/16" OUTRIGGERS
8 - SPACES @ 3'-7½"
23 - SPACES @ 3'-7½"
HSS 6x6x5/16" OUTRIGGERS (SPACED AS SHOWN)

T/SLAB ELEV. = + 15'-0"
4½" NORMAL WT. STRUCTURAL CONCRETE SLAB w/ 6x6-W1.4xW1.4 WWR AND 2" COMPOSITE METAL DECK GALV. (4½" TOTAL THK.)
SEE 1/S3.1 FOR DECK ATTACHMENT

MATCH LINE

COMPOSITE BEAM LEGEND

BEAM SIZE — STUD QUANTITY — BEAM (FACTORED) REACTION
W24x55 (20) R=50k
B1 = W10x12 (4) R=15k

1. STUDS TO BE UNIFORMLY SPACED ALONG BEAM.
2. FOR BEAMS SUPPORT COMPOSITE SLAB AND WITH NO STUDS INDICATED, PROVIDE STUDS AT 24" TYPICAL.

SECOND FLOOR FRAMING PLAN – PART "B"

SCALE : ⅛"= 1'-0"

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HPSC Police and Court Building

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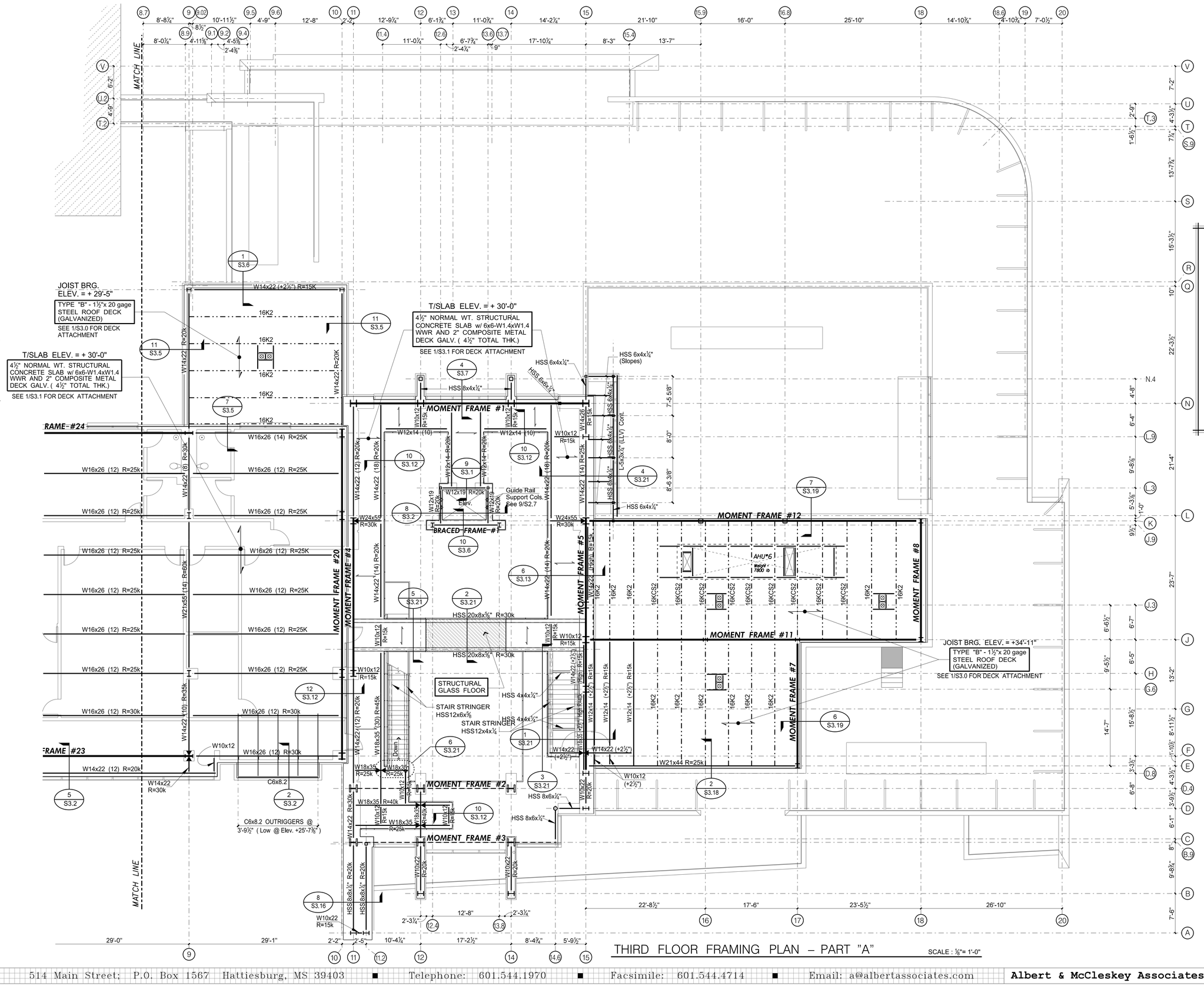
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MATCH LINE
JOIST BRG. ELEV. = + 29'-5"
TYPE "B" - 1½"x 20 gage STEEL ROOF DECK (GALVANIZED)
SEE 1/S3.0 FOR DECK ATTACHMENT
T/SLAB ELEV. = + 30'-0"
4½" NORMAL WT. STRUCTURAL CONCRETE SLAB w/ 6x6-W1.4xW1.4 WWR AND 2" COMPOSITE METAL DECK GALV. (4½" TOTAL THK.)
SEE 1/S3.1 FOR DECK ATTACHMENT
MOMENT FRAME #1
MOMENT FRAME #2
MOMENT FRAME #3
MOMENT FRAME #4
MOMENT FRAME #5
MOMENT FRAME #12
MOMENT FRAME #11
MOMENT FRAME #8
MOMENT FRAME #7
BRACED FRAME #1
RAME #24
RAME #23
HSS 6x4x¼" (Slopes)
HSS 6x4x¼"
HSS 8x4x¼"
HSS 6x6x¼"
L-5x3½x¼" (LLV) Cont.
Guide Rail Support Cols. See 9/S2.7
AHU*6
Weight = 7800 lb
STRUCTURAL GLASS FLOOR
STAIR STRINGER HSS12x6x⅝
STAIR STRINGER HSS12x4x¼
HSS 4x4x¼"
HSS 20x8x⅝" R=30k
HSS 8x6x½"
C6x8.2
C6x8.2 OUTRIGGERS @ 3'-9½" (Low @ Elev. +25'-7⅞")
W14x22 (+2½") R=15K
W14x22 (+2½") R=20K
W14x22 R=20K
W14x22 R=30K
W14x22 (12) R=20k
W14x22 (14) R=20k
W14x22 (18) R=20k
W14x22 (16) R=20k
W14x22 (14) R=25k
W14x26 R=15k
W14x22 (10) R=60k
W14x22 (8) R=30k
W14x22 (6) R=30k
W14x22 (10) R=35k
W14x22 (12) R=45k
W14x22 (+2½")
W12x14 (+2½") R=15k
W12x14 (10)
W12x14-R=20k
W12x19 R=20k
W12x19 R=25k
W10x12 R=15k
W10x12 (+2½")
W10x22 R=20k
W18x35 R=25k
W18x35 R=40k
W18x35 (30) R=45k
W21x44 R=25k
W21x55 (14) R=60k
W24x55 R=30k
W16x26 (14) R=25K
W16x26 (12) R=25k
W16x26 (12) R=30k
16K2
16KCS2
Down
Elev.
W10x12
W10x22
W12x14 (+2½") R=15k
W14x22 (+2½")
W14x22 (+2½") R=15k
W14x22 (+2½") R=20k
W14x22 (+2½") R=25k
W14x22 (+2½") R=30k
W14x22 (+2½") R=35k
W14x22 (+2½") R=45k
W14x22 (+2½") R=60k
W14x22 (+2½") R=15k
W14x22 (+2½") R=20k
W14x22 (+2½") R=25k
W14x22 (+2½") R=30k
W14x22 (+2½") R=35k
W14x22 (+2½") R=45k
W14x22 (+2½") R=60k
W14x22 (+2½")
W14x22 (+2½")
W14x22 (+2½")

T/BRIDGE SLAB ELEV. = VARIES
4½" NORMAL WT. STRUCTURAL CONCRETE SLAB w/ 6x6-W1.4xW1.4 WWR AND 2" COMPOSITE METAL DECK GALV. (4½" TOTAL THICK.)
SEE 1/S3.1 FOR DECK ATTACHMENT

T/SLAB ELEV. = + 27'-6"
4½" NORMAL WT. STRUCTURAL CONCRETE SLAB w/ 6x6-W1.4xW1.4 WWR AND 2" COMPOSITE METAL DECK GALV. (4½" TOTAL THK.)
SEE 1/S3.1 FOR DECK ATTACHMENT

T/SLAB ELEV. = + 30'-0"
4½" NORMAL WT. STRUCTURAL CONCRETE SLAB w/ 6x6-W1.4xW1.4 WWR AND 2" COMPOSITE METAL DECK GALV. (4½" TOTAL THK.)
SEE 1/S3.1 FOR DECK ATTACHMENT

T/BRIDGE SLAB ELEV. = + 26'-6"
4½" NORMAL WT. STRUCTURAL CONCRETE SLAB w/ 6x6-W1.4xW1.4 WWR AND 2" COMPOSITE METAL DECK GALV. (4½" TOTAL THICK.)
SEE 1/S3.1 FOR DECK ATTACHMENT

T/STL. = + 24'-9½"
TYPE "B" - 1½"x 20 gage STEEL ROOF DECK (GALVANIZED)
SEE 1/S3.0 FOR DECK ATTACHMENT

JOIST BRG. ELEV. = + 29'-5"
TYPE "B" - 1½"x 20 gage STEEL ROOF DECK (GALVANIZED)
SEE 1/S3.0 FOR DECK ATTACHMENT

T/SLAB ELEV. = + 30'-0"
4½" NORMAL WT. STRUCTURAL CONCRETE SLAB w/ 6x6-W1.4xW1.4 WWR AND 2" COMPOSITE METAL DECK GALV. (4½" TOTAL THK.)
SEE 1/S3.1 FOR DECK ATTACHMENT

T/ COMPOSITE SLAB ELEV. = + 29'-0"
RAISED FLOORING : 2½" LIGHTWEIGHT CONCRETE SLAB w/ 6x6-W1.4xW1.4 WWR IN SHEETS ON POLYSTYRENE BOARD FILLER & 6" CONCRETE RIBS @6'-0" MAX. E.W. ON 4½" NORMAL WT. STRUCTURAL CONCRETE SLAB w/ 6x6-W1.4xW1.4 WWR AND 2" COMPOSITE METAL DECK GALV. (4½" TOTAL THICKNESS)

T/SLAB ELEV. = + 30'-0"
4½" NORMAL WT. STRUCTURAL CONCRETE SLAB w/ 6x6-W1.4xW1.4 WWR AND 2" COMPOSITE METAL DECK GALV. (4½" TOTAL THK.)
SEE 1/S3.1 FOR DECK ATTACHMENT

MOMENT FRAME #17
MOMENT FRAME #18
MOMENT FRAME #19
MOMENT FRAME #21
MOMENT FRAME #22
MOMENT FRAME #23
MOMENT FRAME #24

Guide Rail Support Cols. See 8/S2.7

COMPUTER FLR. TOP/SLAB = -1'-0" BELOW FIN. FLR.

MATCH LINE

COMPOSITE BEAM LEGEND

BEAM SIZE — STUD QUANTITY — BEAM (FACTORED) REACTION
W24x55 (20) R=50k
B1 = W10x12 (4) R=15k

1. STUDS TO BE UNIFORMLY SPACED ALONG BEAM.
2. FOR BEAMS SUPPORT COMPOSITE SLAB AND WITH NO STUDS INDICATED, PROVIDE STUDS AT 24" TYPICAL.

THIRD FLOOR FRAMING PLAN – PART "B"

SCALE : ⅛"= 1'-0"

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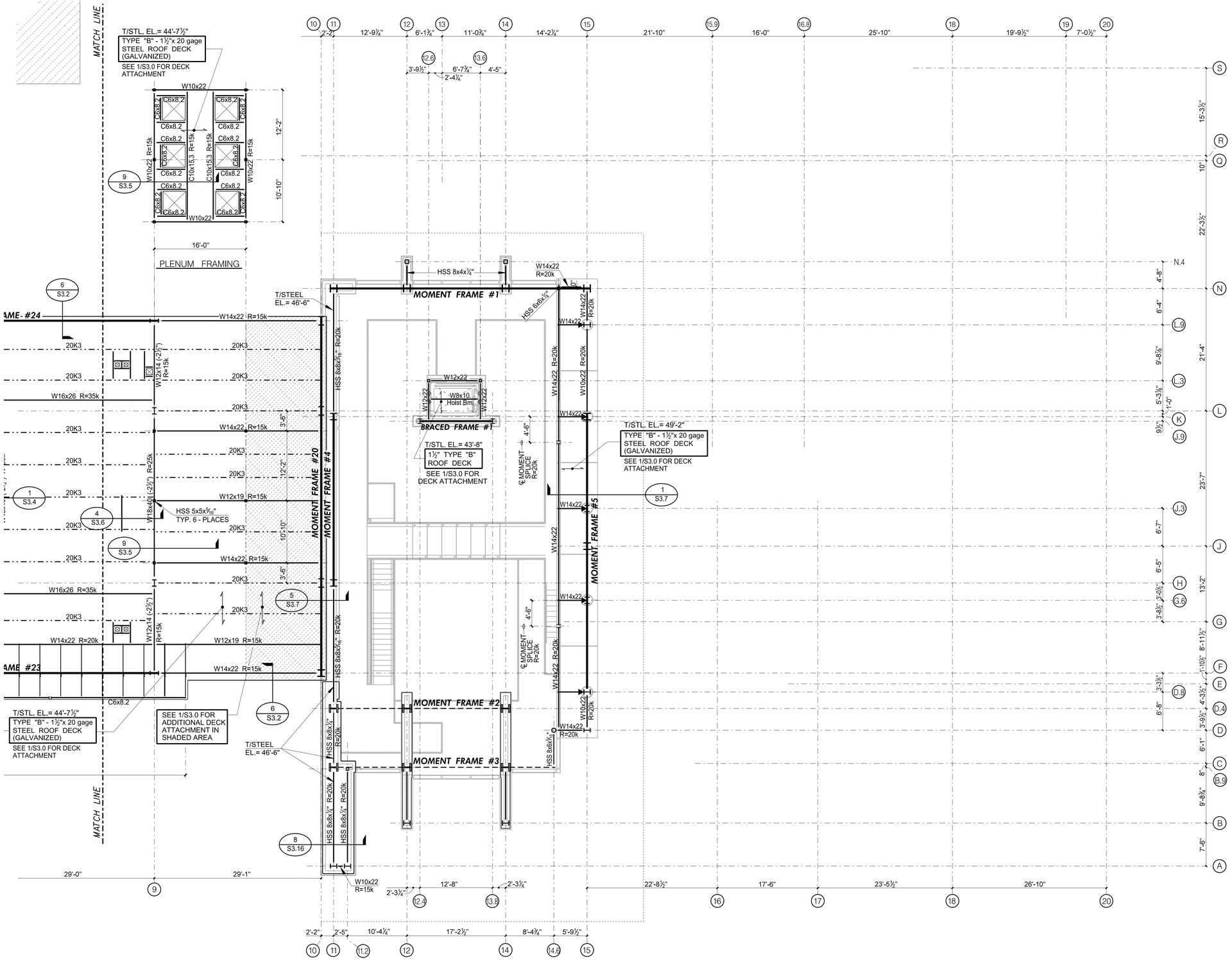
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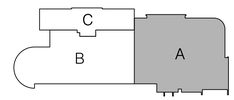
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ROOF FRAMING & POLICE LOBBY ATRIUM PLAN – PART "A" SCALE : ⅜"= 1'-0"



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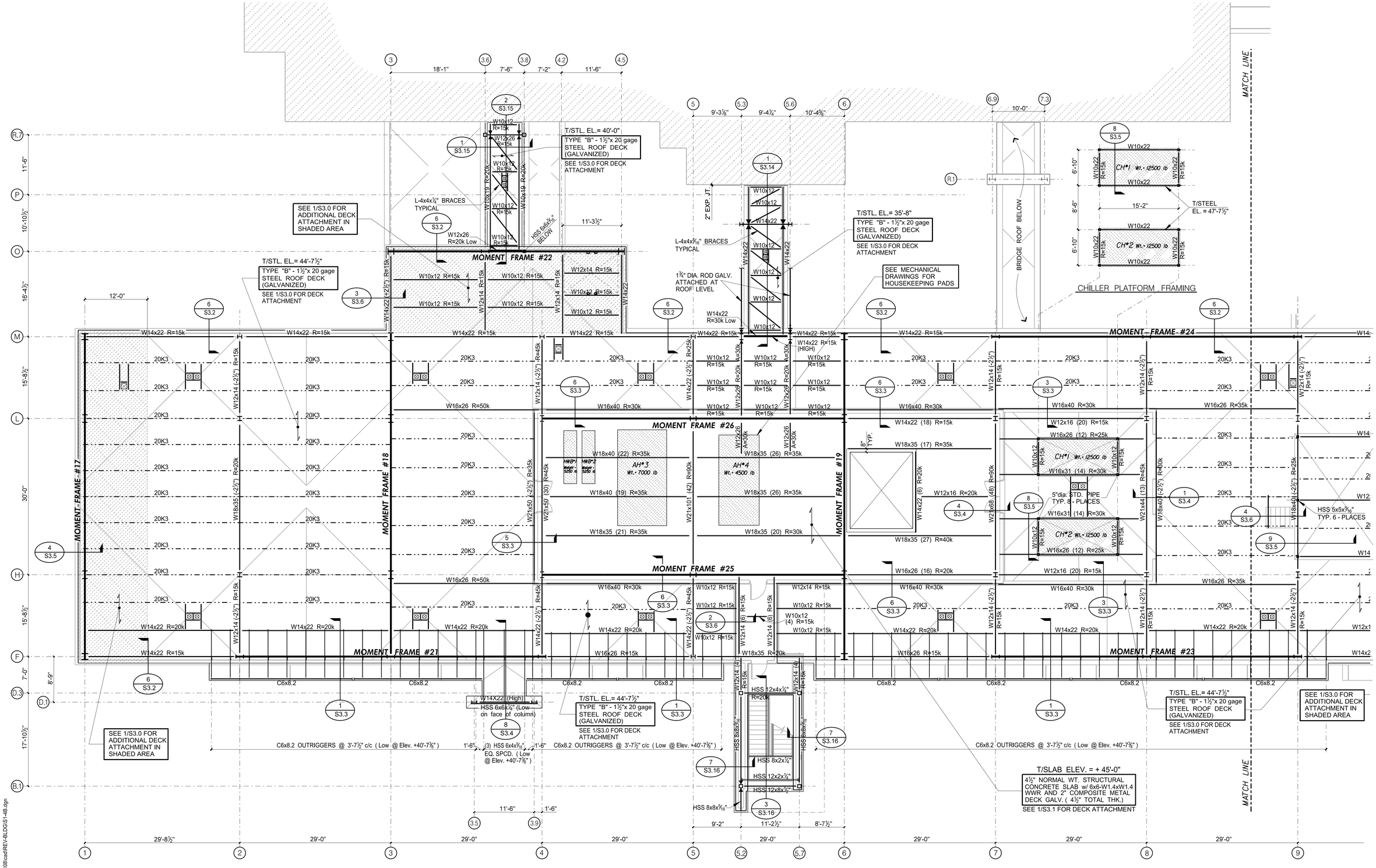
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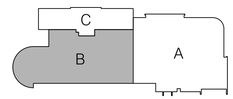
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ROOF FRAMING PLAN – PART "B" SCALE : ⅛"= 1'-0"



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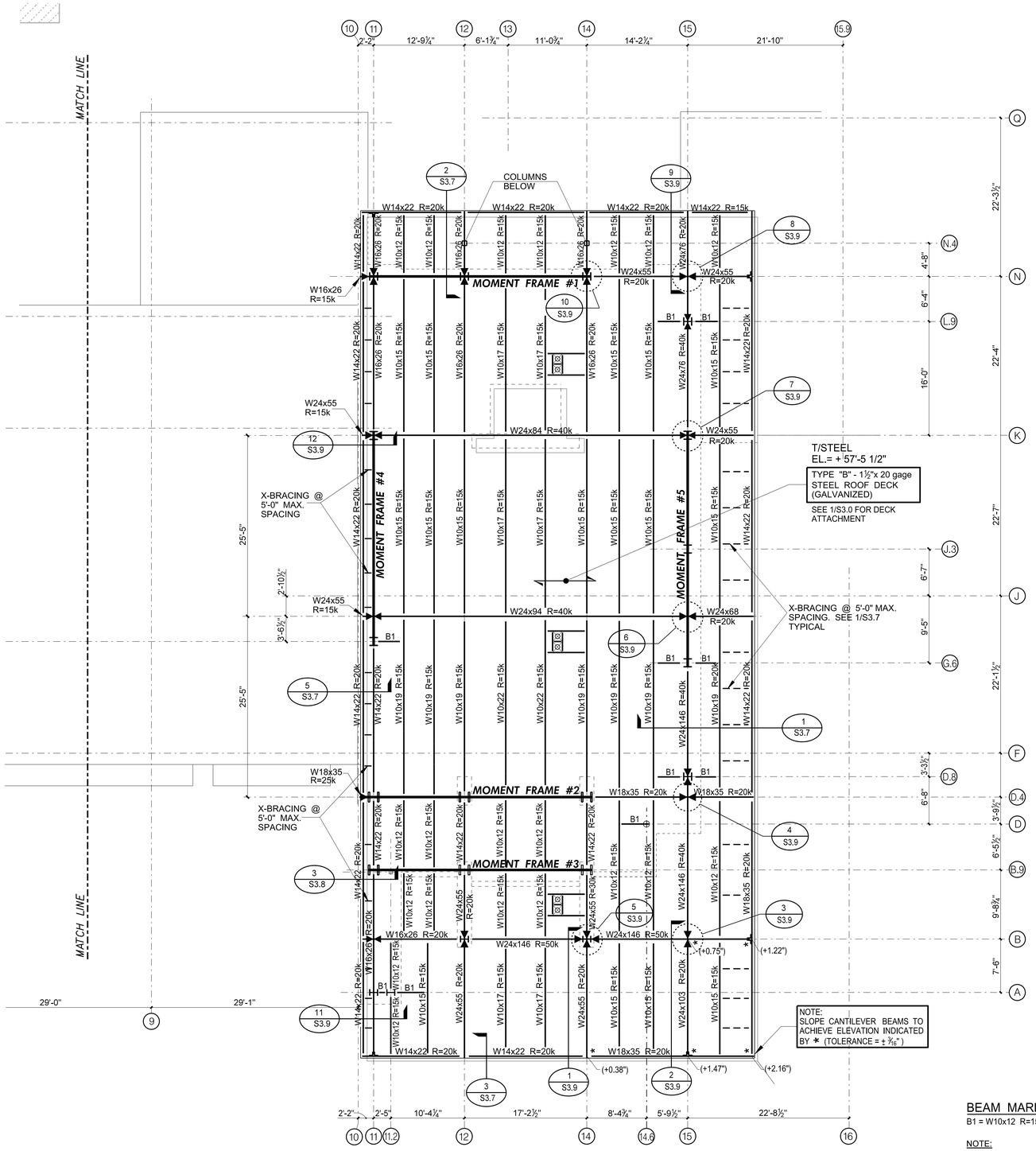
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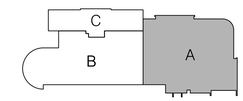
COURT BUILDING ATRIUM ROOF FRAMING PLAN – PART "A"

SCALE : 1/8"= 1'-0"

BEAM MARK LEGEND

B1 = W10x12 R=15k

NOTE:
FOR BEAMS SUPPORTING COMPOSITE SLAB AND w/NO STUDS INDICATED, PROVIDE STUDS @ 24" TYP.



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HATTIESBURG PUBLIC SAFETY COMPLEX

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HPSC Police and Court Building

Drawing Issued:

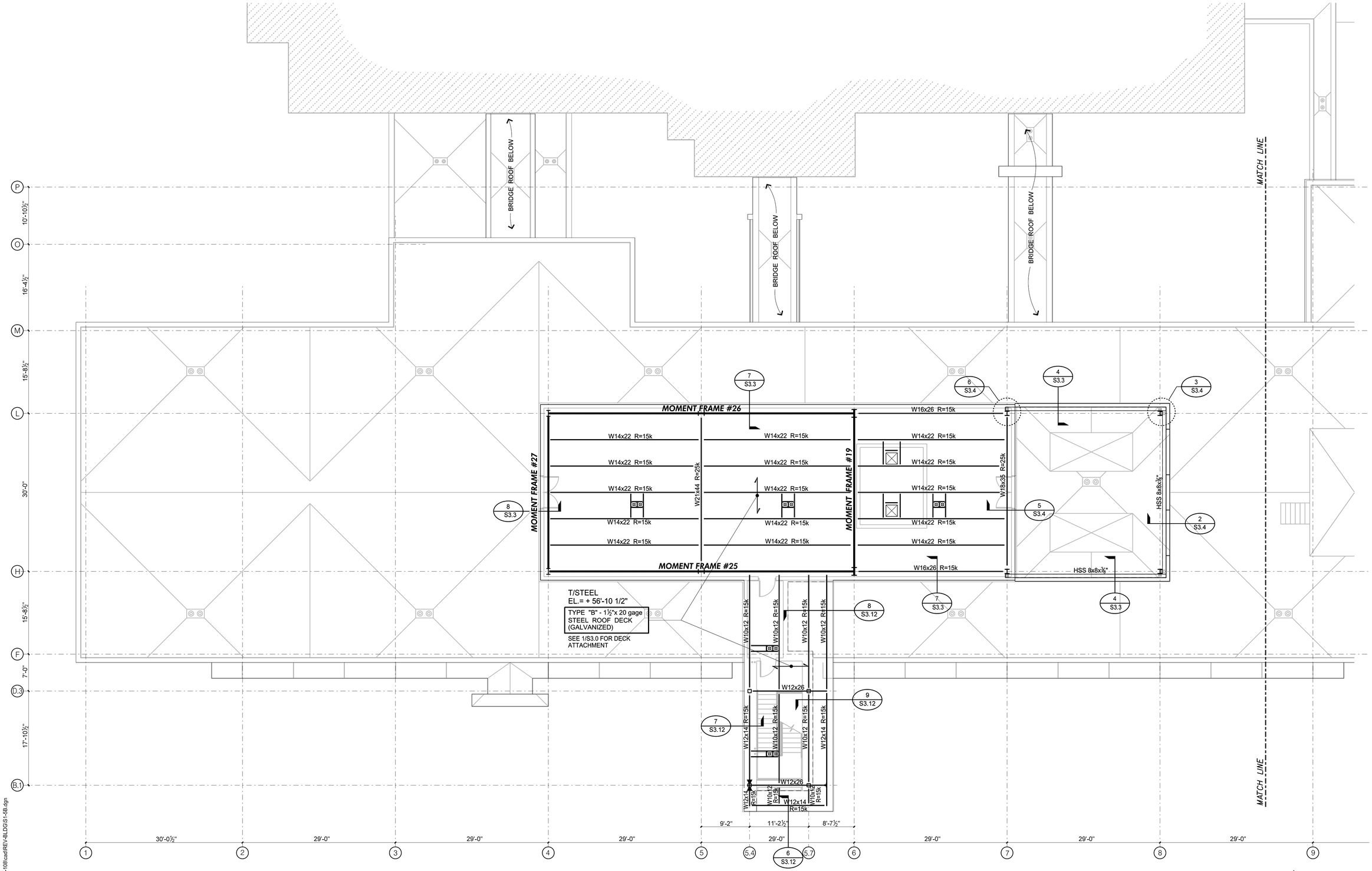
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Checked By: W.G.
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Albert & Associates: 12575

THOMAS C. SCHAEFER — REGISTERED PROFESSIONAL ENGINEER — 21331 — STATE OF MISSISSIPPI

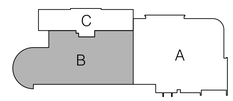
S1.5A

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Steve
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PENTHOUSE ROOF FRAMING PLAN – PART "B"

SCALE : 1/8"= 1'-0"



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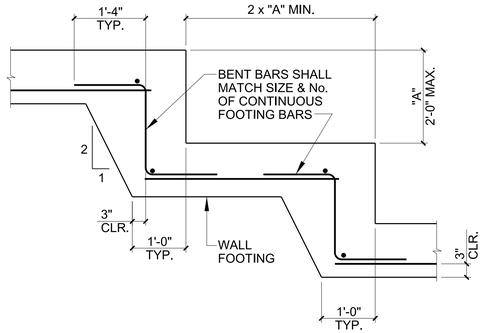
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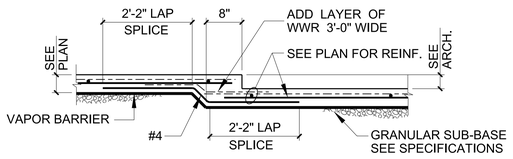
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Albert & Associates: 12575

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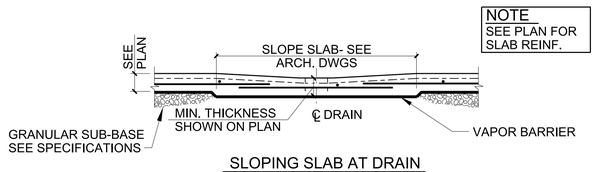
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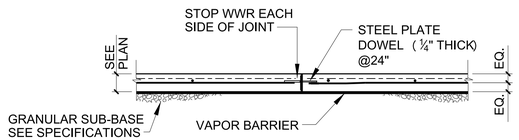
8 STEPPED FOOTING DETAIL



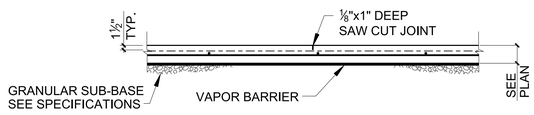
RECESSED SLAB



SLOPING SLAB AT DRAIN

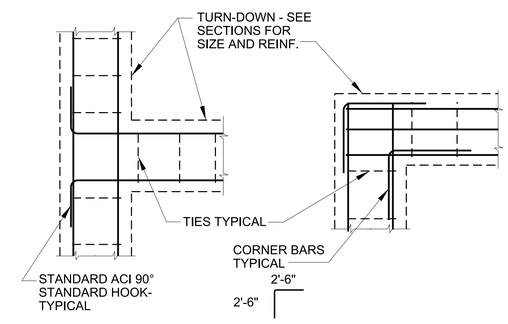


CONSTRUCTION JOINT - WHERE REQUIRED

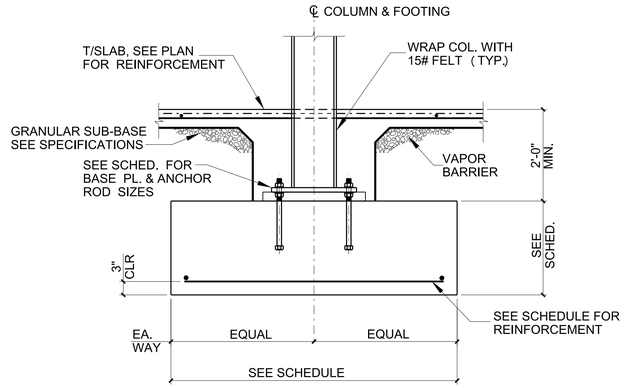


CONTRACTION JOINT AT 16'-0" MAX.

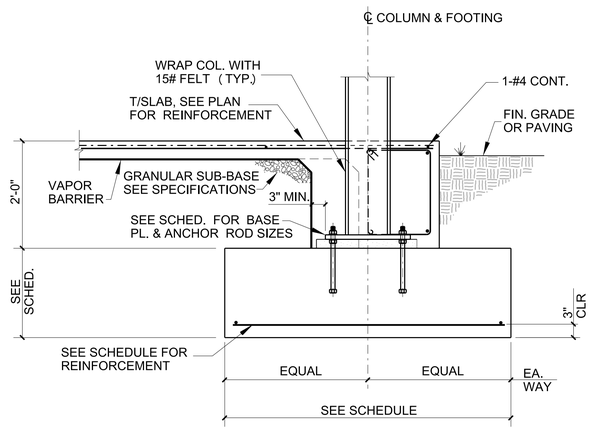
7 SLAB-ON-GRADE DETAILS



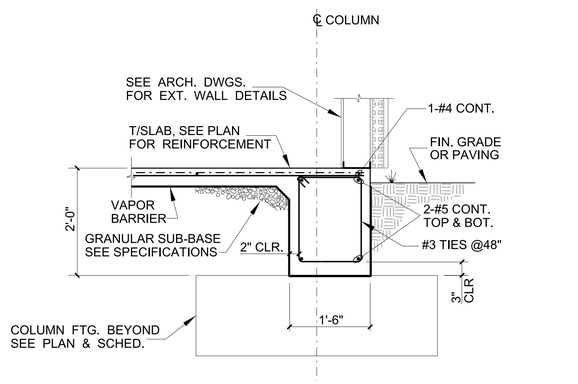
6 TURN-DOWN SLAB INTERSECTION REINFORCING PLAN



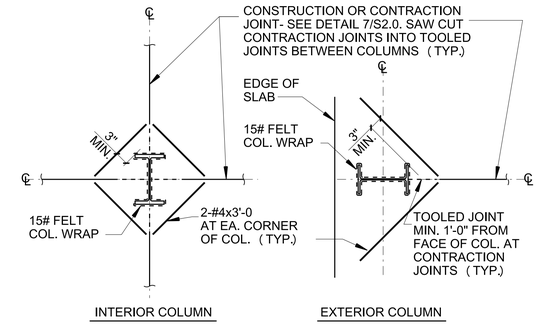
5 TYP. INTERIOR COLUMN FTG.



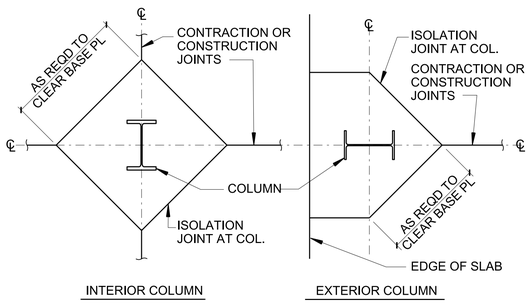
4 TYP. EXTERIOR COLUMN FTG.



3 TYP. EXT. TURNED-DOWN SLAB



FELT WRAPPED COLUMNS



ISOLATION JOINTS AT COLUMNS
(AT CONTRACTORS OPTION)

NOTE: FOR ACTUAL COLUMN SHAPE, SIZE & ORIENTATION SEE PLAN OR SCHEDULE

2 TYPICAL ISOLATION JOINT DETAILS AT STEEL COLUMNS

MARK	SIZE	REINF. EA. WAY	PEDESTAL			REMARKS
			SIZE	REINF.	TIES	
F4	4'-0"x4'-0"X1'-6"	5-#5 BOT.				
F5	5'-0"x5'-0"x1'-6"	5-#6 BOT.				
F6	6'-0"x6'-0"x1'-6"	6-#6 BOT.				
F7	7'-0"x7'-0"x2'-0"	6-#7 BOT.				
F8	8'-0"x8'-0"x2'-6"	8-#7 BOT.				
F9	9'-0"x9'-0"x2'-6"	10-#7 BOT.				
F10	10'-0"x10'-0"x3'-0"	9-#8 BOT.				
F11	11'-0"x11'-0"x3'-0"	11-#8 BOT.				
F12	12'-0"x12'-0"x3'-0"	12-#8 BOT.				
F13	13'-0"x13'-0"x3'-0"	13-#8 BOT.				
F4x8	4'-0"x8'-0"x1'-6"	10-#5 (Short Bot.Bars) 5-#5 (Long Bot.Bars) 5-#4 (Long Top Bars)				
F4x12	4'-0"x12'-0"x1'-6"	15-#5 (Short Bot.Bars) 5-#5 (Long T&B Bars)				
F4x16	4'-0"x16'-0"x2'-0"	20-#5 (Short Bot.Bars) 5-#5 (Long T&B Bars)				
F4x18	4'-0"x18'-0"x1'-6"	28-#4 (Short Bot.Bars) 11-#8 (Long Bot. Bars)				
F8x10	8'-0"x10'-0"x2'-6"	11-#7 (Short Bot.Bars) 8-#7 (Long Bot. Bars)				
F11x22	11'-0"x22'-0"x3'-0	28-#8 (Short Bot.Bars) 28-#6 (Short Top Bars) 11-#8 (Long Bot. Bars) 11-#6 (Long Top Bars)				

1 COLUMN FOOTING AND PEDESTAL SCHEDULE

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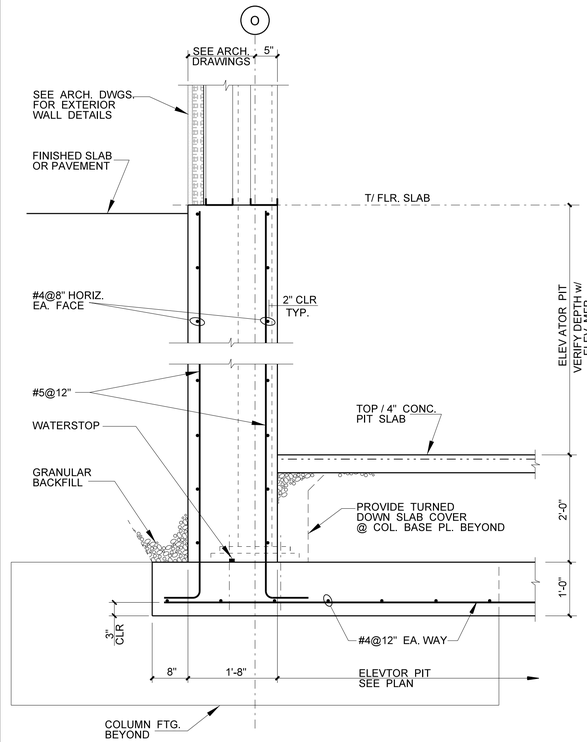
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Albert & Associates: 12575

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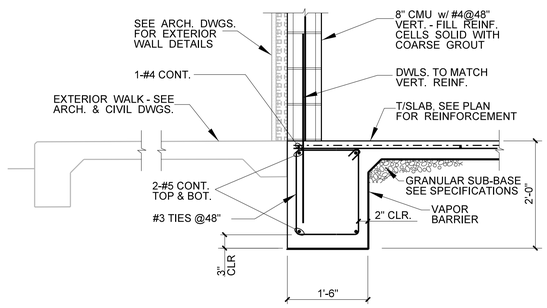
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Nashville, Tennessee 37228
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SDG Project No. 2015-108.20

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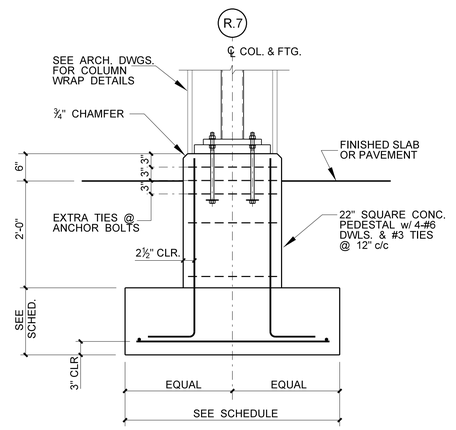
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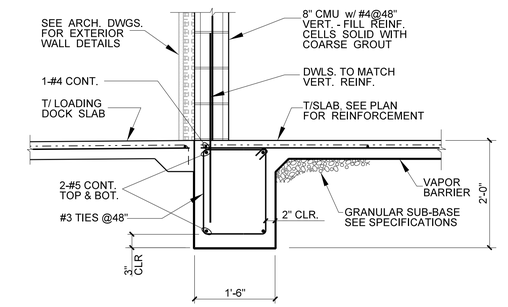
11 EXT. WALL SECTION @ ELEV. PIT



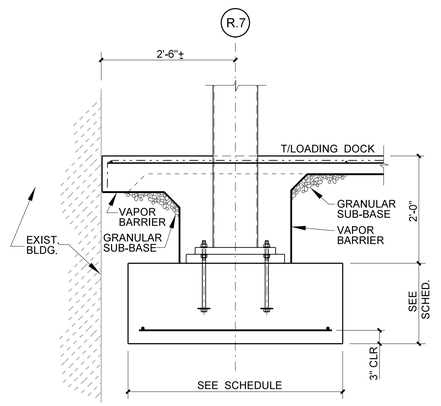
9 SECTION



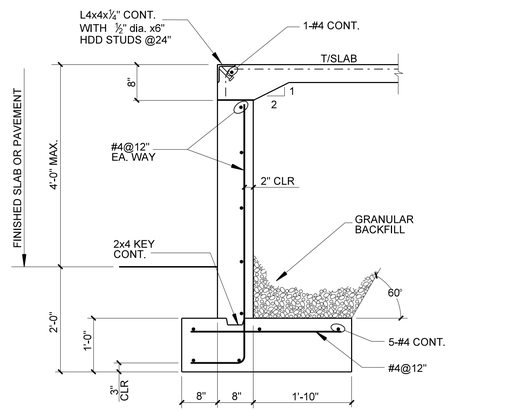
6 EXT. COLUMN @ LOADING DOCK



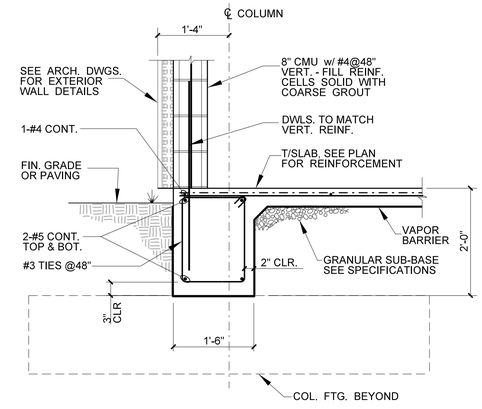
3 EXTERIOR WALL SECTION @ LOADING DOCK CONN. CORRIDOR



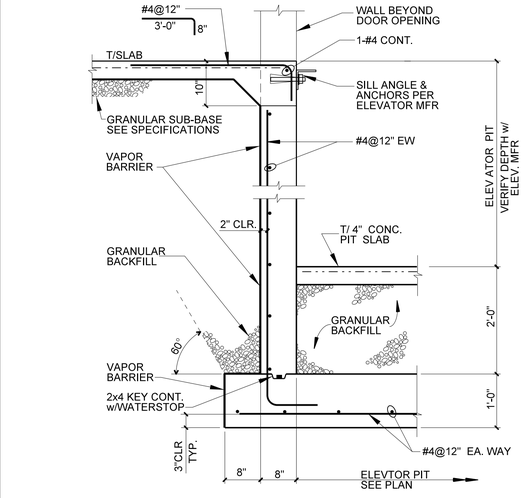
8 COL. FDN. @ LOADING DOCK



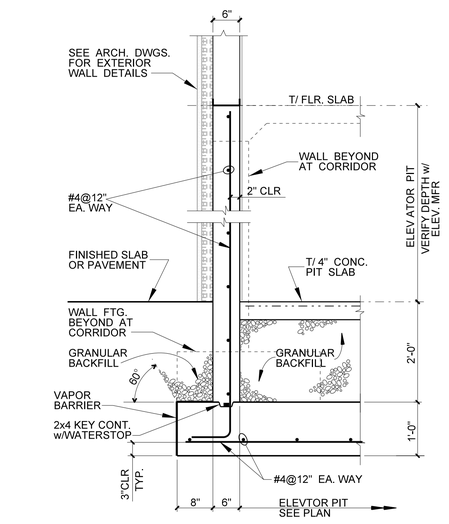
5 SECTION AT LOADING DOCK



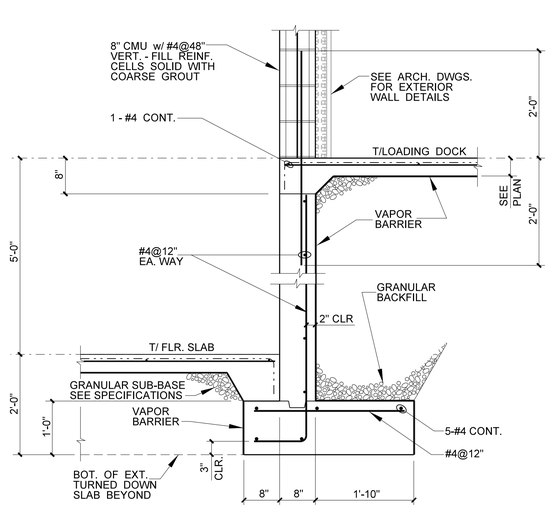
2 EXTERIOR WALL SECTION FIRE / ELEC. RM. @ LOADING DOCK



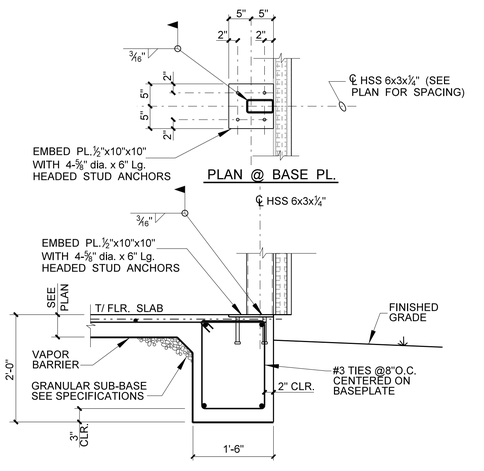
10 ELEVATOR PIT WALL SECTION AT DOOR



7 ELEVATOR PIT WALL SECTION AT GARAGE LEVEL



4 SECTION @ FIRE / ELEC. RM AT LOADING DOCK



1 TYP. EXTERIOR WALL SECTION AT VERT. TUBE

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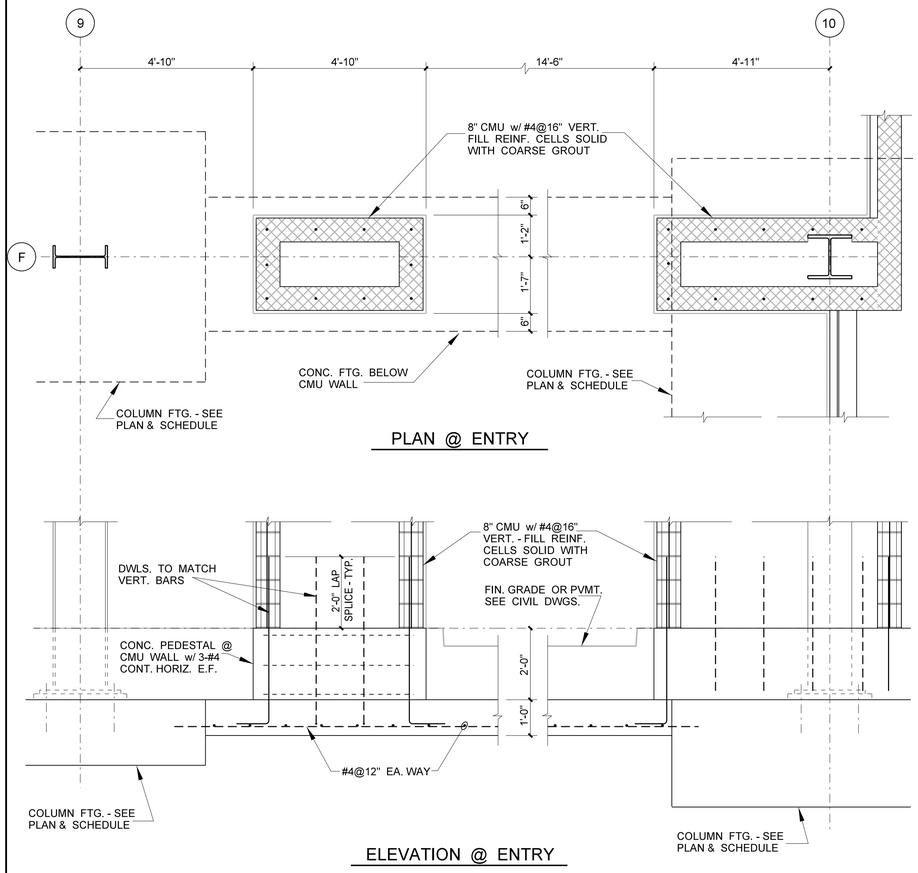
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Albert & Associates: 12575

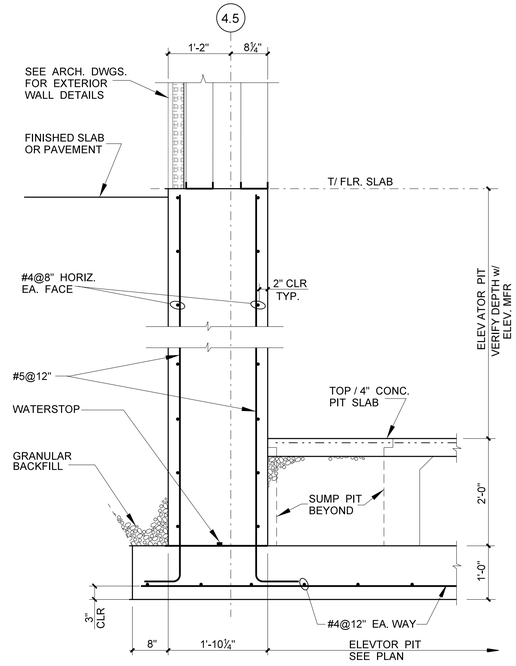
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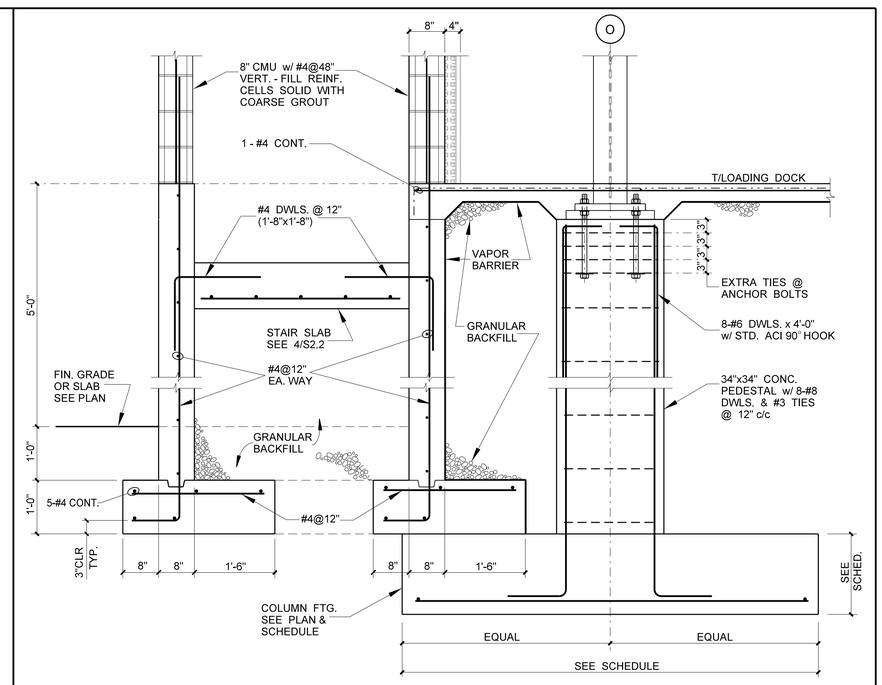
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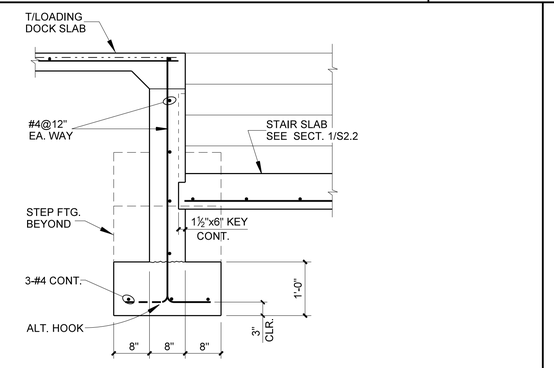
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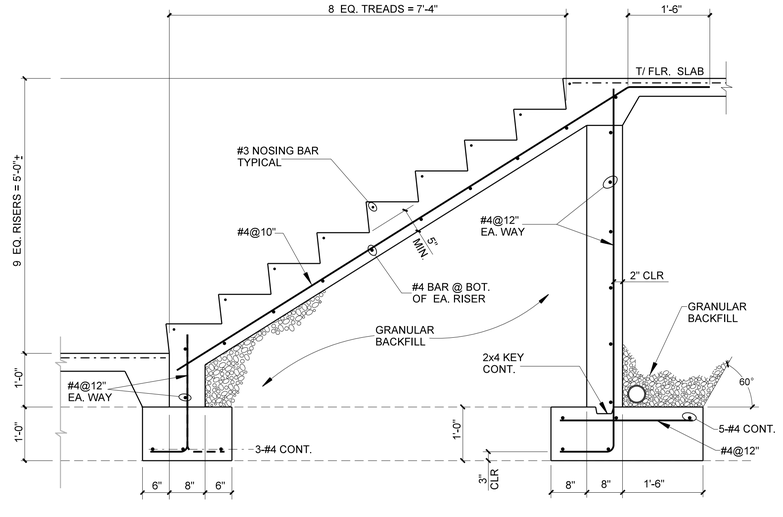
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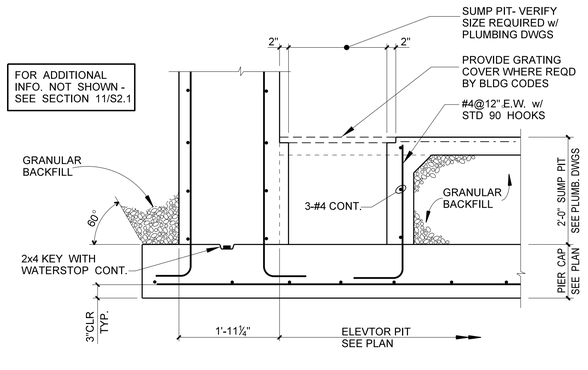












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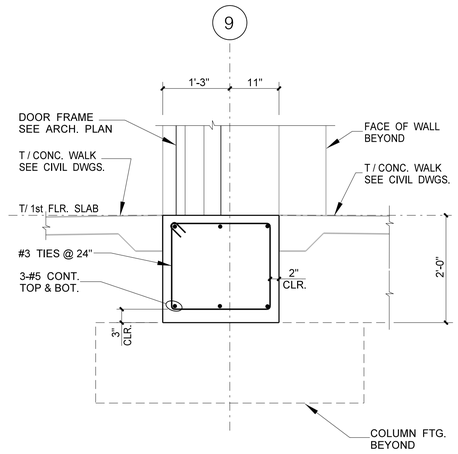
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Albert & Associates: 12575

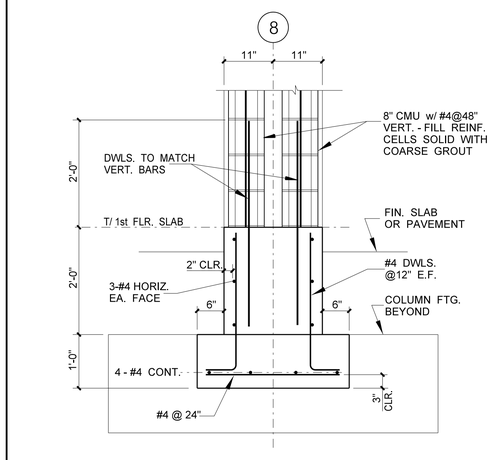
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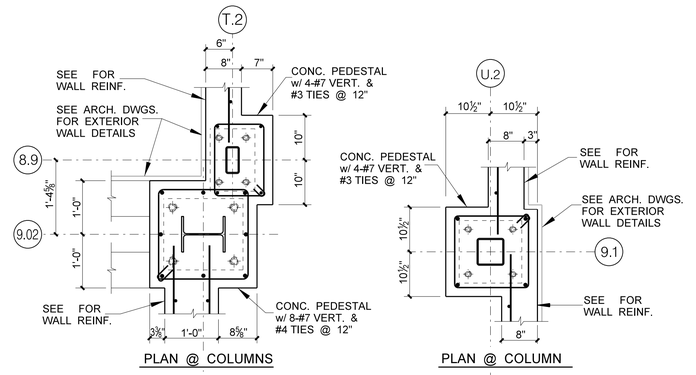
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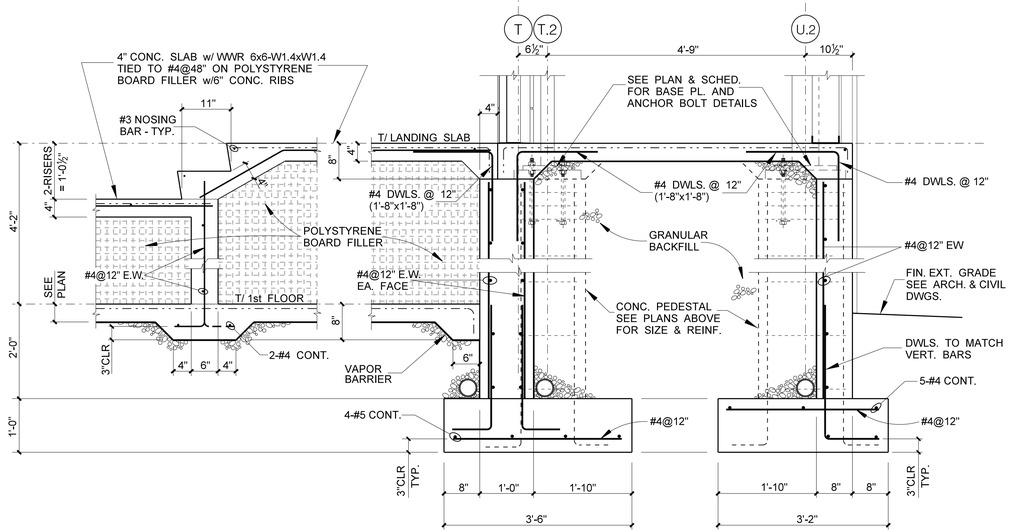


5 FOUND. SECTION @ DOORWAY ENTRY TO SECURE PARKING

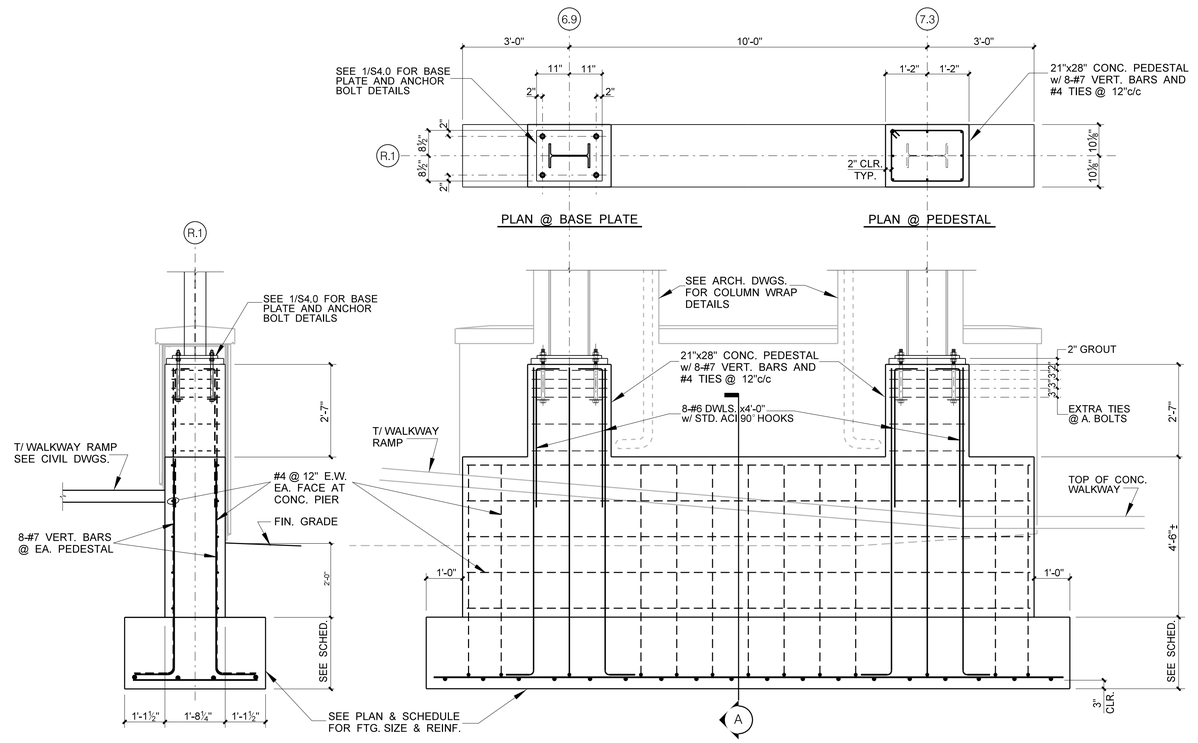


4 CMU WALL FDN. @ SECURE PARKING

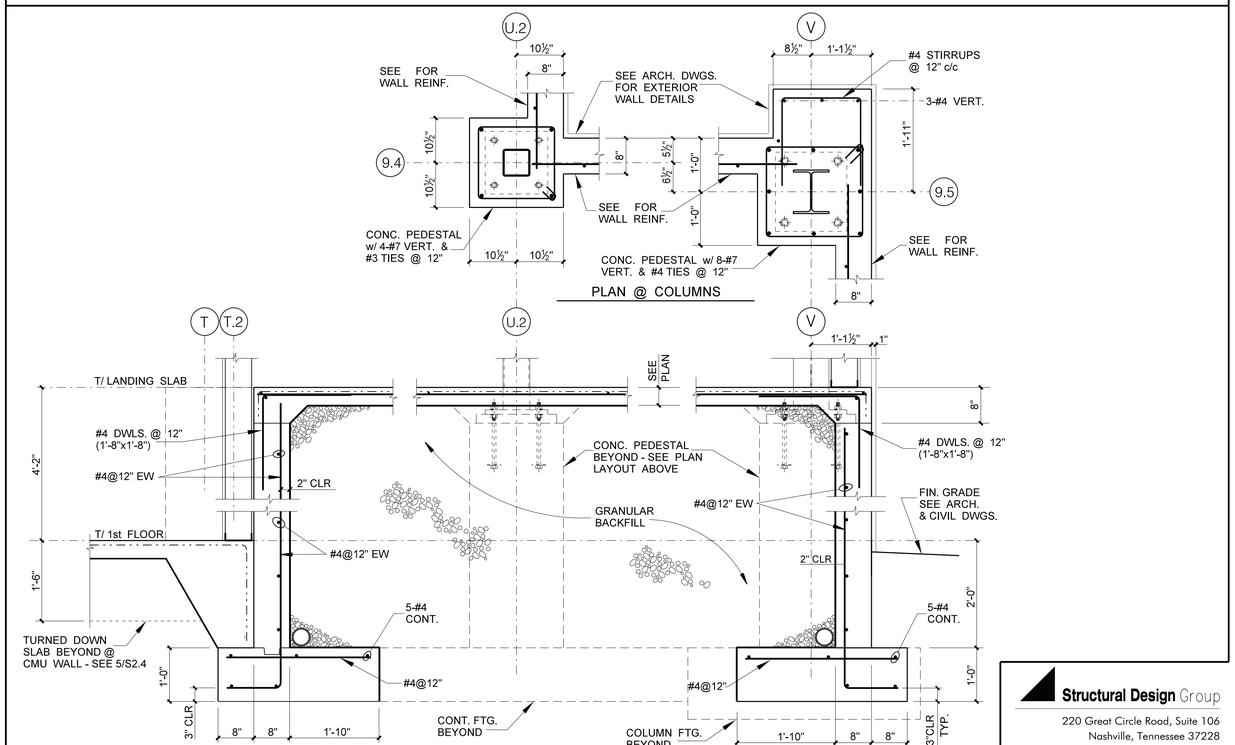




2 SECT. @ CORRIDOR 169 LANDING



3



1 SECT. @ CORRIDOR 168 / 169 LANDING

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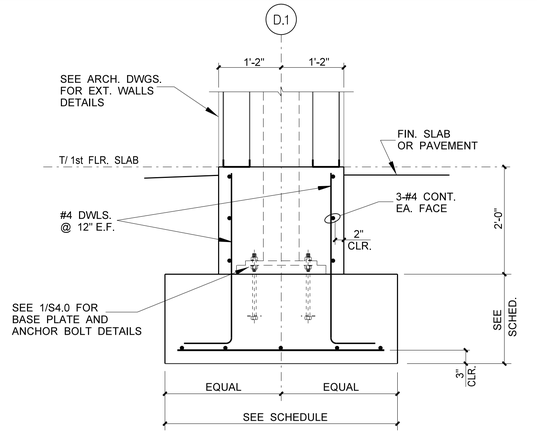
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Client No:	------
Albert & Associates:	12575

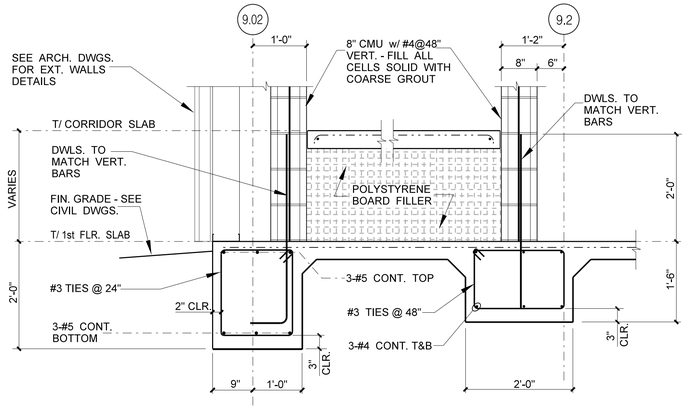
THOMAS C. SCHAEFER
REGISTERED PROFESSIONAL ENGINEER
ENGINEER
11331
STATE OF MISSISSIPPI

Structural Design Group
220 Great Circle Road, Suite 106
Nashville, Tennessee 37228
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SDG Project No. 2015-108.20

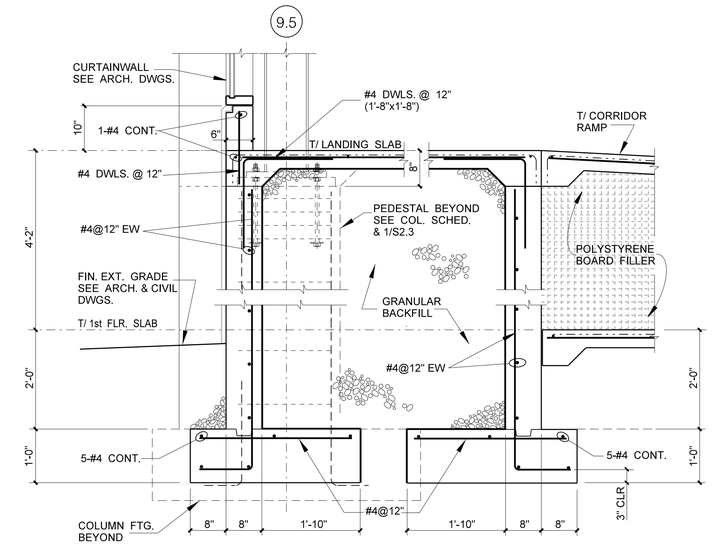
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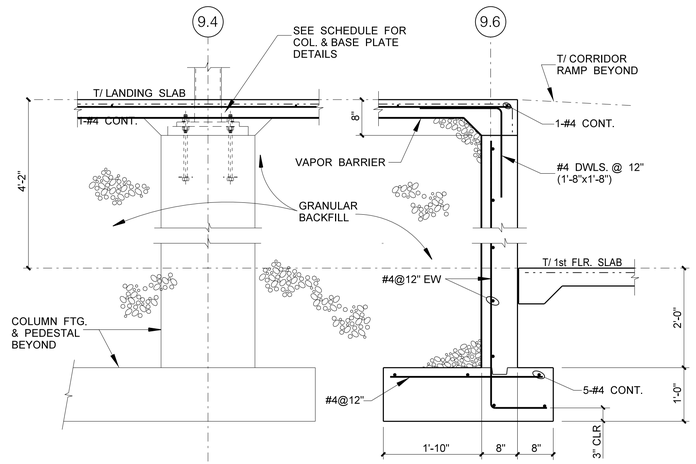
8 2nd FLR. BRIDGE EXTENSION FOUNDATION SECTION



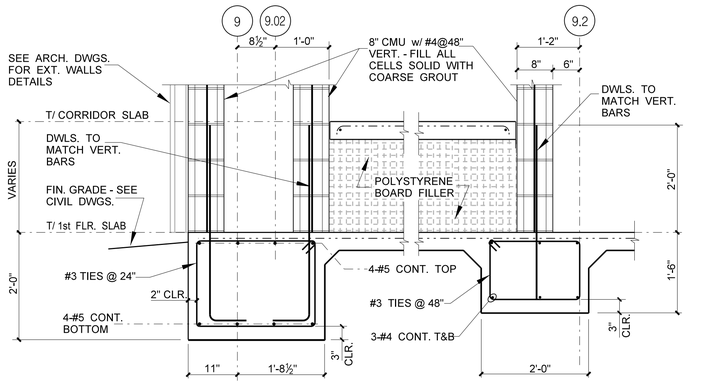
5 SECTION THRU STEPS AT EXTERIOR CORRIDOR



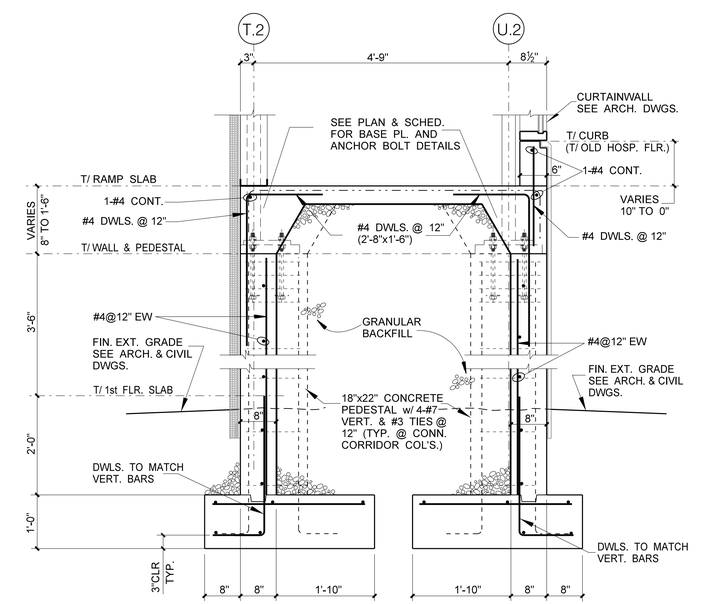
2 RAMP LANDING SECTION (AT EXTERIOR WALL)



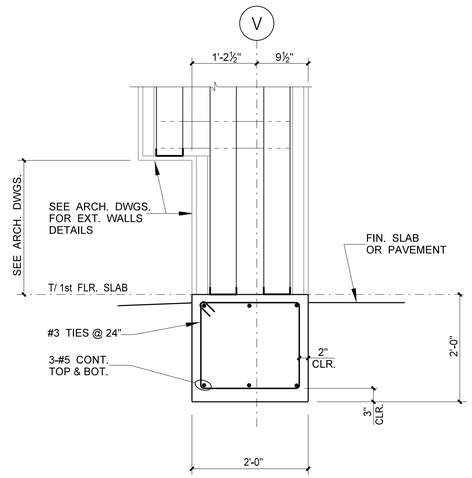
7 SECT. @ CORRIDOR 168/169 LANDING



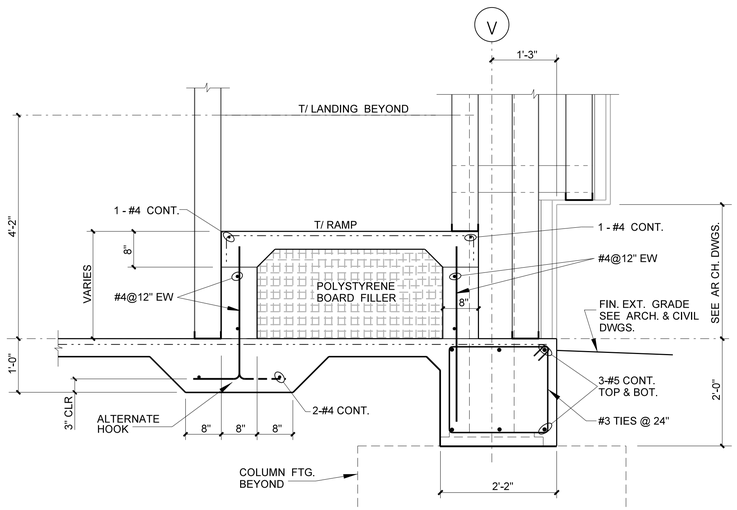
4 SECTION @ EXTERIOR CORRIDOR



1 SECT. THRU CORRIDOR 169 CONNECTOR



6 WINGWALL FDN. @ CORRIDOR 168



3 SECTION @ CORRIDOR 168 RAMP

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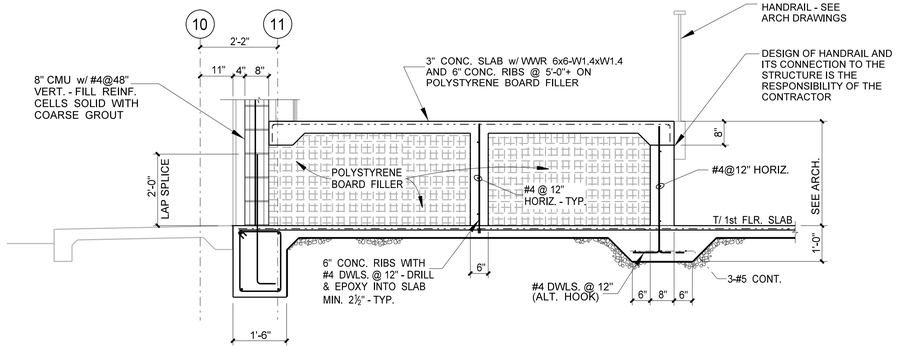
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Date	Rev.	Description
11-19-2018		100% CD

Drawn By:	tw
Checked By:	W.G.
Client No:	----------
Albert & Associates:	12575

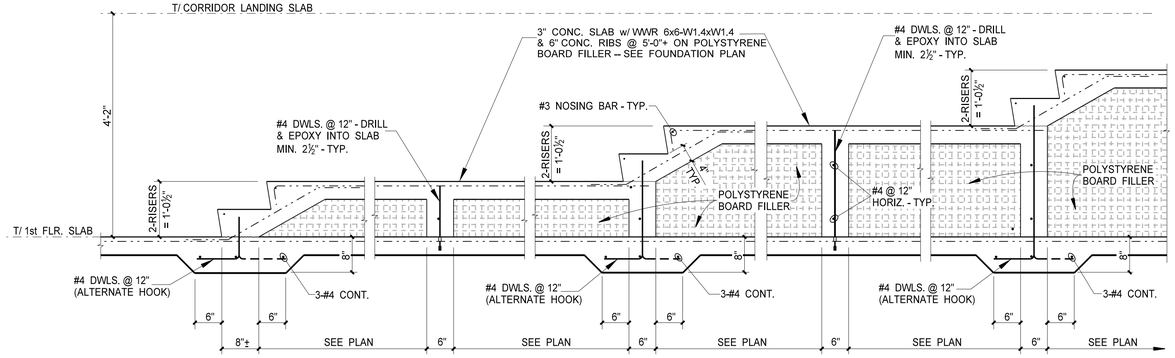
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S2.4

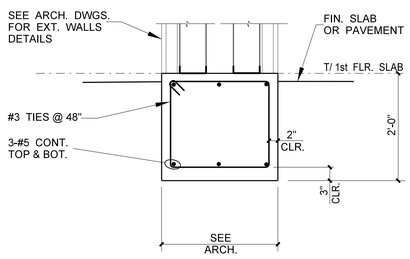
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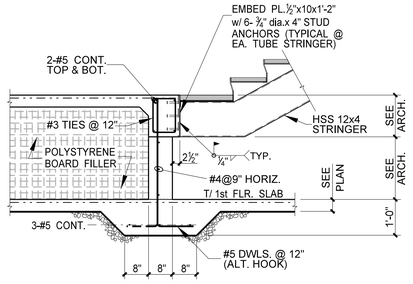
11 SECTION THRU STAIR "A" LANDING (ADJACENT TO GARAGE)



3 SECTION THRU EXTERIOR CORRIDOR



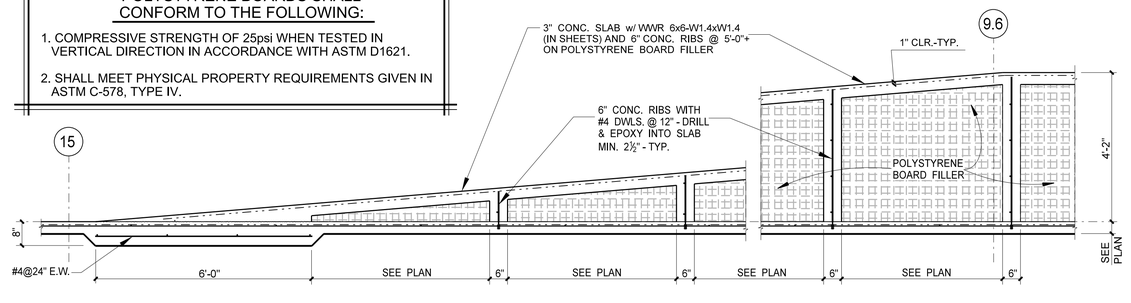
10 SECTION @ WINGWALL FDN.



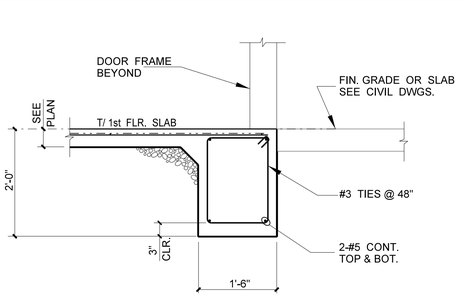
8 SECTION @ STAIR "A" LANDING (AT STRINGER CONNECTION)

POLYSTYRENE BOARDS SHALL CONFORM TO THE FOLLOWING:

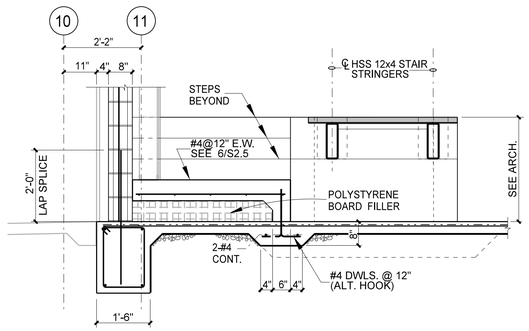
1. COMPRESSIVE STRENGTH OF 25psi WHEN TESTED IN VERTICAL DIRECTION IN ACCORDANCE WITH ASTM D1621.
2. SHALL MEET PHYSICAL PROPERTY REQUIREMENTS GIVEN IN ASTM C-578, TYPE IV.



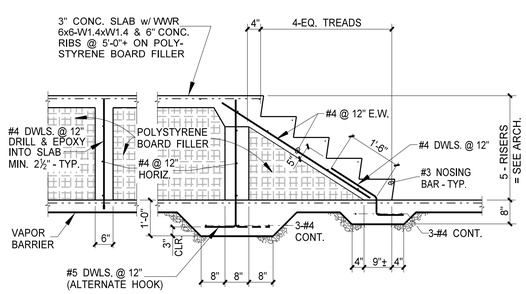
2 RAMP SECTION AT CORRIDOR 168



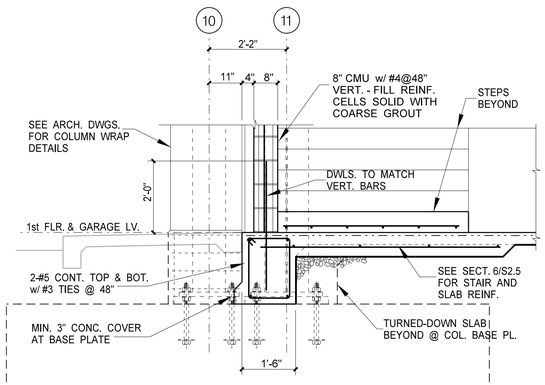
9 SECTION @ RECESSED SIDE ENTRY



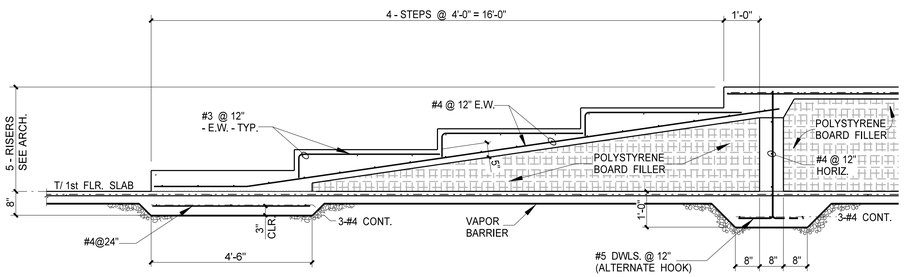
7 SECTION THRU STAIR "A" STEPS (EXTENDED STEPS @ GARAGE)



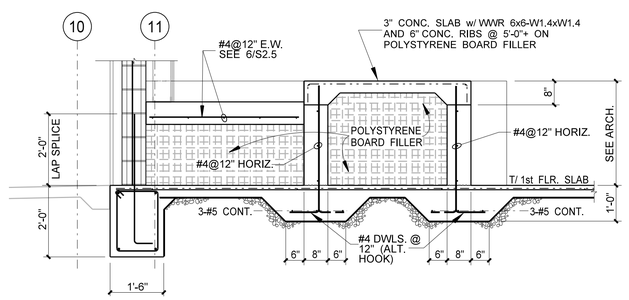
5 SECTION @ STAIR "A" LANDING (AT CURVED STEPS)



1 GRADE BM. SECTION @ GARAGE POLICE LOBBY @ EXTENDED STEPS



6 EXTENDED STEPS @ STAIR "A"



4 SECT. THRU STAIR "A" LANDING (EXTENDED STEPS @ GARAGE)

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Date	Rev.	Description
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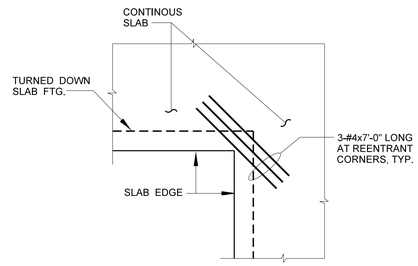
Drawn By: tw
Checked By: W.G.
Client No: ——
Albert & Associates: 12575

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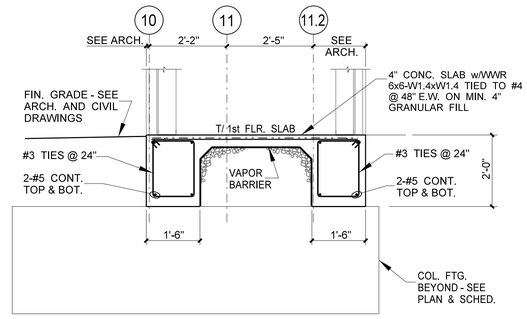
Structural Design Group
220 Great Circle Road, Suite 106
Nashville, Tennessee 37228
p. 615.255.5537
f. 615.255.1486
SDG Project No. 2015-108.20

S2.5

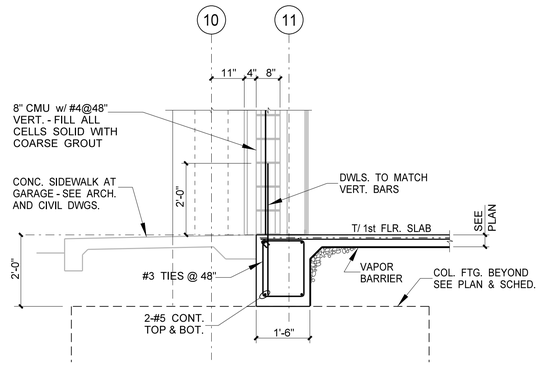
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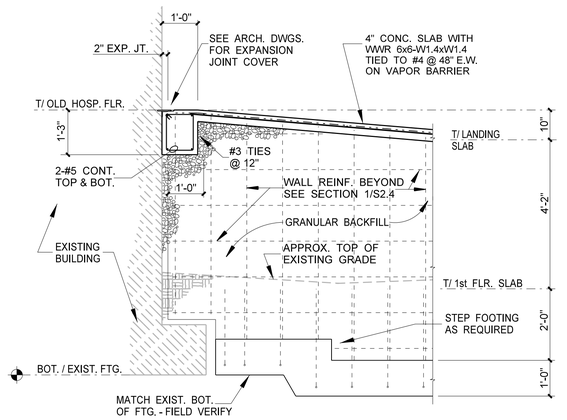
14 SLAB REINFORCEMENT AT REENTRANT CORNER



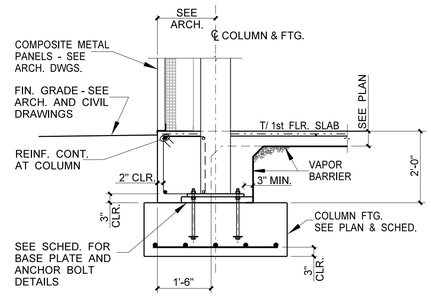
10 SECT. THRU PRECAST MONOLITH WINGWALL AT ENTRY



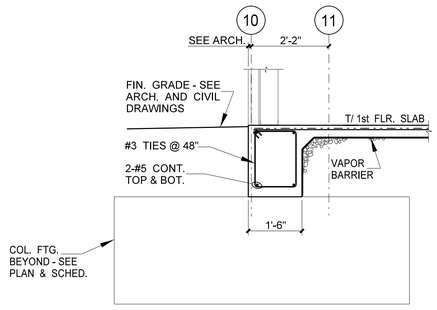
6 1st FLR. SECTION @ POLICE LOBBY (ADJACENT TO GARAGE)



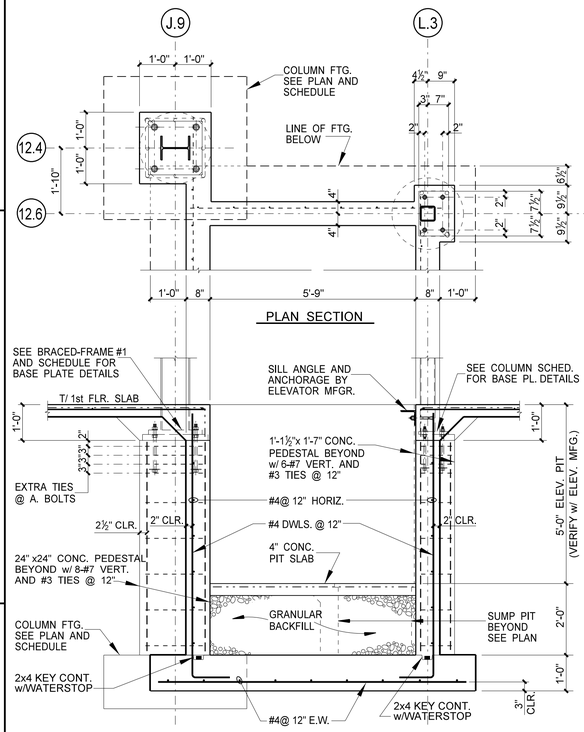
2 CONNECTOR SECTION AT EXISTING BUILDING



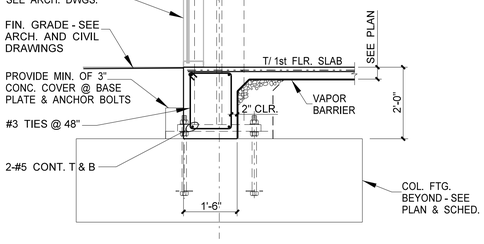
13 EXT. COLUMN FDN. SECTION (AT COMPOSITE PANEL)



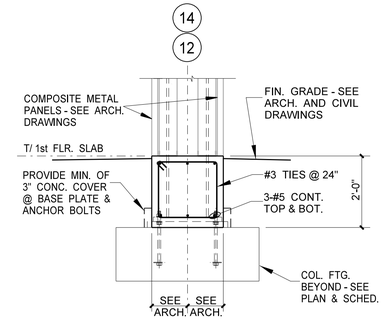
9 SECT. @ POLICE LOBBY VESTIBULE (ADJACENT TO GARAGE)



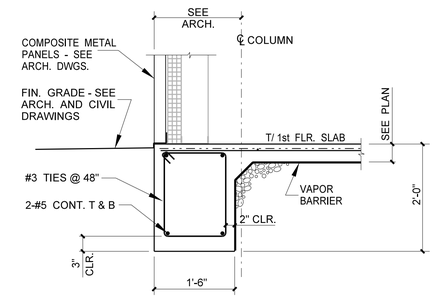
1 TYP. SECTION THRU ELEV. "A"



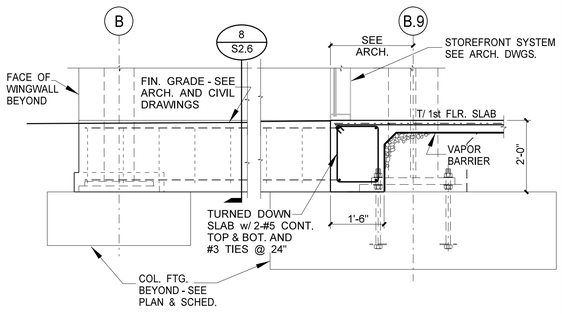
12 FDN. SECTION AT ENTRY



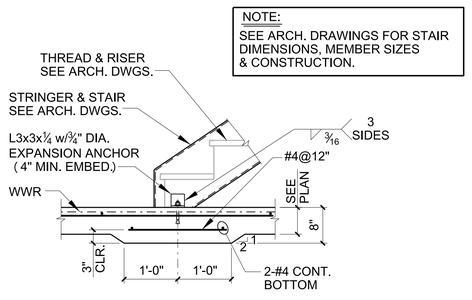
8 SECT. @ POLICE LOBBY VESTIBULE (ADJACENT TO GARAGE)



11 TYP. EXTERIOR FDN. SECTION AT COMPOSITE PANEL



7 1st FLR. SECTION @ ENTRY



3 THICKENED SLAB-ON-GRADE AT STAIR STRINGERS

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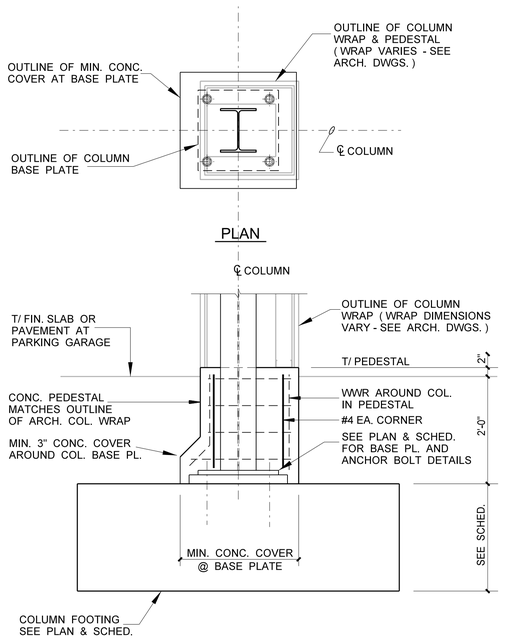
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Client No: ------
Albert & Associates: 12575

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S2.6

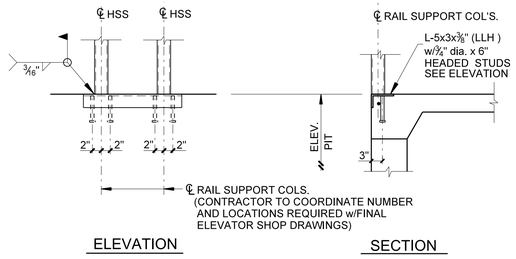
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SDG Project No. 2015-108.20

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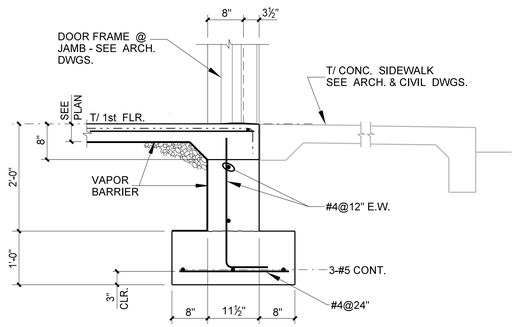


10 TYPICAL COLUMN FDN. DETAIL AT PARKING GARAGE

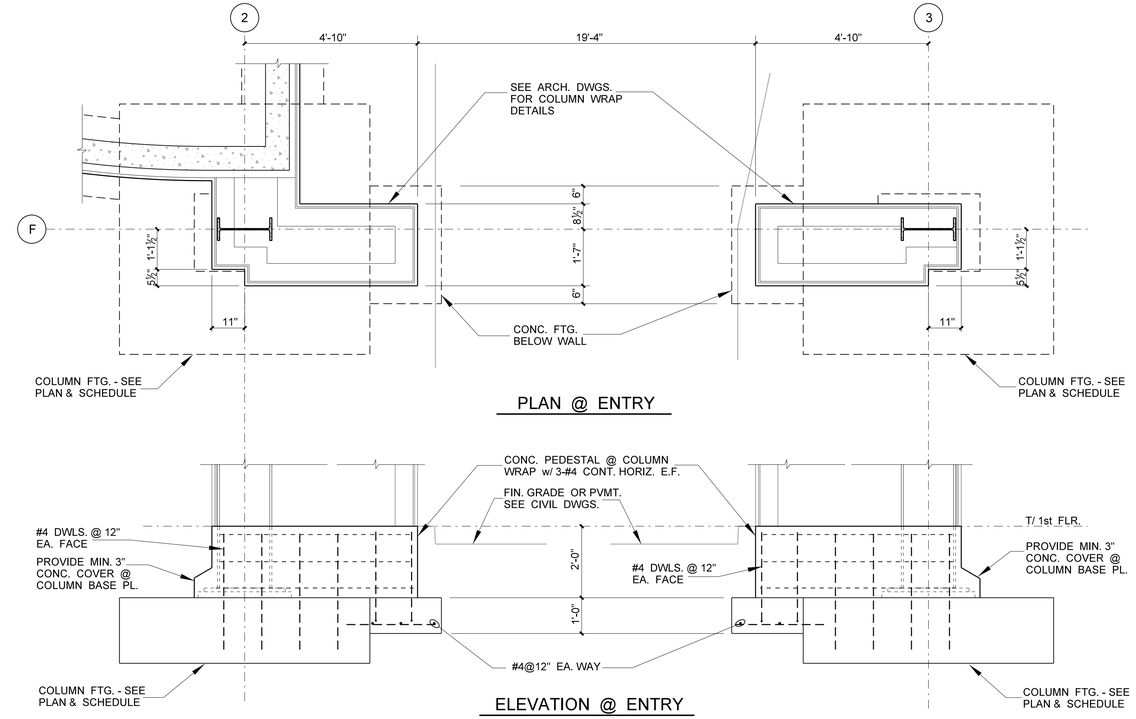
NOTE:
GUIDE RAIL SUPPORT COLUMNS SHALL BE: HSS6x4x5/16 COORDINATE NUMBER AND LOCATIONS W/ELEVATOR DWGS.



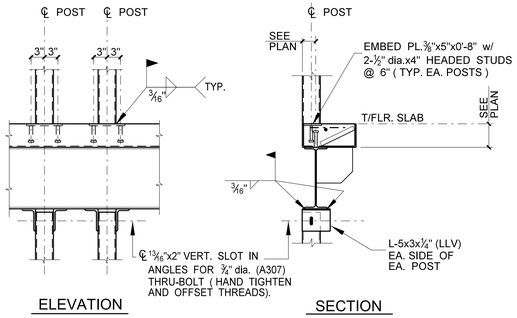
7 ELEV. GUIDE RAIL SUPPORT DETAIL AT PIT WALLS



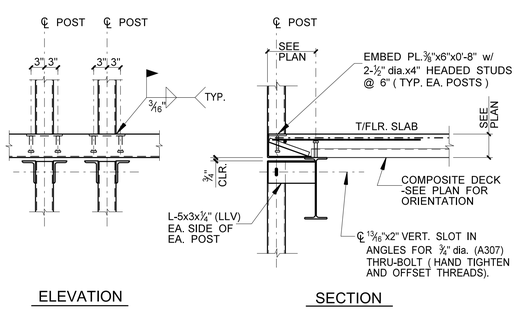
6 SECTION AT DOOR CONC. WALL @ GARAGE PARKING



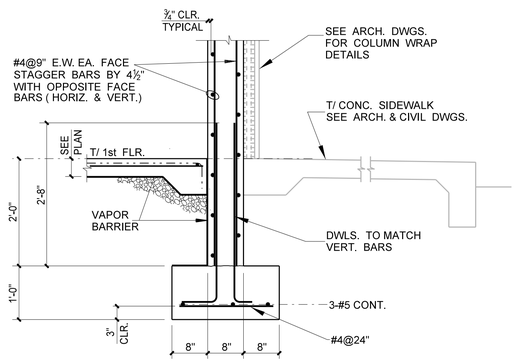
2 DETAIL @ PARKING GARAGE ENTRY



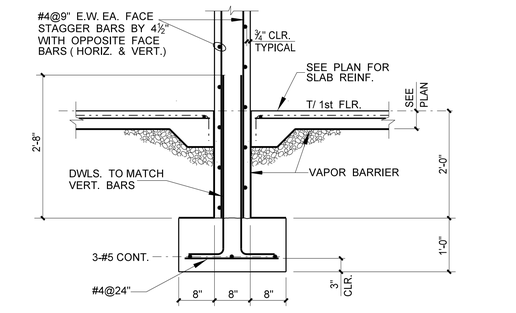
9 ELEV. GUIDE RAIL SUPPORT DETAIL @ COURT COMPLEX



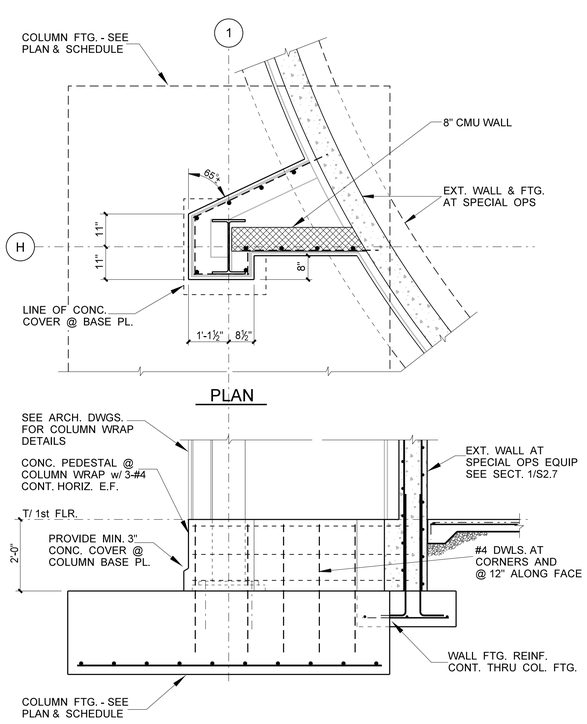
8 ELEV. GUIDE RAIL SUPPORT DETAIL FLR. SLAB @ GARAGE / OFFICE COMPLEX



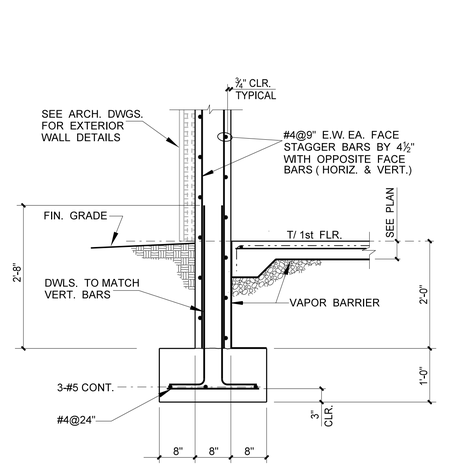
5 WALL SECT. @ WEAPONS VAULT AT GARAGE PARKING



4 WALL SECT. @ WEAPONS VAULT & SPECIAL OPS EQUIP.



3 WINGWALL PILASTER FDN. SECTION (@ SPECIAL OPS EQUIP.)



1 EXT. WALL @ SPECIAL OPS EQUIP. WEAPONS VAULT & ELECT. RM.

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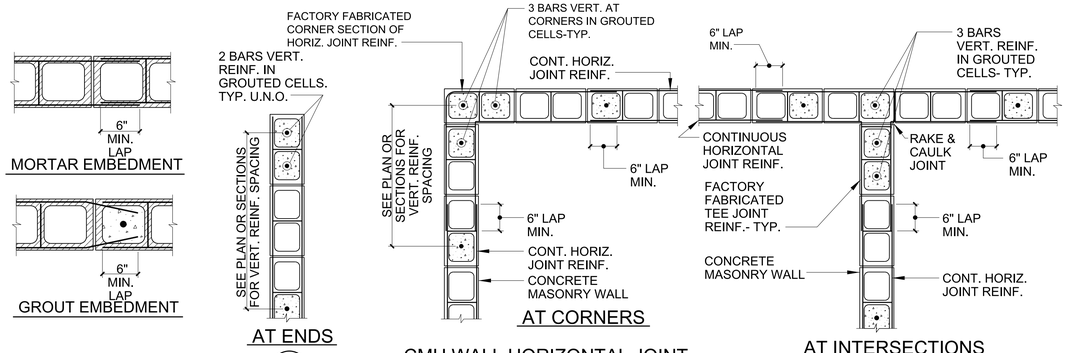
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Client No: ——
Albert & Associates: 12575

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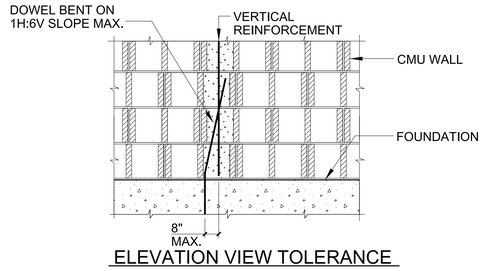
Structural Design Group
220 Great Circle Road, Suite 106
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p. 615.255.5537
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SDG Project No. 2015-108.20

S2.7

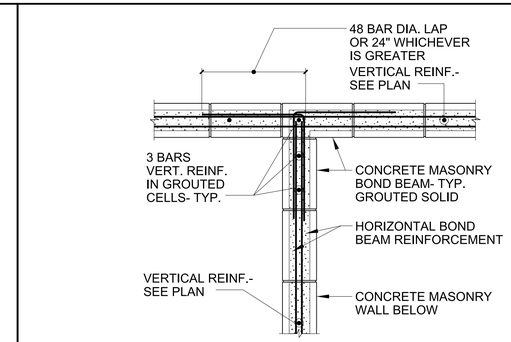
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7 CMU WALL HORIZONTAL JOINT REINFORCEMENT DETAIL

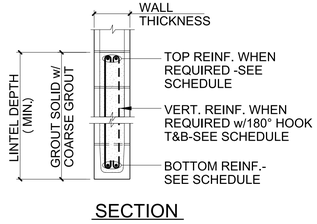


4 DOWEL-PERMITTED BENDING DETAIL

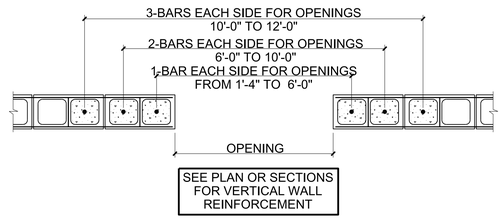


UNMARKED CMU LINTEL SCHEDULE		
WALL OPENING	LINTEL DEPTH	REINFORCING
UP TO 4'-0"	8"	2-#4 BOTTOM
4'-1" TO 6'-0"	8"	2-#5 BOTTOM
6'-1" TO 8'-0"	16"	2-#5 BOTTOM
8'-1" TO 10'-0"	16"	2-#6 BOTTOM

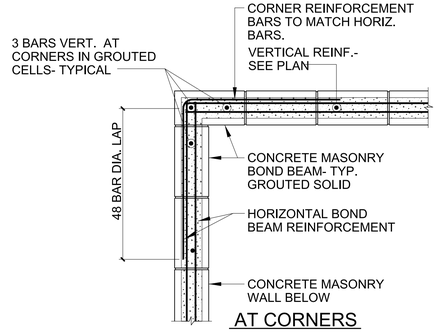
NOTE: 8" MIN. BEARING EACH END-TYP.



6 DOWEL-PERMITTED BENDING DETAIL



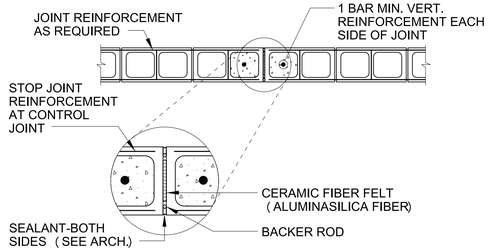
3 CMU WALL OPENING DETAILS

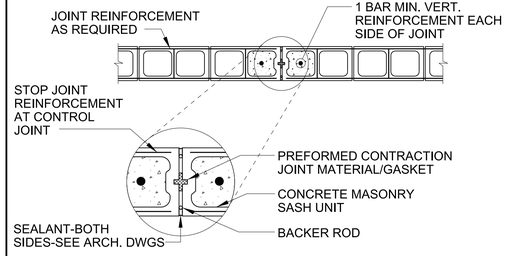


DOUBLE ROW REINFORCEMENT

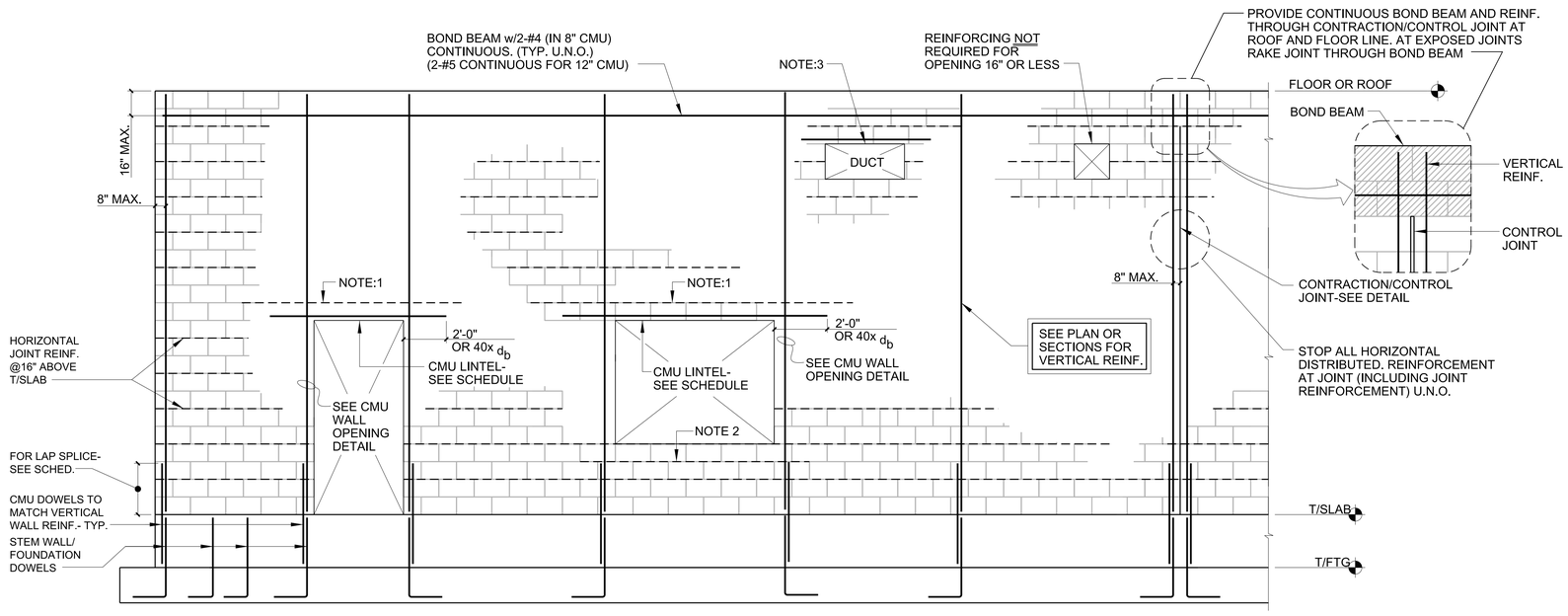
2 CMU BOND BEAM DETAILS

NOTE:
1. SEE STRUCTURAL NOTES FOR MAX. SPACING.
2. LOCATE CONTRACTION JOINTS 2'-0" MINIMUM FROM SIDES OF OPENINGS.
3. CJ (CMU CONTRACTION JOINT) SHOWN ON PLANS INDICATES APPROXIMATE LOCATIONS OF CONTRACTION JOINTS. LOCATIONS ARE INTENDED TO COINCIDE w/CMU COURSING. COORDINATE LOCATION OF JOINTS WITH ARCH. DWGS. SEE ARCH. DWGS FOR LOCATIONS OF BRICK JOINTS.
4. COORDINATE LOCATIONS w/ARCH. DWGS.
5. DO NOT CONSTRUCT CONTRACTION JOINT THROUGH BOND BEAM.





5 CMU WALL CONTRACTION/ CONSTRUCTION JOINT DETAIL



NOTE:
1. ADD HORIZONTAL JOINT REINFORCEMENT ABOVE LINTEL. EXTEND 4'-0"EACH SIDE OF OPENING.
2. ADD HORIZONTAL JOINT REINFORCEMENT BELOW CMU SILL. EXTEND 4'-0" EACH SIDE OF OPENING.
3. FOR MECHANICAL/PLUMBING PENETRATIONS, PROVIDE LINTEL OVER CMU OPENING PER UNMARKED CMU LINTEL SCHEDULE.

ENGINEER NOTE:
BASE OF WALL CONDITION MAY VARY - EDIT AS REQD
DETAIL SHOWN IS FOR NON-SEISMIC PROJECTS

1 TYPICAL CMU WALL REINFORCING ELEVATION

Structural Design Group
220 Great Circle Road, Suite 106
Nashville, Tennessee 37228
p. 615.255.5537
f. 615.255.1486
SDG Project No. 2015-108.20

HATTIESBURG PUBLIC SAFETY COMPLEX
HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

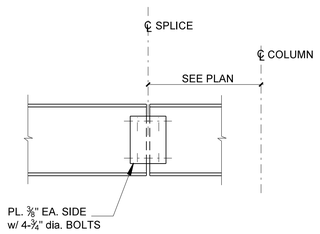
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Date	Rev. Description
11-19-2018	100% CD

Drawn By: tw
Checked By: W.G.
Client No: ———
Albert & Associates: 12575

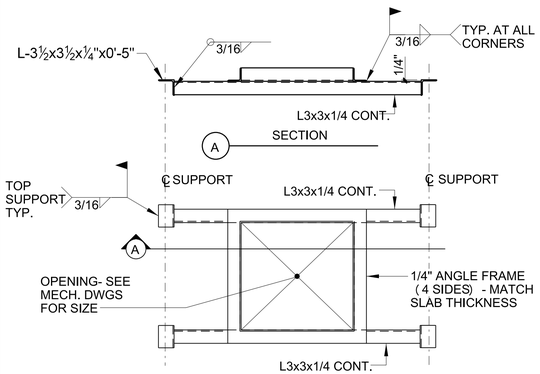
THOMAS C. SCHAEFER REGISTERED PROFESSIONAL ENGINEER 21331 STATE OF MISSISSIPPI

S2.8

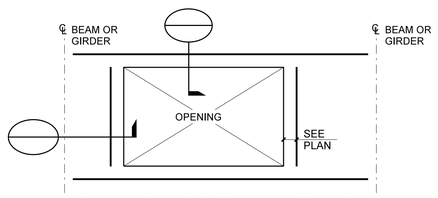
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11 STANDARD SHEAR SPLICE

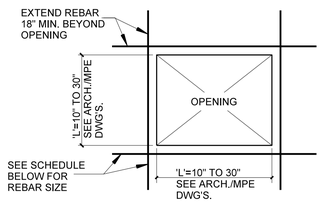


10 FLOOR OPENING FRAME DETAIL FOR OPENINGS LESS THAN 3'-0"



NOTE: BEAM CONNECTIONS SHALL BE DESIGNED FOR A MINIMUM END REACTION OF 12 KIPS (FACTORED) UNO ON PLANS

B STRUCTURAL FRAME FOR OPENINGS OVER 30" UNO ON PLANS



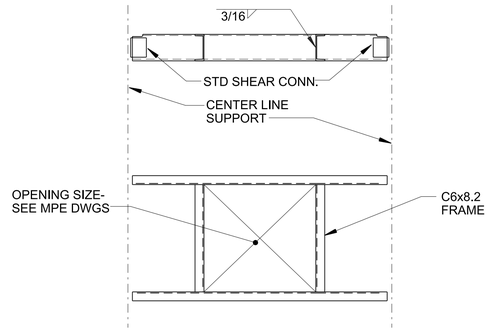
NOTE!
FORM OR SLEEVE OPENING TO EXCLUDE CONCRETE. CUT DECK AFTER CONCRETE HAS OBTAINED A MIMIMUM OF 75% OF THE SPECIFIED COMPRESIVE STRENGTH.

A REINFORCING FOR OPENINGS UP TO 30"

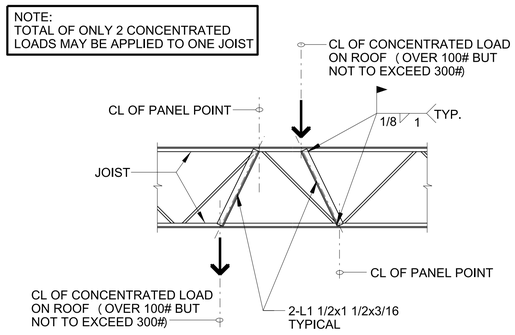
FLOOR OPENING REINFORCING SCHEDULE		
L	REINFORCEMENT	REMARKS
TO 10"	NO REBARS REQUIRED.	-
10" TO 16"	2-#4 EA. SIDE	-
16" TO 30"	3-#4 EA. SIDE	-
OVER 30"	REQUIRES STRUCTURAL STEEL FRAME	-

NOTE: PLACE REINFORCEMENT TO UNDERSIDE OF WWR.

9 TYPICAL COMPOSITE SLAB OPENING SCHEDULE AND DETAILS

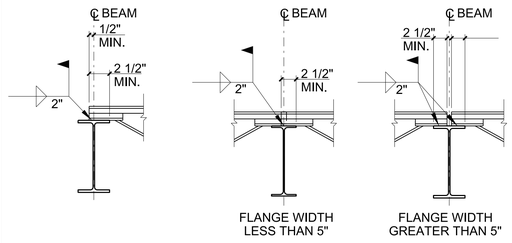


8 CHANNEL ROOF OPENING FRAME



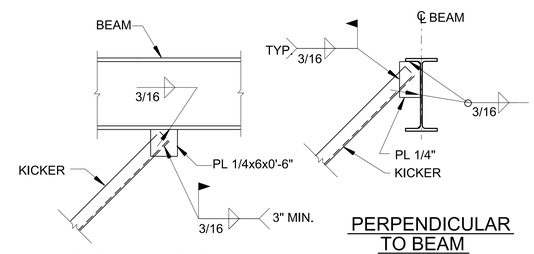
7 TYPICAL JOIST REINFORCEMENT (FOR CONCENTRATED LOADS)

NOTE:
SEE PLAN OR OTHER SECTIONS FOR SEAT DEPTH

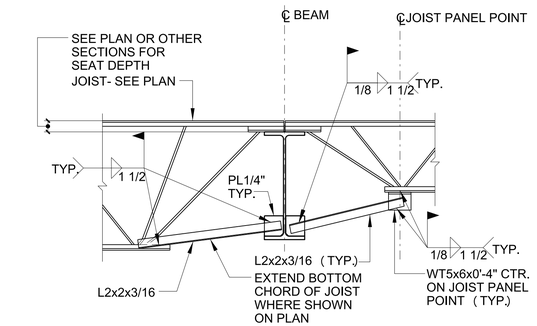


A AT STEEL

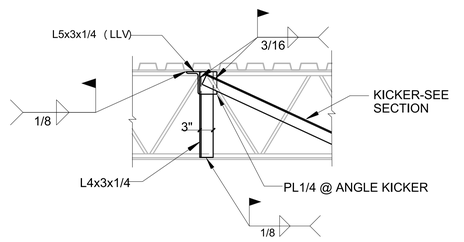
6 TYPICAL JOIST BEARING DETAILS



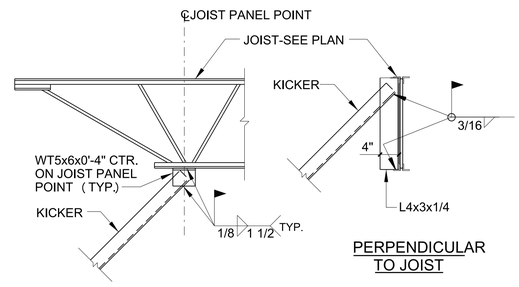
5 KICKER ANCHORAGE AT BEAMS



4 JOIST BOTTOM CHORD EXTENSION



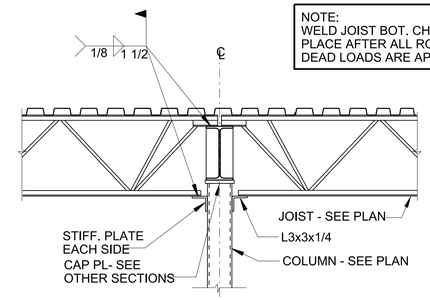
3B BETWEEN JOISTS



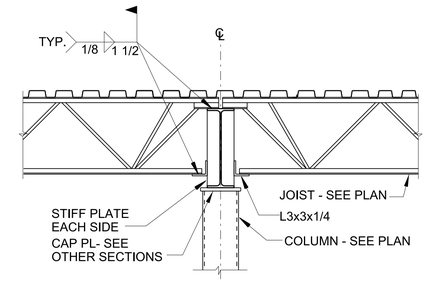
3A AT JOISTS

3 KICKER ANCHORAGE AT JOIST

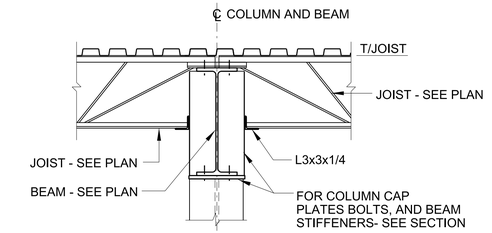
NOTE:
WELD JOIST BOT. CHORD PLACE AFTER ALL ROOF DEAD LOADS ARE APPLIED.



2D SECTION

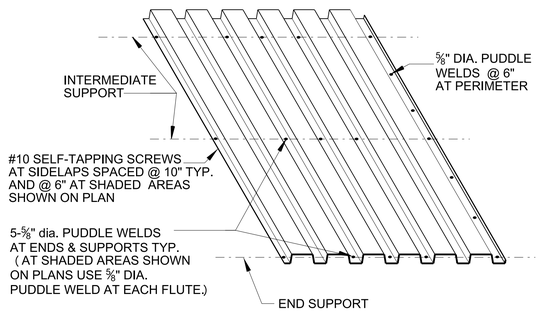


2C SECTION



2A SECTION

2 SECTION AT COLUMN



1 ROOF DECK ATTACHMENT DETAIL 1 1/2" TYPE "B"

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HATTIESBURG PUBLIC SAFETY COMPLEX

HPSC Police and Court Building

Drawing Issued:	
Date	Rev. Description
11-19-2018	100% CD

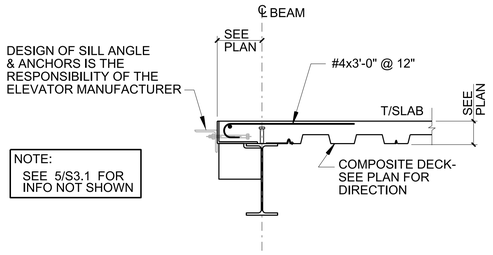
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Client No: ———
Albert & Associates: 12575

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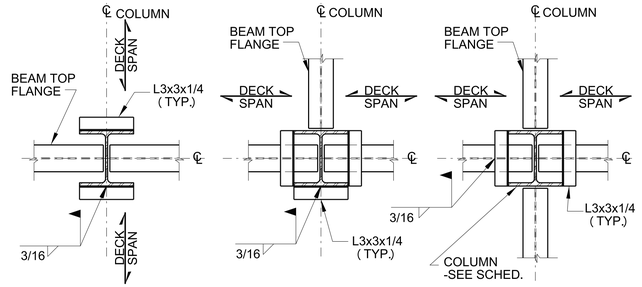
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Structural Design Group
220 Great Circle Road, Suite 106
Nashville, Tennessee 37228
p. 615.255.5537
f. 615.255.1486
SDG Project No. 2015-108.20

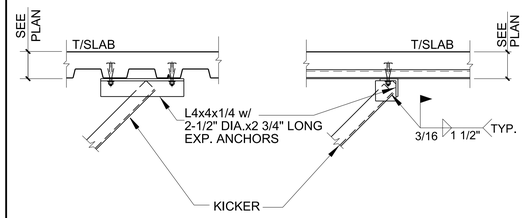
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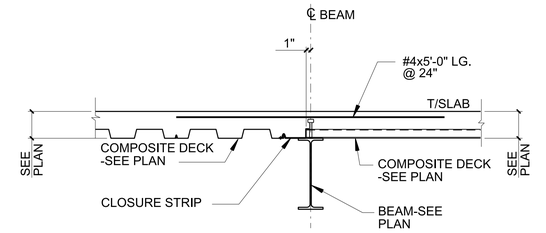
9 SECTION AT ELEVATOR SILL SUPPORT



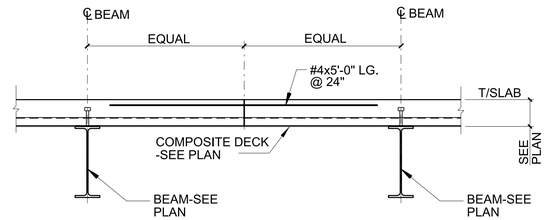
6 COMPOSITE DECK SUPPORT AT STEEL COLUMNS



4 DETAIL-KICKER ANCHORAGE AT COMPOSITE SLAB

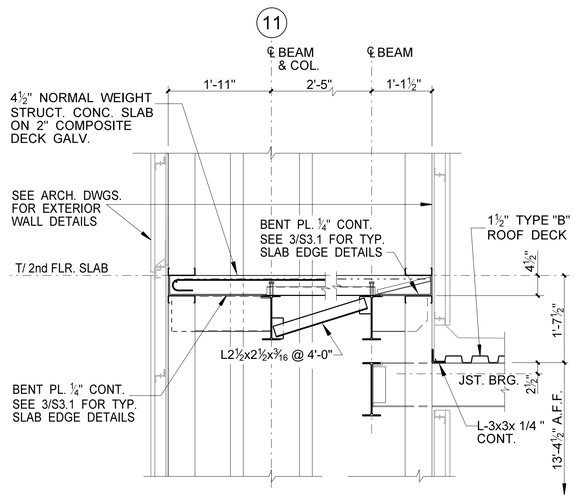


B DETAIL OF CHANGE IN DECK SPAN



A AT CONSTRUCTION JOINT

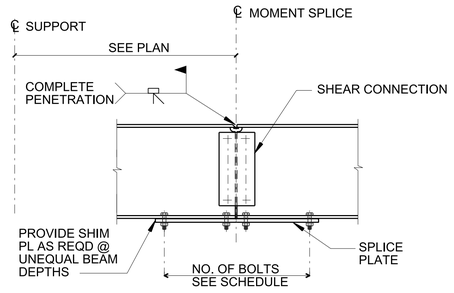
2 TYPICAL COMPOSITE SLAB SECTIONS



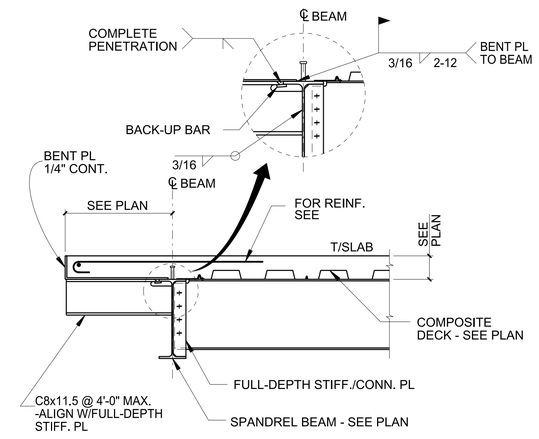
8 SECTION @ MONOLITH WING (@ COURT COMPLEX ENTRY)

BEAM SIZE	NO. OF BOLTS (★)	PLATE SIZE
W14	8	1/4"x6"
W16	12	3/8"x7"
W18	12	3/8"x7"

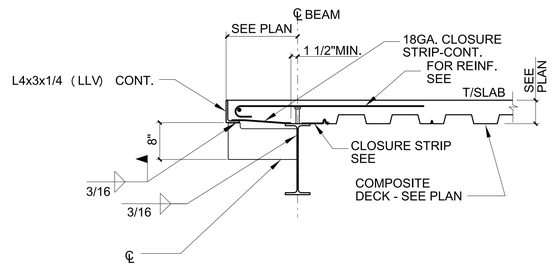
(★) NUMBER OF BOLTS SHOWN IS THE TOTAL REQUIRED AND IS TO BE PLACED IN TWO ROWS



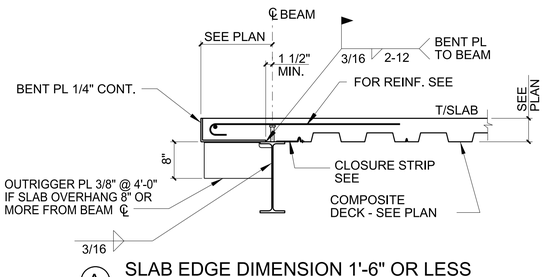
7 WELDED/BOLTED BEAM MOMENT SPLICE



B SLAB EDGE DIMENSION GREATER THAN 1'-6" AND LESS THAN 2'-0"

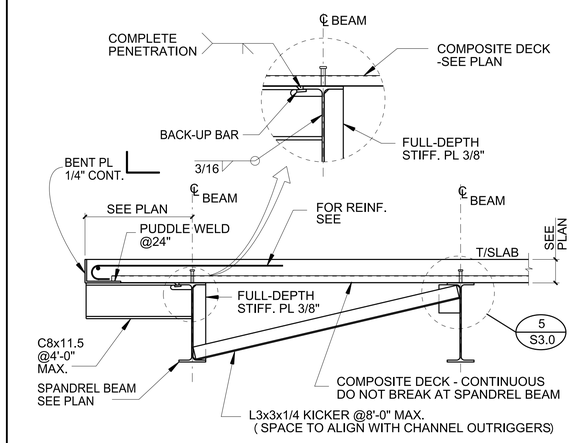


ALTERNATE AT CONTRACTORS OPTION

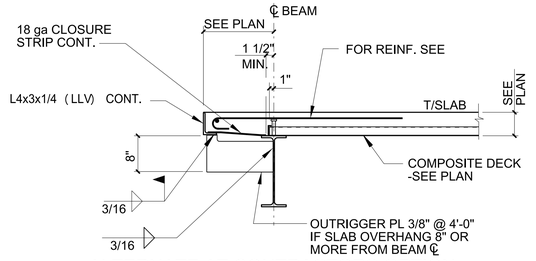


A SLAB EDGE DIMENSION 1'-6" OR LESS

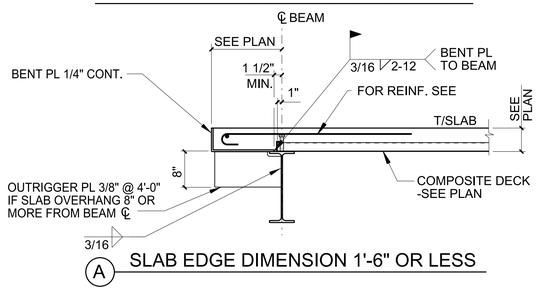
5 TYPICAL FLOOR SPANDREL SECTION w/DECK PARALLEL



B SLAB EDGE DIMENSION GREATER THAN 1'-6" AND LESS THAN 2'-0"

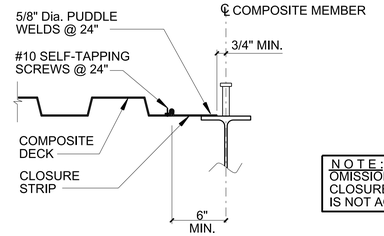


ALTERNATE AT CONTRACTORS OPTION



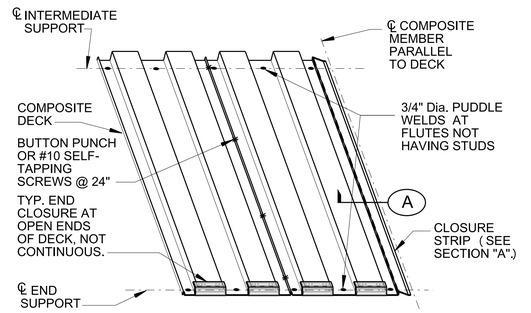
A SLAB EDGE DIMENSION 1'-6" OR LESS

3 TYPICAL FLOOR SPANDREL SECTION w/DECK PERPENDICULAR



NOTE:
OMISSION OF CLOSURE STRIP IS NOT ACCEPTABLE.

A CLOSURE STRIP SECTION



1 COMPOSITE DECK ATTACHMENT DETAIL

Structural Design Group
220 Great Circle Road, Suite 106
Nashville, Tennessee 37228
p. 615.255.5537
f. 615.255.1486
SDG Project No. 2015-108.20

HATTIESBURG PUBLIC SAFETY COMPLEX
HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

Drawing Issued:		
Date	Rev.	Description
11-19-2018		100% CD

Drawn By:	tw
Checked By:	W.G.
Client No:	----------
Albert & Associates:	12575

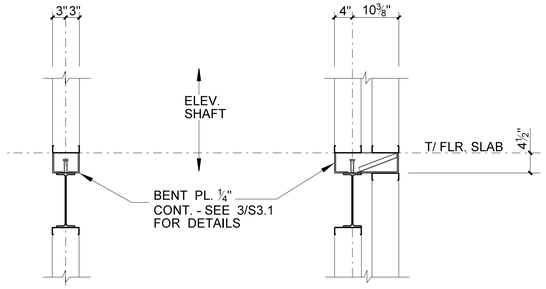
THOMAS C. SCHAEFER REGISTERED PROFESSIONAL ENGINEER 21331 STATE OF MISSISSIPPI

S3.1

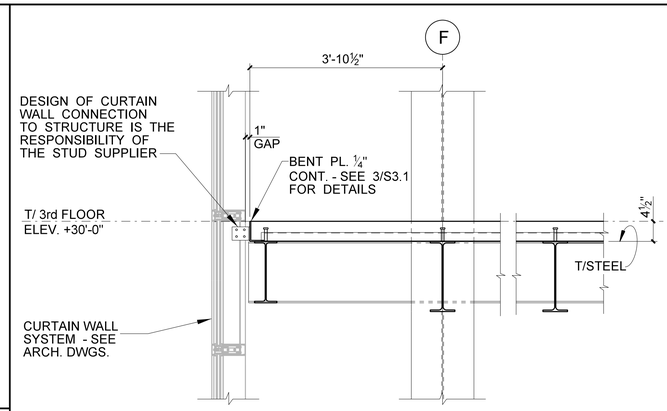
FRAMING SECTIONS AND DETAILS

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com **Albert & McCleskey Associates Architects**

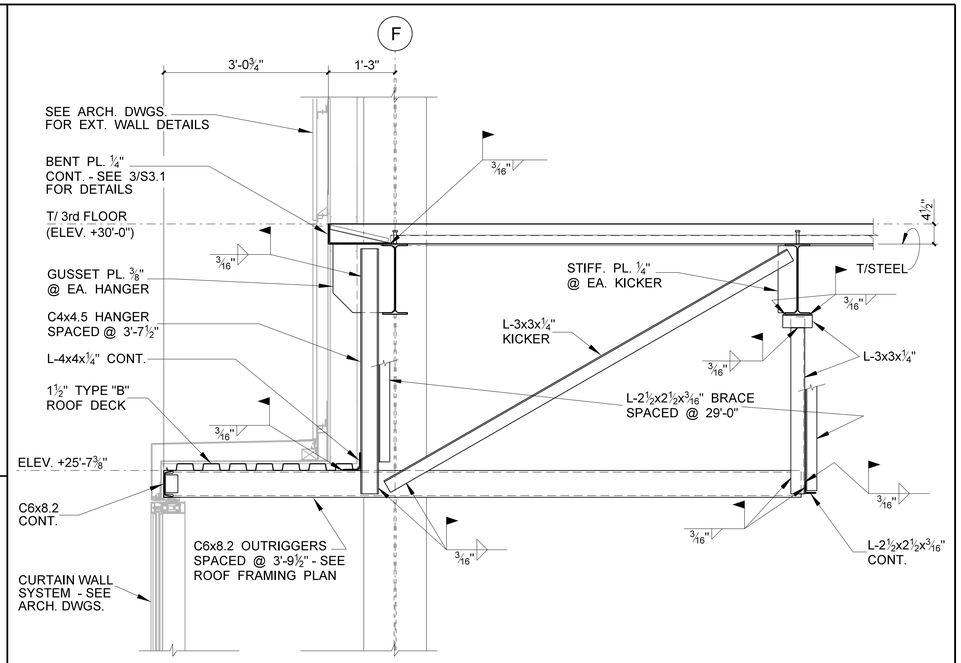
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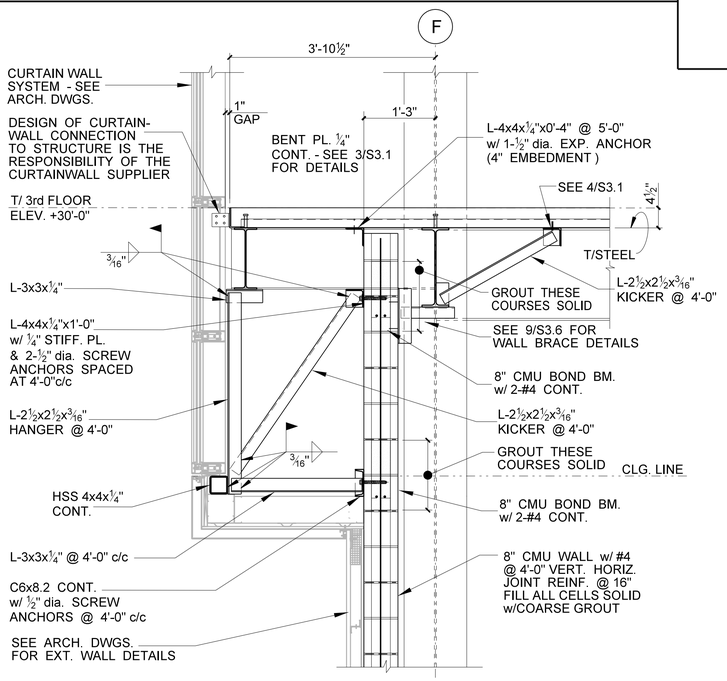
8 TYP. ELEV. "A" CROSS SECTION



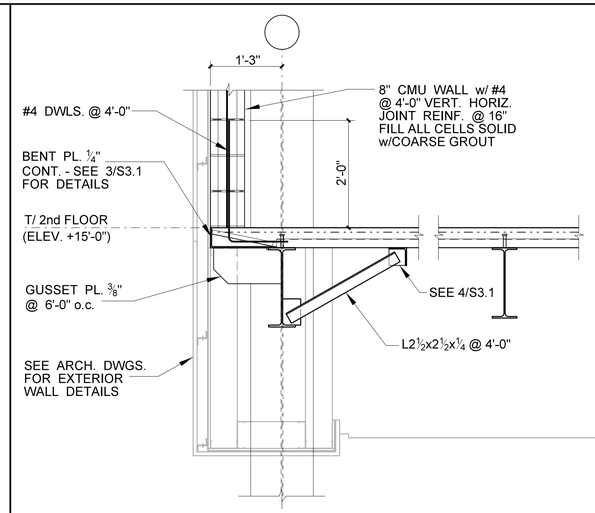
5 EXT. WALL SECTION @ 3rd FLR.
(@ FRONT CURTAINWALL OVERHANG)



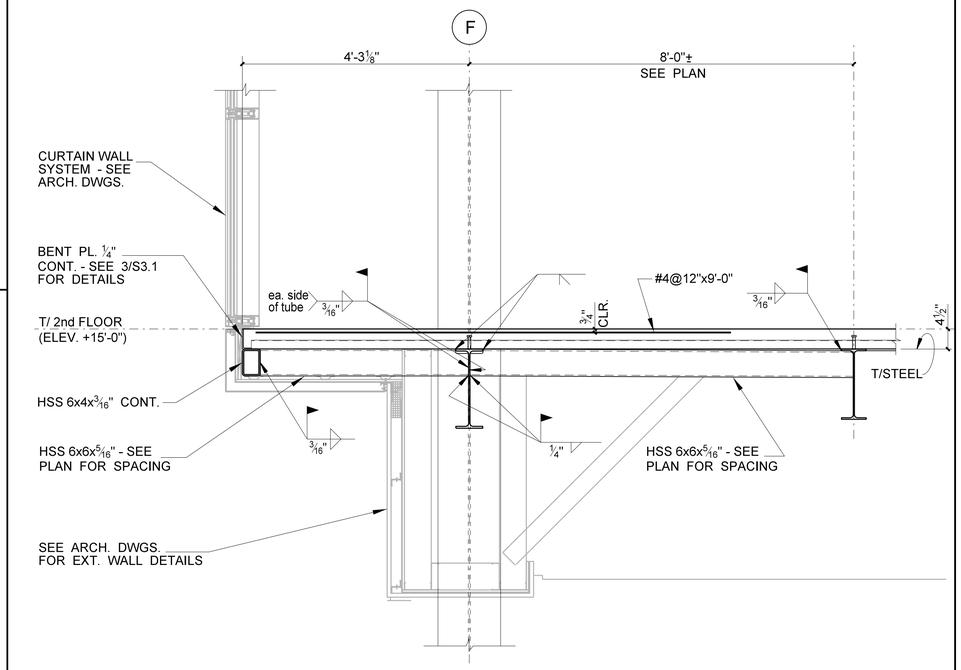
2 EXT. WALL SECTION @ 3rd FLR.
(ABOVE GARAGE SECURITY ENTRY)



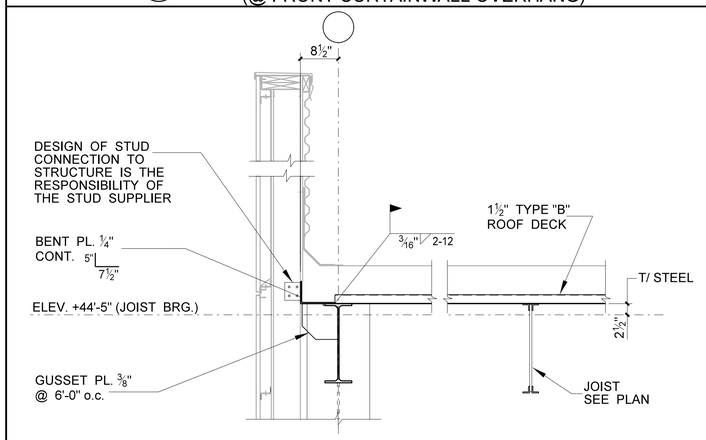
7 EXT. WALL SECTION @ 3rd FLR.
(@ FRONT CURTAINWALL OVERHANG)



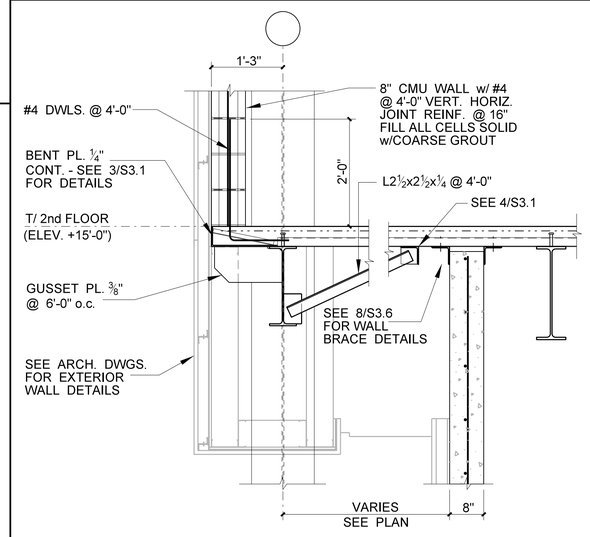
4 EXT. WALL SECTION @ 2nd FLR.



1 EXT. WALL SECTION @ 2nd FLR.
(@ FRONT CURTAINWALL OVERHANG)



6 TYP. ROOF SECTION @ EXT. WALL



3 EXT. WALL SECTION @ 2nd FLR.

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HPSC Police and Court Building

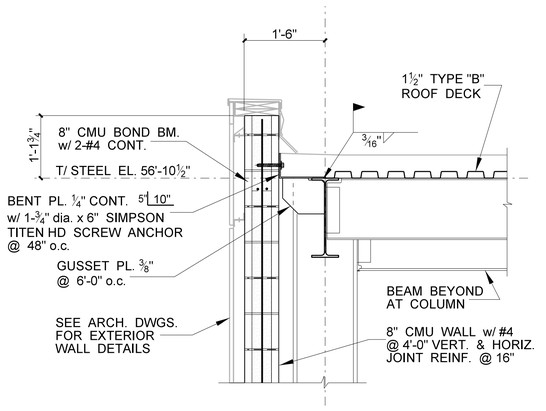
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Date	Rev.	Description
11-19-2018		100% CD

Drawn By:	tw
Checked By:	W.G.
Client No:	———
Albert & Associates:	12575

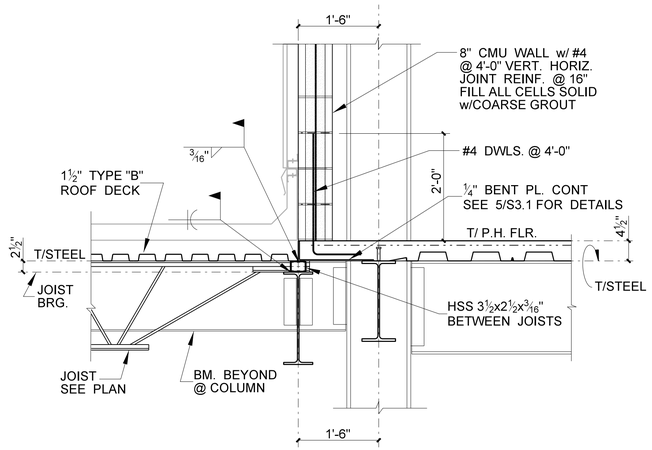
THOMAS C. SCHAEFER — REGISTERED PROFESSIONAL ENGINEER — 21331 — STATE OF MISSISSIPPI

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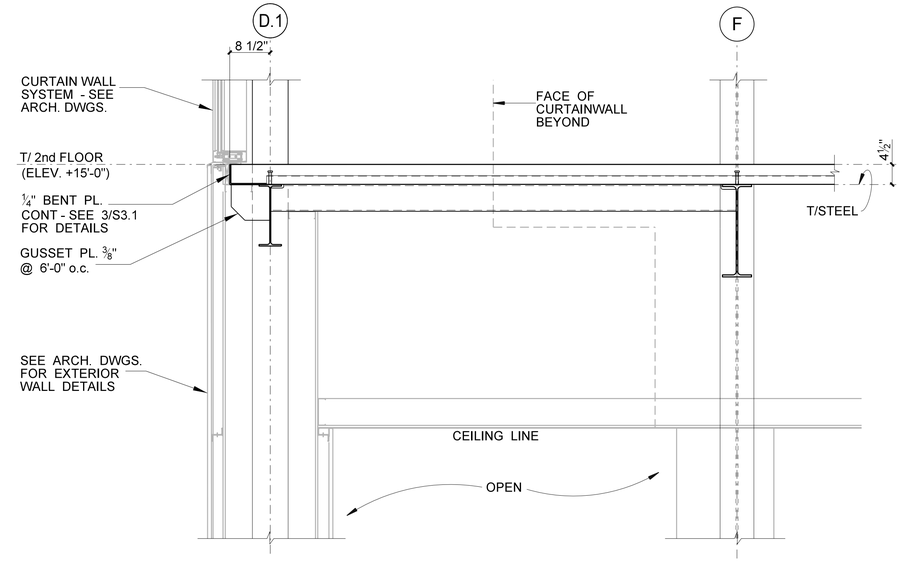
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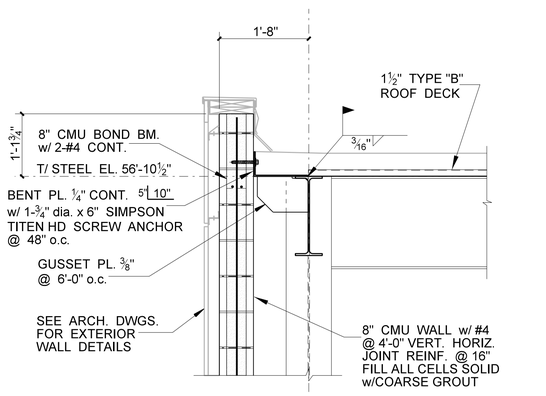
8 EXTERIOR WALL @ P.H. ROOF



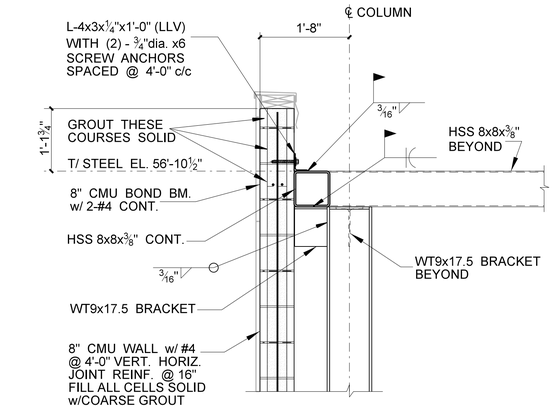
5 EXTERIOR WALL @ P.H. FLOOR AND ROOF



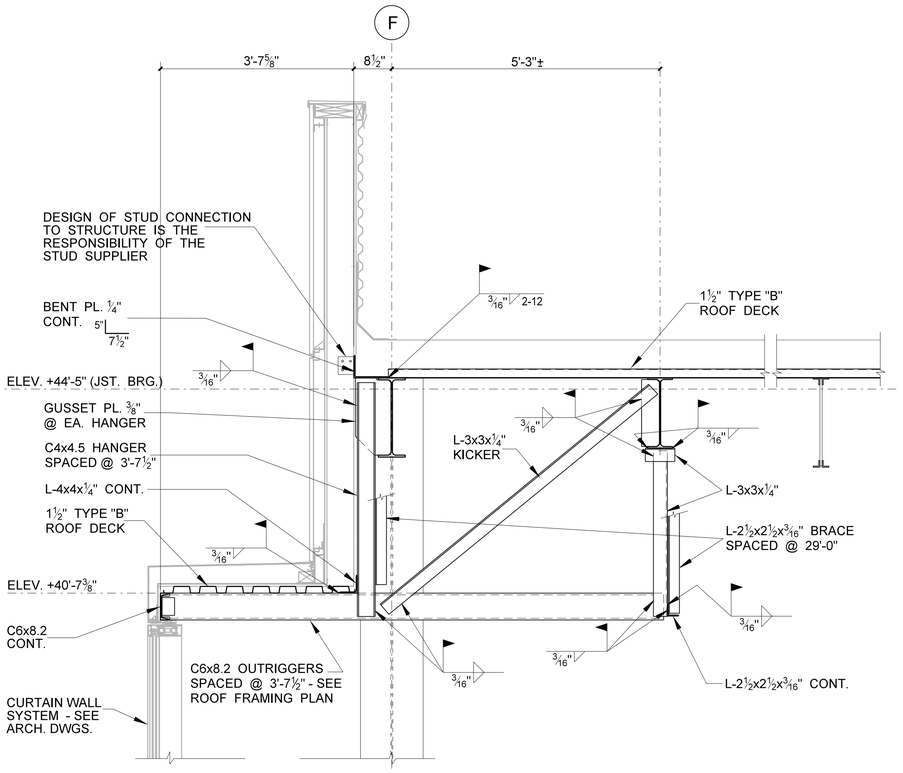
2 SECOND FLOOR SECTION @ CORRIDOR BRIDGE EXTENSION



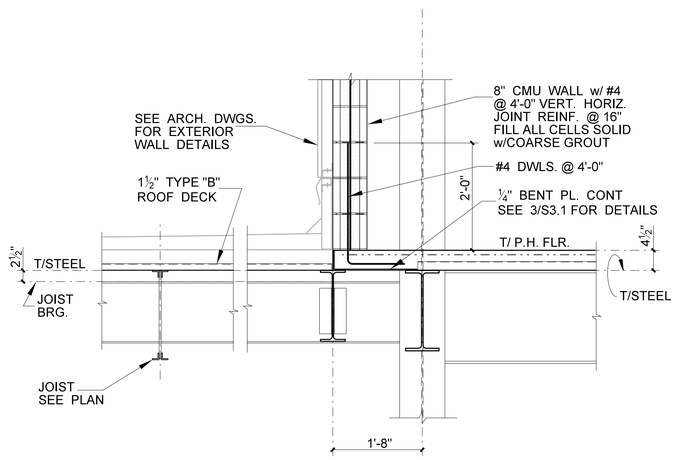
7 EXTERIOR WALL @ P.H. ROOF



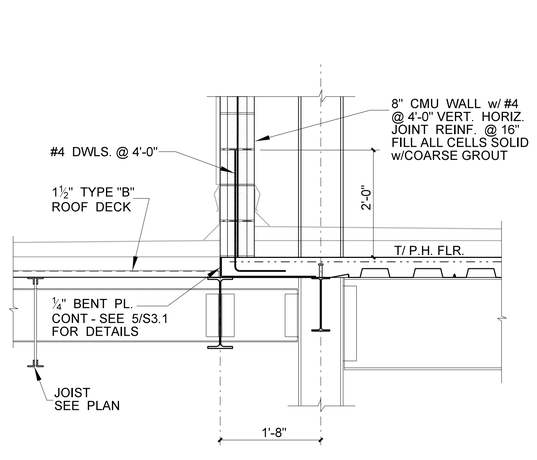
4 SCREEN WALL @ P.H. ROOF



1 TYP. ROOF SECTION @ EXT. WALL (@ FRONT CURTAINWALL OVERHANG)



6 EXTERIOR WALL @ P.H. FLOOR AND ROOF



3 SCREEN WALL SECT.@ ROOF (P.H. FLR. LEVEL)

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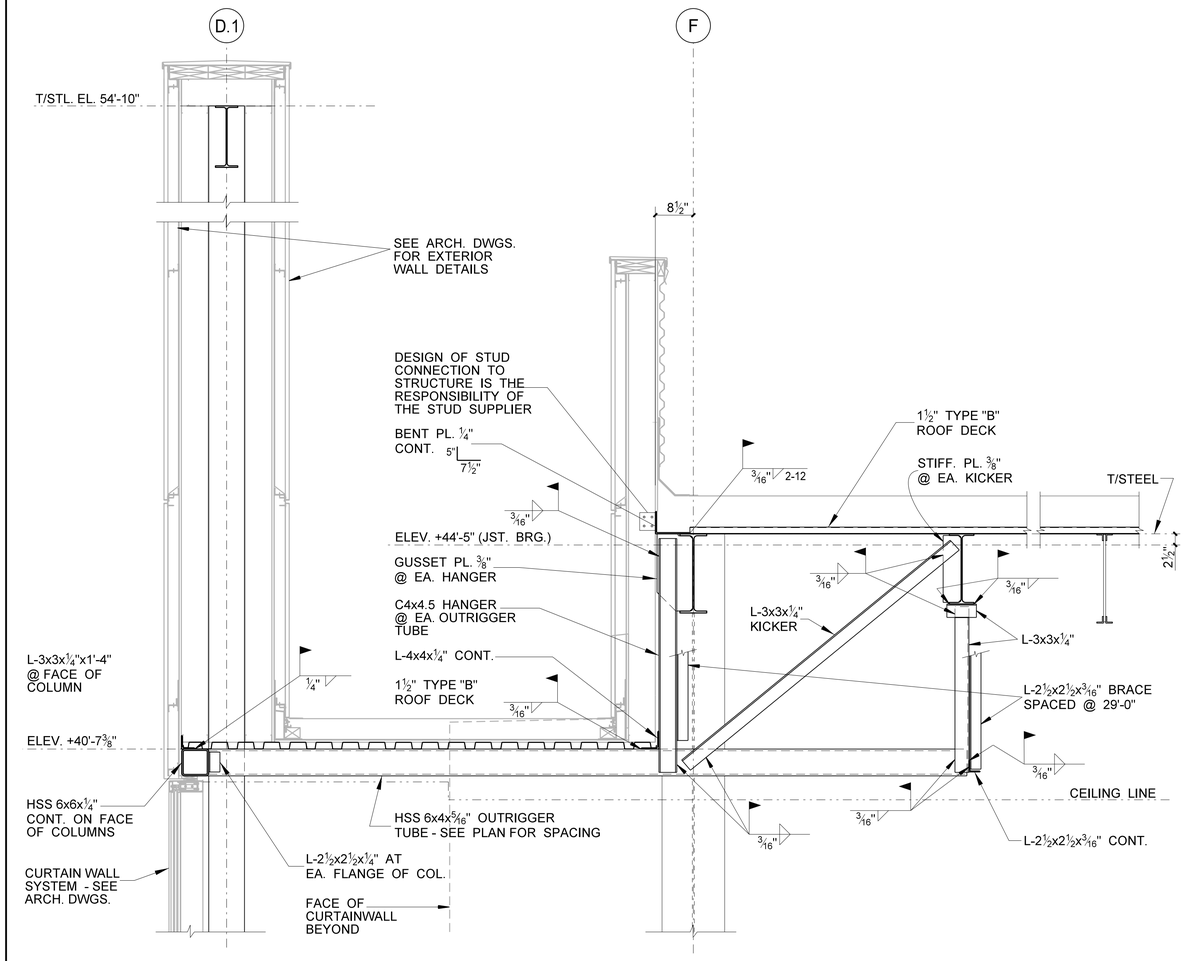
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Client No:	———
Albert & Associates:	12575

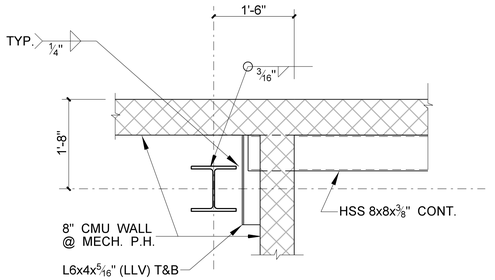
THOMAS C. SCHAEFER — REGISTERED PROFESSIONAL ENGINEER — No. 21331 — STATE OF MISSISSIPPI

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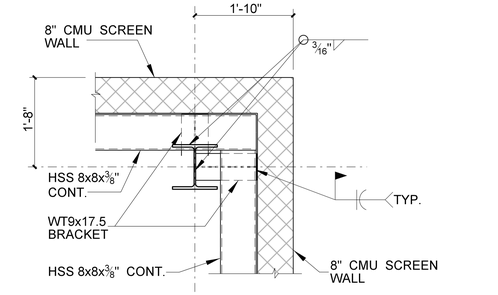
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f. 615.255.1486
SDG Project No. 2015-108.20



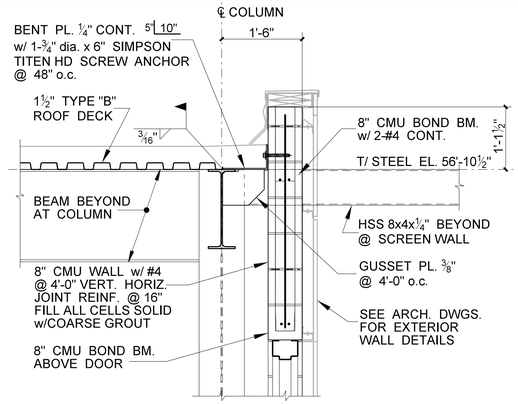
8 ROOF SECTION @ CORRIDOR BRIDGE EXTENSION



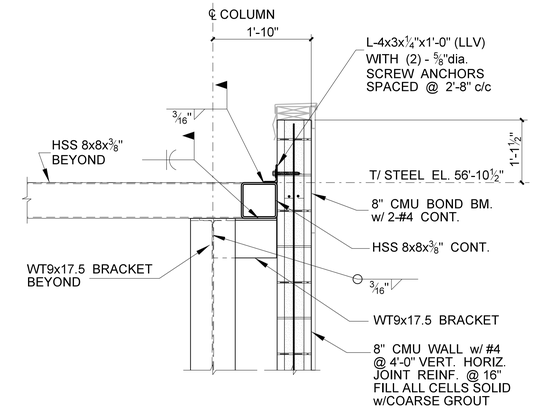
6 PLAN @ P.H. CORNER COL.



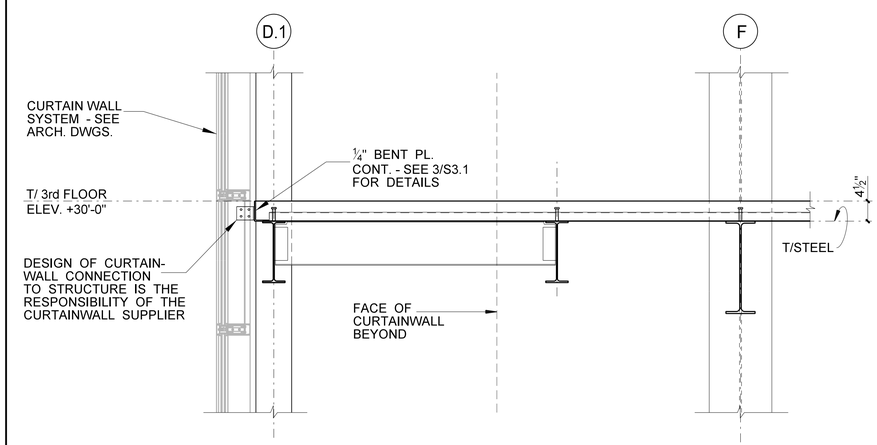
3 PLAN @ SCREEN WALL CORNER COL.



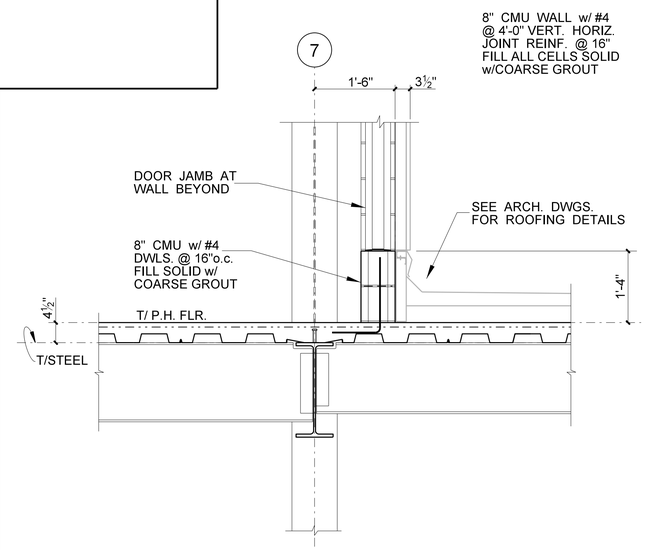
5 EXTERIOR WALL @ P.H. ROOF



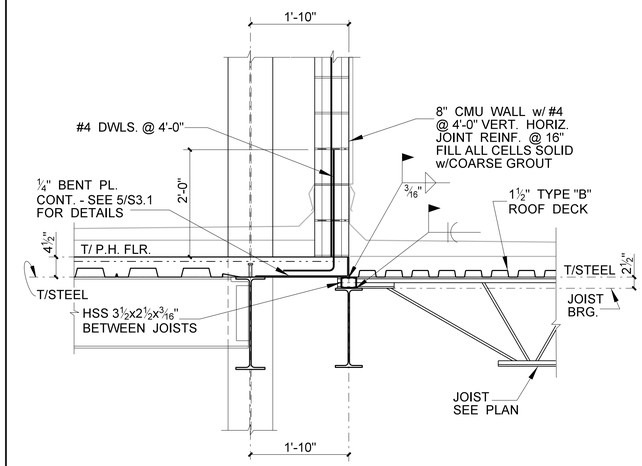
2 SCREEN WALL ROOF SECTION



7 THIRD FLOOR SECTION @ CORRIDOR BRIDGE EXTENSION



4 EXTERIOR WALL @ P.H. ROOF (AT DOOR OPENING)



1 MECH. SCREEN WALL SECTION @ FLR. SLAB / ROOF JOIST

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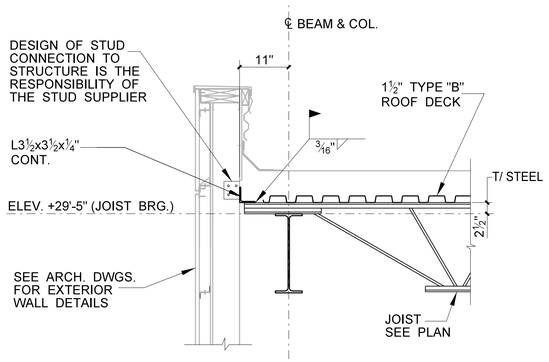
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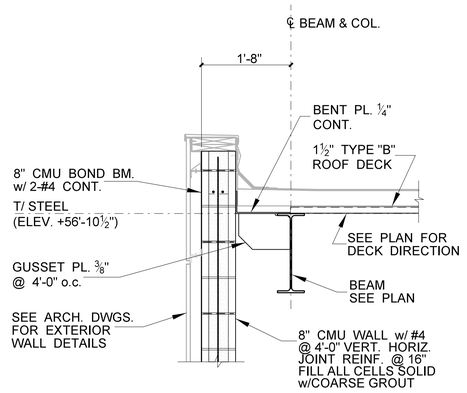
THOMAS C. SCHENCK REGISTERED ENGINEER 21331 STATE OF MISSISSIPPI

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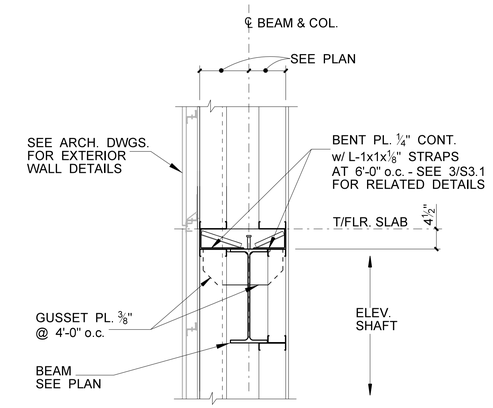
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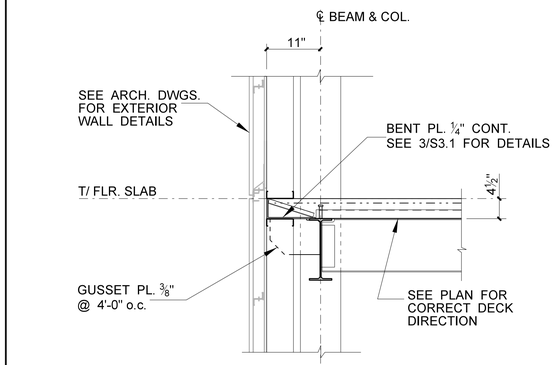
11 EXTERIOR WALL SECTION AT 3rd FLOOR ROOF



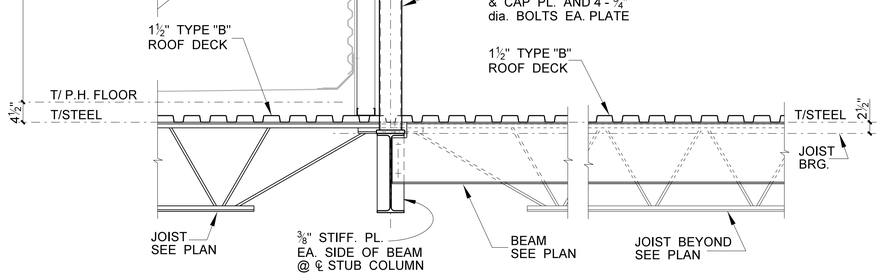
10 TYP. MECH. P.H. ROOF SECTION



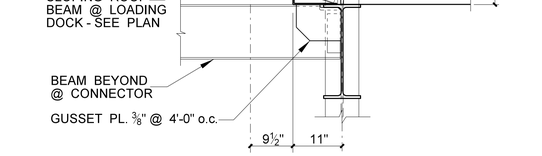
6 EXT. WALL SECTION @ ELEVATOR



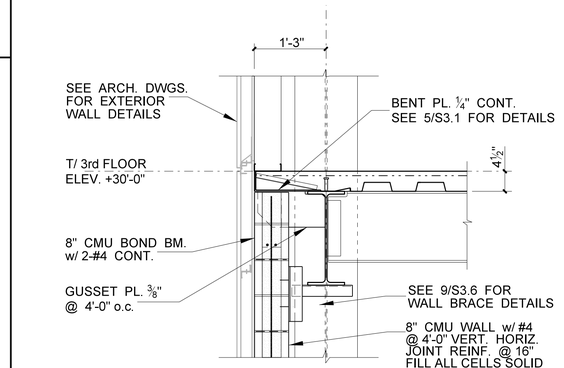
3 EXT. WALL @ FLOOR SLAB



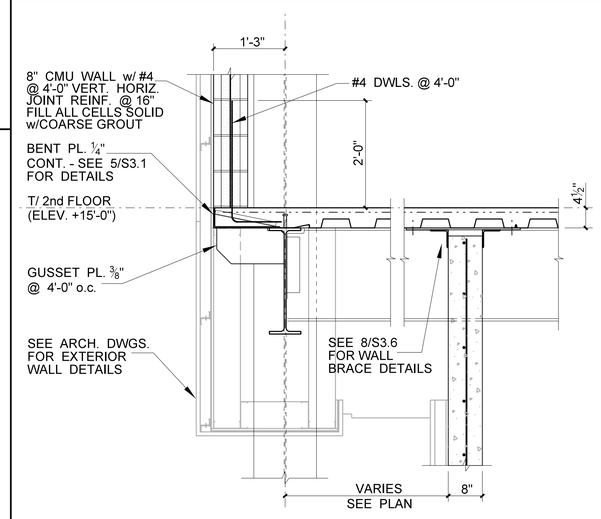
9 SECTION @ ROOFTOP PLENUM



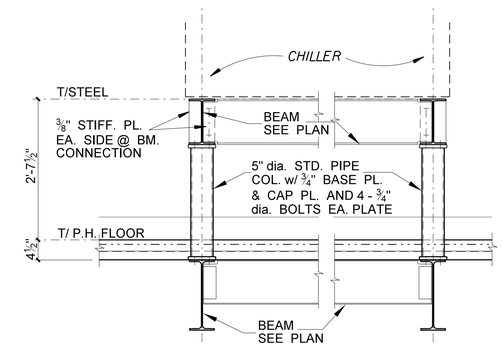
5 2nd FLR. @ LOADING DOCK ROOF



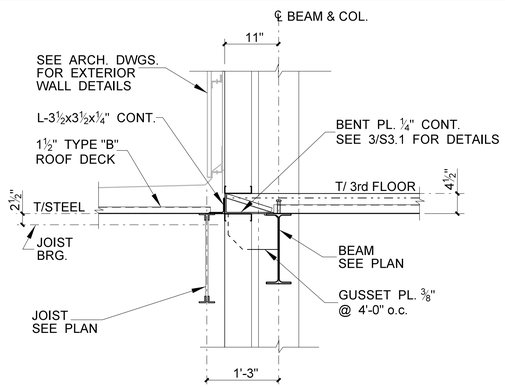
2 EXT. WALL SECTION @ 3rd FLR.



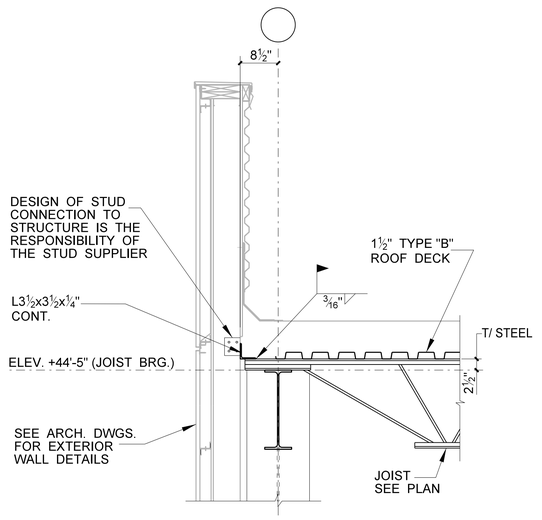
1 EXT. WALL SECTION @ 2nd FLR.



8 TYP. SECTION @ CHILLER SUPPORT



7 3rd FLR. EXT. WALL @ LOW ROOF



4 TYP. ROOF SECTION @ EXT. WALL

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Client No:
Albert & Associates: 12575

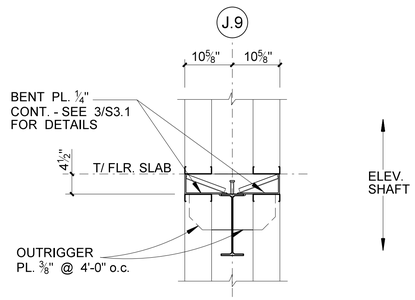
THOMAS C. SCHARLAU 21331 REGISTERED PROFESSIONAL ENGINEER STATE OF MISSISSIPPI

S3.5

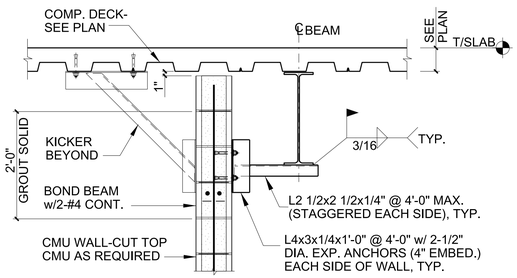
FRAMING SECTIONS AND DETAILS

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com **Albert & McCleskey Associates Architects**

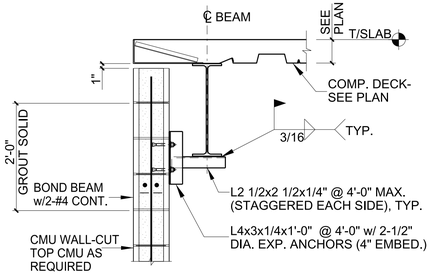
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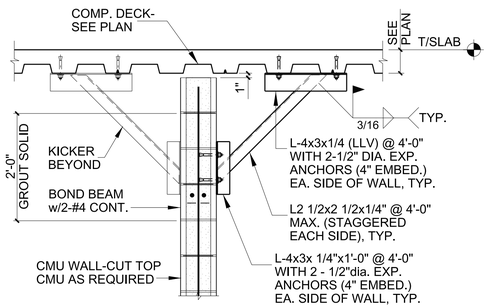
10 ELEV. SHAFT WALL SECTION AT BRACED FRAME #1



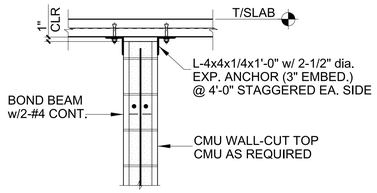
F ADJACENT TO BEAM



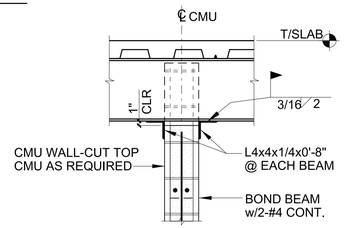
E @ SLAB EDGE



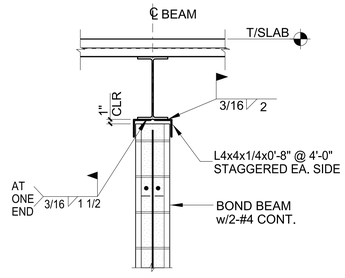
D COMPOSITE SLAB



A WALL PERPENDICULAR TO DECK

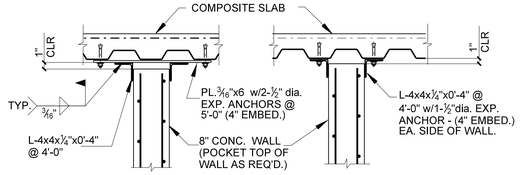


B CMU PERPENDICULAR TO BEAM

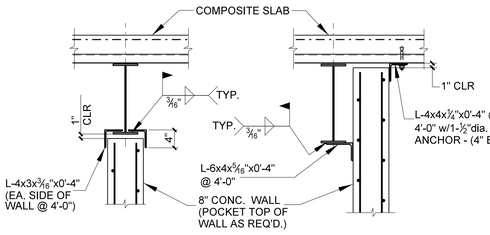


C CMU PARALLEL TO BEAM

9 TYPICAL CMU PARTITION WALL BRACING DETAILS @ COMPOSITE SLAB

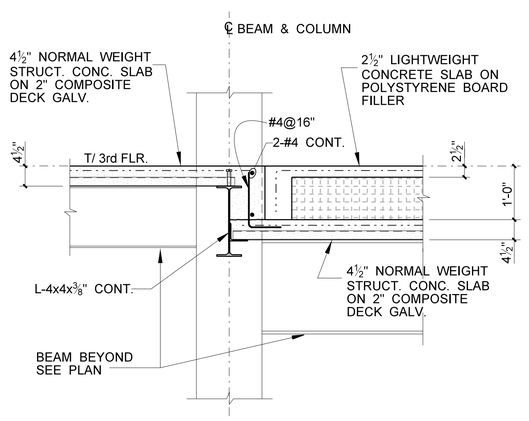


WALL PARALLEL WITH DECK SPAN/DIRECTION

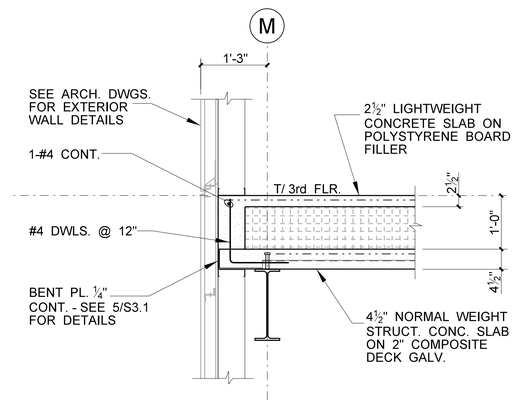


WALL PERPENDICULAR TO DECK SPAN/DIRECTION

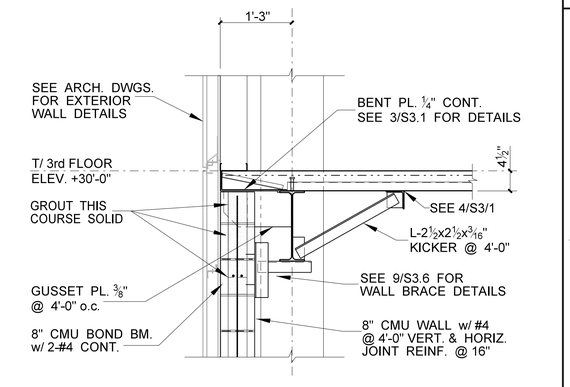
8 TYPICAL CONCRETE WALL BRACING DETAILS AT COMPOSITE SLAB



7 3rd FLR. SECTION @ RAISED FLR. SLAB

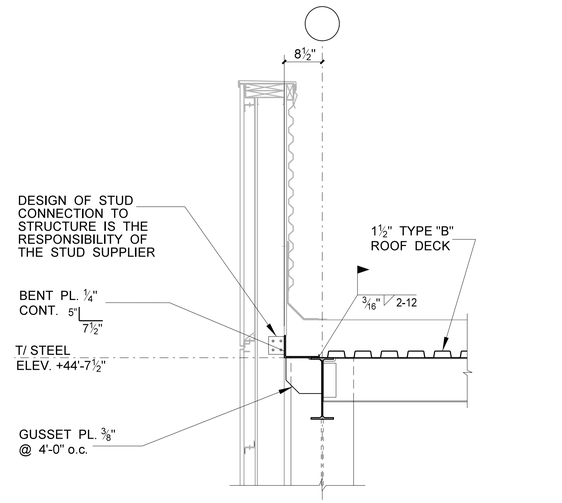


6 EXT. WALL SECTION @ 3rd FLR. (@ DROPPED SLAB FOR COMPUTER FLR.)

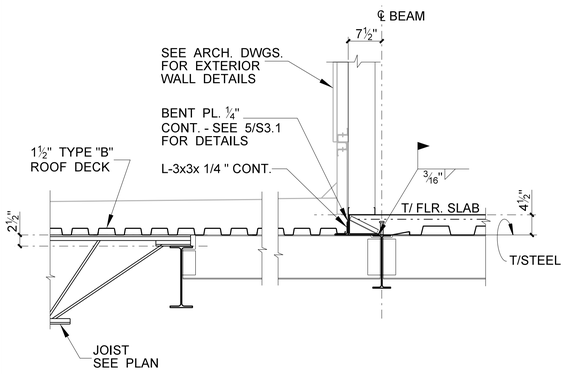


5 EXT. WALL SECTION @ 3rd FLR.

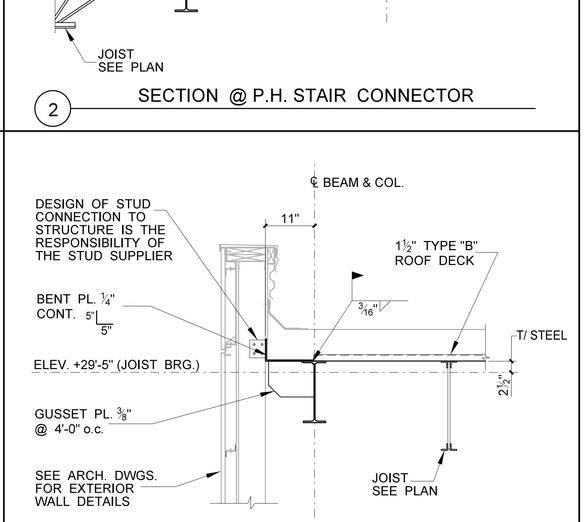
4 STAIR SECT. @ ROOFTOP PLENUM



3 TYP. ROOF SECTION @ EXT. WALL



2 SECTION @ P.H. STAIR CONNECTOR



1 EXTERIOR WALL SECTION AT 3rd FLOOR ROOF

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220 Great Circle Road, Suite 106
Nashville, Tennessee 37228
p. 615.255.5537
f. 615.255.1486
SDG Project No. 2015-108.20

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

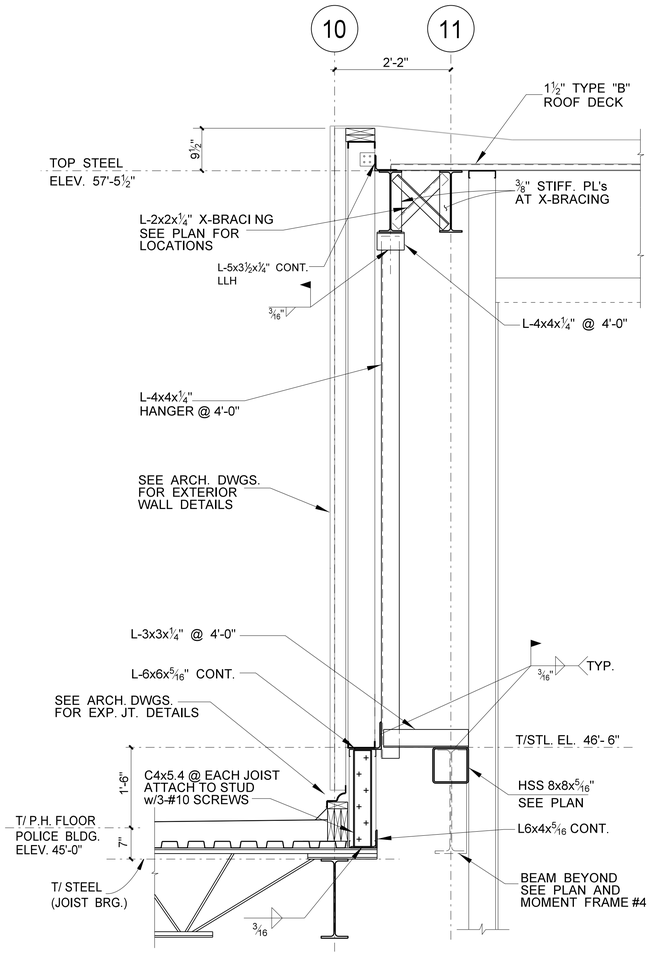
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11-19-2018	100% CD

Drawn By:	tw
Checked By:	W.G.
Client No:	------
Albert & Associates:	12575

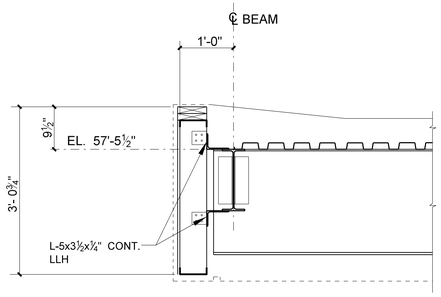
THOMAS C. SCHAEFER — REGISTERED PROFESSIONAL ENGINEER — 21331 — STATE OF MISSISSIPPI

S3.6

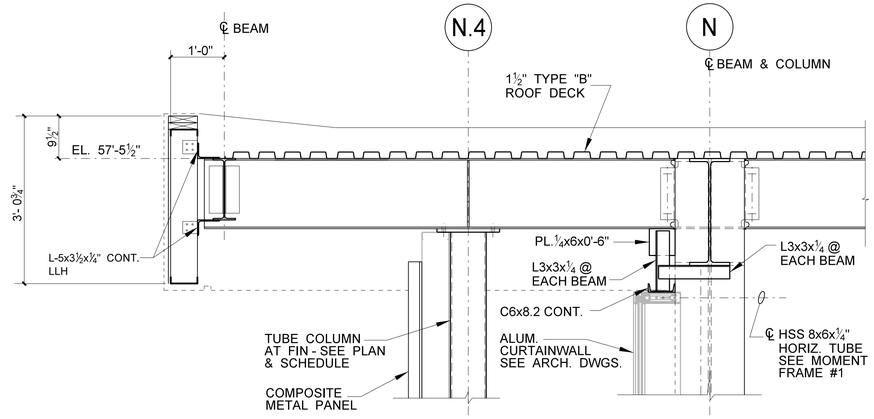
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Staff:
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5 ATRIUM ROOF SECTION AT POLICE BLDG. ROOF

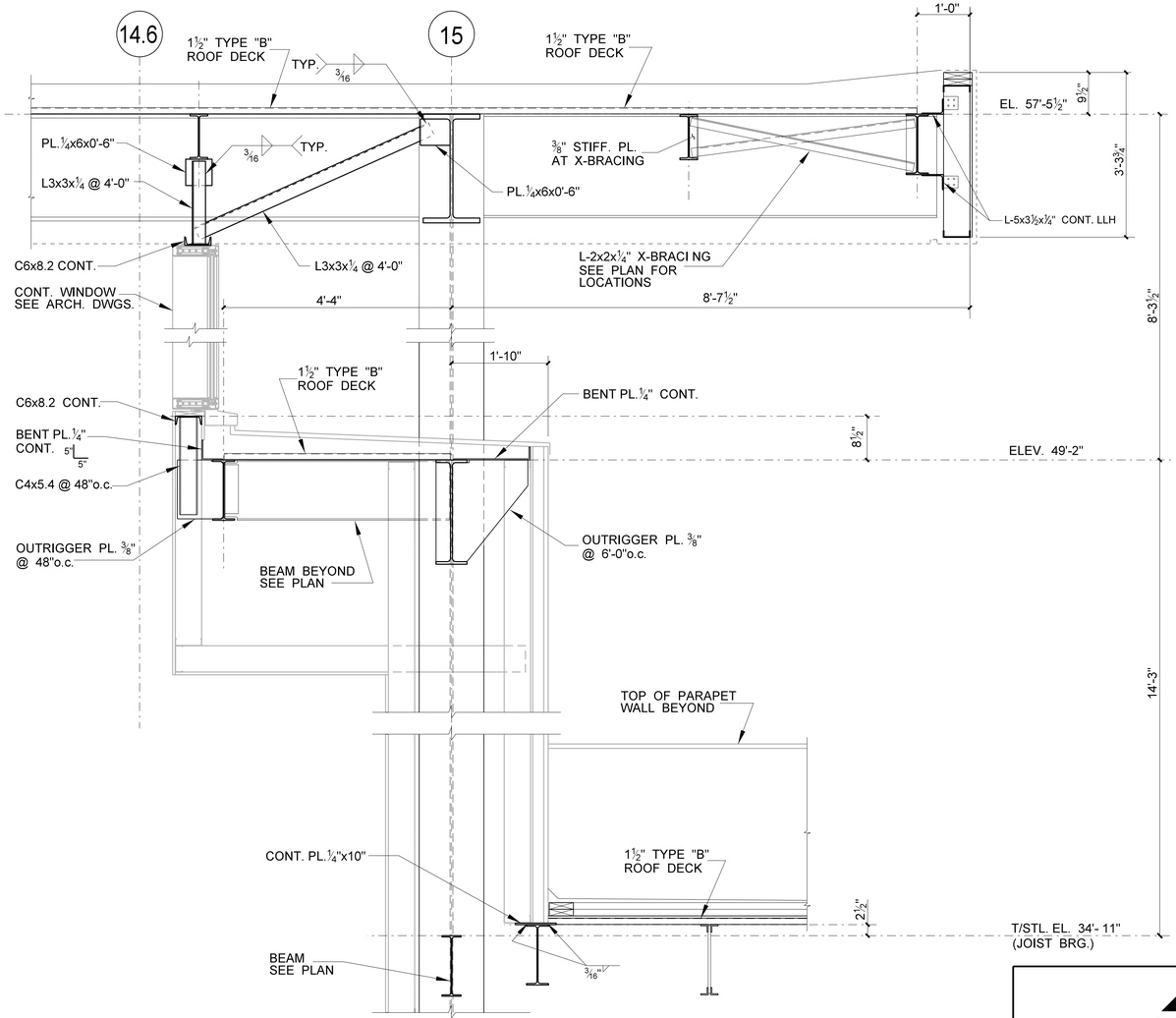


3 TYP. ATRIUM ROOF SECTION



2 ATRIUM ROOF SECTION AT MOMENT FRAME #1

4 ATRIUM EXT. WALL @ 3rd FLR.



1 ATRIUM ROOF SECTION AT CONT. RECESSED WINDOW

CITY OF HATTIESBURG MISSISSIPPI

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Date	Rev.	Description
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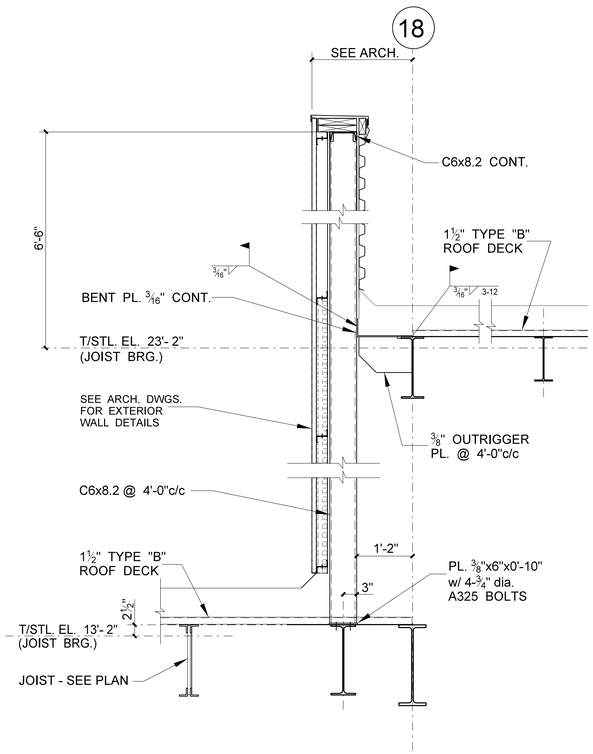
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Checked By: W.G.
Client No: ——
Albert & Associates: 12575

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S3.7

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Nashville, Tennessee 37228
p. 615.255.5537
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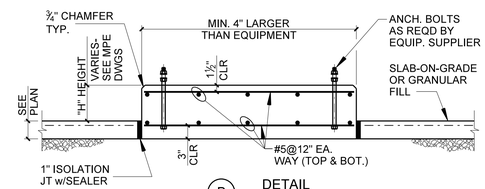
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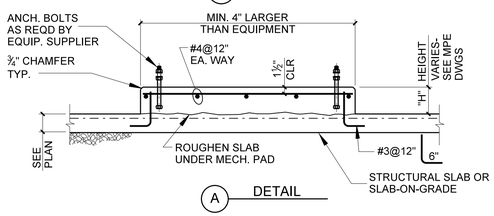
6 HIGH ROOF / LOW ROOF SECTION

NOTES

1. PAD AND CURB DETAILS DEPICTED ABOVE SHALL APPLY UNLESS NOTED OTHERWISE IN THE CONTRACT DOCUMENTS. COORDINATE CURB WIDTHS AND HEIGHTS WITH THE ARCHITECTURAL AND STRUCTURAL DRAWINGS. THE HEIGHT "H" OF MECHANICAL EQUIPMENT PADS SHALL BE COORDINATED WITH THE MPE DRAWINGS.
2. THE CONTRACTOR SHALL PROVIDE CONCRETE PADS ADEQUATE FOR THE SUPPORT OF THE MPE EQUIPMENT. EXACT SIZES, LOCATIONS, HEIGHTS AND ANY SPECIAL DETAILS FOR THE PADS SHALL BE OBTAINED FROM THE VENDORS BEFORE INSTALLATION OF THE PADS. PADS SHALL BE INSTALLED IN ACCORDANCE WITH THE EQUIPMENT STANDARDS. ALL EMBEDDED ITEMS SHALL BE COORDINATED WITH THE EQUIPMENT SUPPLIER. THE PADS SHALL RECEIVE A SMOOTH TROWELED FINISH.
3. DETAIL 'A'--FOR USE UNDER ALL EQUIPMENT SUPPORTED ON SLABS-ON-GRADE. DETAIL IS ALSO APPLICABLE FOR ALL EQUIPMENT SUPPORTED ON ELEVATED STRUCTURAL SLABS
4. DETAIL 'B'--FOR USE UNDER ALL EQUIPMENT WEIGHING OVER 2000 POUNDS SUPPORTED ON SLABS-ON-GRADE.

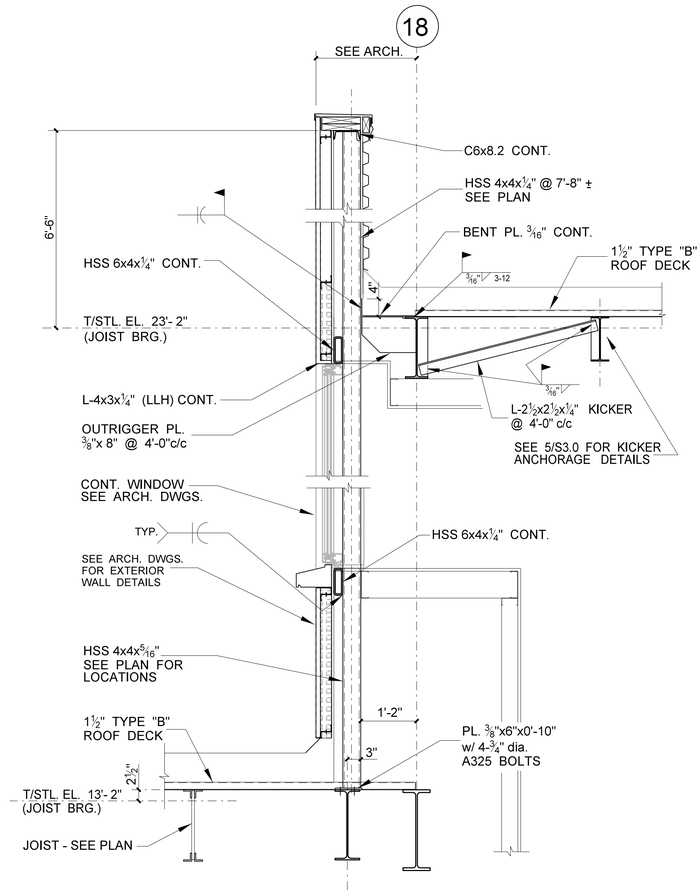


B DETAIL

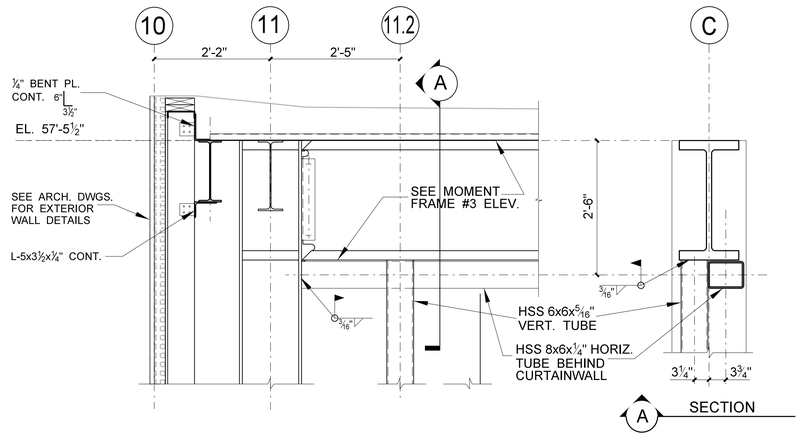


A DETAIL

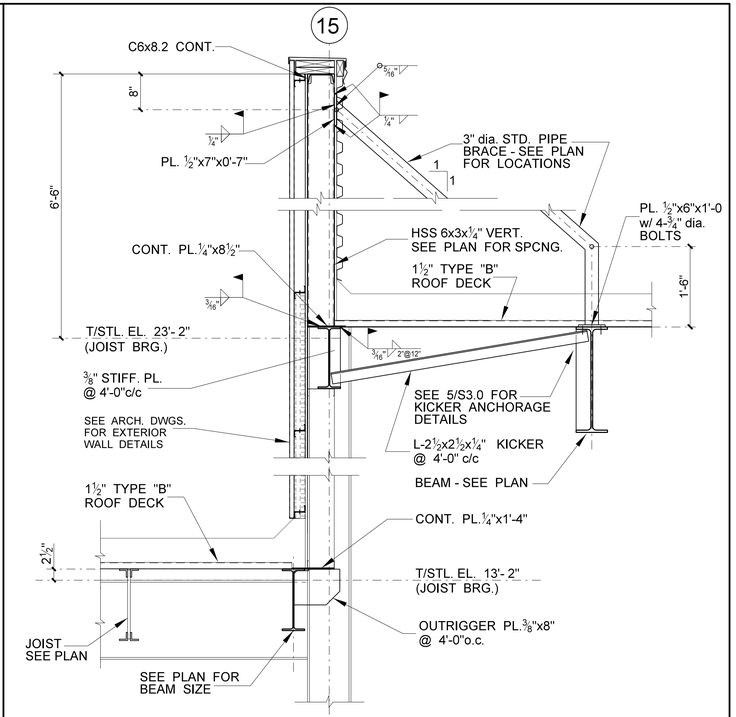
5 HOUSEKEEPING EQUIPMENT PAD DETAIL



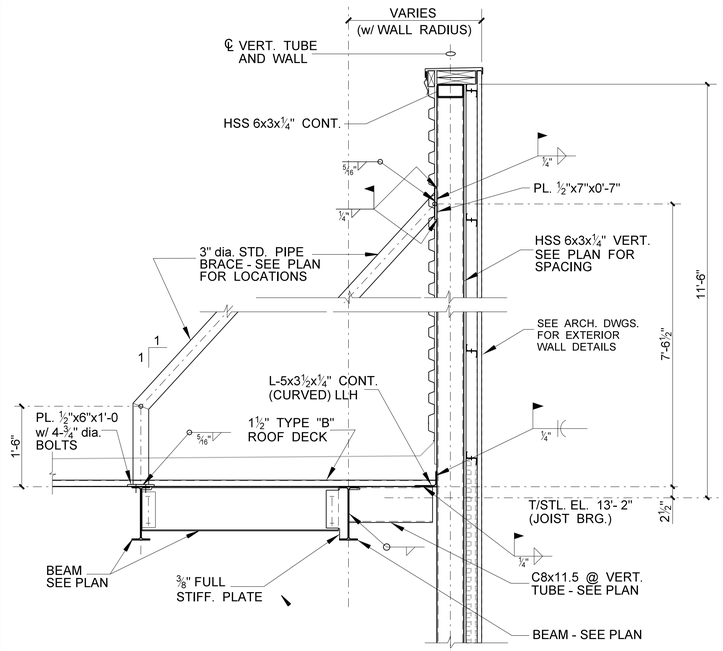
4 HIGH ROOF / LOW ROOF SECTION AT CLERESTORY WINDOW



3 ROOF FRAMING DETAIL



2 HIGH ROOF / LOW ROOF SECTION



1 LOW ROOF @ HIGH PARAPET (AT CURVED WALL)

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Nashville, Tennessee 37228
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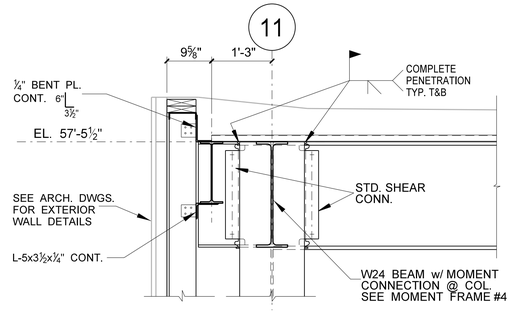
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Checked By: W.G.
Client No: ------
Albert & Associates: 12575

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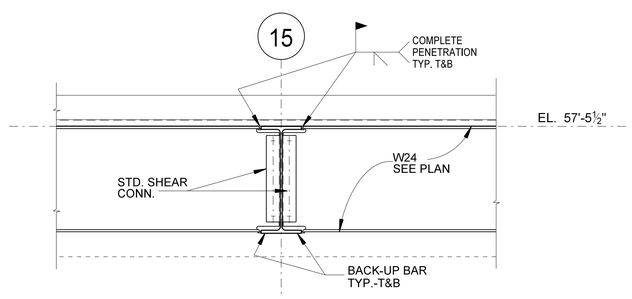
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FRAMING SECTIONS AND DETAILS

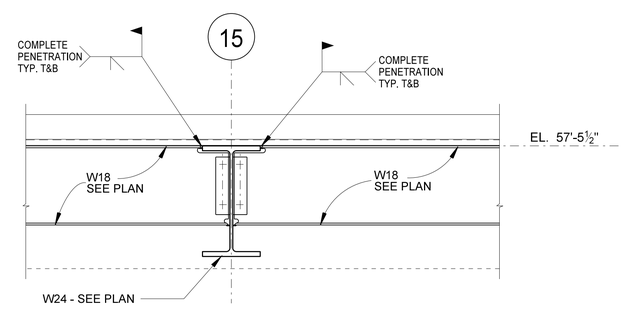
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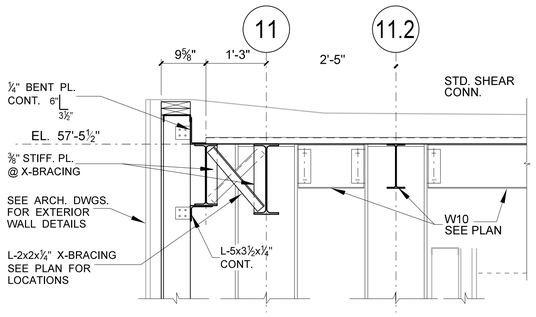
12 ROOF FRAMING DETAIL



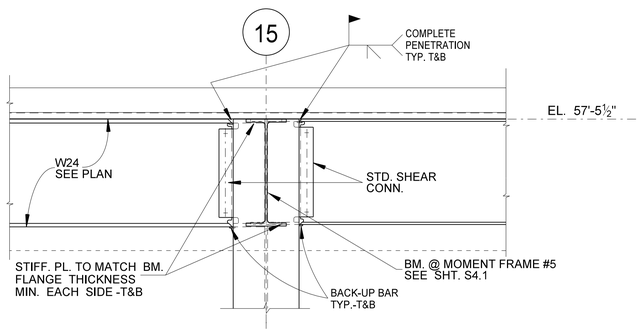
8 ROOF FRAMING DETAIL



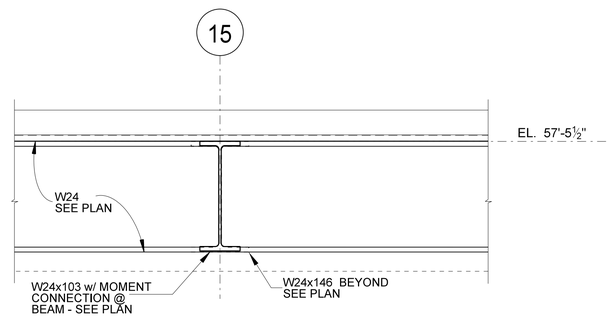
4 ROOF FRAMING DETAIL



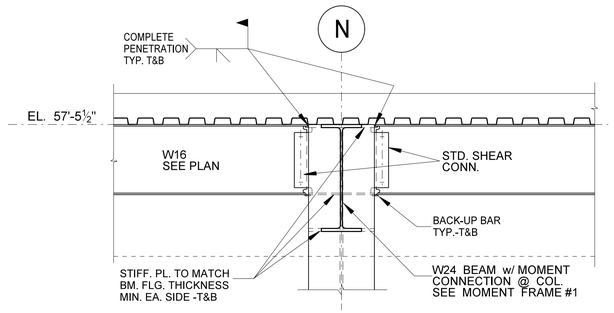
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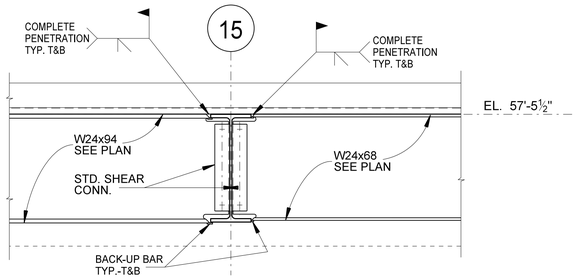
7 ROOF FRAMING DETAIL



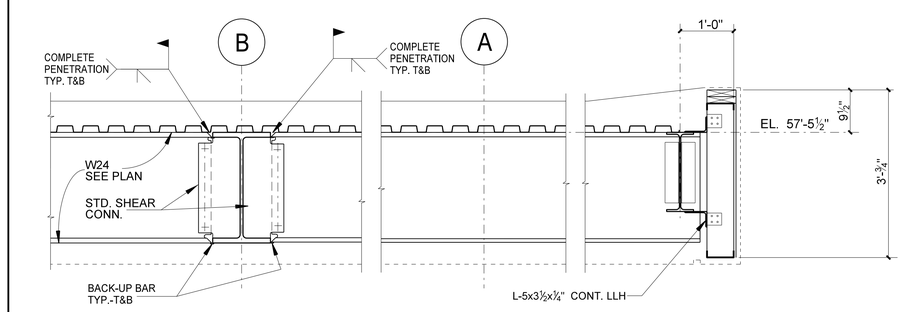
3 ROOF FRAMING DETAIL



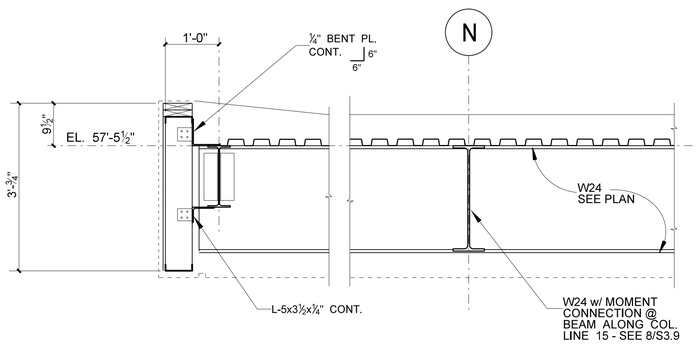
10 ROOF FRAMING DETAIL



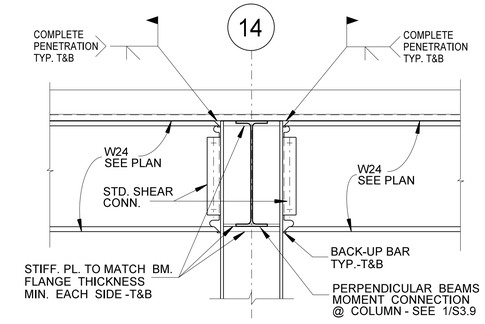
6 ROOF FRAMING DETAIL



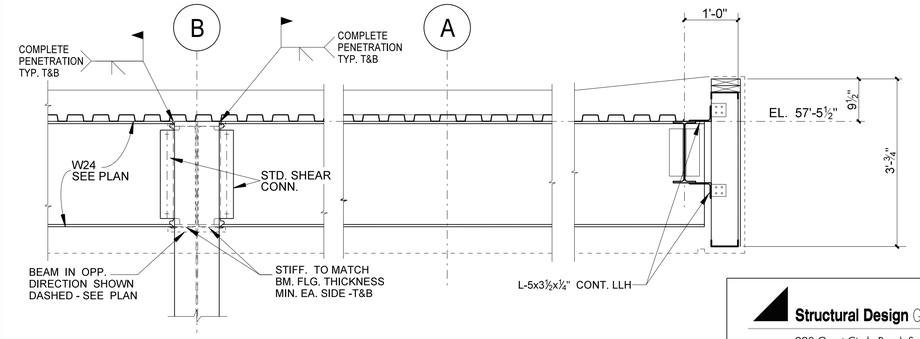
2 ROOF FRAMING DETAIL



9 ROOF FRAMING DETAIL



5 ROOF FRAMING DETAIL



1 ATRIUM ROOF SECTION AT ENTRY

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220 Great Circle Road, Suite 106
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HPSC Police and Court Building

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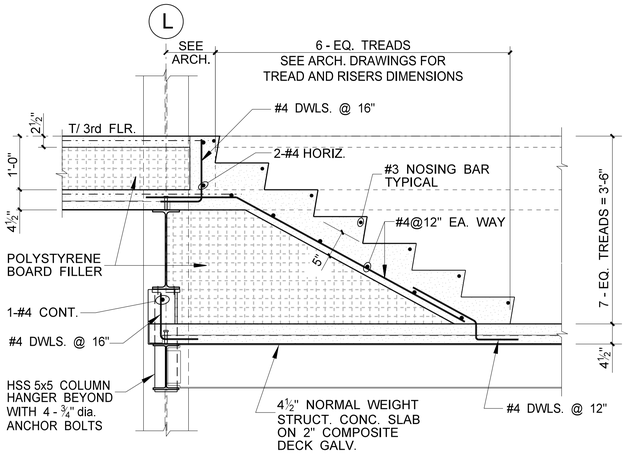
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Albert & Associates: 12575

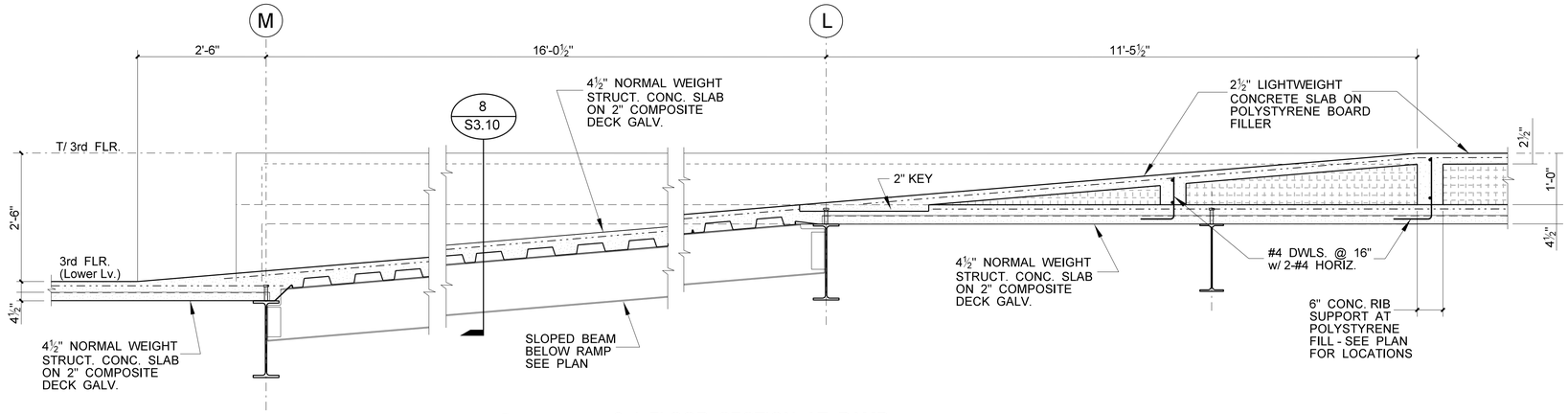
THOMAS C. SCHAFER — REGISTERED PROFESSIONAL ENGINEER — 11331 — STATE OF MISSISSIPPI

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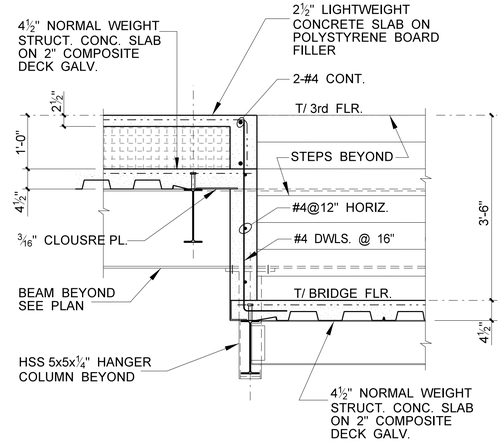
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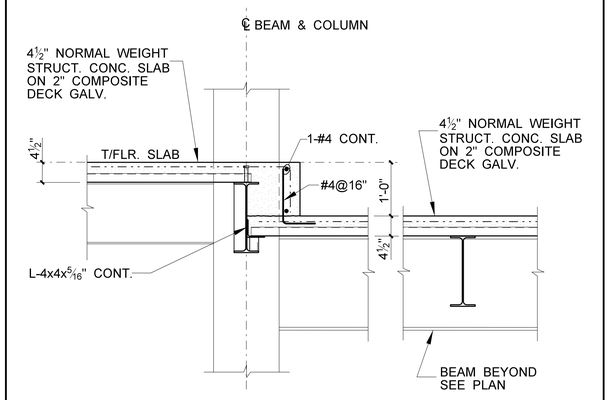
10 STEPS @ 3rd FLR. BRIDGE WALKWAY



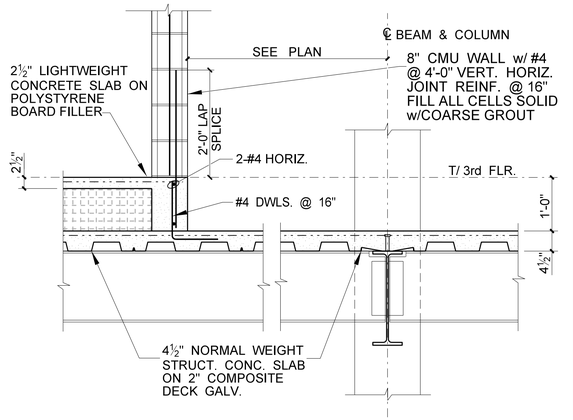
5 3rd FLOOR SECTION AT RAMP



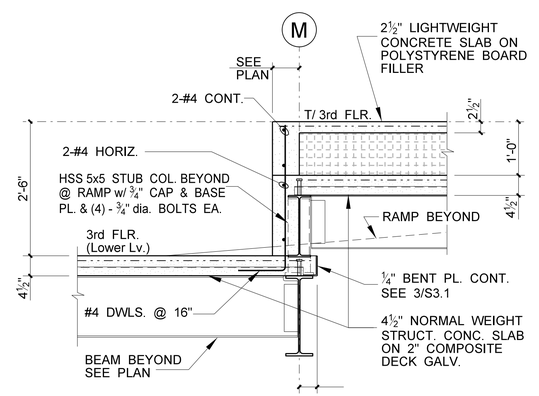
9 3rd FLR. @ BRIDGE WALKWAY



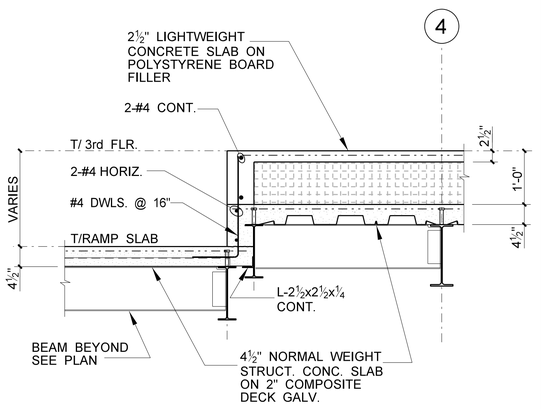
7 FLOOR SLAB @ COMPUTER FLOOR



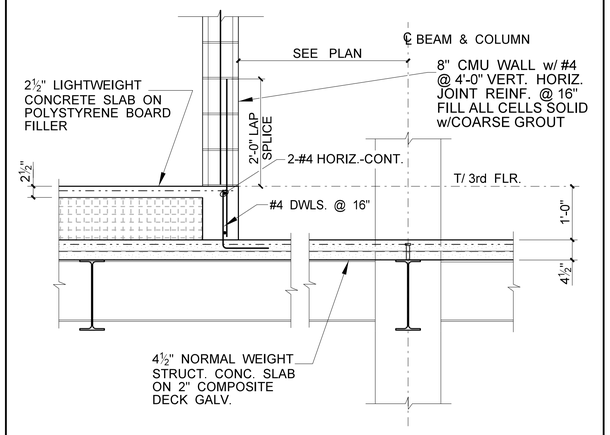
4 FLOOR SLAB @ COMPUTER FLOOR



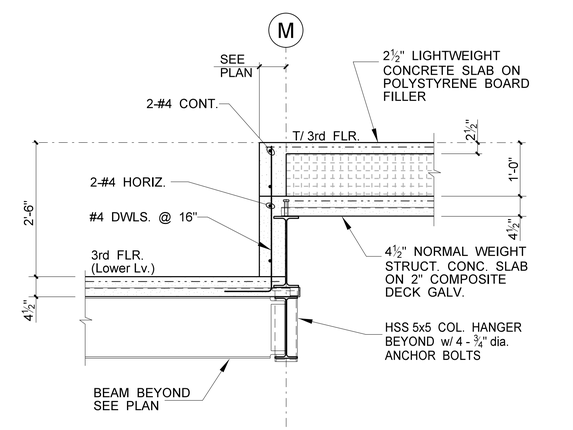
2 3rd FLOOR LOWER LEVEL (@ DROPPED SLAB FOR COMPUTER FLR.)



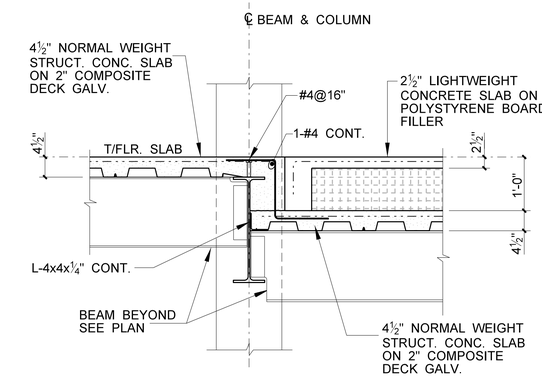
8 SECTION THRU RAMP @ 3rd FLR



6 FLOOR SLAB @ COMPUTER FLOOR



3 3rd FLOOR LOWER LEVEL (@ DROPPED SLAB FOR COMPUTER FLR.)



1 3rd FLR. SECTION @ DROPPED SLAB

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Date	Rev.	Description
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Checked By:	W.G.
Client No:	----------
Albert & Associates:	12575

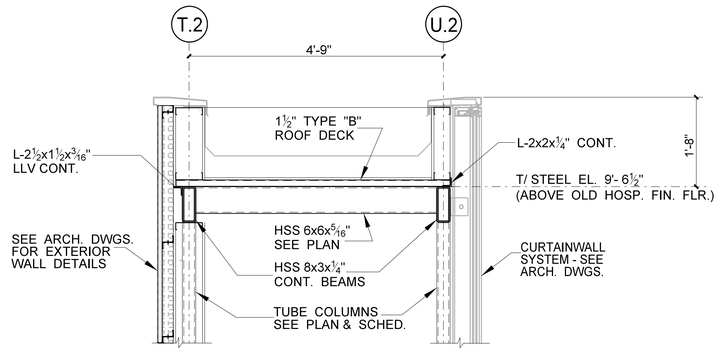
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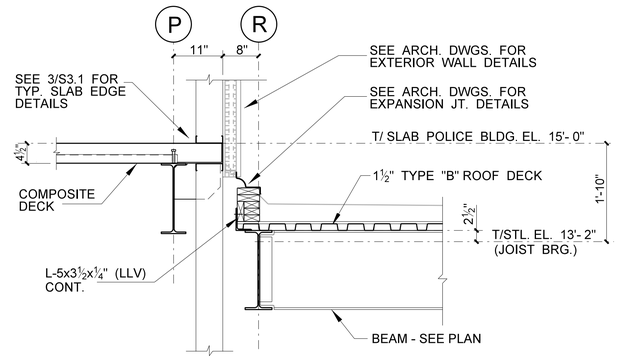
514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com
Albert & McCleskey Associates Architects

FRAMING SECTIONS AND DETAILS

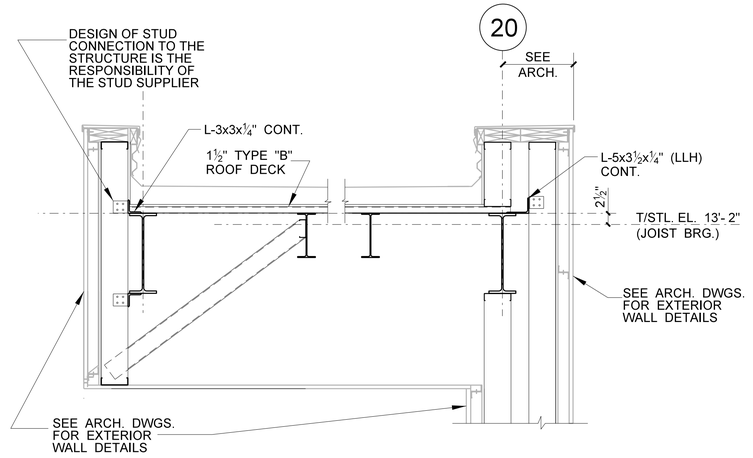
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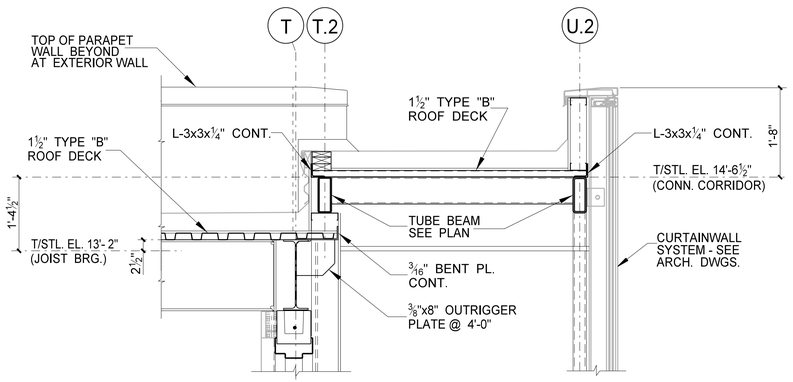
8 SECTION @ CONNECTING CORRIDOR TO EXISTING BUILDING



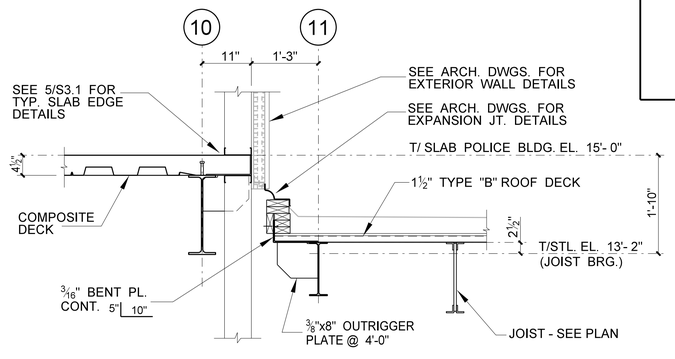
5 LOW ROOF @ POLICE BUILDING



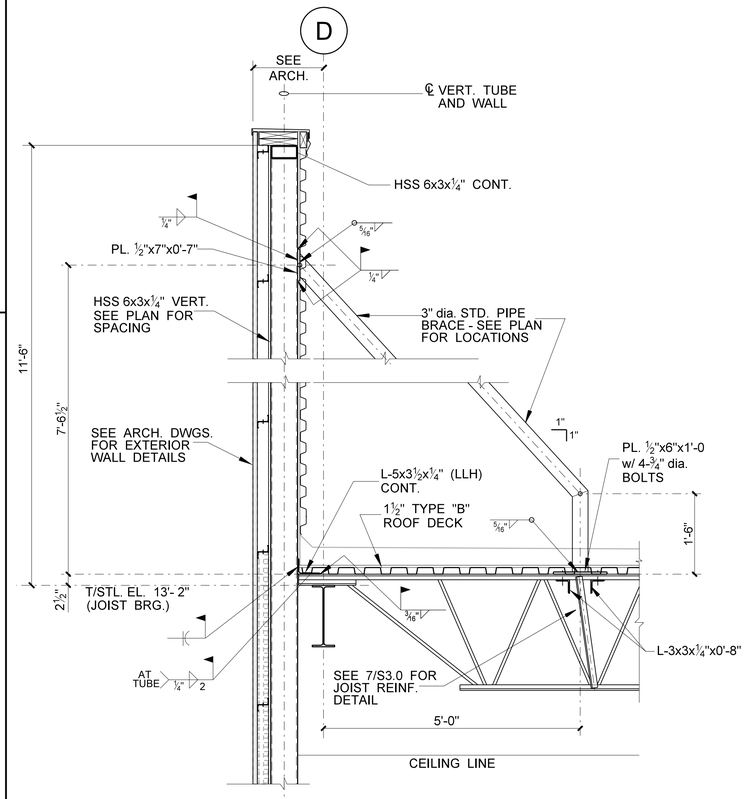
2 LOW ROOF CANOPY SECTION (AT EXTERIOR WINGWALL



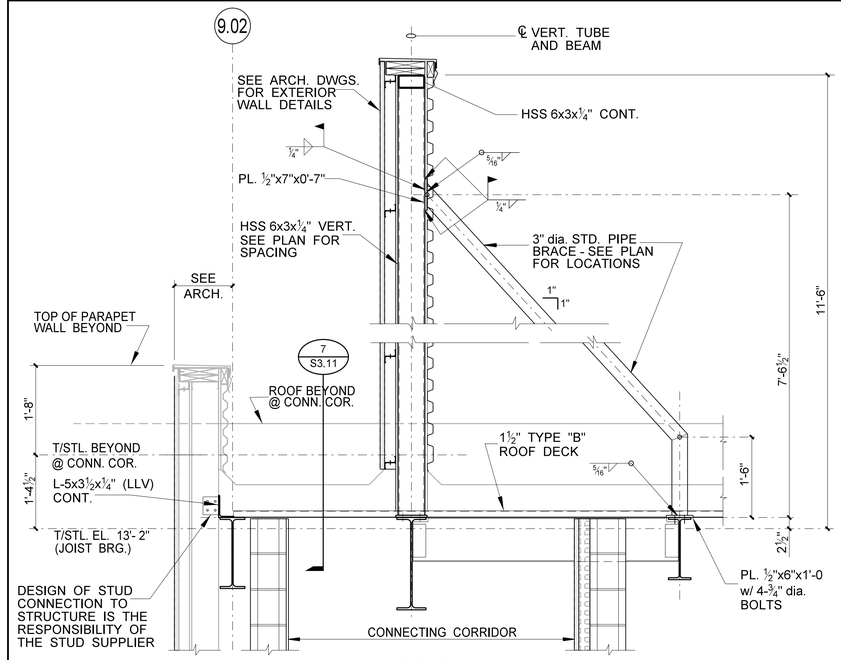
7 ROOF SECT. @ CONNECTING CORRIDOR (AT EXTERIOR CORRIDOR)



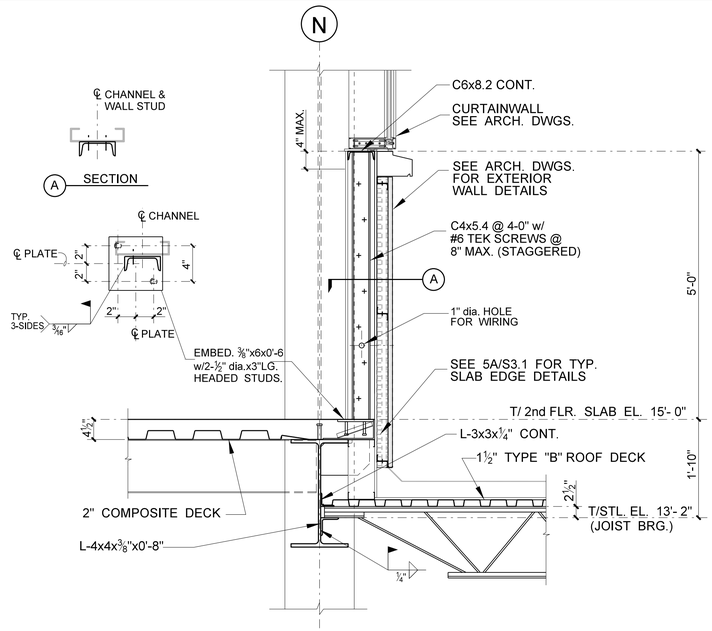
4 LOW ROOF @ POLICE BUILDING



1 LOW ROOF @ HIGH PARAPET (JOIST PERPENDICULAR)



6 ROOF SECTION AT CONNECTING CORRIDOR



3 LOW ROOF @ POLICE LOBBY

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CITY OF HATTIESBURG MISSISSIPPI

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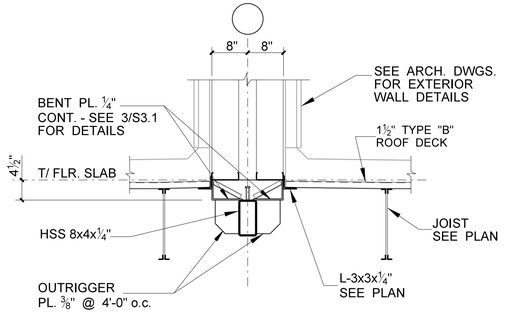
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Albert & Associates:	12575

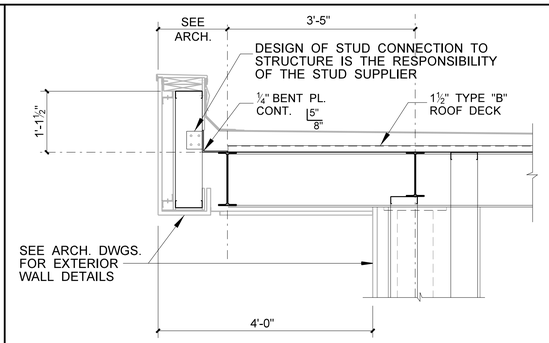
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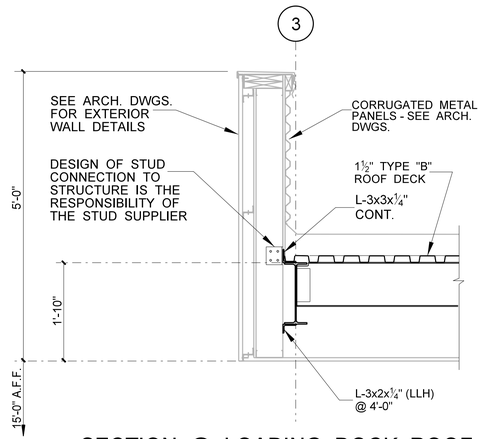
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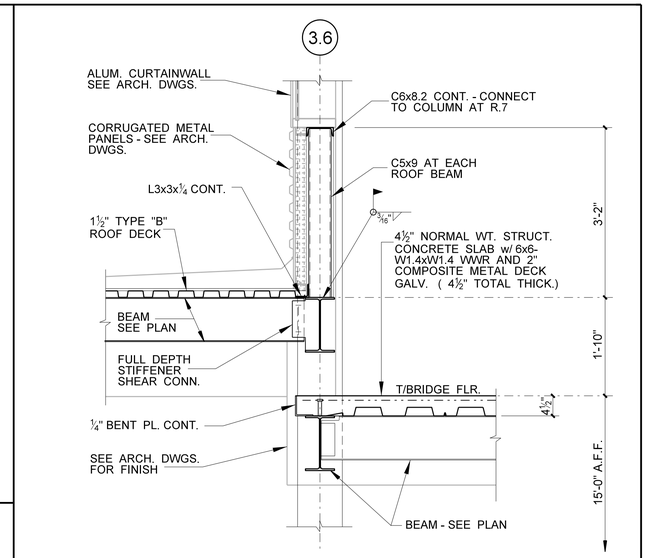
13 SECTION



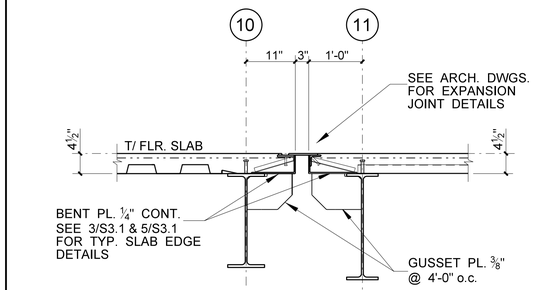
9 STAIR "B" ROOF SECTION



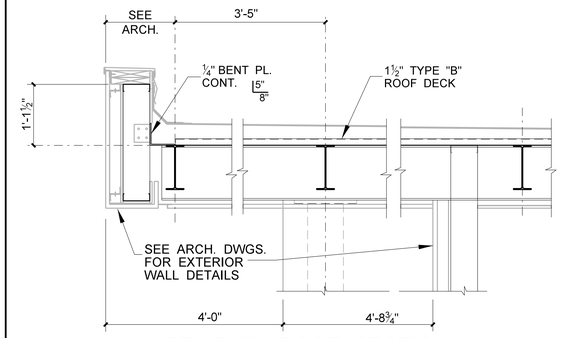
5 SECTION @ LOADING DOCK ROOF



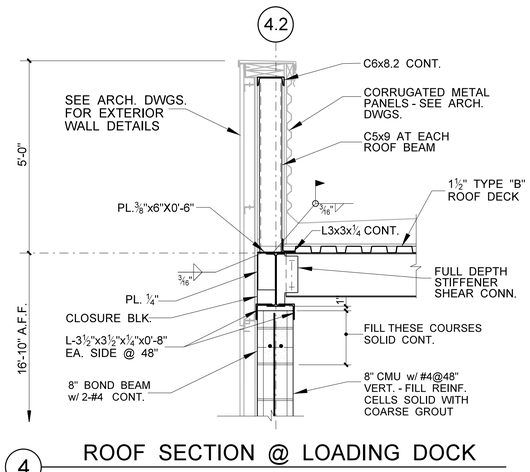
2 BRIDGE SECTION @ LOADING DOCK



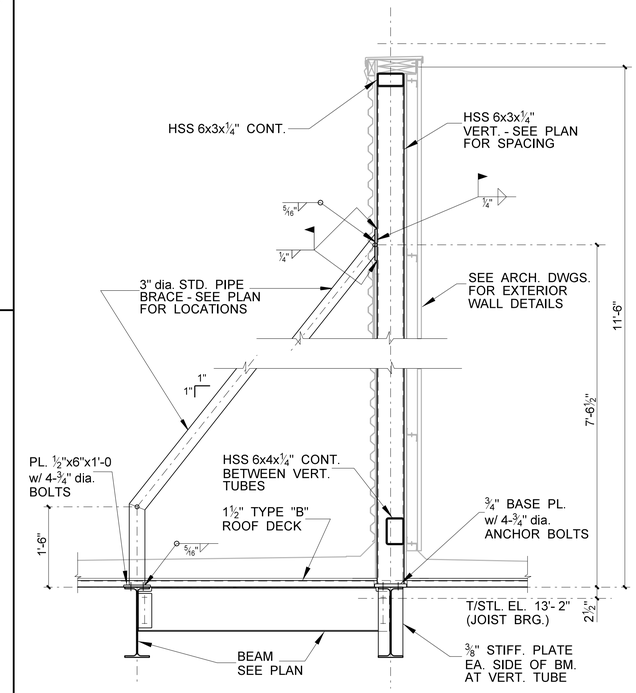
12 TYP. SECTION @ EXPANSION JT.



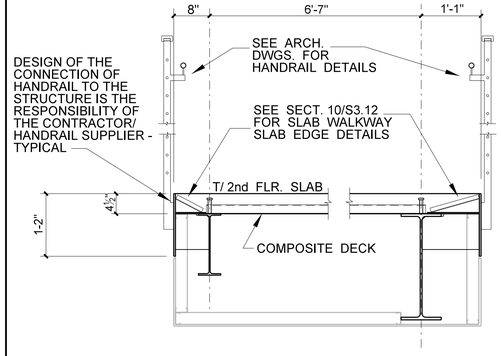
8 STAIR "B" ROOF SECTION (@ CONNECTOR)



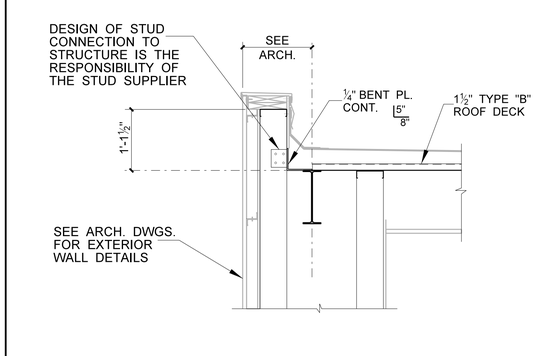
4 ROOF SECTION @ LOADING DOCK



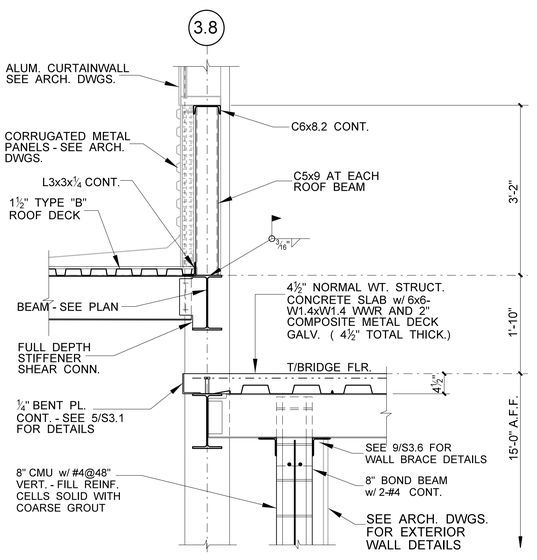
1 SCREENWALL SECT. @ LOW ROOF



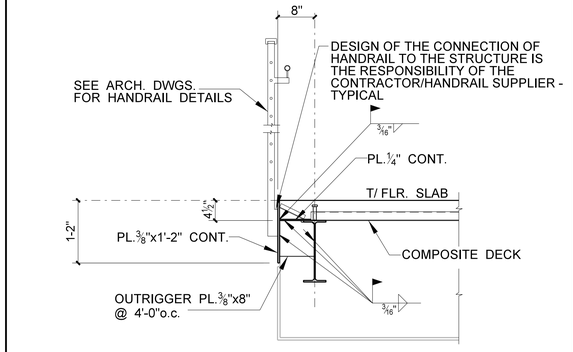
11 SECTION @ 2nd FLR. WALKWAY SLAB



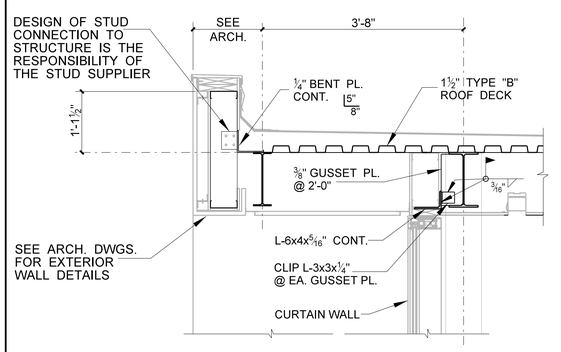
7 STAIR "B" ROOF SECTION



3 BRIDGE SECTION @ LOADING DOCK



10 TYP. SECTION @ WALKWAY SLAB EDGE WITH HANDRAIL



6 STAIR "B" ROOF SECTION

STRUCTURAL DESIGN GROUP
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CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

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HPSC Police and Court Building

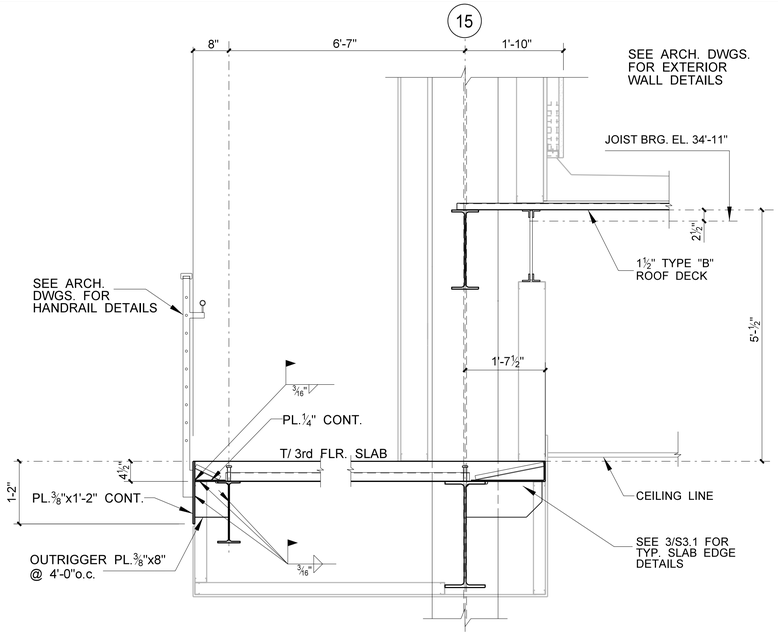
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Date	Rev.	Description
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Albert & Associates:	12575

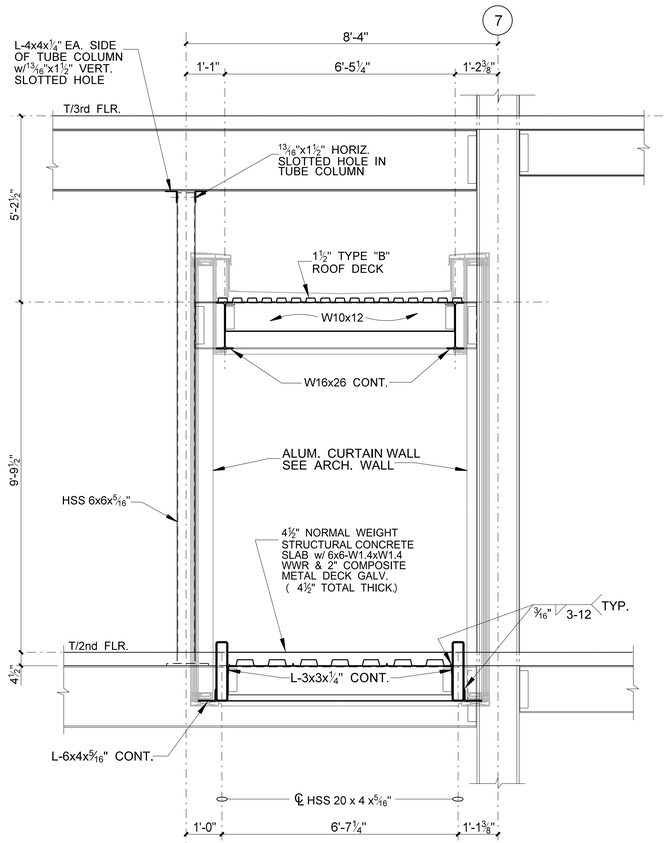
THOMAS C. SCHAEFER REGISTERED PROFESSIONAL ENGINEER 21331 STATE OF MISSISSIPPI

S3.12

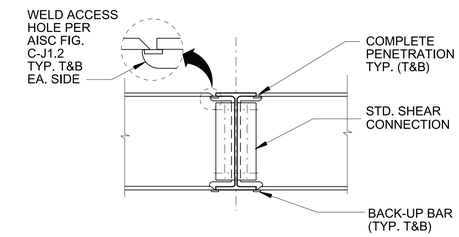
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220 Great Circle Road, Suite 106
Nashville, Tennessee 37228
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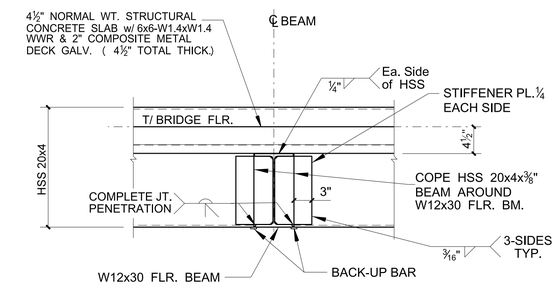
6 ATRIUM WALKWAY @ 3rd FLR.



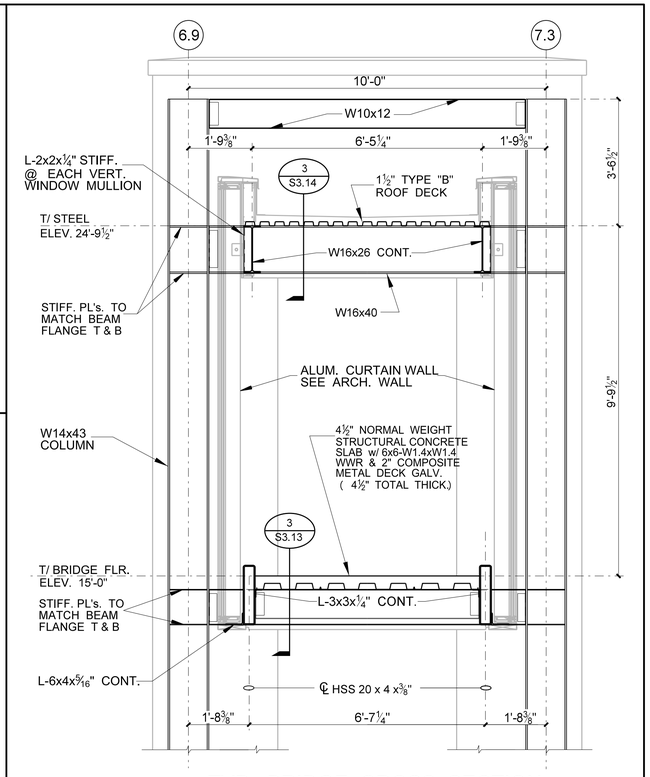
5 TYP. BRIDGE CROSS SECTION AT OFFICE BUILDING COMPLEX



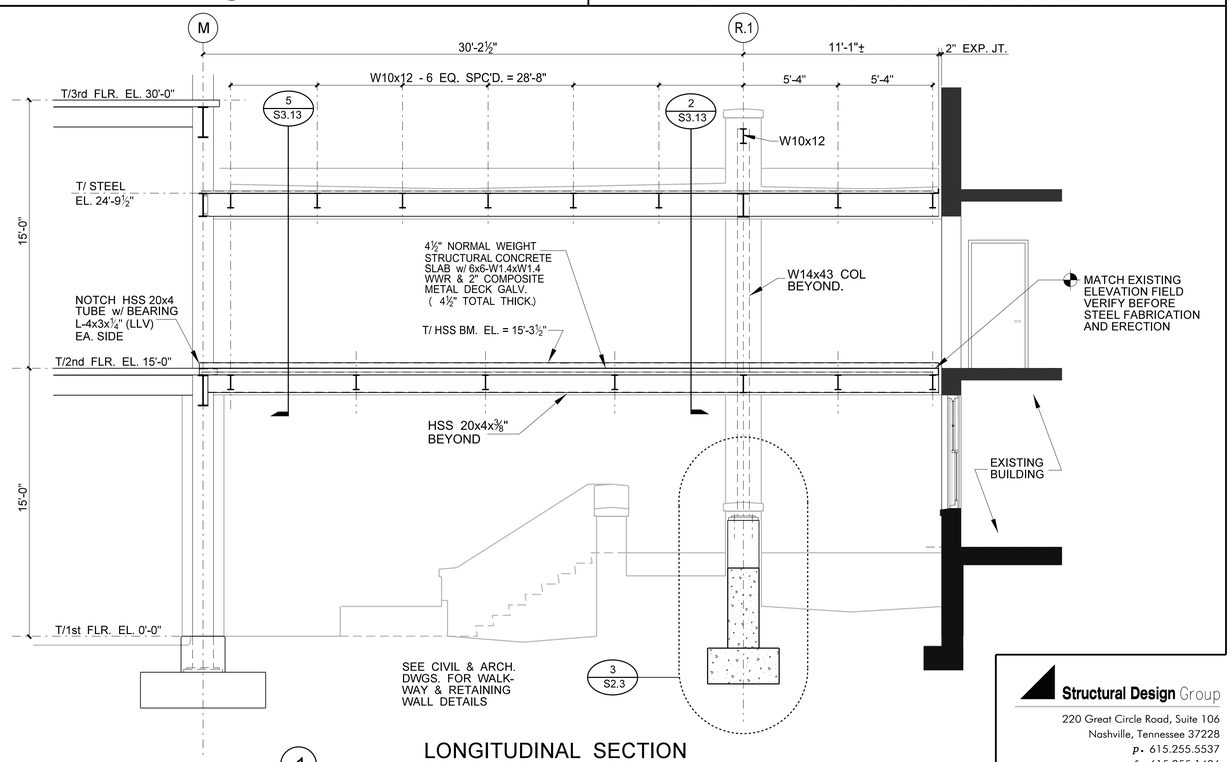
4 WELD - THRU DETAIL AT UNEQUAL BEAM DEPTHS



3 HSS 20x4 TUBE WELD-THRU DETAIL @ W12x30 FLR. BEAM



2 TYP. BRIDGE CROSS SECTION AT HANGER SUPPORT



1 LONGITUDINAL SECTION THRU 2nd FLOOR BRIDGE

HATTIESBURG PUBLIC SAFETY COMPLEX
HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

Drawing Issued:		
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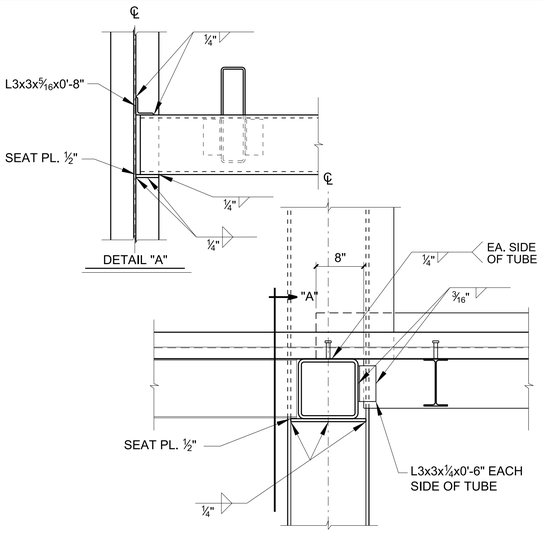
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Albert & Associates: 12575

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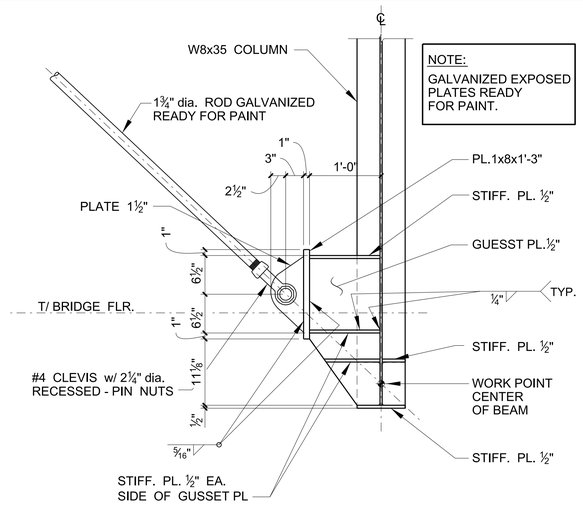
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220 Great Circle Road, Suite 106
Nashville, Tennessee 37228
p. 615.255.5537
f. 615.255.1486
SDG Project No. 2015-108.20

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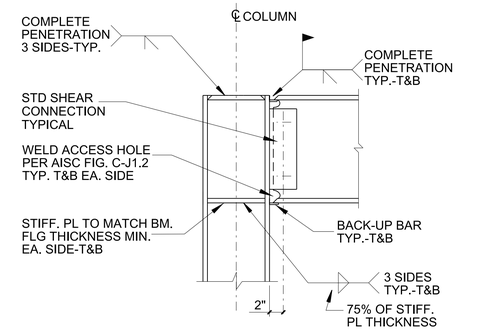
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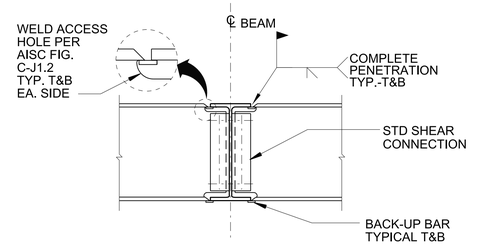
9 DETAIL AT COLUMN



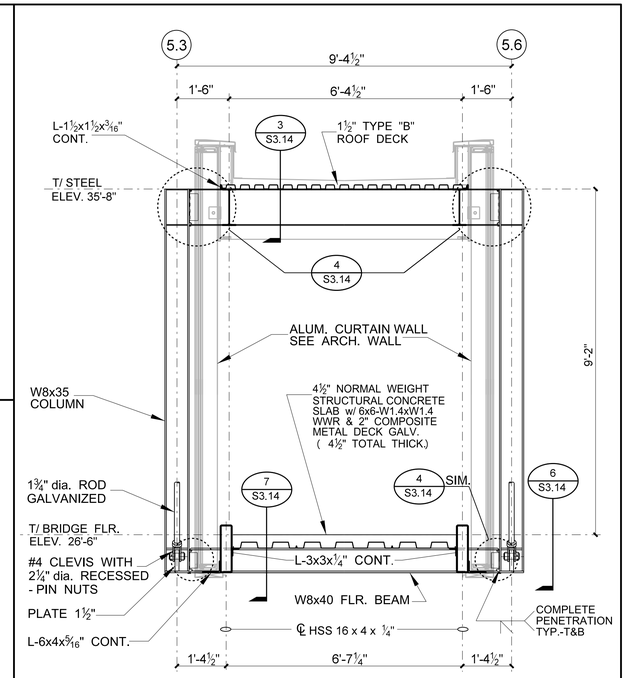
6 HANGER ROD SUPPORT DETAIL AT BRIDGE COLUMN



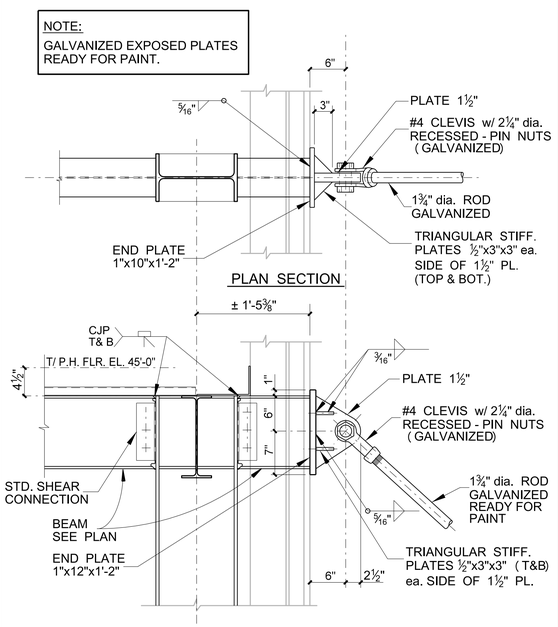
4 BM. MOMENT CONN. @ COLUMN



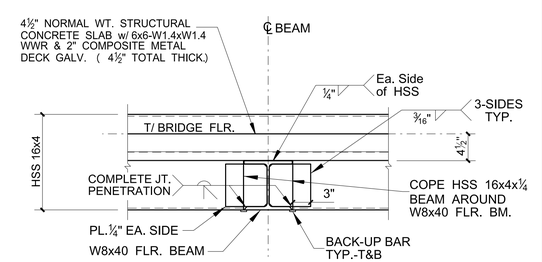
3 BEAM WELD-THRU @ BEAM



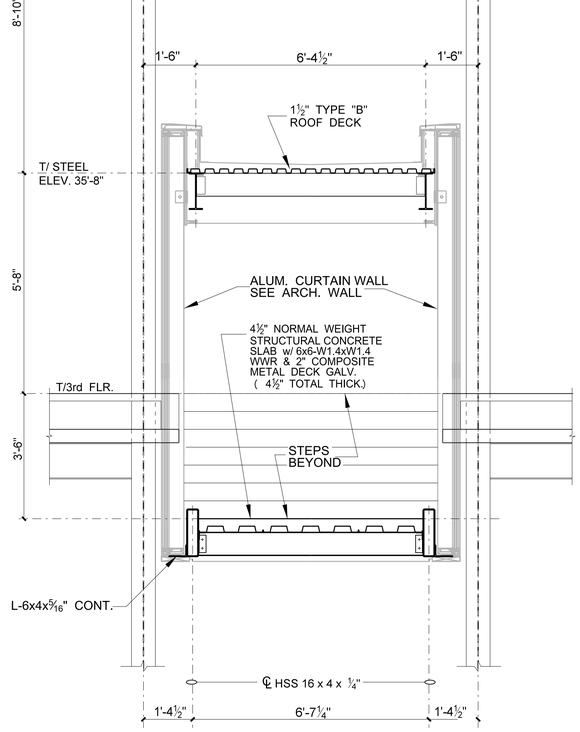
2 TYP. BRIDGE CROSS SECTION AT HANGER SUPPORT



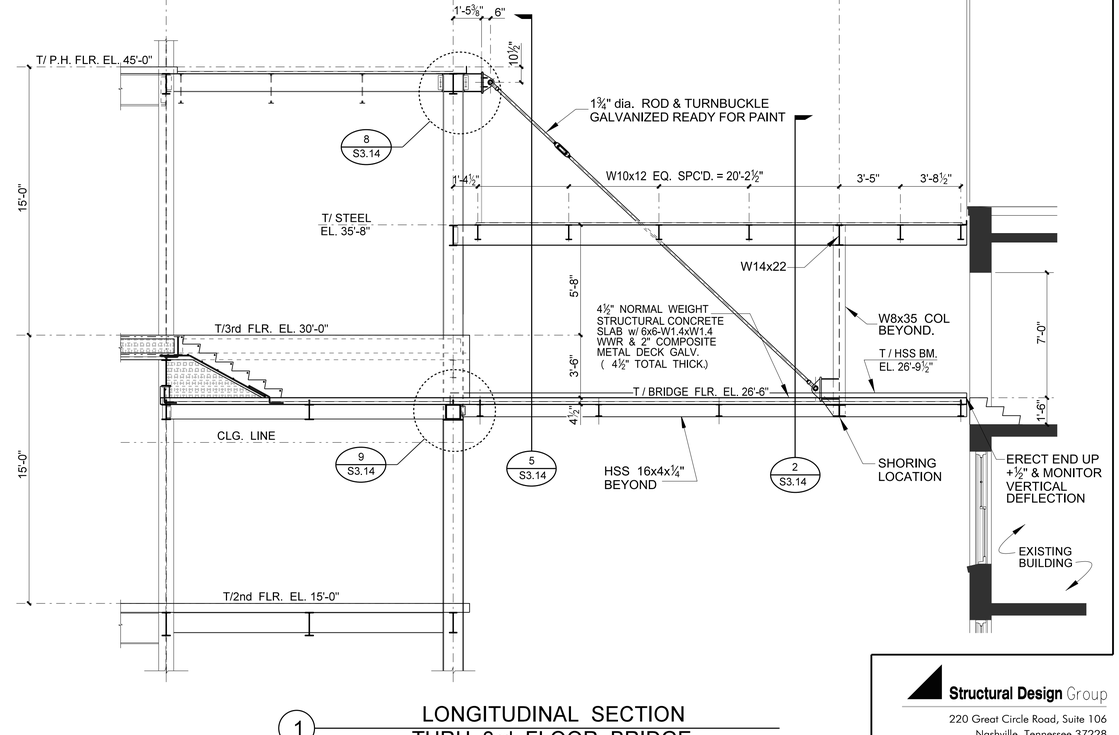
8 HANGER ROD ANCHORAGE DETAIL AT PRECAST FLR. BEAM



7 HSS 16x4 TUBE WELD-THRU DETAIL @ W8x40 FLR. BEAM



5 TYP. BRIDGE CROSS SECTION AT NEW BUILDING



1 LONGITUDINAL SECTION THRU 3rd FLOOR BRIDGE

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HPSC Police and Court Building

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Date	Rev.	Description
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Albert & Associates:	12575

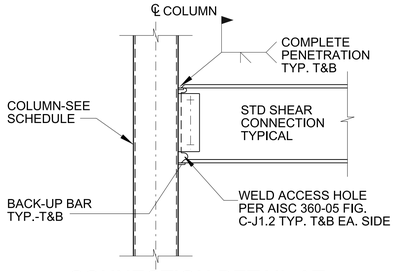
THOMAS C. SCHAEFER REGISTERED PROFESSIONAL ENGINEER 21331 STATE OF MISSISSIPPI

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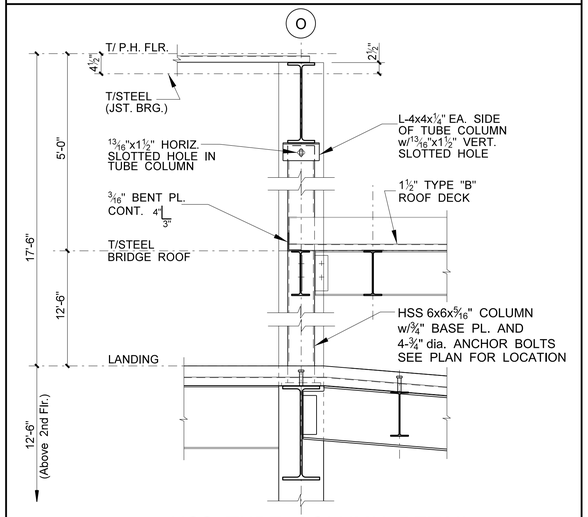
514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com **Albert & McCleskey Associates Architects**

FRAMING SECTIONS AND DETAILS

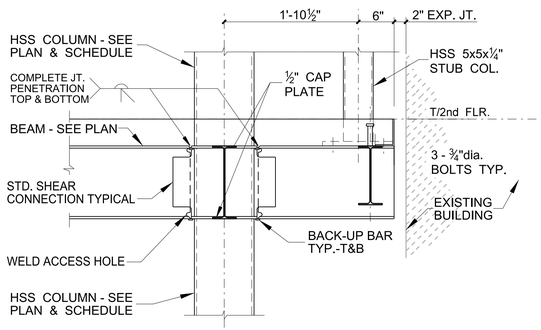
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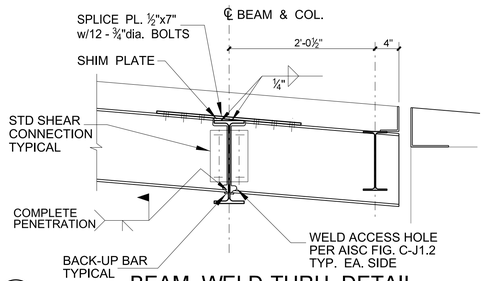
6 CONNECTION DETAIL AT TUBE COLUMN



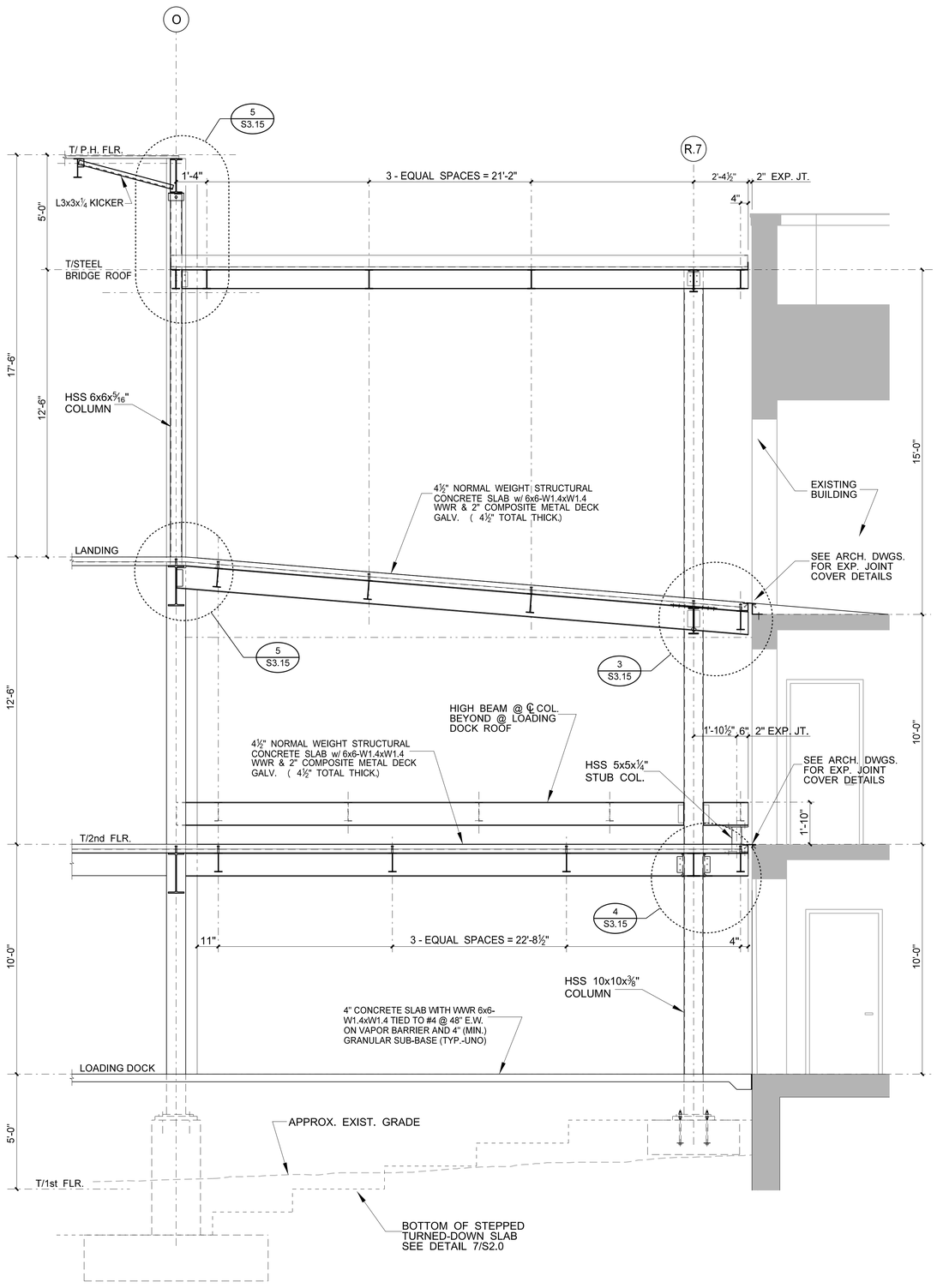
5 HSS TUBE COLUMN DETAIL (AT CONNECTOR BRIDGE)



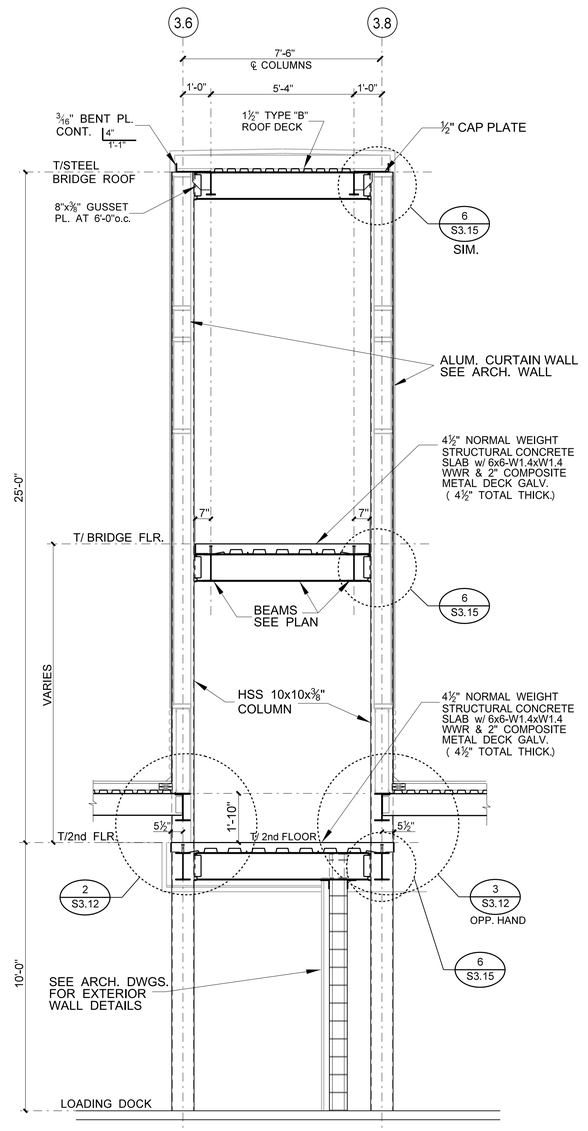
4 BEAM WELD-THRU DETAIL AT TUBE COLUMN



3 BEAM WELD-THRU DETAIL



2 LONGITUDINAL BRIDGE SECTION AT LOADING DOCK



1 CONNECTING BRIDGE CROSS SECTION AT LOADING DOCK

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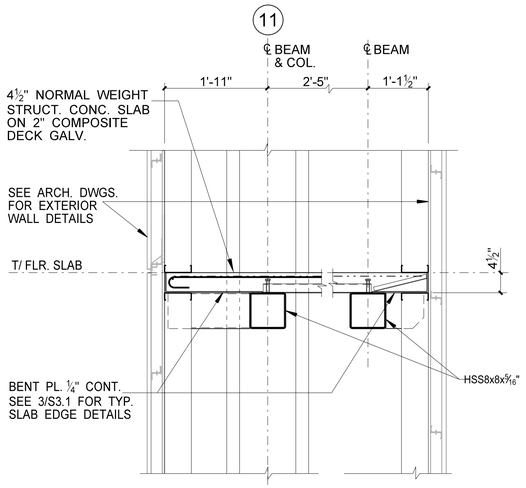
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Albert & Associates: 12575

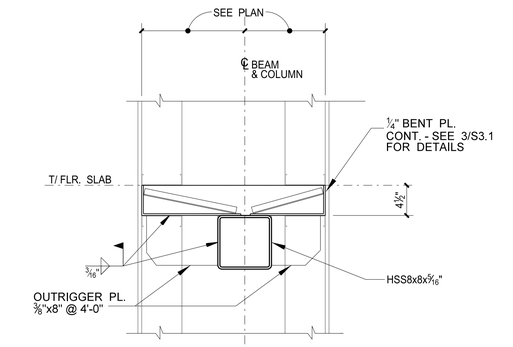
THOMAS C. SCHAEFER REGISTERED PROFESSIONAL ENGINEER 21331 STATE OF MISSISSIPPI

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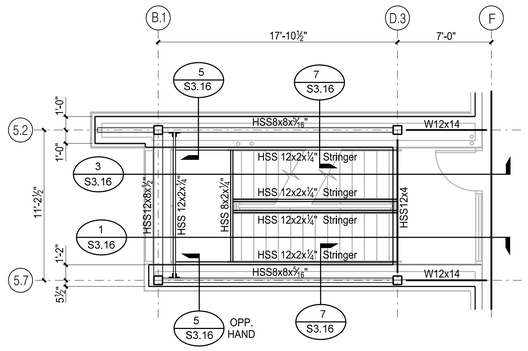
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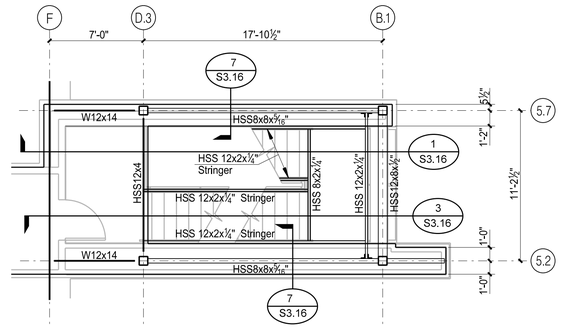
8 SECTION @ MONOLITH WING (@ COURT COMPLEX ENTRY)



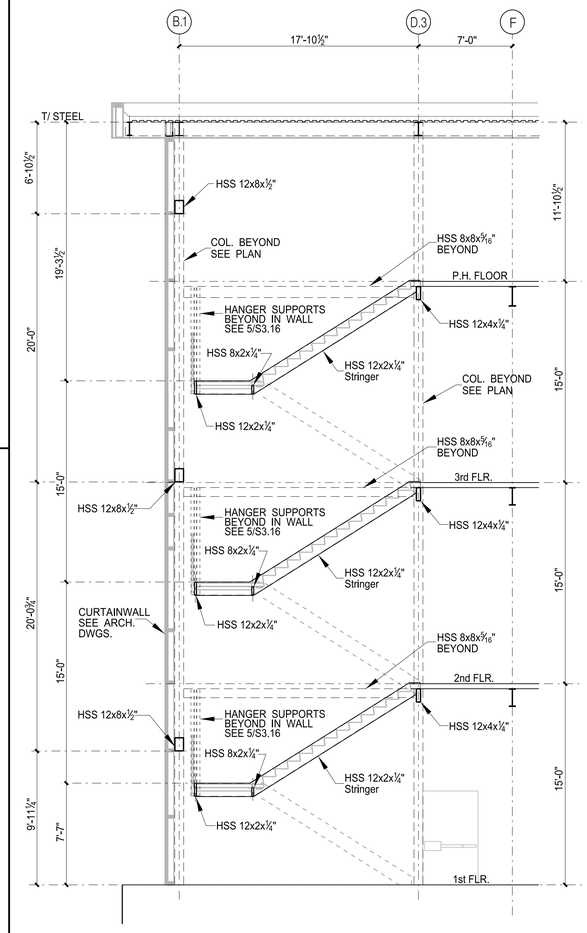
7 TYP. STAIR "B" SIDE WALL SECTION



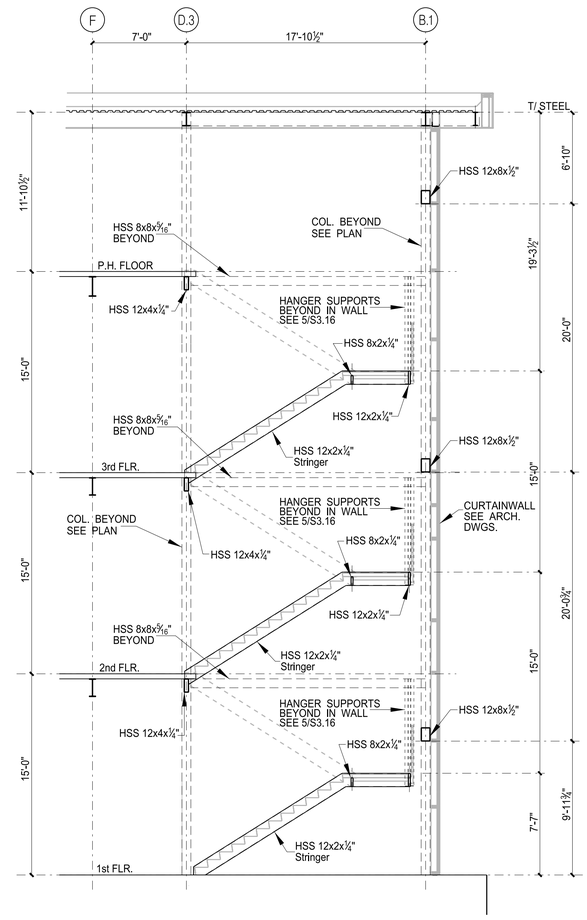
4 STAIR PLAN @ 2nd & 3rd FLR.



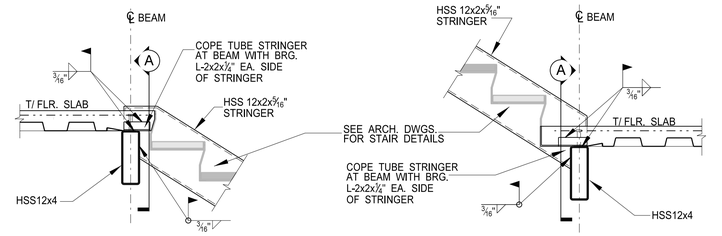
2 STAIR PLAN & P.H. FLR.



3 STAIR SECTION



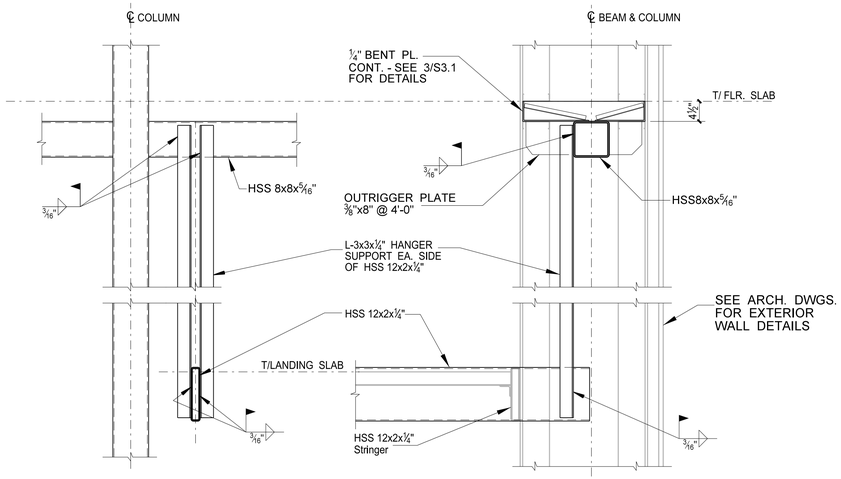
1 STAIR SECTION



BEAM @ DOWN STAIR

BEAM @ UP STAIR

6 STAIR "B" STRINGER CONNECTION DETAIL @ FLR. BEAM



ELEVATION SECTION

5 STAIR LANDING HANGER DETAIL

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HATTIESBURG PUBLIC SAFETY COMPLEX
HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

Drawing Issued:

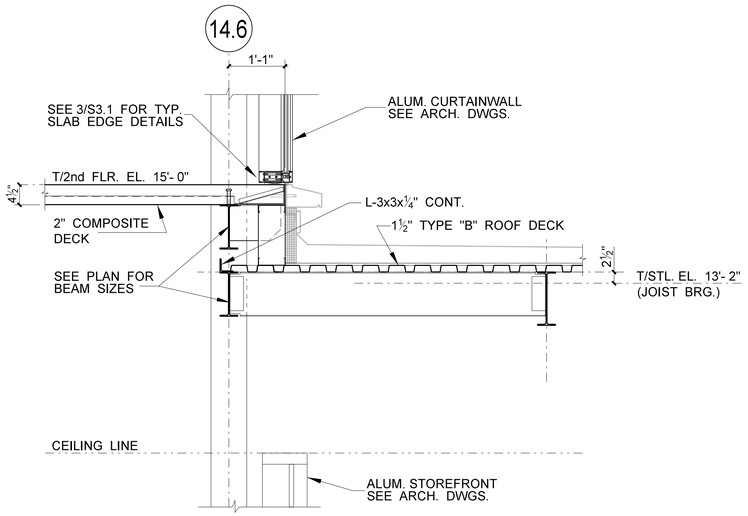
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Albert & Associates: 12575

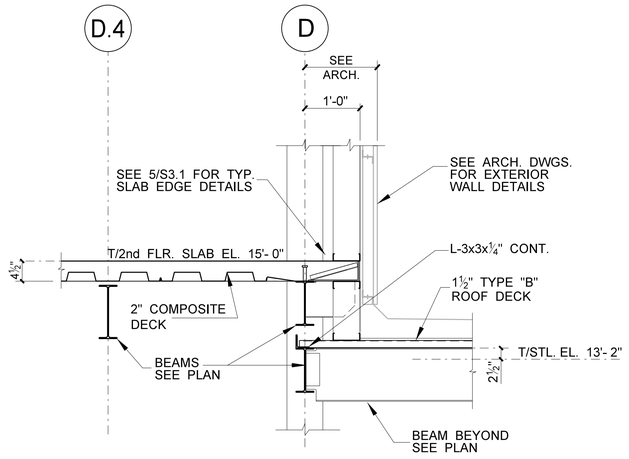
THOMAS C. SCHAEFER REGISTERED PROFESSIONAL ENGINEER 21331 STATE OF MISSISSIPPI

S3.16

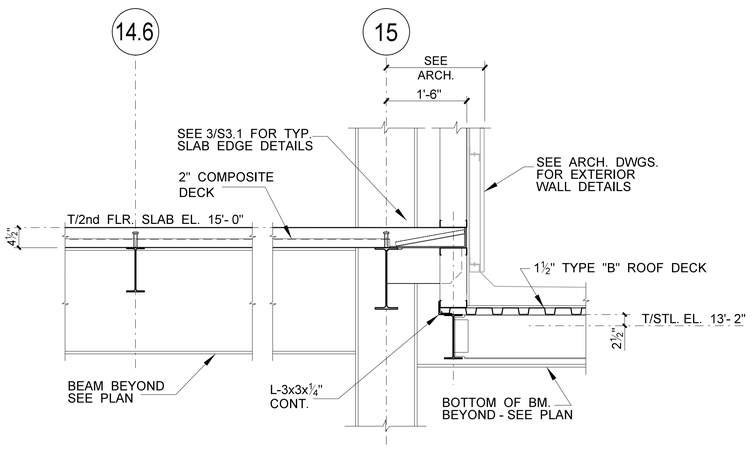
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Nashville, Tennessee 37228
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SDG Project No. 2015-108.20



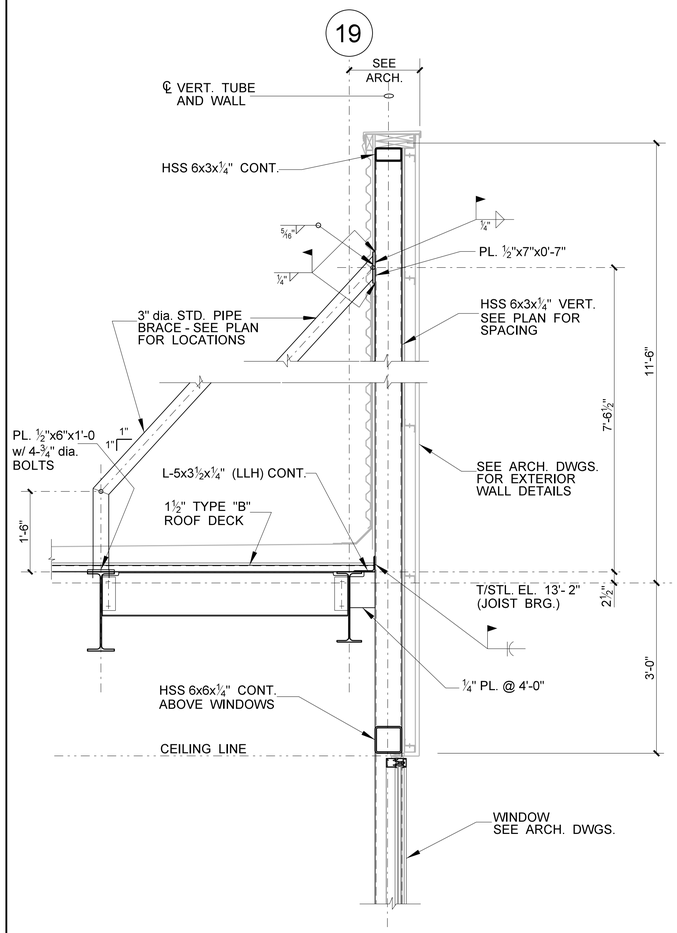
6 2nd FLOOR SECTION @ LOW ROOF AT POLICE LOBBY



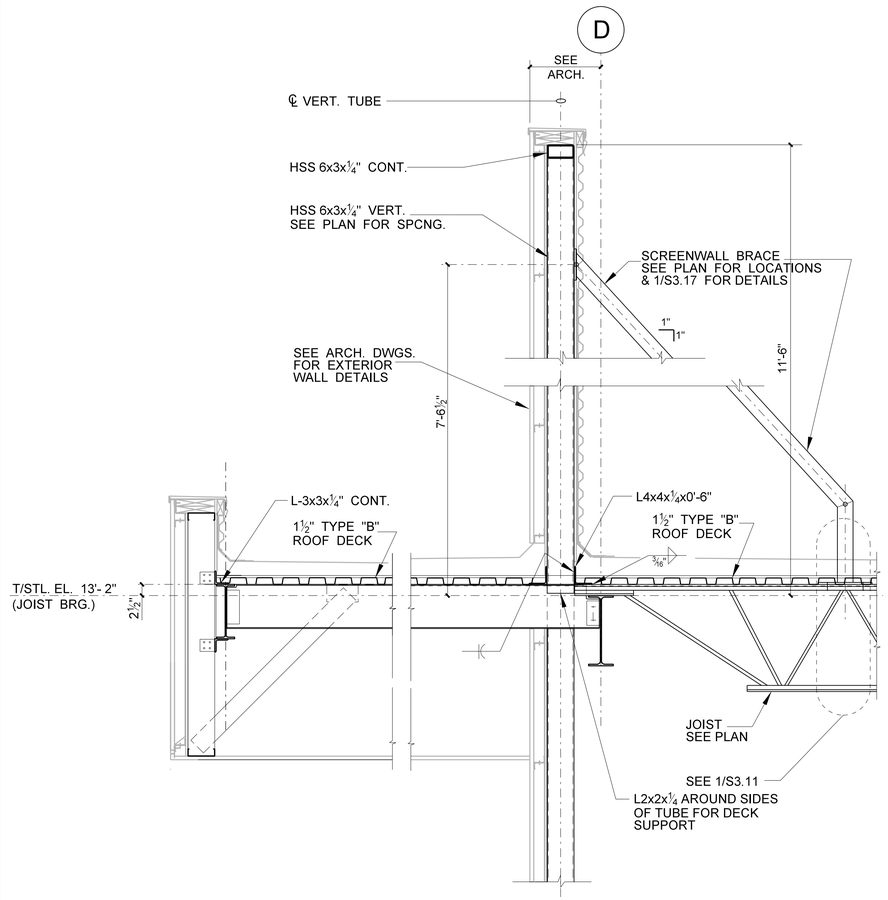
4 2nd FLOOR SECTION @ LOW ROOF AT POLICE LOBBY



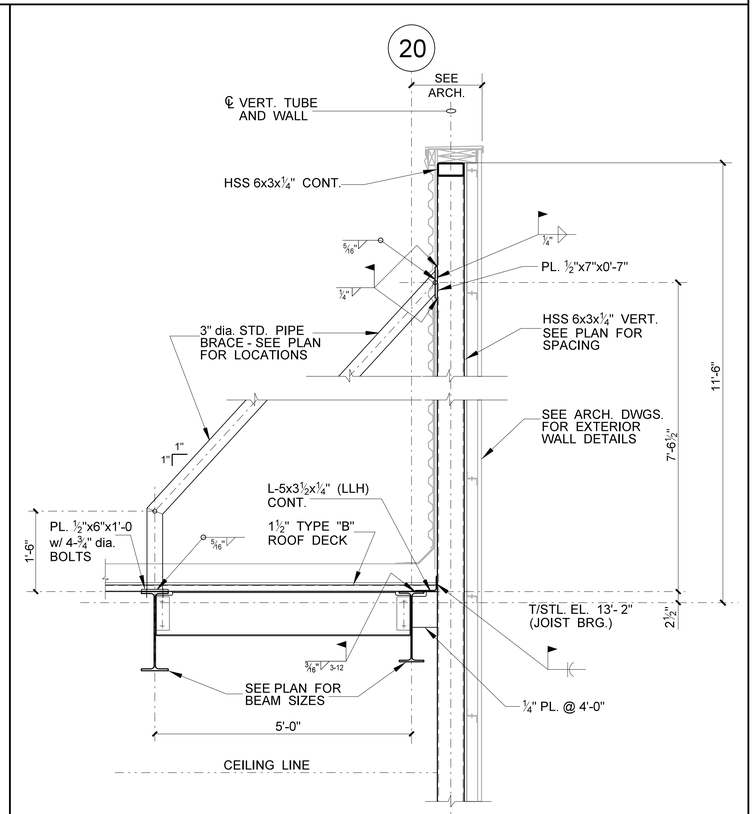
2 2nd FLOOR SECTION @ LOW ROOF AT POLICE LOBBY



5 LOW ROOF @ HIGH PARAPET AT CONT. WINDOWS



3 LOW ROOF CANTILEVERED CANOPY (WITH HIGH PARAPET)



1 LOW ROOF @ HIGH PARAPET (JOIST PARALLEL)

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

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HPSC Police and Court Building

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Date	Rev.	Description
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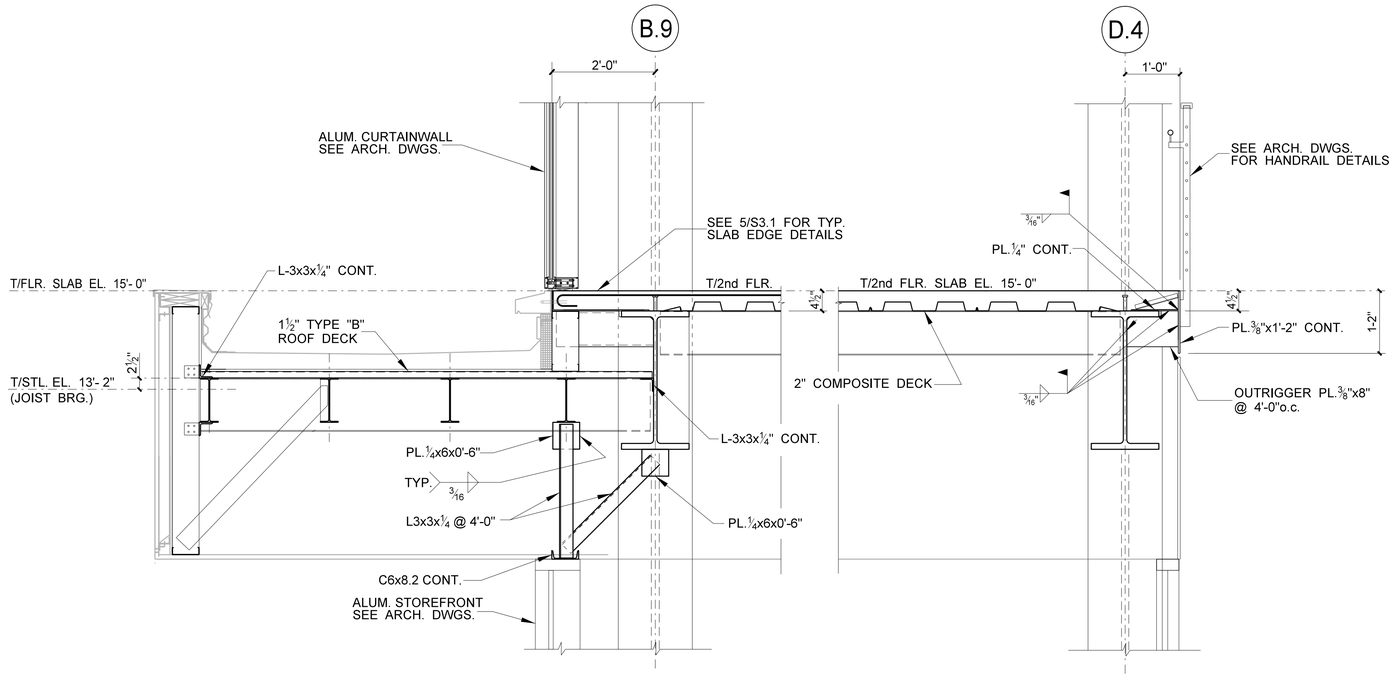
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THOMAS C. SCHAEFER REGISTERED PROFESSIONAL ENGINEER 11331 STATE OF MISSISSIPPI

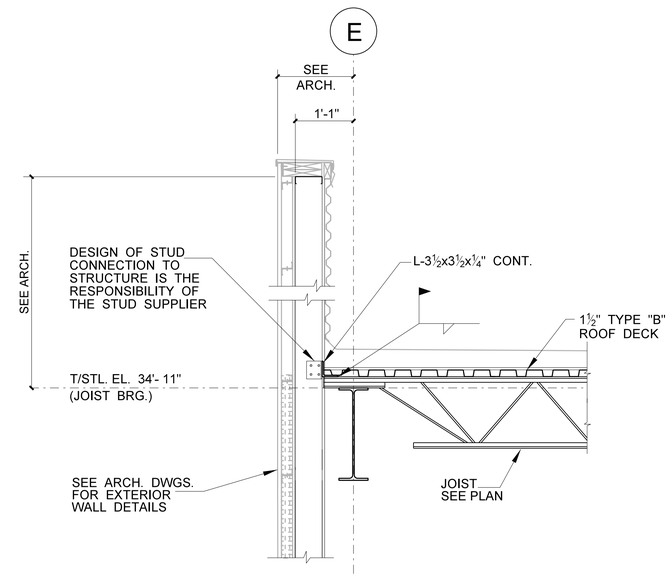
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S3.17

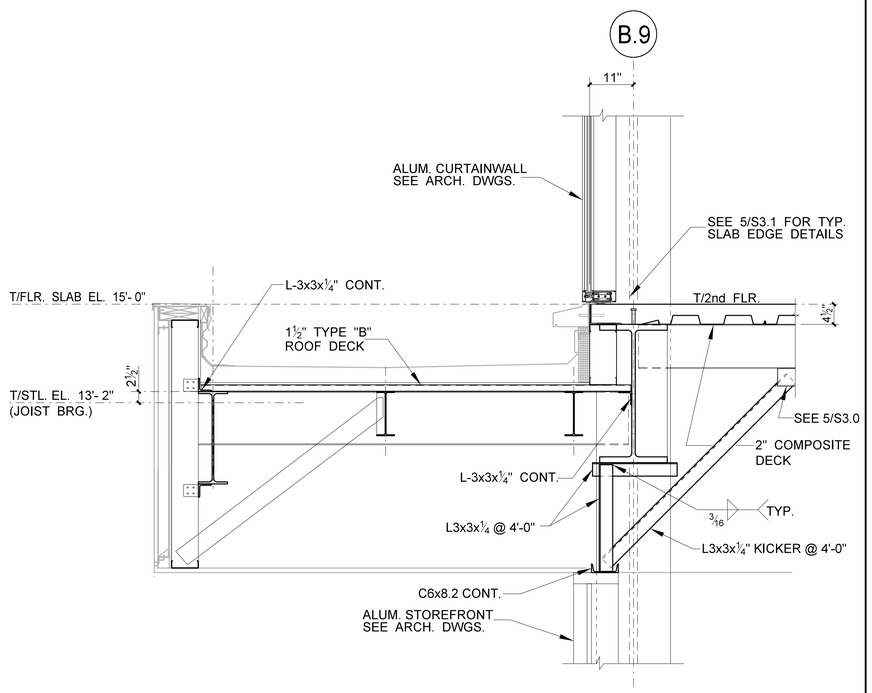
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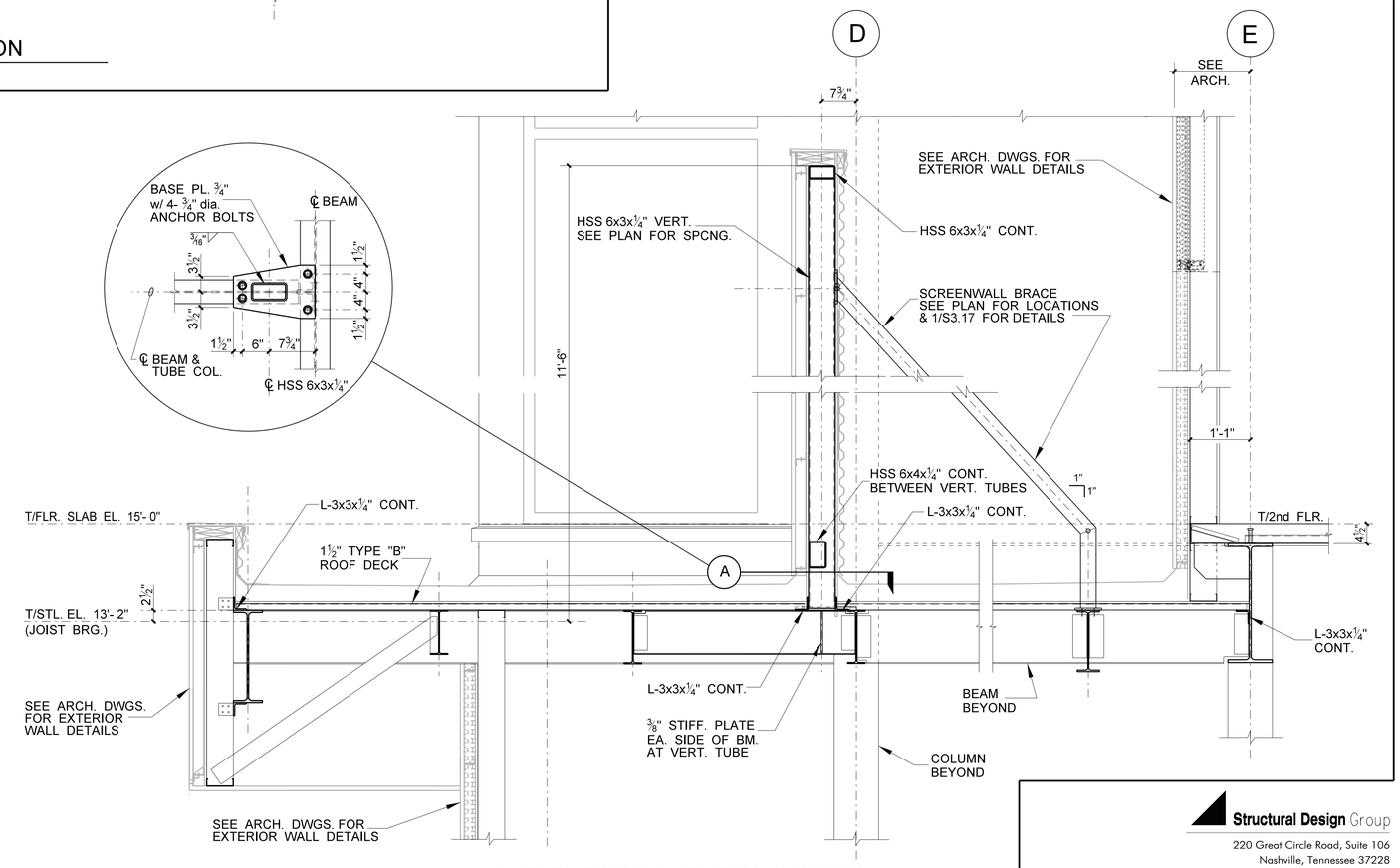
4 ENTRY CANOPY SECTION AT SECOND FLOOR



2 2nd FLOOR ROOF SECTION (WITH COMPOSITE PANELS)



3 ENTRY CANOPY SECTION AT SECOND FLOOR



1 1st FLR. ROOF & ENTRY CANOPY AT SCREEN WALL

HATTIESBURG PUBLIC SAFETY COMPLEX
HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■ HATTIESBURG POLICE DEPARTMENT ■

HPSC Police and Court Building

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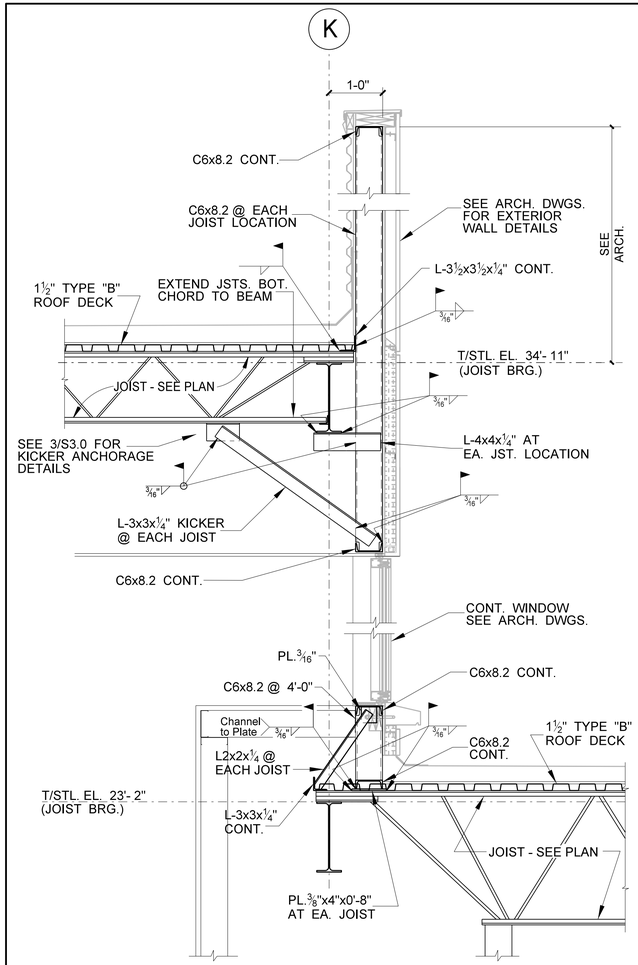
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Checked By:	W.G.
Client No:	———
Albert & Associates:	12575

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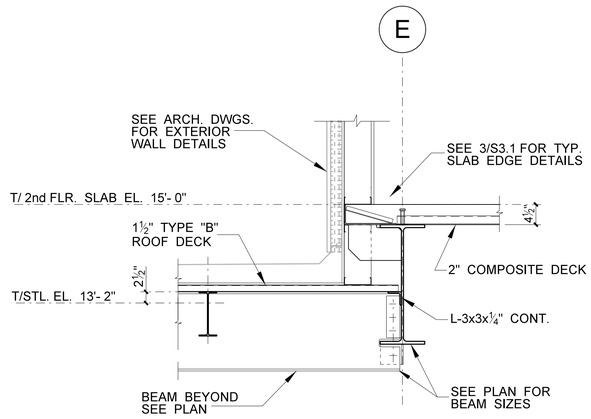
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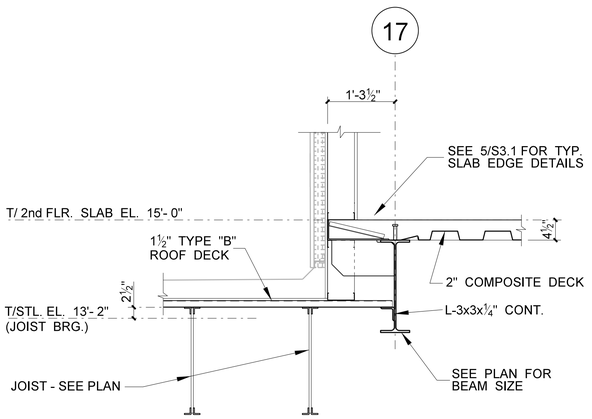
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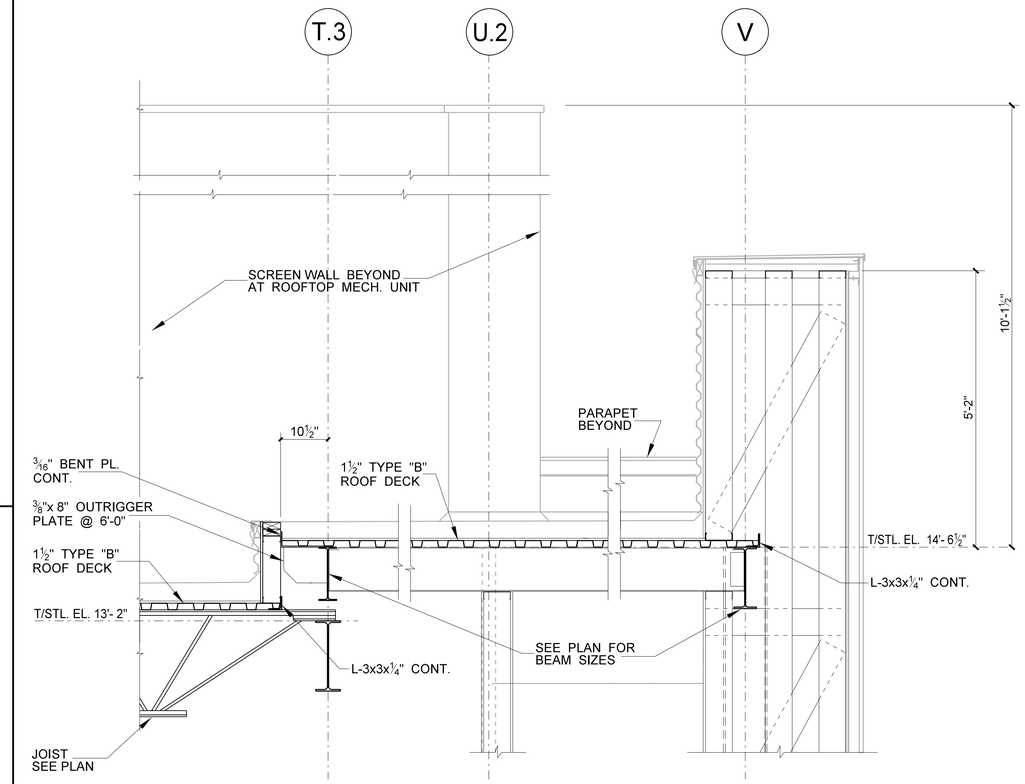
7 HIGH ROOF / LOW ROOF SECTION AT COURT LOBBY



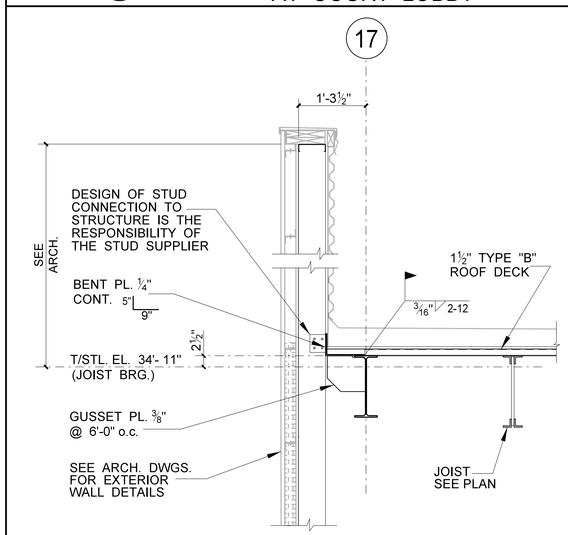
5 LOW ROOF SECTION @ 2nd FLR.



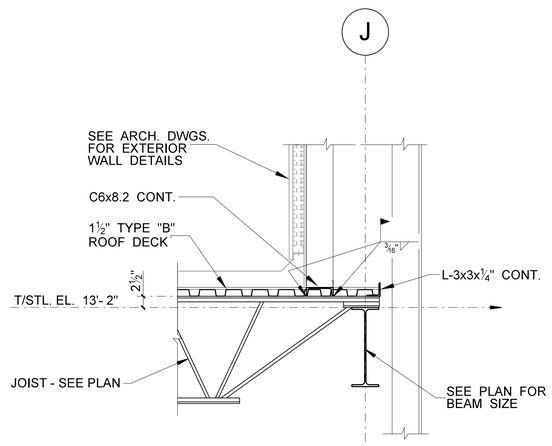
4 LOW ROOF SECTION @ 2nd FLR.



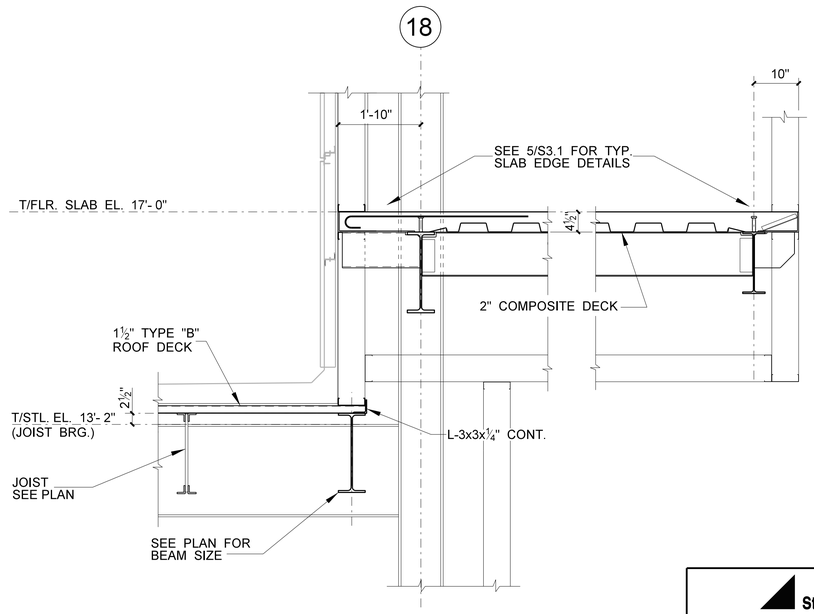
2 LOW ROOF SECTION RAISED SECT. @ CORRIDOR RAMP



6 2nd FLOOR ROOF SECTION



3 LOW ROOF @ COURT LOBBY



1 EXT. WALL @ LOW ROOF ABOVE COURT CLERK DESK

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CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

Drawing Issued:

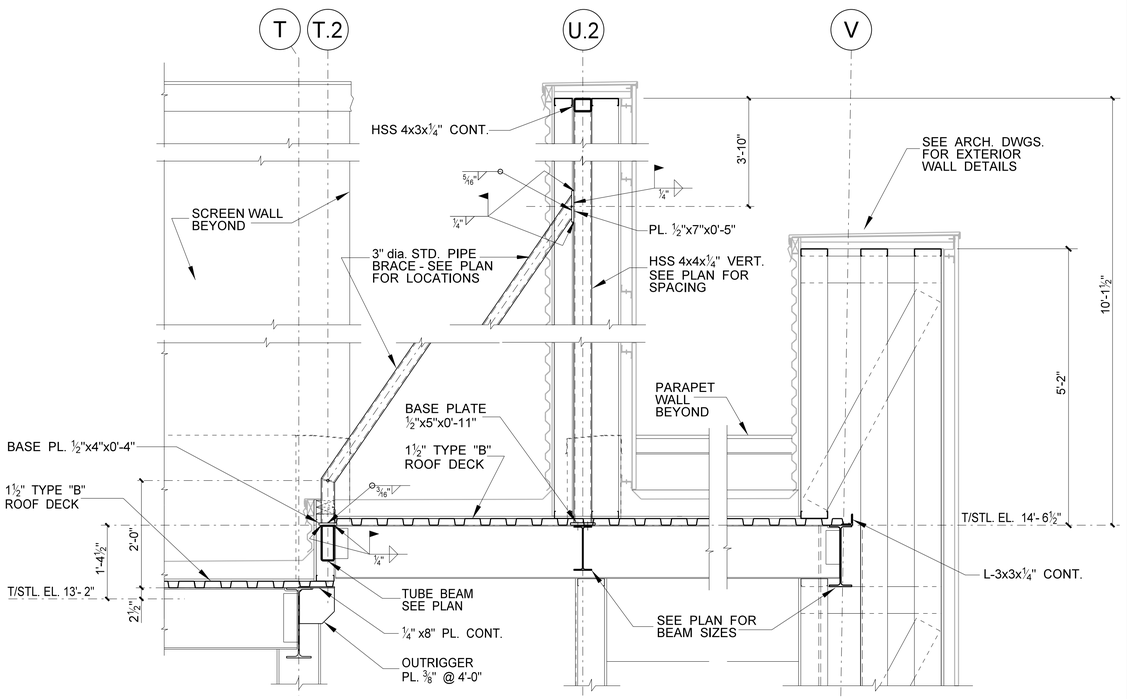
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Albert & Associates: 12575

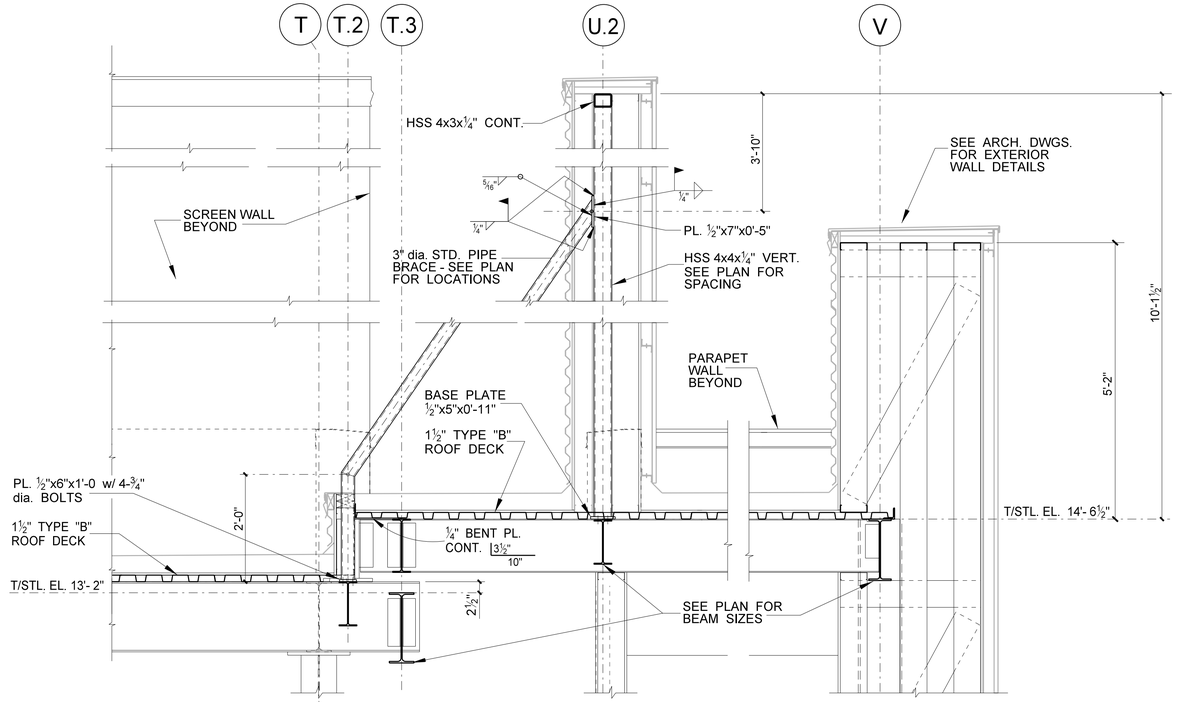
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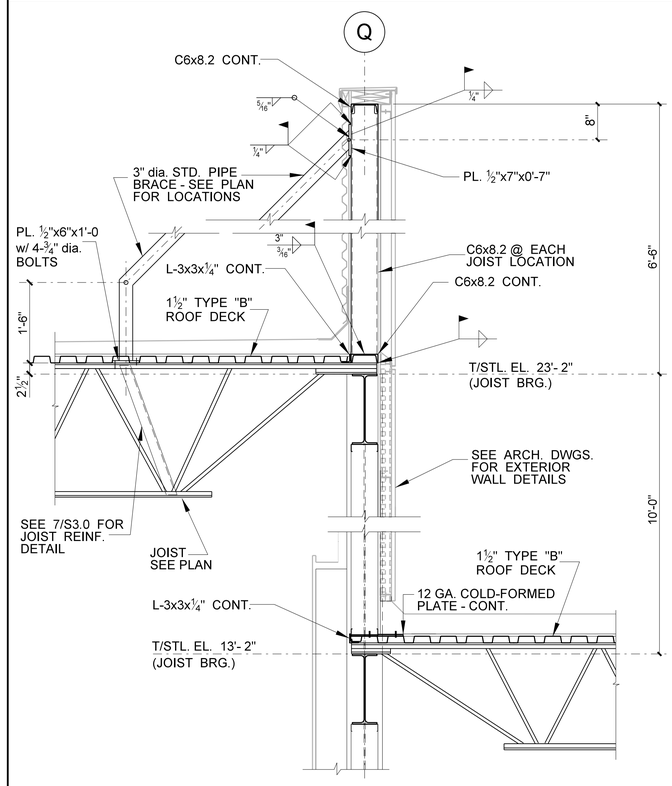
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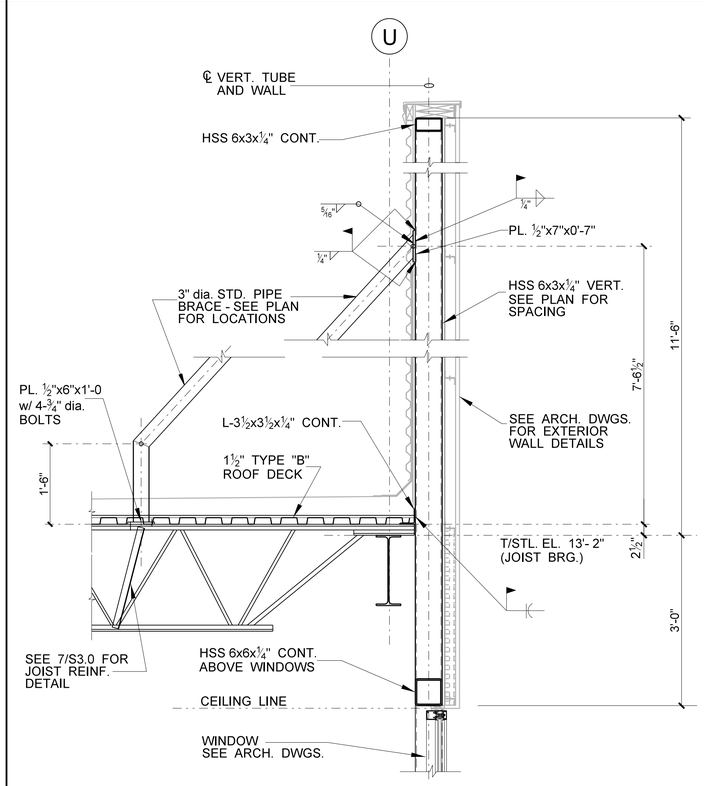
5 LOW ROOF SECTION
RAISED SECT. @ CORRIDOR RAMP



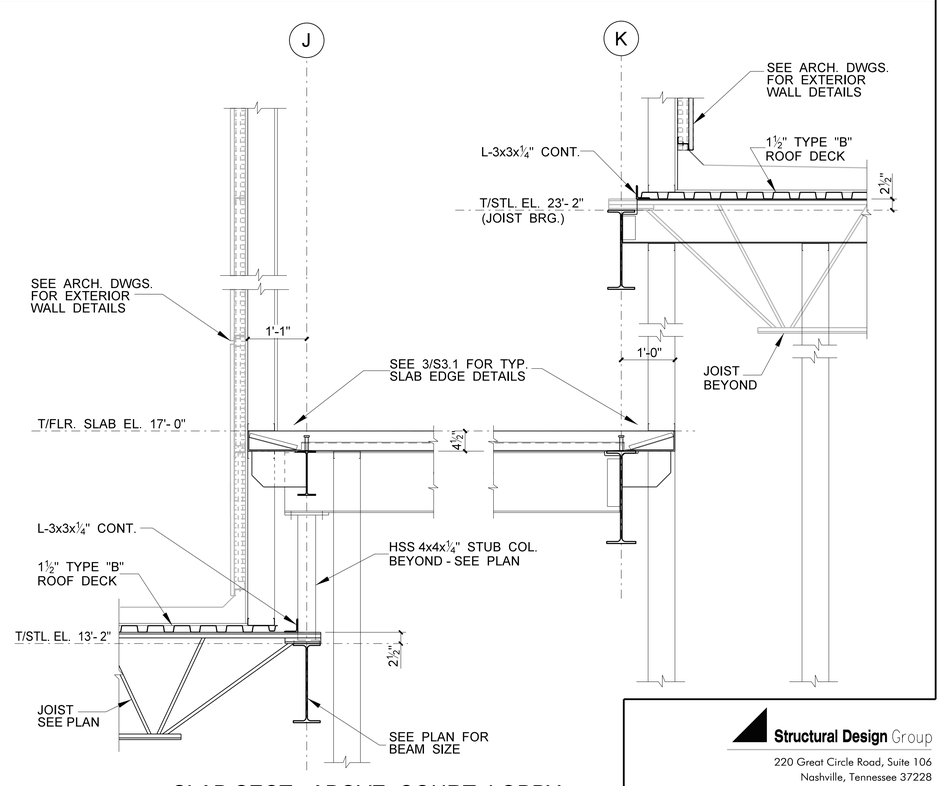
2 LOW ROOF SECTION
RAISED SECT. @ CORRIDOR RAMP



4 HIGH ROOF / LOW ROOF SECTION
AT COURT ROOM



3 LOW ROOF @ HIGH PARAPET
AT CONT. WINDOWS



1 SLAB SECT. ABOVE COURT LOBBY
BETWEEN LOW ROOF & HIGH ROOF

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

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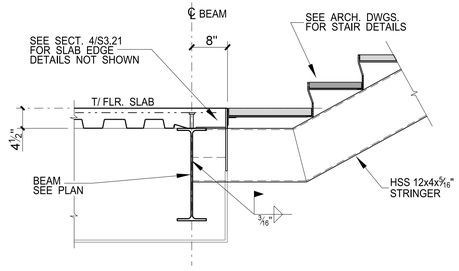
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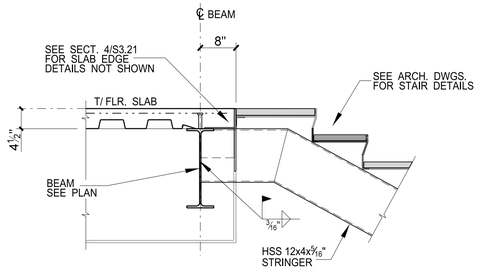
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FRAMING SECTIONS AND DETAILS

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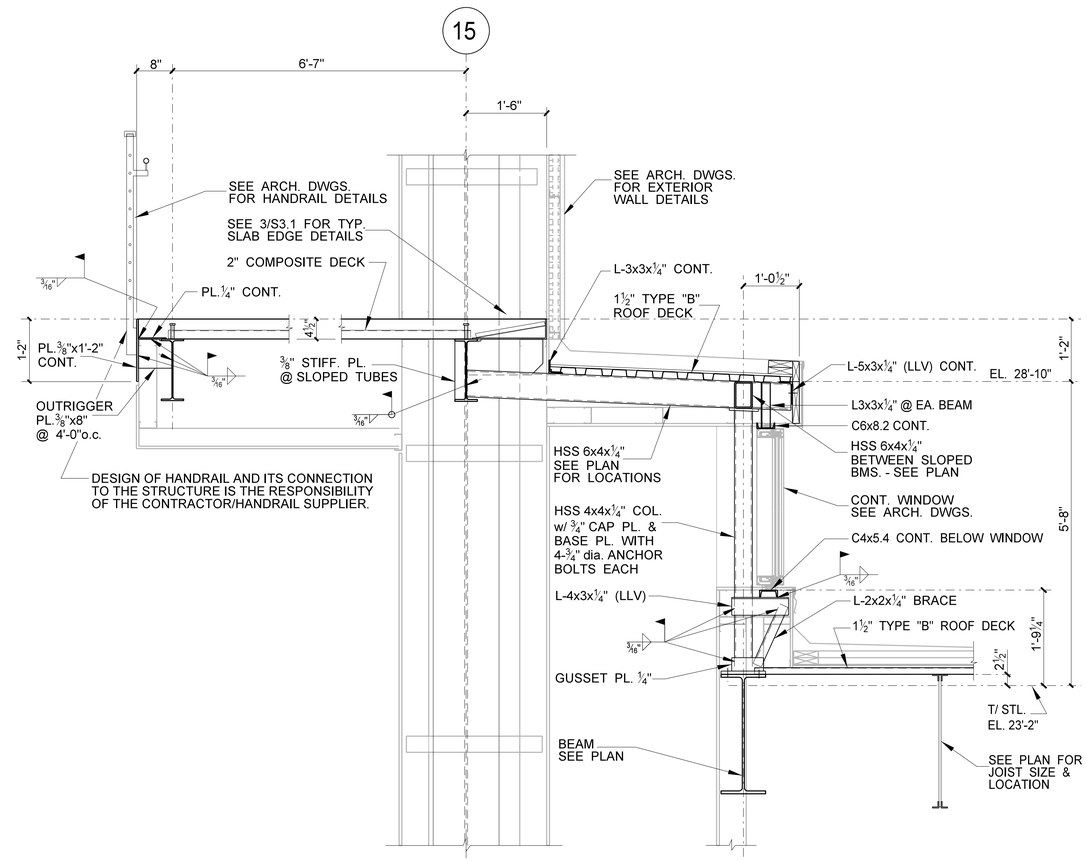


BEAM @ UP STAIR

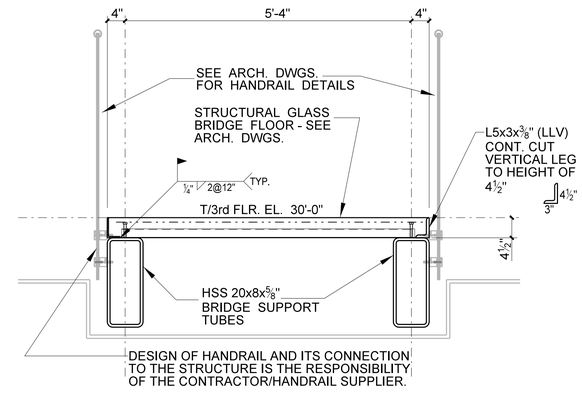


BEAM @ DOWN STAIR

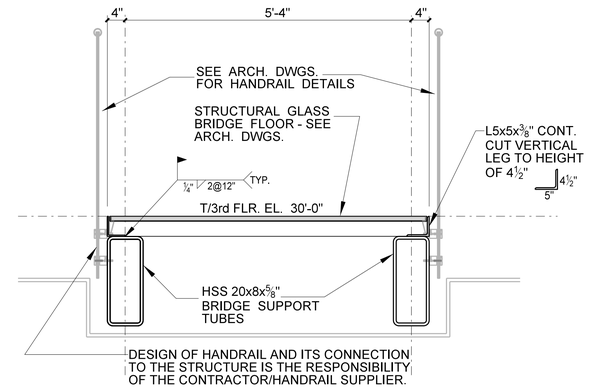
6 STAIR "A" STRINGER CONNECTION DETAIL @ FLR. BEAM



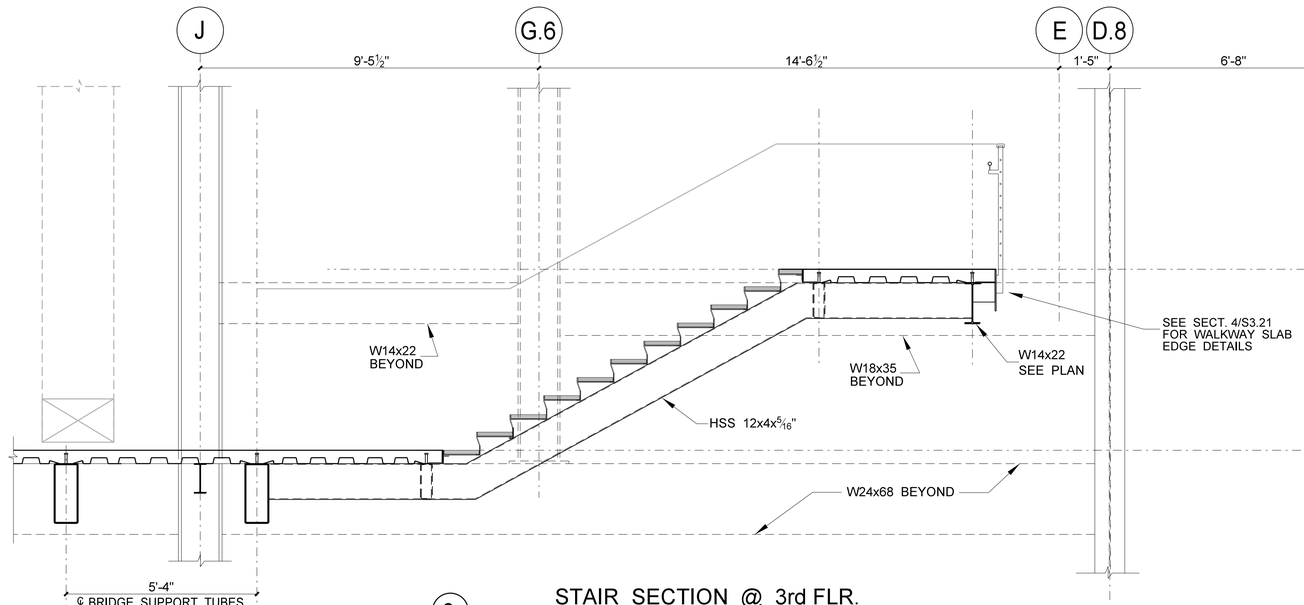
4 CLERESTORY WINDOW @ COURT RM ADJACENT TO ATRIUM WALKWAY



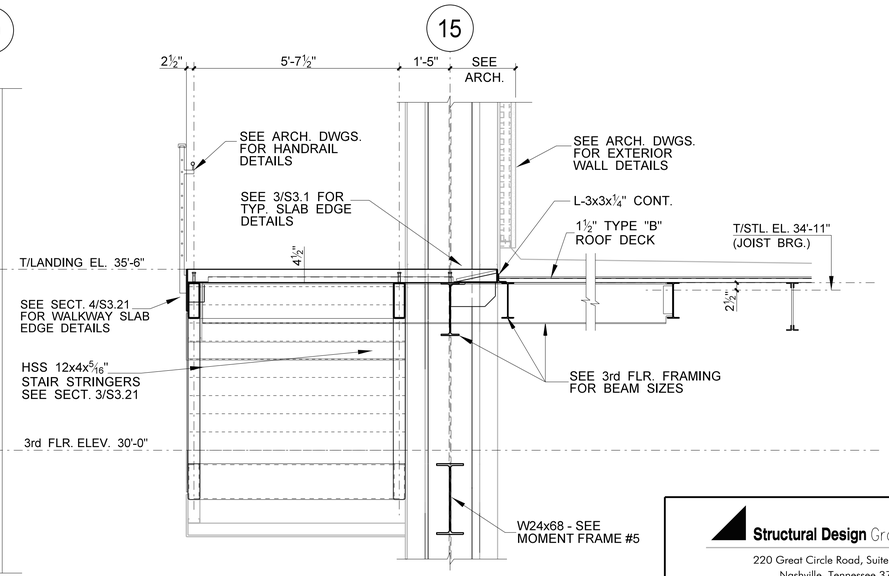
5 BRIDGE SECTION (@ COMPOSITE SLAB)



2 BRIDGE SECTION (@ STRUCTURAL GLASS)



3 STAIR SECTION @ 3rd FLR.



1 ROOF SECTION @ STAIR

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CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

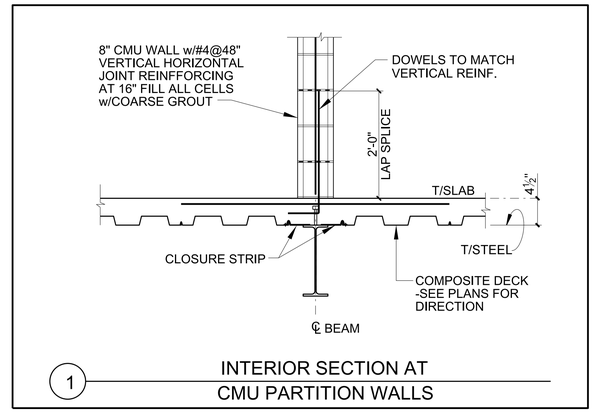
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1 INTERIOR SECTION AT CMU PARTITION WALLS

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HATTIESBURG PUBLIC SAFETY COMPLEX

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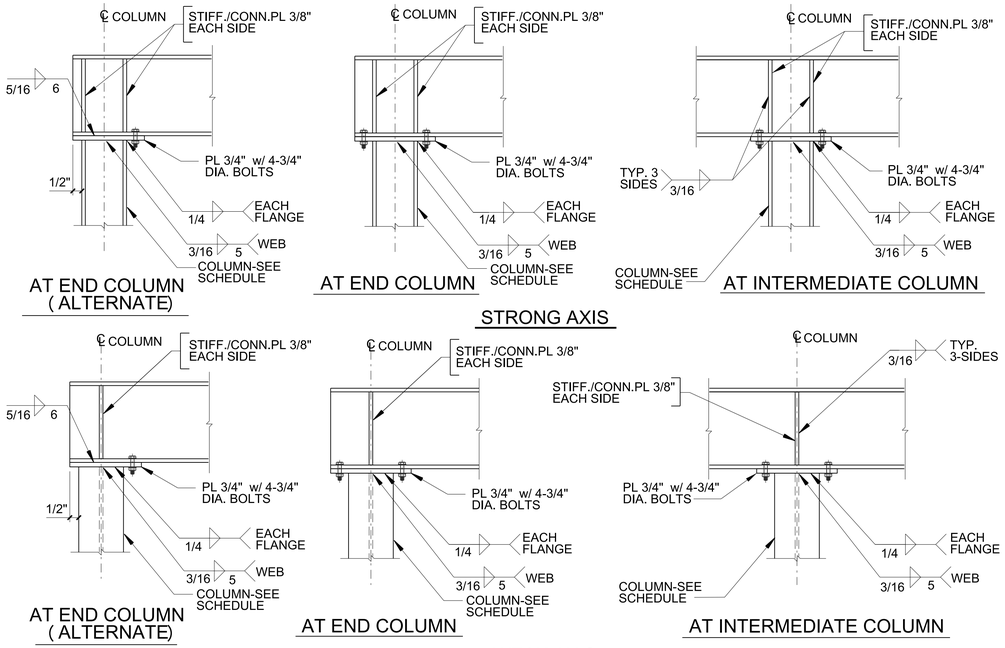
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Albert & Associates: 12575

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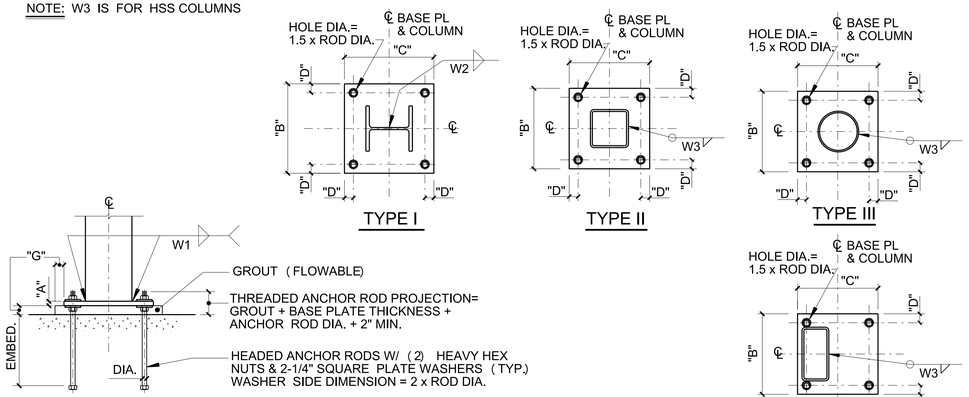
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2 BEAM TO COLUMN CONNECTION FOR CONTINUOUS BEAMS

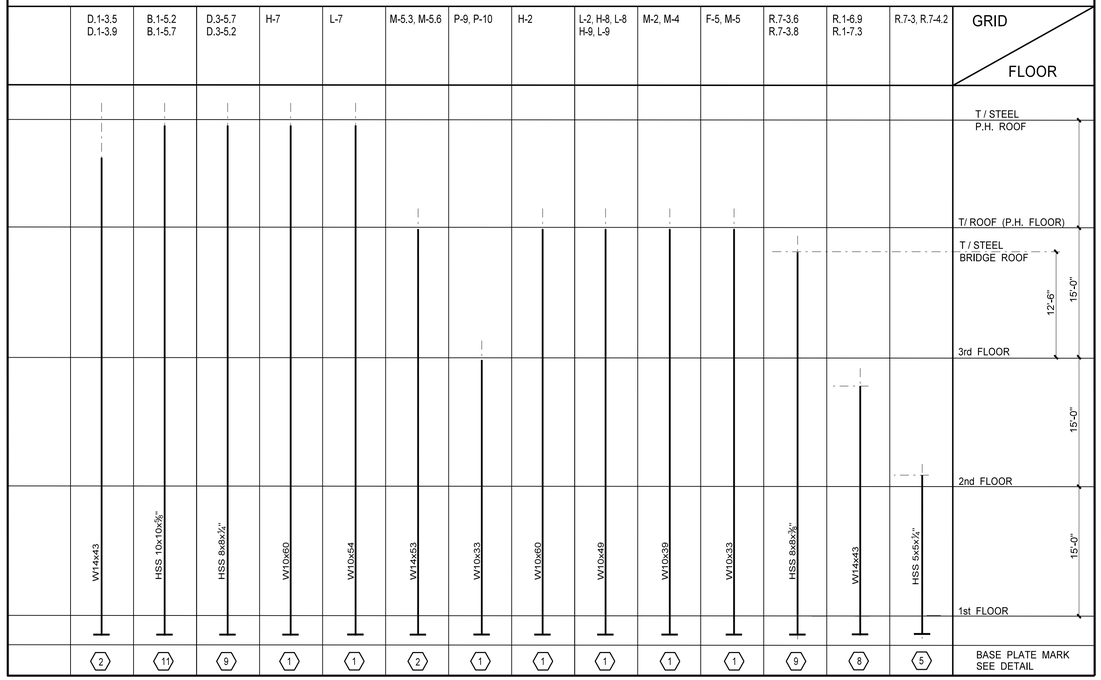
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⟨2⟩	I	1"	22"	22"	2"	4	1"	12"	¼"	3/16"	-	2"	
⟨3⟩	I	1½"	23"	23"	2"	4	1"	12"	¼"	3/16"	-	2"	
⟨4⟩	II	1"	14"	11"	2"	4	1"	12"	-	-	¼"	2"	
⟨5⟩	II	1"	13"	13"	2"	4	1"	12"	-	-	¼"	2"	
⟨6⟩	II	1"	18"	18"	2"	4	1"	12"	-	-	¼"	2"	
⟨7⟩	III	1"	16"	16"	2"	4	1"	12"	-	-	¼"	2"	
⟨8⟩	I	1"	17"	22"	2"	4	1"	12"	¼"	3/16"	-	2"	SEE DETAIL 3/S2.3
⟨9⟩	II	1"	16"	16"	2"	4	1"	12"	-	-	¼"	2"	
⟨10⟩	II	1"	10"	15"	2"	4	1"	12"	-	-	¼"	2"	SEE DETAIL 1/S2.6
⟨11⟩	II	1½"	19"	19"	2"	4	1¼"	15"	-	-	CJP	2"	SEE DETAIL 1/S2.6
⟨12⟩	IV	1"	14"	11"	2"	4	1"	12"	-	-	¼"	2"	
⟨13⟩	II	1"	12"	12"	2"	4	1"	12"	-	-	¼"	2"	SEE DETAIL 2/S2.3

NOTE: W3 IS FOR HSS COLUMNS

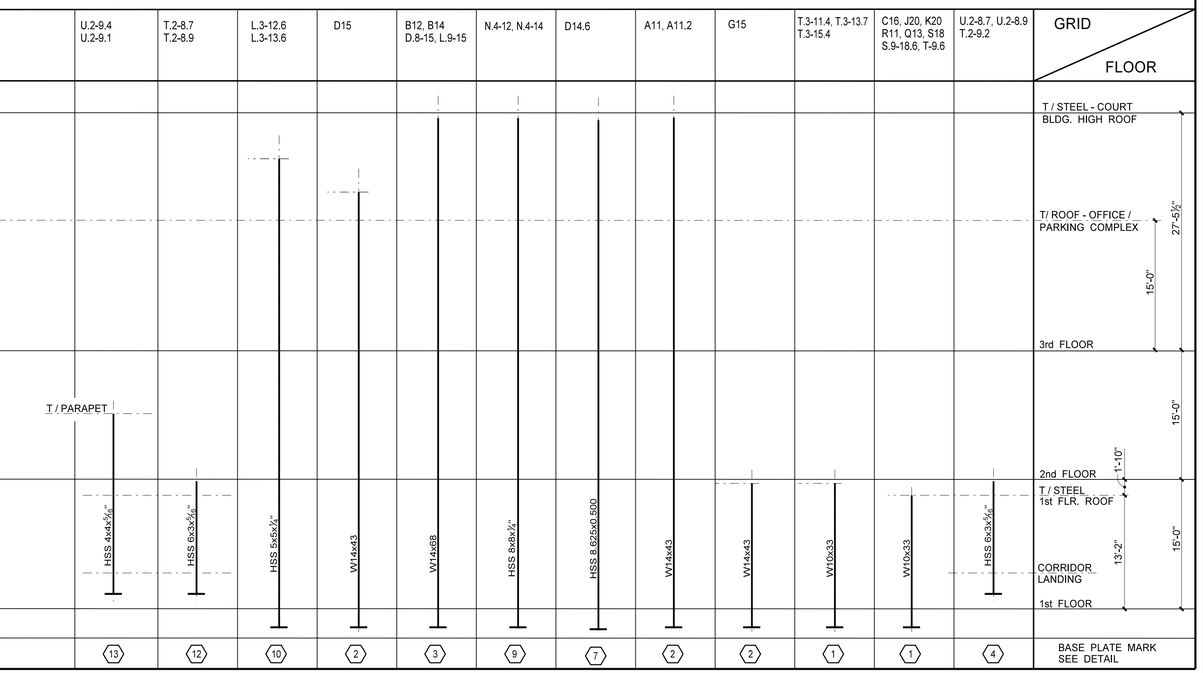


1 BASE PLATE & ANCHOR ROD SCHEDULE NON-MOMENT FRAME COLUMNS

COLUMN SCHEDULE — PART "B" OFFICE/PARKING COMPLEX



COLUMN SCHEDULE — PART "A" COURTROOM COMPLEX



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f. 615.255.1486
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HATTIESBURG PUBLIC SAFETY COMPLEX
HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

Drawing Issued:

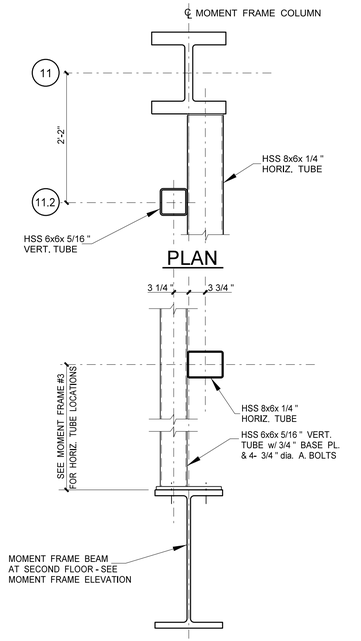
Date	Rev.	Description
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Checked By: W.G.
Client No: ------
Albert & Associates: 12575

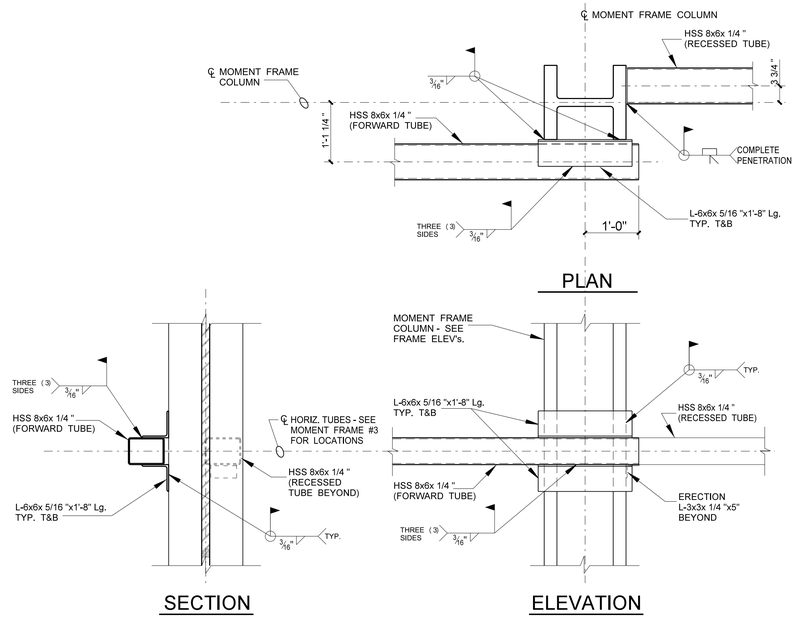
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S4.0

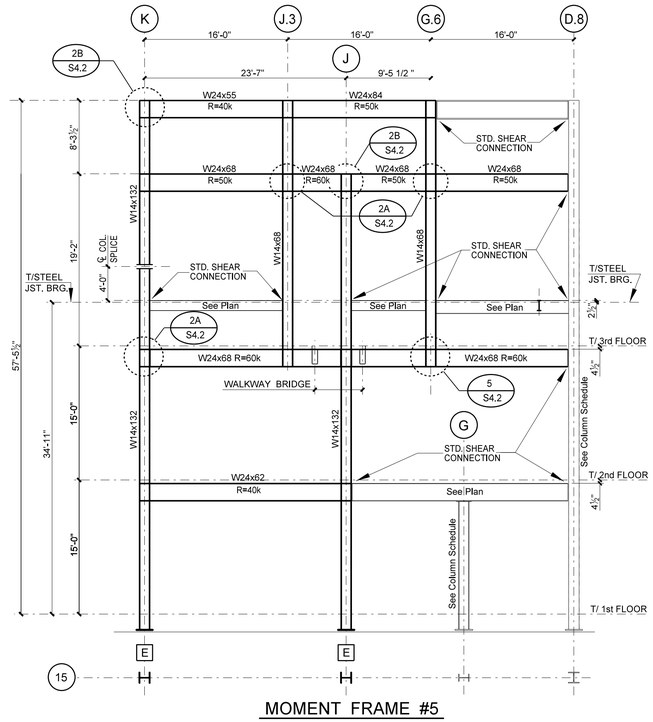
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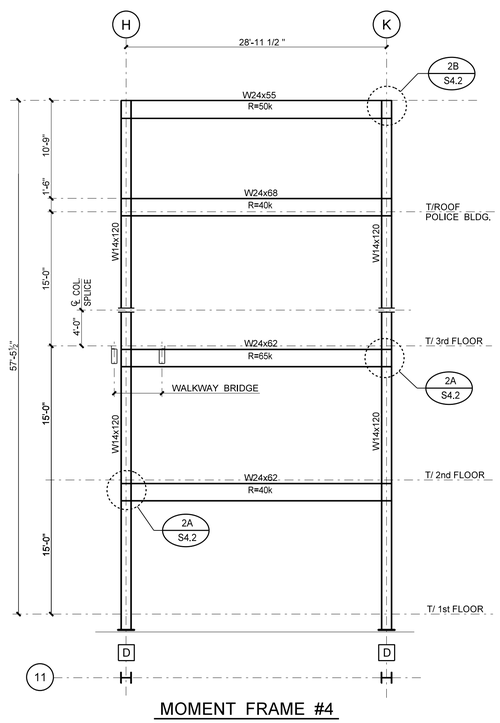
2 SECTION @ VERT. TUBE AT MOMENT FRAME #3



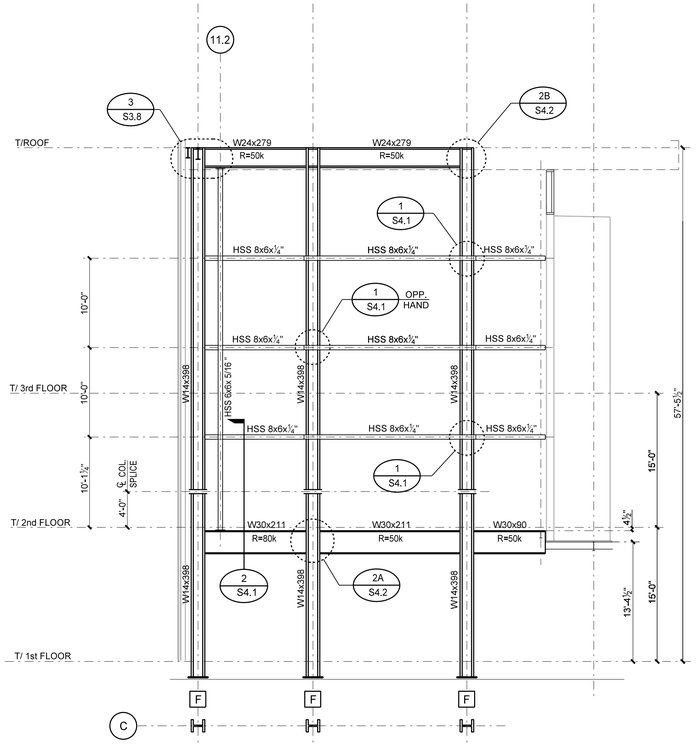
1 DETAIL - HORIZONTAL TUBES AT MOMENT FRAME #3



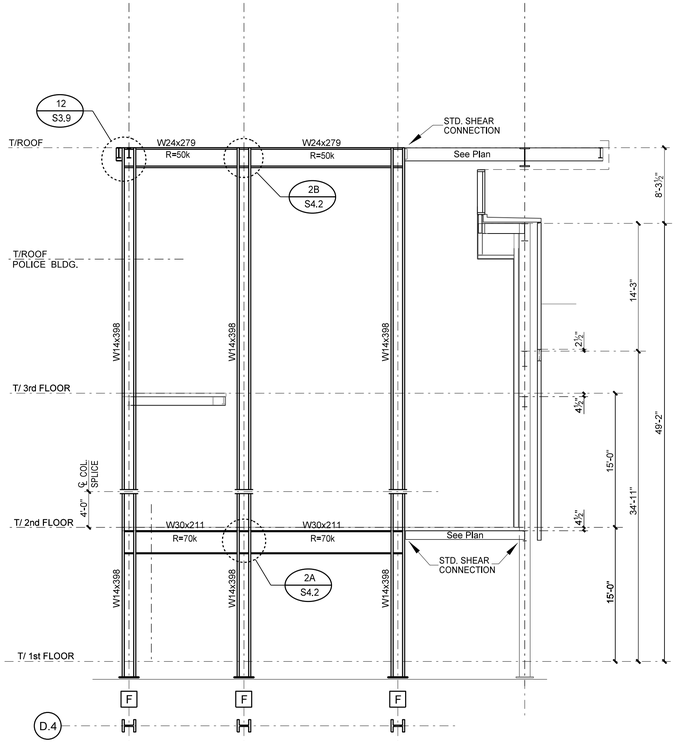
MOMENT FRAME #5



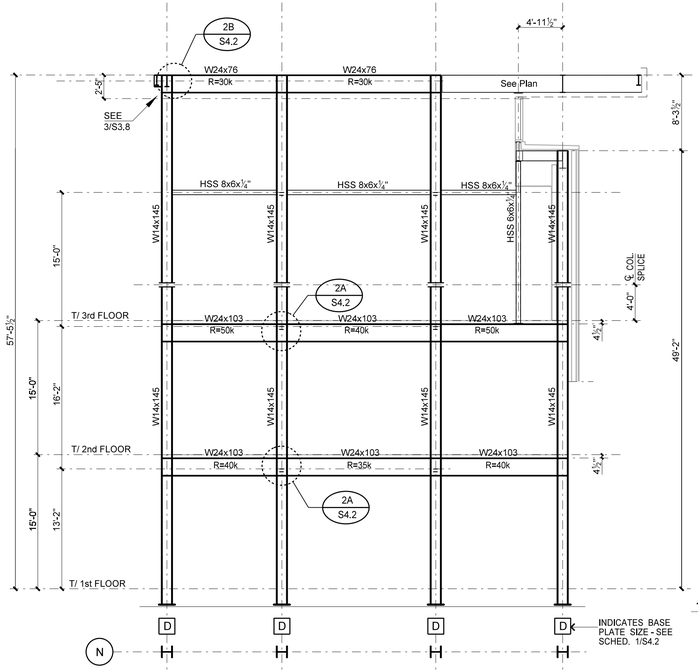
MOMENT FRAME #4



MOMENT FRAME #3



MOMENT FRAME #2



MOMENT FRAME #1

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HPSC Police and Court Building

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Date	Rev.	Description
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Drawn By: tw
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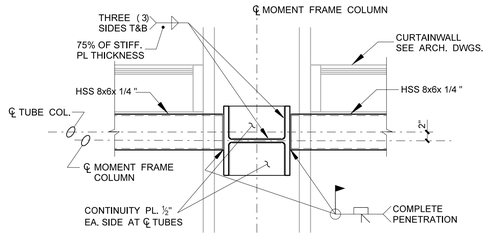
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S4.1

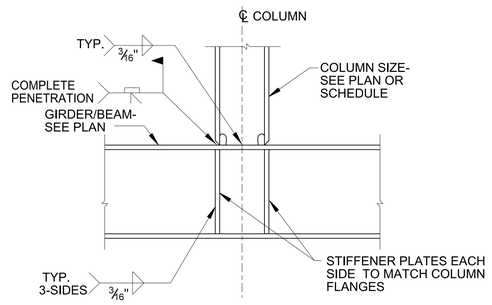
514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com **Albert & McCleskey Associates Architects**

MOMENT FRAME ELEVATIONS

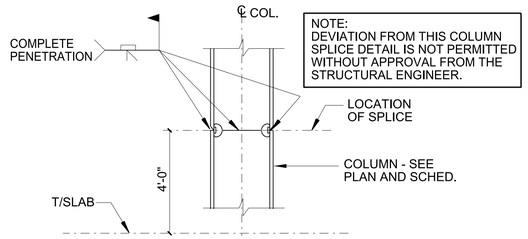
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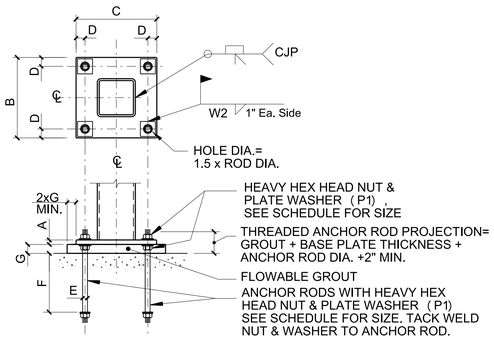
5 DETAIL - TUBE CONN. AT COL. AT MOMENT FRAME #1



4 SECTION AT COLUMN BEARING ON TRANSFER GIRDER/BEAM



3 COMPLETE PENETRATION WELDED COLUMN FIELD SPLICE DETAIL



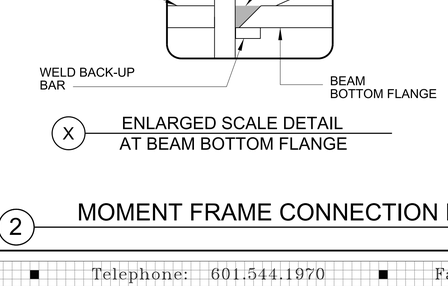
1A BASE PL. AND ANCHOR ROD SCHEDULE FOR MOMENT FRAME TUBE COLUMNS

BASE PLATE MARK	BASE PLATE				*ANCHOR RODS			GROUT	WELD	PLATE WASHER	
	A	B	C	D	No.	E	F	G	W1	P1	W2
A	1"	18"	18"	2"	4	1"	12"	2"	3/16"	3/16"x2x2	3/16"
B	1¼"	18"	18"	2"	4	1"	12"	2"	3/16"	3/16"x2x2	3/16"
C	1½"	18"	18"	2"	4	1"	12"	2"	3/16"	3/16"x2x2	3/16"
D	2"	24"	24"	2"	6	1½"	18"	2½"	¼"	5/16"x3x3	3/16"
E	2¼"	24"	24"	2¼"	6	1½"	18"	2½"	¼"	5/16"x3x3	3/16"
F	2¼"	28"	28"	2¼"	6	1½"	18"	2½"	5/16"	5/16"x3x3	3/16"
G	2"	24"	24"	2¼"	4	1½"	18"	2½"	¼"	5/16"x3x3	3/16"
H	2"	26"	26"	2⅝"	6	1¾"	21"	2½"	¼"	⅜"x3½x3½	3/16"
I	2¼"	26"	26"	2⅝"	6	1¾"	21"	2½"	¼"	⅜"x3½x3½	3/16"
J	2"	27"	27"	2¼"	4	1½"	18"	2½"	3/16"	5/16"x3x3	3/16"
K	2½"	29"	29"	2⅝"	6	1¾"	21"	2½"	¼"	⅜"x3½x3½	3/16"

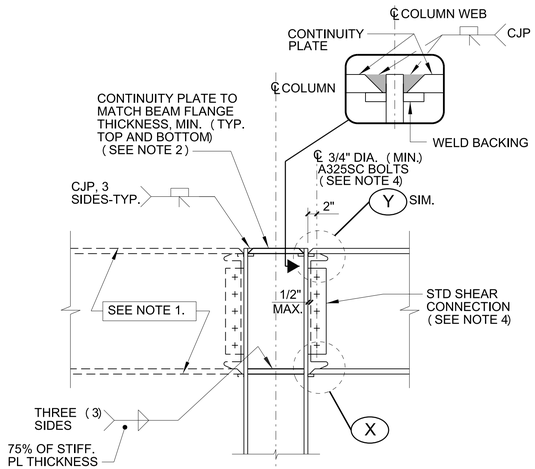
* NOTE: ANCHOR RODS FOR MOMENT FRAMES TO BE ASTM F1554, GRADE 55.

NOTES:

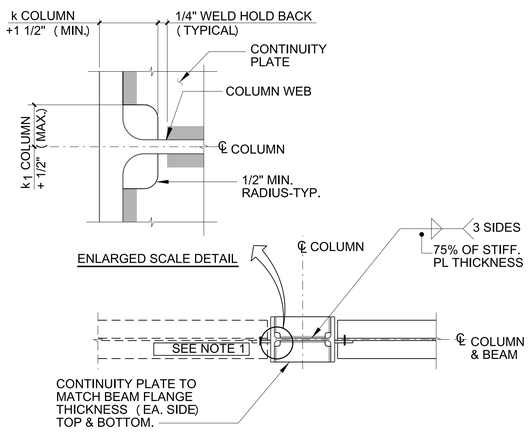
1. JOINT DETAILS SYMMETRICAL ABOUT COLUMN CENTERLINE AT INTERIOR COLUMNS.
2. CONTINUITY PLATES SHALL BE ASTM A572, GRADE 50 STEEL.
4. SHEAR CONNECTION PLATE AND BOLTS SHALL BE DESIGNED FOR THE REACTIONS SHOWN ON THE MOMENT FRAME ELEVATIONS.



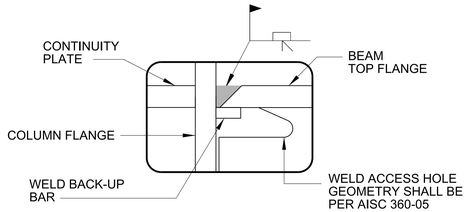
C CONNECTION DETAIL AT TUBE COLUMN



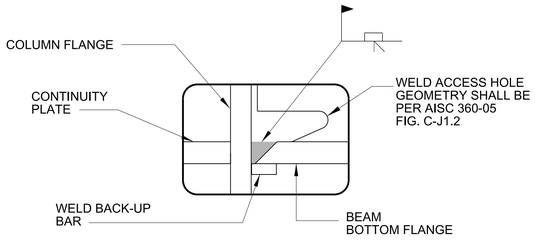
B CONNECTION DETAIL AT ROOF



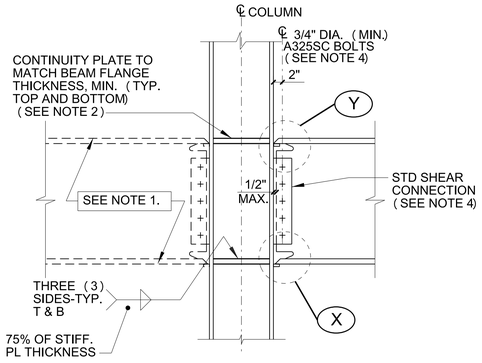
PLAN VIEW DETAIL WITHOUT DOUBLER PLATE



Y ENLARGED SCALE DETAIL AT BEAM TOP FLANGE

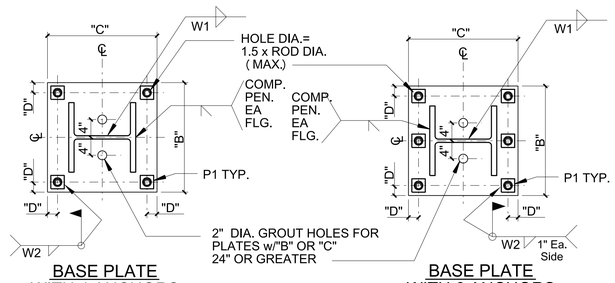


X ENLARGED SCALE DETAIL AT BEAM BOTTOM FLANGE



A CONNECTION DETAIL AT FLOOR

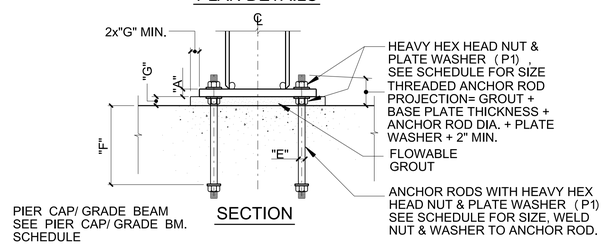
2 MOMENT FRAME CONNECTION DETAILS



BASE PLATE WITH 4 ANCHORS

PLAN DETAILS

BASE PLATE WITH 6 ANCHORS



SECTION

1 BASE PL. AND ANCHOR ROD SCHEDULE FOR MOMENT FRAME WIDE FLANGE COL's.

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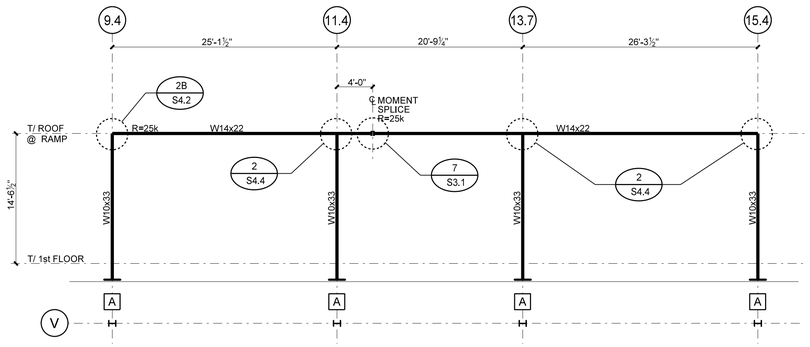
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Client No: ------
Albert & Associates: 12575

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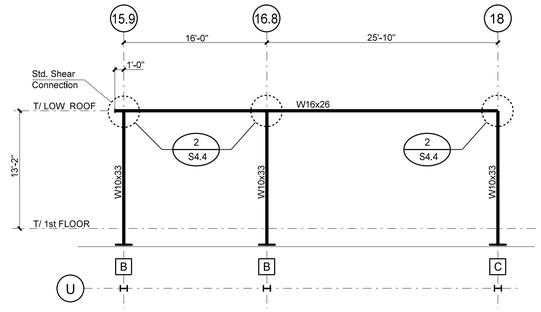
S4.2

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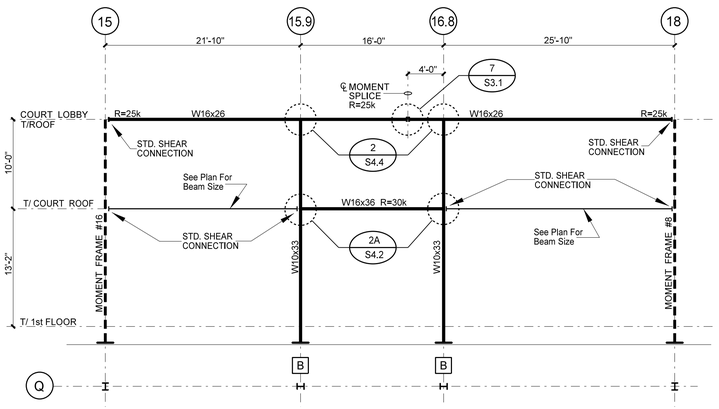
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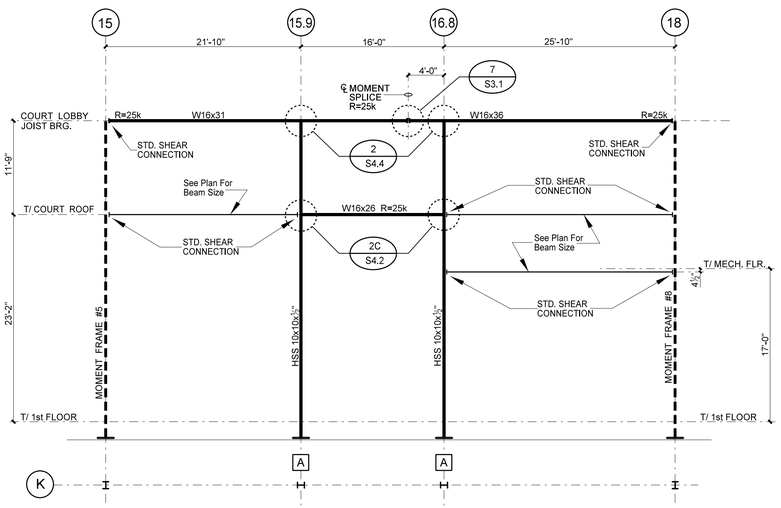
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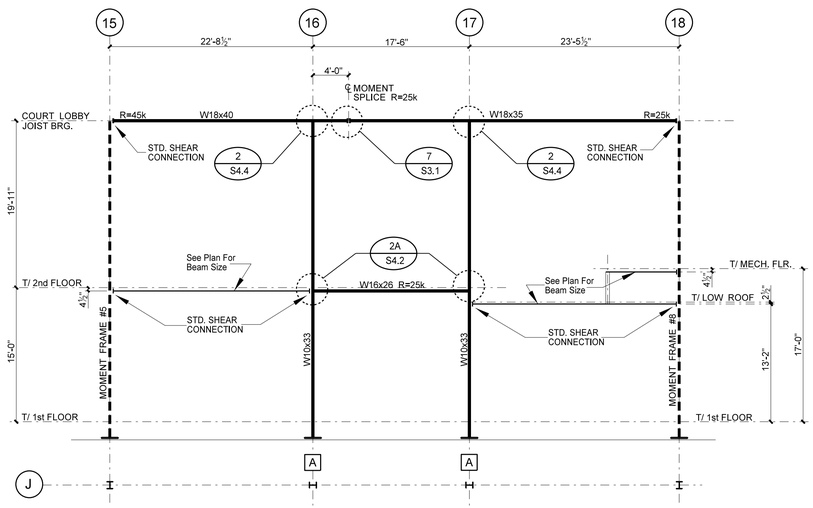
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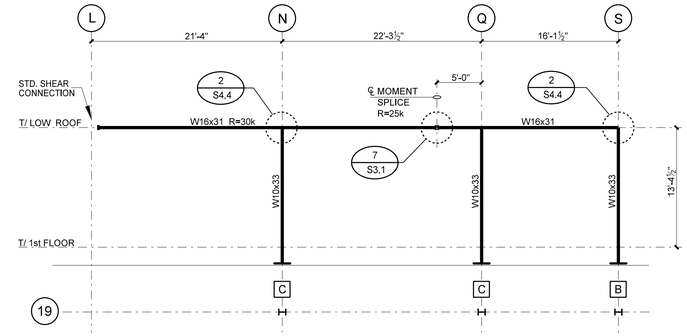
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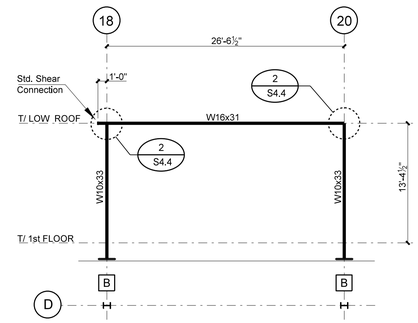
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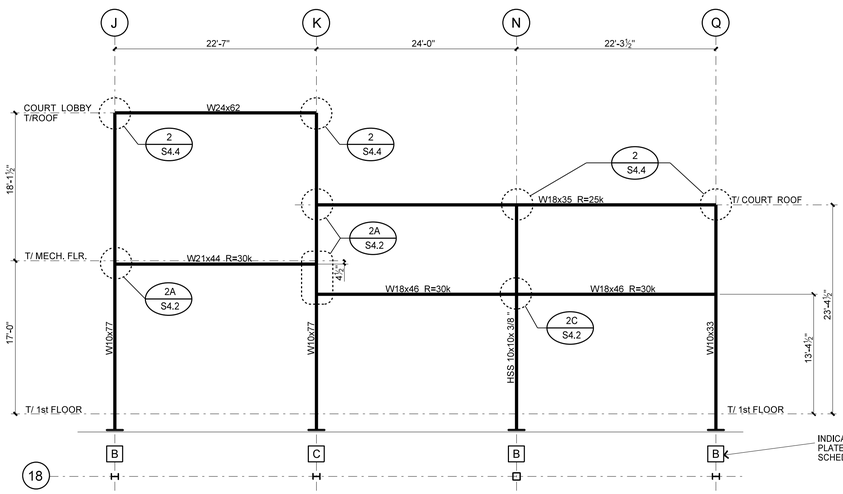
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MOMENT FRAME #9

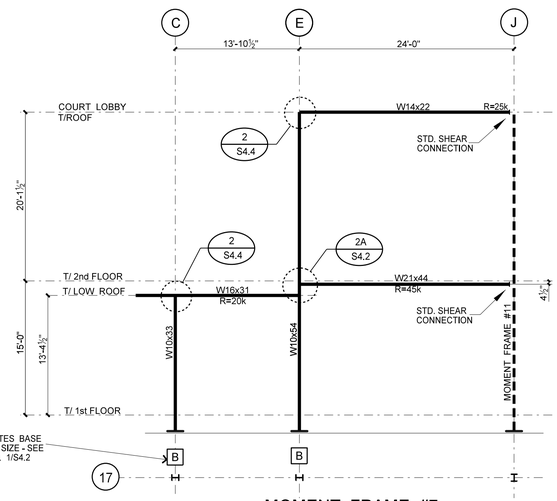


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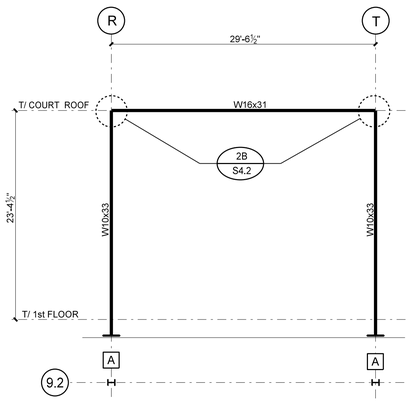


MOMENT FRAME #8

INDICATES BASE PLATE SIZE - SEE SCHED. 1/S4.2



MOMENT FRAME #7



MOMENT FRAME #6

STRUCTURAL DESIGN GROUP
21-APR-2017 15:27
Steve
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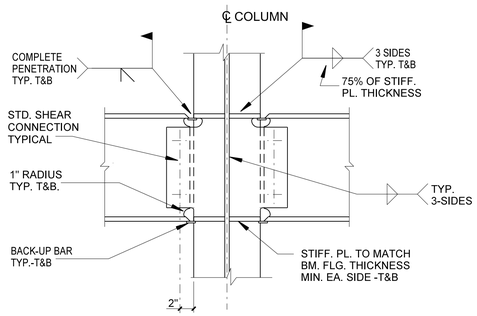
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Checked By: W.G.
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Albert & Associates: 12575

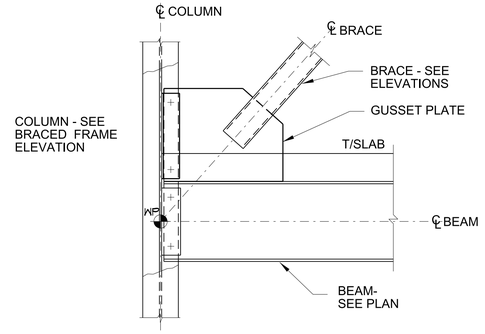
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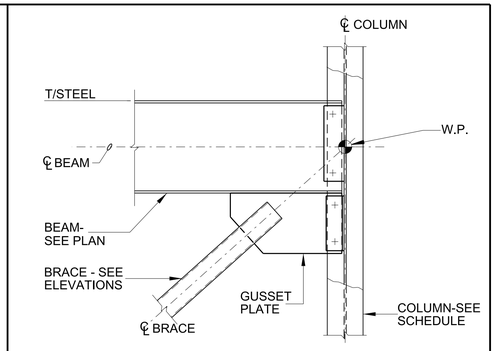
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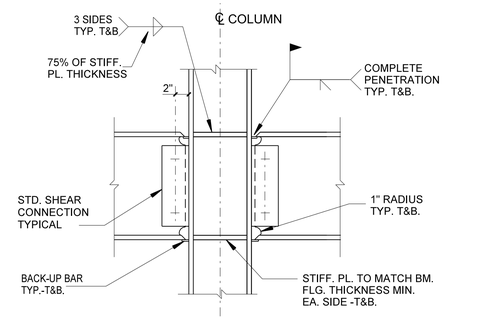
6 WELD THRU COLUMN WEB



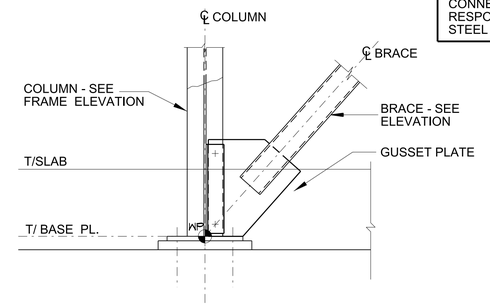
4 DETAIL



1 DETAIL

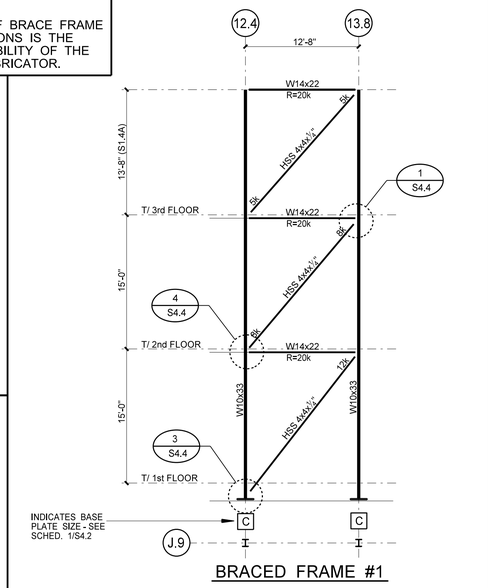


5 WELD THRU COLUMN FLANGE

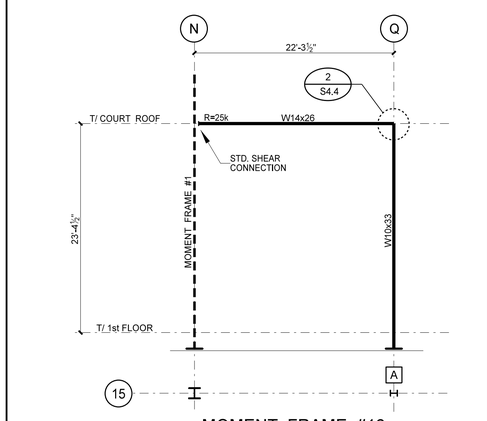


3 DETAIL

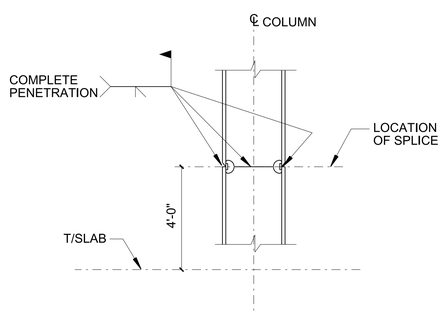
NOTE:
DESIGN OF BRACE FRAME CONNECTIONS IS THE RESPONSIBILITY OF THE STEEL FABRICATOR.



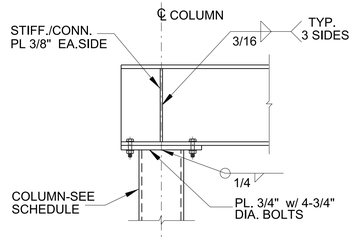
BRACED FRAME #1



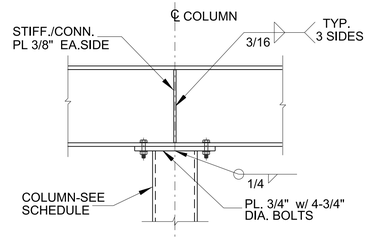
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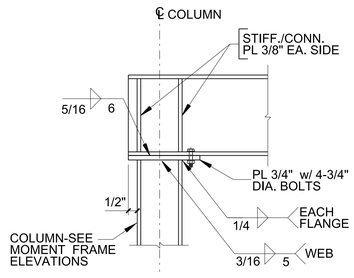
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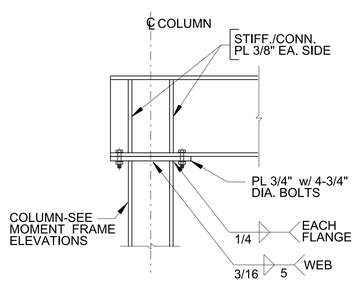
AT END TUBE COLUMN



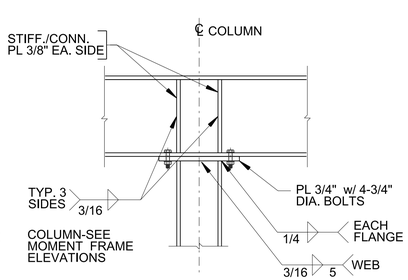
AT INTERMEDIATE TUBE COLUMN



AT END COLUM (ALTERNATE)



AT END COLUMN



AT INTERMEDIATE COLUMN

2 CONT. BEAM TO COLUMN CONNECTION AT MOMENT FRAMES

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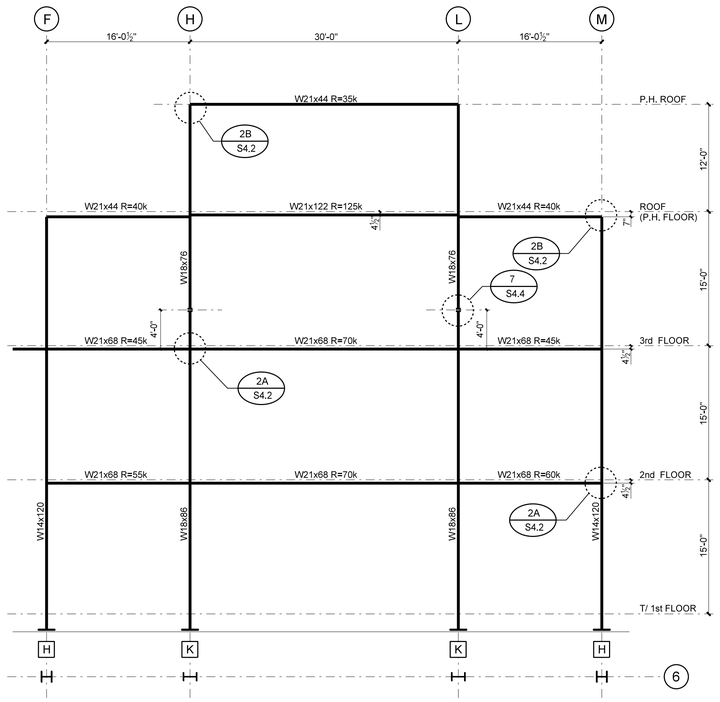
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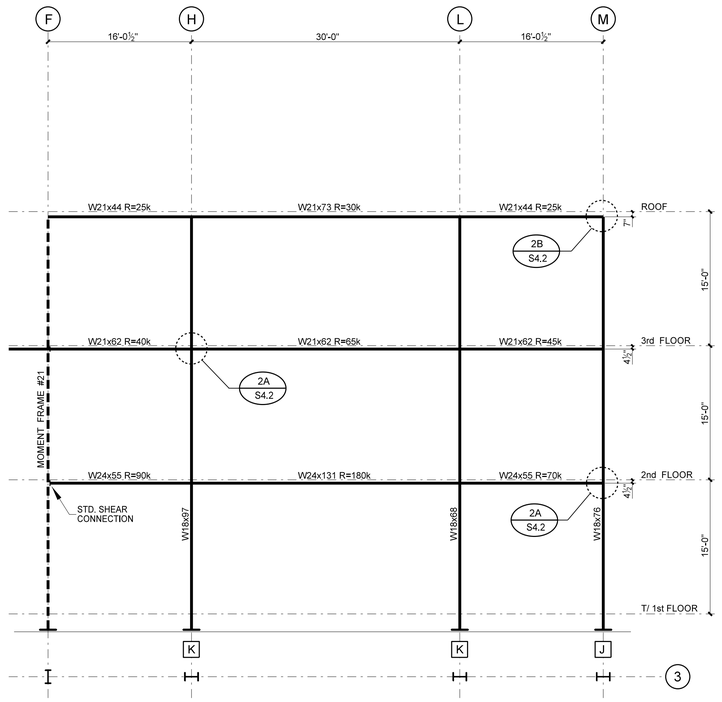
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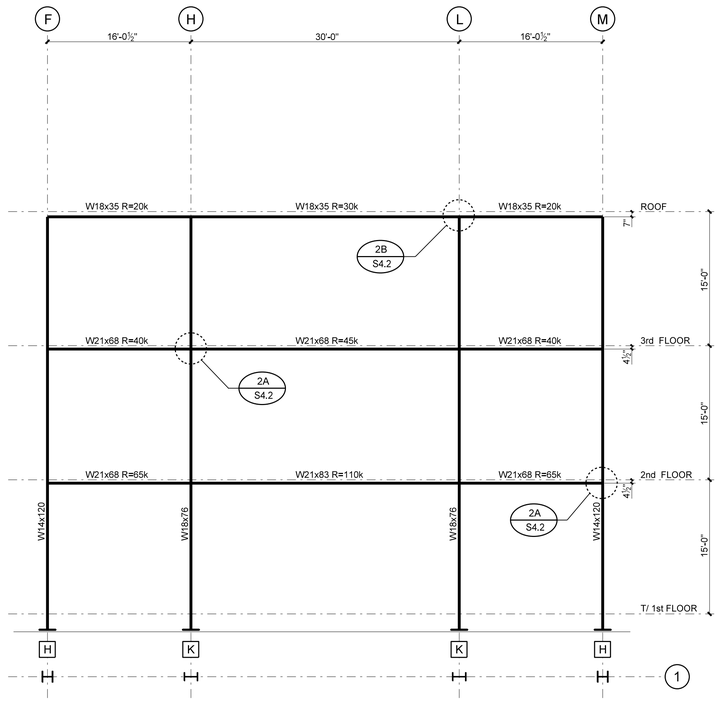
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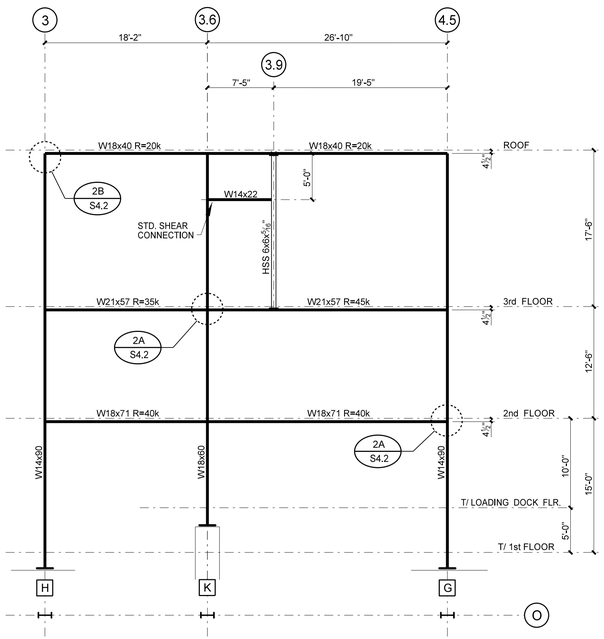
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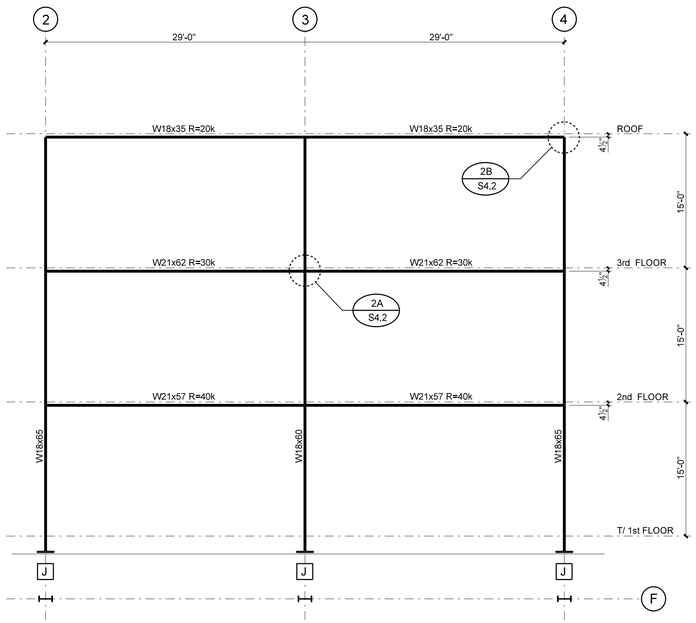
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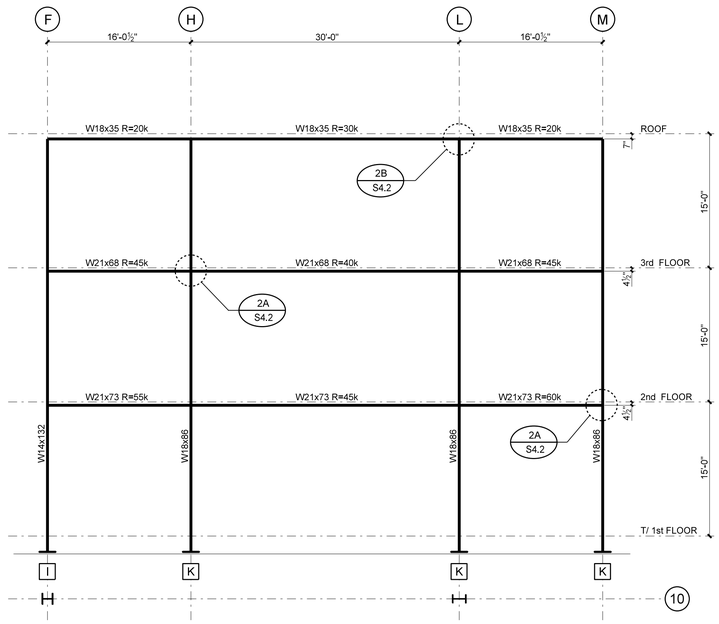
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MOMENT FRAME #22



MOMENT FRAME #21



MOMENT FRAME #20

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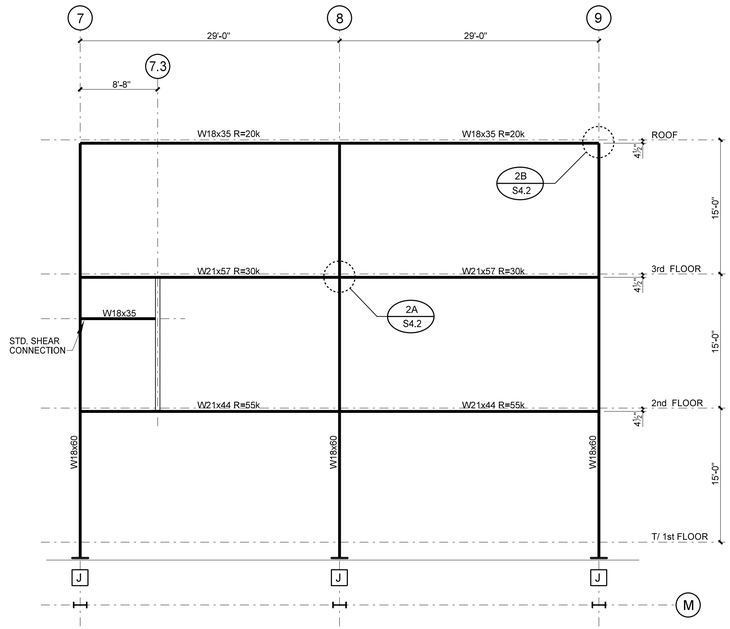
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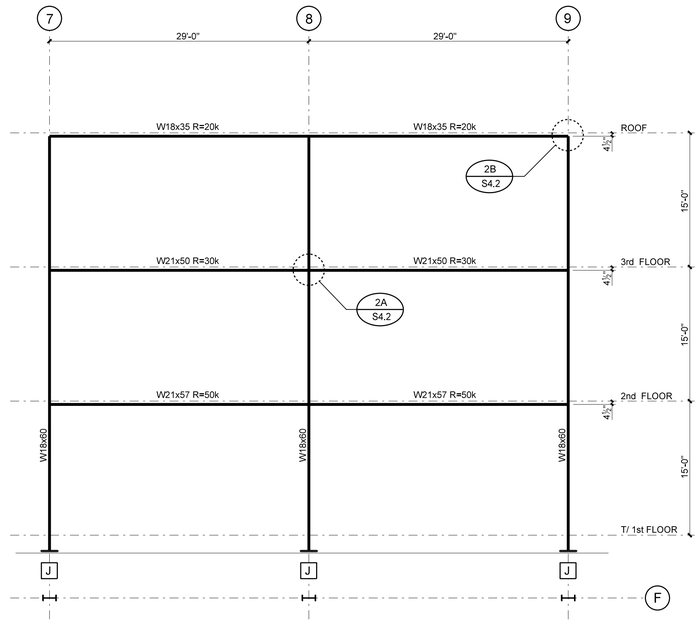
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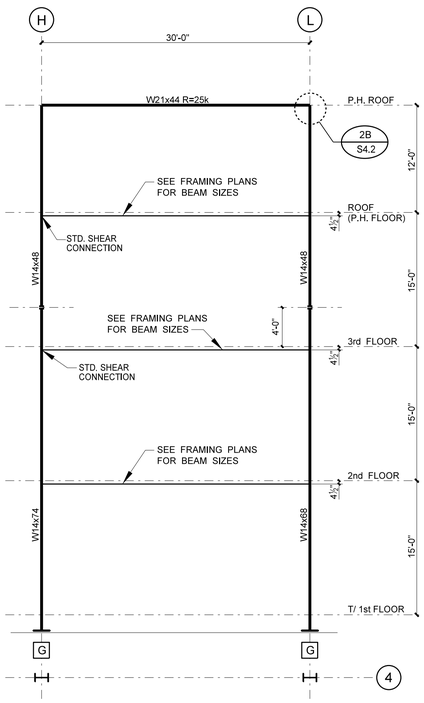
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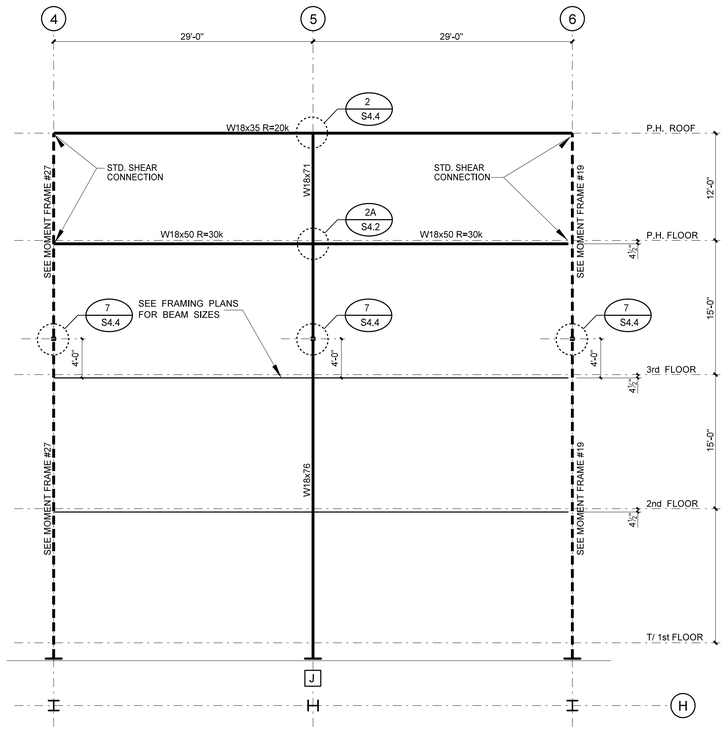
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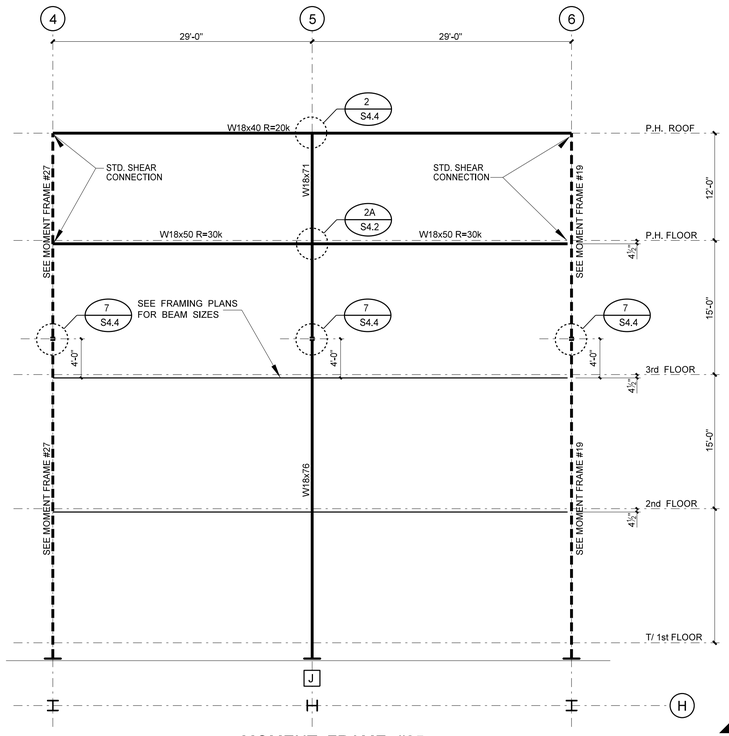
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PLUMBING ABBREVIATIONS

ABBREVIATIONS – PLUMBING

AAV	AIR ADMITTANCE VALVE
AD	ACCESS DOOR
AHU	AIR HANDLING UNIT
AS	AIR SEPARATOR
BTU	BRITISH THERMAL UNIT
CFM	CUBIC FEET PER MINUTE
CTG	CEILING TRANSFER GRILLE
CG	CEILING GRILLE
CO	CLEAN OUT
CU	CONDENSING UNIT
CW	DOMESTIC COLD WATER
DIA	DIAMETER
DN	DOWN
ET	EXPANSION TANK
EWH	ELECTRIC WATER HEATER
EWT	ENTERING WATER TEMPERATURE
°F	DEGREES FAHRENHEIT
FC	FLEXIBLE CONNECTION (DUCT OR PIPE)
FLR	FLOOR
FT	FEET
GF	GAS FURNACE
GPM	GALLONS PER MINUTE
GWH	GAS WATER HEATER
HP	HORSE POWER
HR	HOUR
HW	HOT WATER

ABBREVIATIONS – PLUMBING

ID	INSIDE DIMENSION
KW	KILOWATT
LBS	POUNDS
MAX	MAXIMUM
MBH	THOUSAND BTU PER HOUR
MFG	MANUFACTURER
MIN	MINIMUM
MUA	MAKE UP AIR UNIT
NC	NORMALLY CLOSED
NIC	NOT IN THIS CONTRACT
NO	NORMALLY OPEN
NTS	NOT TO SCALE
P	PUMP
PRV	PRESSURE REDUCING VALVE
PSI	POUNDS PER SQUARE INCH (GAUGE)
RPM	REVOLUTIONS PER MINUTE
RP	RECIRC PUMP
SQFT	SQUARE FEET
TYP	TYPICAL
VTR	VENT THRU ROOF
W/	WITH
EW	EXISTING DOMESTIC WATER
EDCW	EXISTING DOMESTIC COLD WATER
EDHW	EXISTING DOMESTIC HOT WATER
EDHWR	EXISTING DOMESTIC HOT WATER RECIRC
EG	EXISTING GAS (NATURAL)

PLUMBING LEGEND

PIPING LEGEND

	DOMESTIC COLD WATER
	DOMESTIC HOT WATER (110°)
	DOMESTIC HOT WATER RECALCULATING LINE (110°)
	SANITARY WASTE
	PLUMBING VENT
	PRIMARY STORM DRAIN
OF	SECONDARY OVERFLOW STORM
CD	CONDENSATE DRAIN
PC	PUMPED CONDENSATE
F	FIRE PROTECTION
G	GAS PIPING
	CONCEALED FIRE SPRINKLER HEAD
	FIRE SPRINKLER UPRIGHT PENDANT
WCO	WALL CLEANOUT
CO	CLEANOUT (ABOVE CEILING OR OVERHEAD)
FFCO	FLUSH FLOOR CLEANOUT
FGCO	FLUSH GRADE CLEANOUT
	2-WAY FLUSH GRADE CLEAN OUT
	HOSE BIBB
	CONCRETE THRUST BLOCK
FM	FLOW METER
FS	FLOW SWITCH
	FIRESTOPPING
	PIPE SLEEVE
	BEAM PENETRATION
	PIPE CAP
	PIPE BLIND FLANGE
	UNION
	SHUT-OFF VALVE
	NORMALLY CLOSED SHUT-OFF VALVE

PIPING LEGEND (CONT.)

	GLOBE VALVE
	CHECK VALVE
	AUTOMATIC THREE-WAY CONTROL VALVE
	AUTOMATIC TWO-WAY CONTROL VALVE
	RELIEF VALVE
	ANGLE RELIEF VALVE
	PRESSURE REDUCING VALVE (PRV)
	LUBRICATED PLUG VALVE
	SOLENOID VALVE
	BUTTERFLY VALVE (MANUAL)
	BALL VALVE
	PUMP
	REFRIGERANT EXPANSION VALVE
	SIGHT GLASS
	MANUAL AIR VENT
	AUTOMATIC AIR VENT
	THERMOMETER
	PIPE SENSOR WELL (THERMOMETER)
	PRESSURE GAUGE AND COCK
	PRESSURE GAUGE WITH LOOP
	TEMPERATURE-PRESSURE TEST FITTING
	CENTER LINE
P 1	PLUMBING RISER DESIGNATION
	NEW CONNECTION TO EXISTING PIPING, DUCTWORK AND/OR EQUIPMENT

SHEET INDEX – PLUMBING

SHEET	TITLE
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P□□□□	FIRST FLOOR PLAN PART B □PLUMBING
P□□□□	SECOND FLOOR PLAN PART A □PLUMBING
P□□□□	SECOND FLOOR PLAN PART B □PLUMBING
P□□□□	THIRD FLOOR PLAN PART A □PLUMBING
P□□□□	THIRD FLOOR PLAN PART B □PLUMBING
P□□□□	ROOF PLAN PART A □PLUMBING
P□□□□	ROOF PLAN PART B □PLUMBING
P□□□	PLUMBING DETAILS
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FP□□□□	FIRST FLOOR PLAN PART A □FIRE PROTECTION
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FP□□□□	SECOND FLOOR PLAN PART A □FIRE PROTECTION
FP□□□□	SECOND FLOOR PLAN PART B □FIRE PROTECTION
FP□□□□	THIRD FLOOR PLAN PART A □FIRE PROTECTION
FP□□□□	THIRD FLOOR PLAN PART B □FIRE PROTECTION
FP□□□□	ROOF PLAN PART B □FIRE PROTECTION
FP□□□	FIRE PROTECTION DETAILS

GENERAL NOTES:

1 CONTRACTOR IS RESPONSIBLE FOR COORDINATING ALL PLUMBING AND FIRE PROTECTION INSTALLATIONS WITH OTHER TRADES SUCH AS ELECTRICAL, STRUCTURAL, HVAC, LIGHTING, CEILING CONSTRUCTION AND SUPPORTS, ETC. ANY CONFLICTS ARISING OUT OF A LACK OF CONSTRUCTION COORDINATION OR DUE TO LACK OF CONSIDERATION FOR THE NEEDS OF OTHER TRADES SHALL BE RESOLVED AT NO EXPENSE TO THE OWNER.

2 ALL PIPING SHALL BE INSTALLED IN SUCH A MANNER THAT CONFLICTS WITH AIR CONDITIONING DUCTS AND WITH CEILING LIGHTS WILL NOT OCCUR. IN SOME INSTANCES, WHERE INDICATED, PIPING SHALL BE INSTALLED WITH SLEEVES THROUGH BEAMS. CONTRACTOR SHALL BE RESPONSIBLE FOR FURNISHING THE SIZES OF SLEEVES AND THE ELEVATIONS AT WHICH OPENINGS ARE TO BE MADE PRIOR TO INSTALLATION OF STRUCTURAL MEMBERS.

3 FOR EVERY PIPE SLEEVE PENETRATING FIRE RATED WALLS AND SLABS, USE 3M OR EQUIVALENT FIRE BARRIER WRAP STRIP FS-165, 3M CAULK CP 25 AND 3M PUTTY 303, ASTM E-814, U.L. LISTED, CAPABLE OF RAPID EXPANSION WHEN EXPOSED TO HEAT. COMPLIES WITH BOCA, ICBO AND SSBC. PROVIDES 3 HOUR FIRE RATING.

4 ALL SANITARY AND STORM DRAINAGE PIPING SHALL BE INSTALLED AT 1/8" PER FOOT SLOPE UNLESS OTHERWISE NOTED. FIXTURE ARMS AND SMALL BRANCHES SHALL BE SLOPED IN ACCORDANCE WITH THE STANDARD PLUMBING CODE.

5 PROVIDE ACCESS PANELS FOR SHOCK ABSORBERS, VALVES AND CLEANOUT COVERS FOR CLEANOUT PLUGS AS SPECIFIED. EACH ITEM SHALL BE PROVIDED WITH ITS ACCESS PANEL OR COVER. ACCESS PANELS AND CLEANOUT COVERS SHALL BE EASILY ACCESSIBLE AND CONTRACTOR WILL BE RESPONSIBLE FOR LOCATING THESE ITEMS SO THAT SHOCK ABSORBER, VALVE OR CLEANOUT LIES WITHIN WALL OR CEILING IMMEDIATELY BEHIND COVER OR PANEL. CONTRACTOR SHALL COORDINATE THE LOCATION OF PANELS AND COVERS WITH OTHER TOILET ACCESSORIES AND FIXTURES AS WELL AS ARCHITECTURAL LAYOUT.

6 DURING FINAL PUNCH LIST INSPECTION, CONTRACTOR SHALL HAVE ALL CLEANOUT COVERS AND ACCESS PANELS OPENED AND ITEMS EXPOSED FOR VERIFICATION AS TO THEIR INSTALLATION BY CONTRACTING OFFICER.

7 PROVIDE AUTOMATIC RESEALS FOR ALL FLOOR DRAINS.

8 SPRINKLER HEAD LOCATIONS SHALL BE SYMMETRICAL WITH ROOM, LIGHTS, DIFFUSERS, ETC. AND COORDINATE WITH THE REFLECTIVE CEILING PLANS. HEADS SHALL BE AS FOLLOWS.

A. LAY-IN CEILING SHALL HAVE SEMI-RECESSED HEADS WITH ESCUTCHEON COLOR SELECTED BY THE ARCHITECT.

B. SHEET ROCK OR PLASTER CEILINGS SHALL HAVE FULLY CONCEALED HEADS WITH COLOR OF CAP SELECTED BY THE ARCHITECT.

9 ALL PIPING TO COMPLY WITH 2012 IBC SEISMIC DESIGN CATEGORY C, OCCUPANCY CATEGORY IV.

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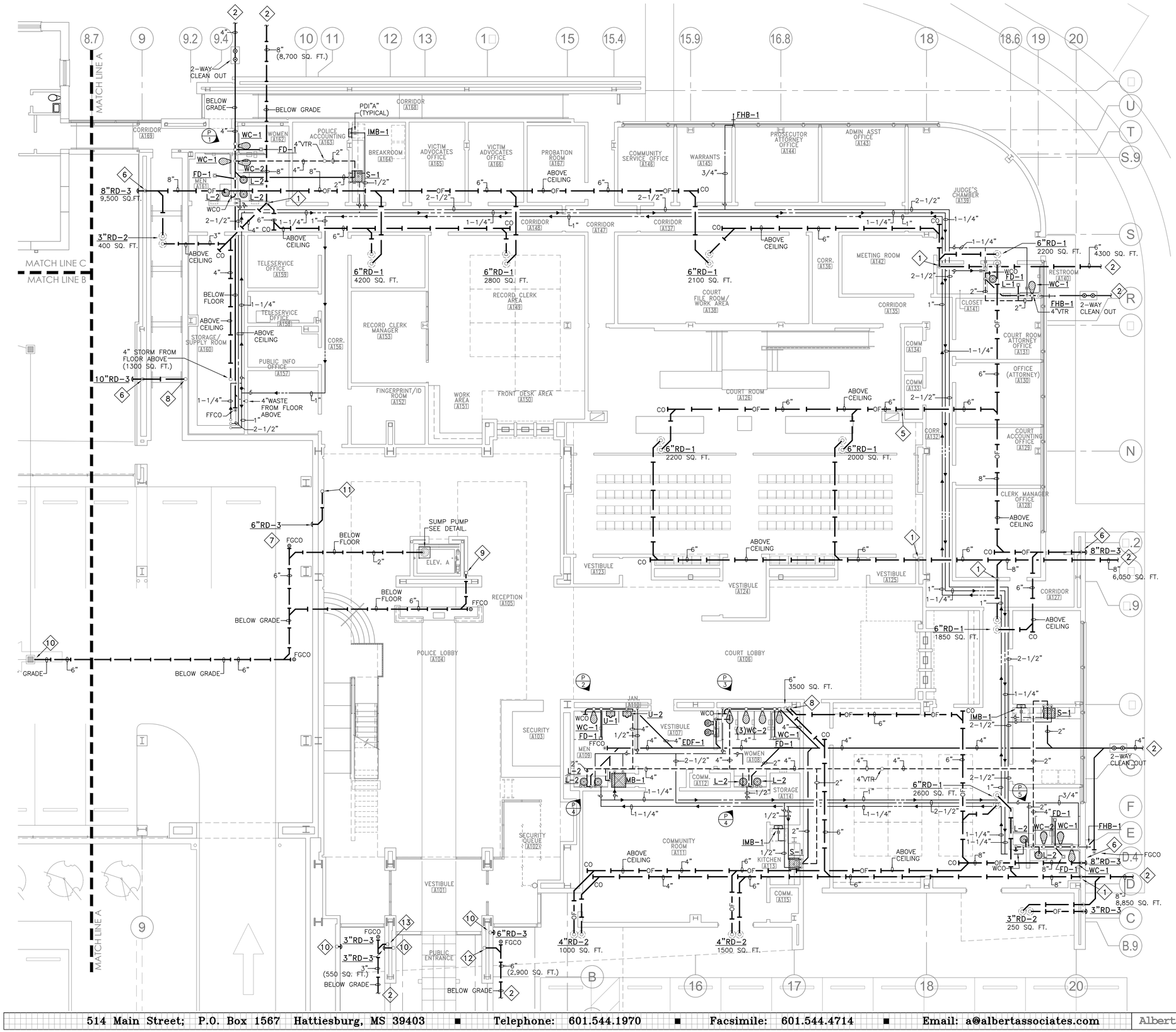
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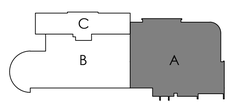


PLAN NOTES:

1. STORM DRAIN PIPING DOWN TO BELOW FLOOR.
2. CONTINUATION UNDER ANOTHER DIVISION.
3. 6" WASTE FROM FLOOR ABOVE. OFF-SET ABOVE CEILING AND DROP TO BELOW GRADE.
4. 3" COLD WATER UP TO FLOOR ABOVE.
5. RUN OVERFLOW DRAIN IN WEBBING OF TRUSSES AND DROP OVERFLOW DRAIN DOWN IN WALL TO 11'-0" ABOVE FINISH FLOOR.
6. SECONDARY OVERFLOW DRAINAGE PIPE TO DROP DOWN TO 18" ABOVE GRADE AND DISCHARGE ABOVE GRADE. DISCHARGE FROM THIS PIPE INDICATES A PROBLEM EXIST.
7. 2" DRAIN LINE FROM ELEVATOR SUMP PUMP. DRAIN BELOW FLOOR TO CATCH BASIN IN PARKING GARAGE.
8. SECONDARY STORM OVERFLOW DRAIN FROM FLOOR ABOVE. OFF-SET ABOVE CEILING.
9. 6" STORM FROM ABOVE. CONTINUE DOWN TO BELOW GRADE.
10. SECONDARY STORM OVERFLOW FROM FLOOR ABOVE. TURN OUT ABOVE GRADE AND DISCHARGE THROUGH RD-3.
11. SECONDARY STORM OVERFLOW FROM FLOOR ABOVE. OFF-SET, AND TURN OUT ABOVE GRADE AND DISCHARGE THROUGH RD-3.
12. 6" STORM DRAIN FROM FLOOR ABOVE. CONTINUE DOWN TO BELOW GRADE.
13. 3" STORM DRAIN FROM FLOOR ABOVE. CONTINUE DOWN TO BELOW GRADE.

FIRST FLOOR PLAN PART A – PLUMBING

SCALE: 1/8" = 1'-0"



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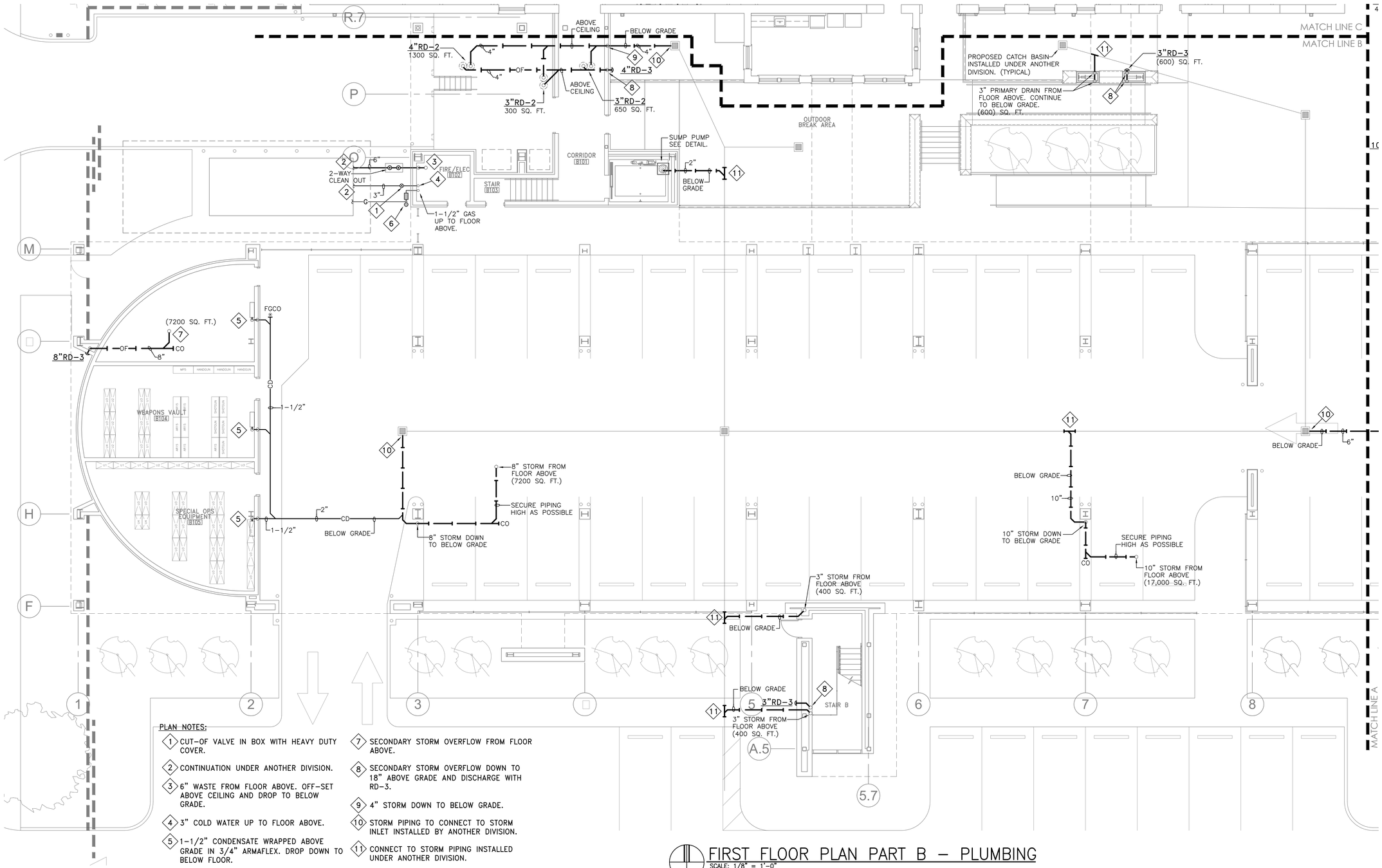
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PLAN NOTES:

1. CUT-OF VALVE IN BOX WITH HEAVY DUTY COVER.
2. CONTINUATION UNDER ANOTHER DIVISION.
3. 6" WASTE FROM FLOOR ABOVE. OFF-SET ABOVE CEILING AND DROP TO BELOW GRADE.
4. 3" COLD WATER UP TO FLOOR ABOVE.
5. 1-1/2" CONDENSATE WRAPPED ABOVE GRADE IN 3/4" ARMAFLEX. DROP DOWN TO BELOW FLOOR.
6. GAS METER AND REGULATOR BY UTILITY COMPANY AT CONTRACTOR'S EXPENSE. SIZE REGULATOR FOR 3600 CFH AT 2 LBS. ENTER BUILDING ABOVE GRADE WITH GAS COCK.
7. SECONDARY STORM OVERFLOW FROM FLOOR ABOVE.
8. SECONDARY STORM OVERFLOW DOWN TO 18" ABOVE GRADE AND DISCHARGE WITH RD-3.
9. 4" STORM DOWN TO BELOW GRADE.
10. STORM PIPING TO CONNECT TO STORM INLET INSTALLED BY ANOTHER DIVISION.
11. CONNECT TO STORM PIPING INSTALLED UNDER ANOTHER DIVISION.

FIRST FLOOR PLAN PART B - PLUMBING

SCALE: 1/8" = 1'-0"

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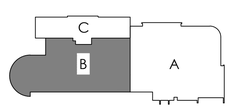
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PLAN NOTES:

1. 1-1/4" HOT WATER, 1" HOT WATER AND 2-1/2" COLD WATER FROM FLOOR BELOW. RISE TO ABOVE CEILING.
2. 10" SECONDARY STORM OVERFLOW DOWN TO FLOOR BELOW.
3. 6" SECONDARY STORM OVERFLOW FROM FLOOR ABOVE. CONTINUE TO FLOOR BELOW.
4. 6" PRIMARY STORM DRAIN FROM ABOVE. CONTINUE TO FLOOR BELOW.
5. 3" PRIMARY STORM DRAIN FROM ABOVE. CONTINUE TO FLOOR BELOW.
6. 3" SECONDARY STORM OVERFLOW FROM FLOOR ABOVE. CONTINUE TO FLOOR BELOW
7. 8" SECONDARY STORM DRAIN FROM ABOVE.

MATCH LINE C
MATCH LINE B
MATCH LINE A

SMALL INTERVIEW ROOM [B255]
SMALL INTERVIEW ROOM [B256]
FILES/STOR. [B257]
CORR. [B254]
BREAK ROOM [B253]
INTERNAL AFFAIRS [B251]
WORK ROOM [B252]
ADMINISTRATIVE ASSISTANT'S OFFICE [B206]
CONFERENCE ROOM [B205]
DOMESTIC VIOLENCE OFFICE [B208]
DOMESTIC VIOLENCE OFFICE [B207]
CORRIDOR [B204]
WORK AREA [B203]
ADMIN. ASST OFFICE [B202]
INVESTIGATIONS LOBBY [B201]
EMPLOYEE TOILET [B214]
EMPLOYEE TOILET [B213]
BREAK ROOM [B212]
CORRIDOR [B215]
CAPT. OFFICE [B220]
PALS COORDINATOR OFFICE [B222]
WAITING [B223]
LT. OFFICE [B221]
STORAGE ROOM [B218]
ELEC. [B219]
CUBICLES [B225]
SMALL MEETING ROOM [B224]
ELEV. A
POLICE LOBBY [A201]
PRESS/BRIEFING ROOM [A202]

4"VTR
4" STORM DOWN TO FLOOR BELOW (1300 SQ. FT.)
4"RD-1 1300 SQ. FT.
4"WASTE DOWN TO FLOOR BELOW
2"VTR
10" CO
CO
1-1/4"
2-1/2"
1"
S-1
IMB-1
WC-1
WCO
FFCO
FD-1
L-2
EDF-1
PDI "A" (TYPICAL)
MB-1
8" STORM FROM FLOOR ABOVE (6200 SQ. FT.)
BELOW FLOOR
4"RD-1 1200 SQ. FT.
4"RD-1 900 SQ. FT.
4"RD-1 1400 SQ. FT.
6" SECONDARY STORM OVERFLOW DOWN TO FLOOR BELOW. (3500 SQ. FT.)
6" STORM DOWN TO FLOOR BELOW (3500 SQ. FT.)

S.9 S R N .2 .9 G F E D.4 D C B.9
8 9 10 11 11.2 12 12.4 13.8 1□ 14.6 15 16 17 18 20
A B

SECOND FLOOR PLAN PART A – PLUMBING

SCALE: 1/8" = 1'-0"

C B A

Engineering Resource Group, Inc.
350 Edgewood Terrace Drive
Jackson, MS 39206
Phone: (601) 362-3552
Fax: (601) 366-6418

ERG# 15-28.2

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT

HPSC Police and Court Building

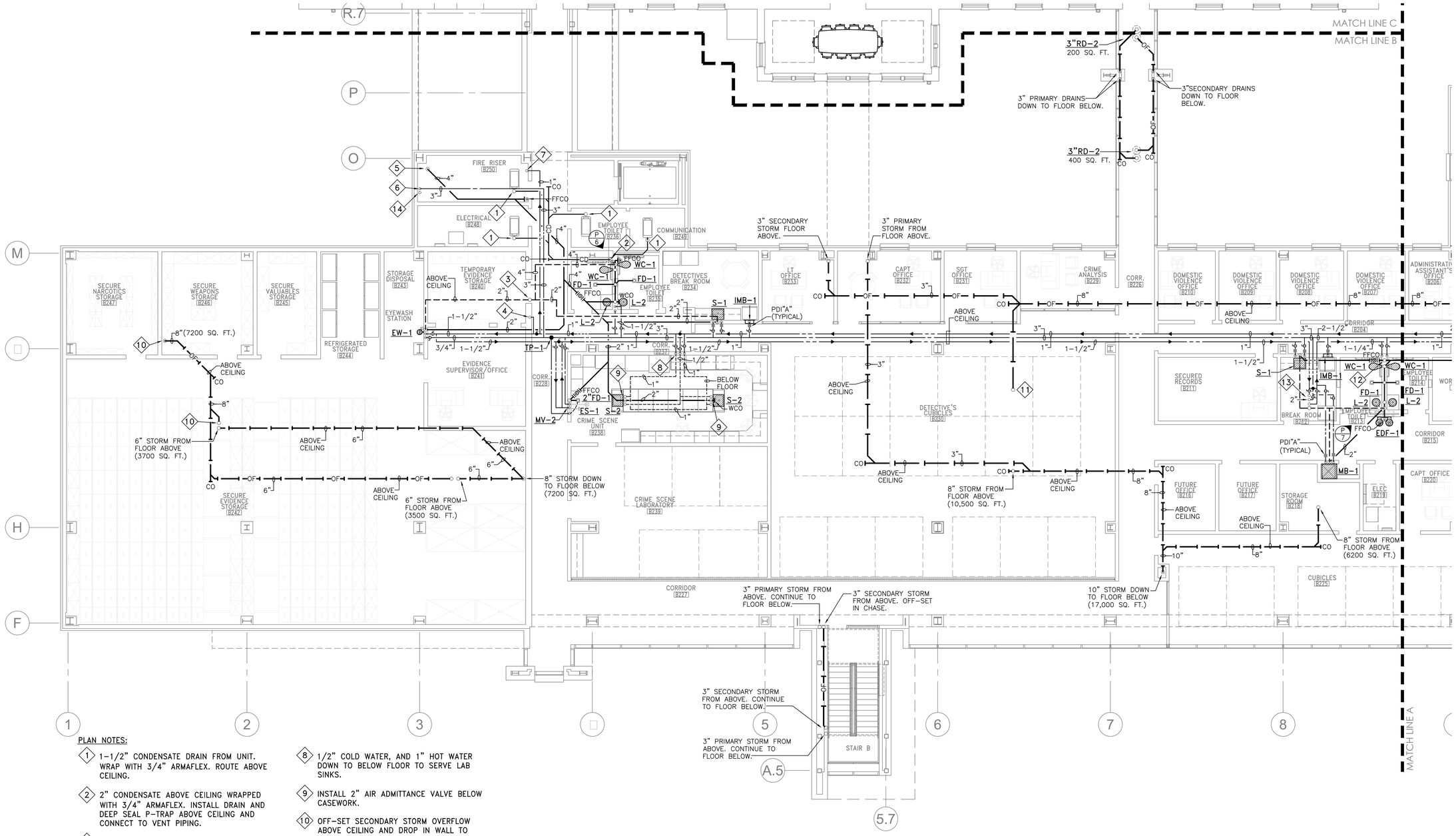
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Checked By: CM,TP
Client No: ------
Albert & Associates: 12575

CHAD E. MCCLESKEY ENGINEER 20107 1/13/2017 STATE OF MISSISSIPPI

P1.2a



PLAN NOTES:

1. 1-1/2" CONDENSATE DRAIN FROM UNIT. WRAP WITH 3/4" ARMAFLEX. ROUTE ABOVE CEILING.
2. 2" CONDENSATE ABOVE CEILING WRAPPED WITH 3/4" ARMAFLEX. INSTALL DRAIN AND DEEP SEAL P-TRAP ABOVE CEILING AND CONNECT TO VENT PIPING.
3. 4" VENT TO FLOOR ABOVE.
4. 1-1/2" HOT WATER FROM FLOOR BELOW. RISE TO ABOVE CEILING.
5. 4" WASTE DOWN TO FLOOR BELOW.
6. 3" COLD WATER FROM FLOOR BELOW.
7. 1" HOT WATER CIRC. UP TO FLOOR ABOVE.
8. 1/2" COLD WATER, AND 1" HOT WATER DOWN TO BELOW FLOOR TO SERVE LAB SINKS.
9. INSTALL 2" AIR ADMITTANCE VALVE BELOW CASEWORK.
10. OFF-SET SECONDARY STORM OVERFLOW ABOVE CEILING AND DROP IN WALL TO FLOOR BELOW.
11. SECONDARY STORM OVERFLOW FROM FLOOR ABOVE. OFF-SET ABOVE CEILING.
12. 4" WASTE FROM FLOOR ABOVE.
13. PIPING UP TO FLOOR ABOVE.
14. 1-1/2" GAS FROM BELOW. CONTINUE TO FLOOR ABOVE.

SECOND FLOOR PLAN PART B - PLUMBING

SCALE: 1/8" = 1'-0"

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HATTIESBURG PUBLIC SAFETY COMPLEX

HPSC Police and Court Building

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Client No:	--------
Albert & Associates:	12575

CHAD E. MCCLESKEY
REGISTERED
ENGINEER
20102
1/13/2017
STATE OF MISSISSIPPI

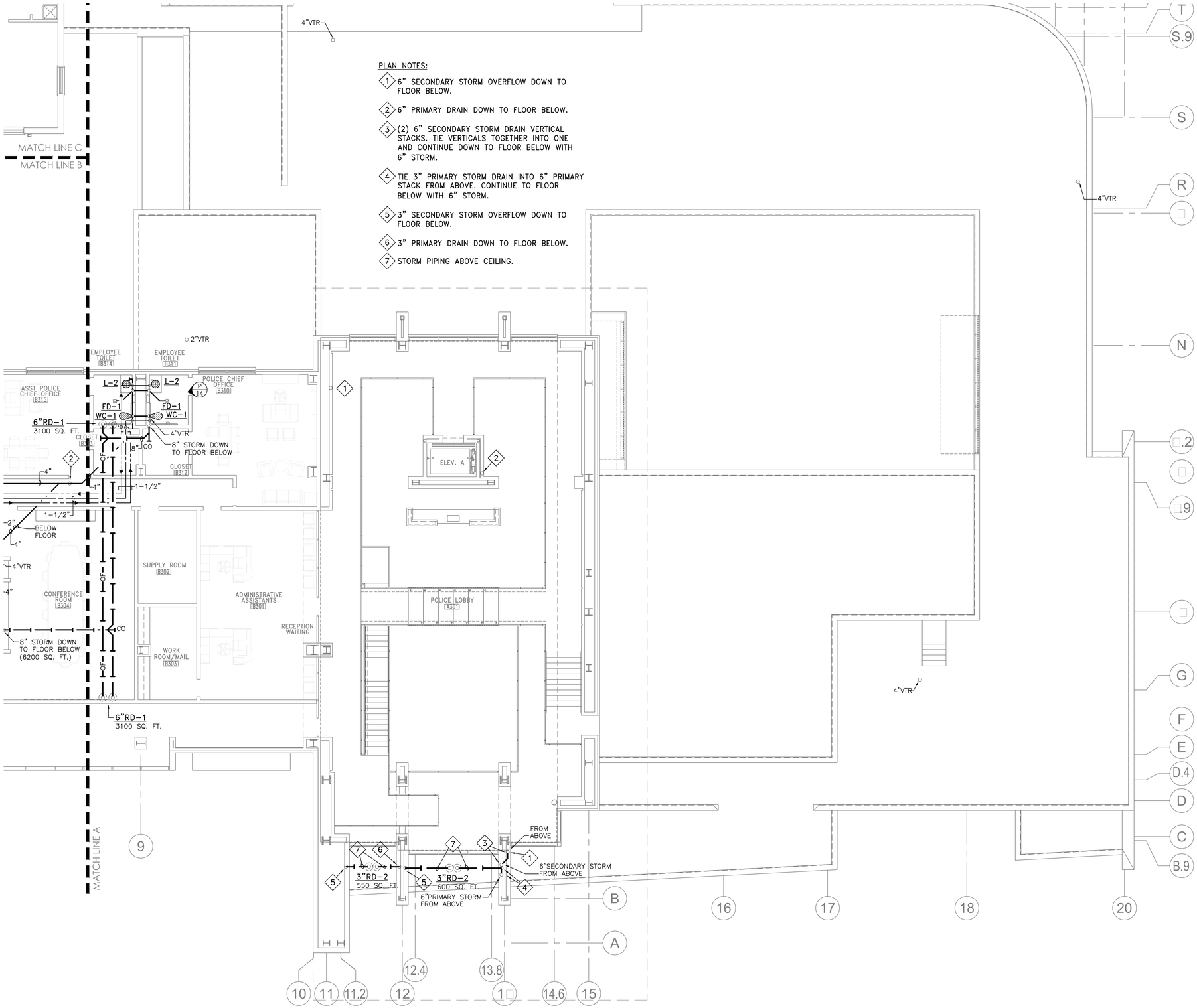
P1.2b

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com | Albert & McCleskey Associates Architects

SECOND FLOOR PLAN PART B - PLBG

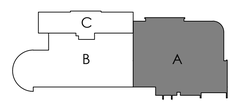
PLAN NOTES:

1. 6" SECONDARY STORM OVERFLOW DOWN TO FLOOR BELOW.
2. 6" PRIMARY DRAIN DOWN TO FLOOR BELOW.
3. (2) 6" SECONDARY STORM DRAIN VERTICAL STACKS. TIE VERTICALS TOGETHER INTO ONE AND CONTINUE DOWN TO FLOOR BELOW WITH 6" STORM.
4. TIE 3" PRIMARY STORM DRAIN INTO 6" PRIMARY STACK FROM ABOVE. CONTINUE TO FLOOR BELOW WITH 6" STORM.
5. 3" SECONDARY STORM OVERFLOW DOWN TO FLOOR BELOW.
6. 3" PRIMARY DRAIN DOWN TO FLOOR BELOW.
7. STORM PIPING ABOVE CEILING.



THIRD FLOOR PLAN PART A – PLUMBING

SCALE: 1/8" = 1'-0"



HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT

HPSC Police and Court Building

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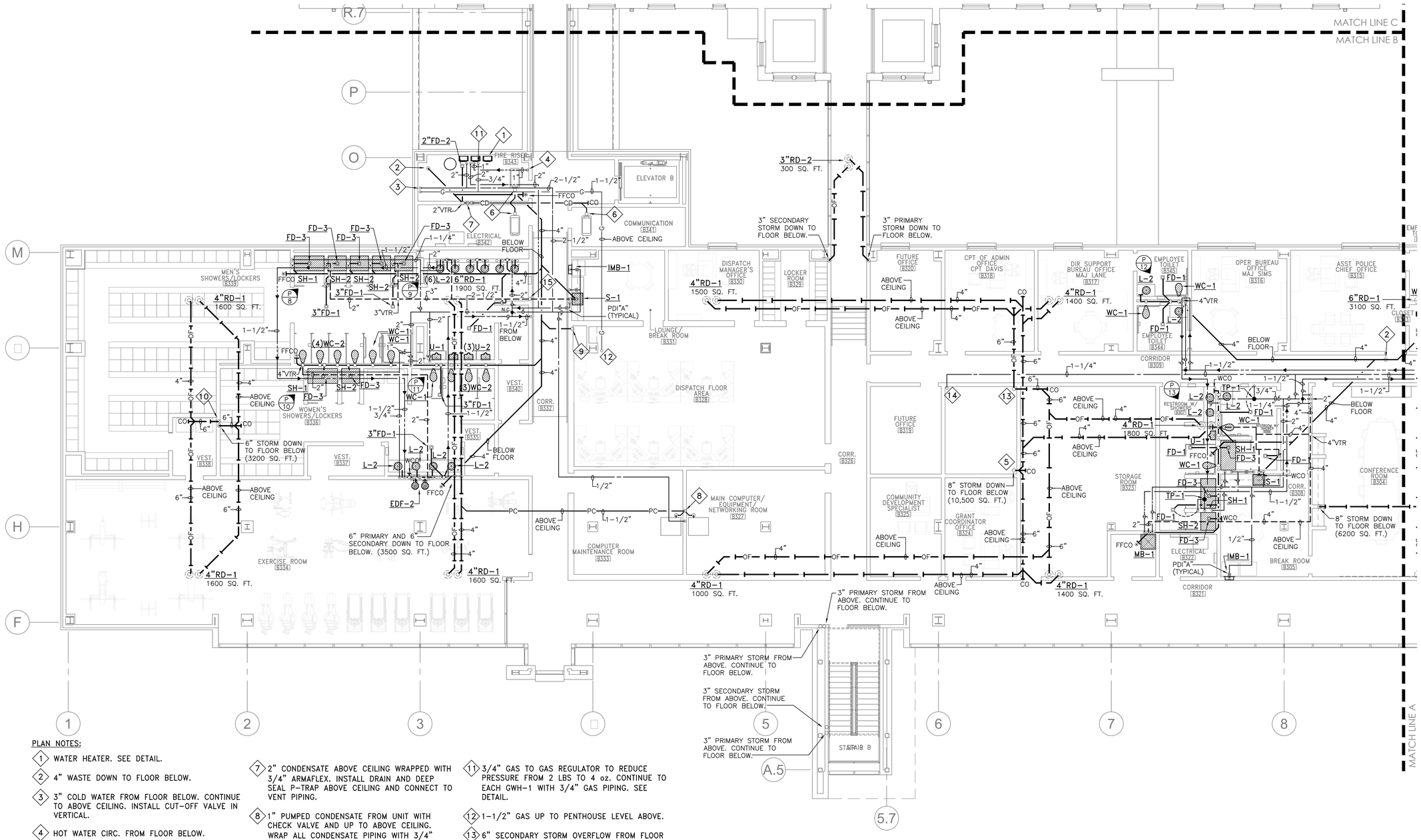
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CHAD E. MCCLESKEY REGISTERED ENGINEER 20102 1/13/2017 STATE OF MISSISSIPPI

P1.3a

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350 Edgewood Terrace Drive
Jackson, MS 39206
Phone: (601) 362-3552
Fax: (601) 366-6418
ERG# 15-28.2



PLAN NOTES:

1. WATER HEATER. SEE DETAIL.
2. 4" WASTE DOWN TO FLOOR BELOW.
3. 3" COLD WATER FROM FLOOR BELOW. CONTINUE TO ABOVE CEILING. INSTALL CUT-OFF VALVE IN VERTICAL.
4. HOT WATER CIRC. FROM FLOOR BELOW.
5. 6" STORM FROM FLOOR ABOVE. CONTINUE TO FLOOR BELOW WITH 8" STORM.
6. 1-1/2" CONDENSATE DRAIN FROM UNIT. WRAP WITH 3/4" ARMAFLEX. ROUTE ABOVE CEILING.
7. 2" CONDENSATE ABOVE CEILING WRAPPED WITH 3/4" ARMAFLEX. INSTALL DRAIN AND DEEP SEAL P-TRAP ABOVE CEILING AND CONNECT TO VENT PIPING.
8. 1" PUMPED CONDENSATE FROM UNIT WITH CHECK VALVE AND UP TO ABOVE CEILING. WRAP ALL CONDENSATE PIPING WITH 3/4" ARMAFLEX. RUN ABOVE CEILING AND CONNECT TO STORM PIPING.
9. 4" WASTE FROM FLOOR ABOVE. CONTINUE DOWN TO FLOOR BELOW.
10. SECONDARY STORM OVERFLOW DOWN TO FLOOR BELOW.
11. 3/4" GAS TO GAS REGULATOR TO REDUCE PRESSURE FROM 2 LBS TO 4 oz. CONTINUE TO EACH GWH-1 WITH 3/4" GAS PIPING. SEE DETAIL.
12. 1-1/2" GAS UP TO PENTHOUSE LEVEL ABOVE.
13. 6" SECONDARY STORM OVERFLOW FROM FLOOR ABOVE. CONTINUE TO FLOOR BELOW WITH 8" STORM.
14. 1-1/4" COLD WATER UP TO FLOOR ABOVE.
15. 4"VENT FROM BELOW.

THIRD FLOOR PLAN PART B – PLUMBING

SCALE: 1/8" = 1'-0"

C
B
A

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Fax: (601) 366-6418
ERG# 15-28.2

CITY OF HATTIESBURG MISSISSIPPI 1884

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT

HPSC Police and Court Building

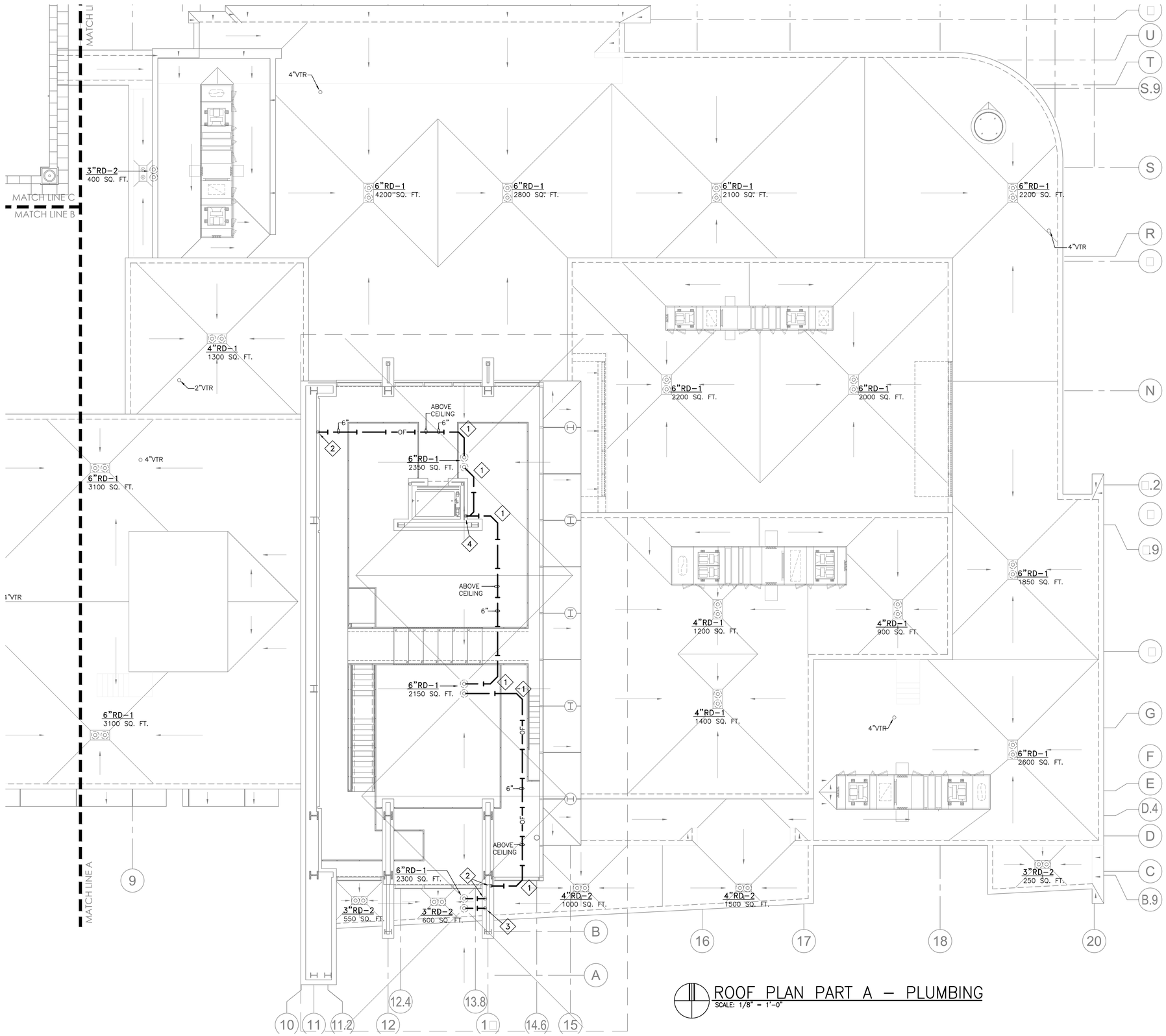
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Albert & Associates: 12575

FRED E. MCCLESKEY JR. REGISTERED PROFESSIONAL ENGINEER 20102 1/13/2017 STATE OF MISSISSIPPI

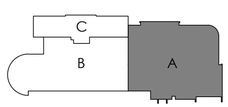
P1.3b



ROOF PLAN PART A – PLUMBING
SCALE: 1/8" = 1'-0"

PLAN NOTES:

1. INSTALL LONG SWEEP FITTINGS IN STORM PIPING IN THIS AREA. DUE TO HEIGHT OF PIPING IN THIS AREA, STORM PIPING CAN BE CLEARED OF ANY DEBRIS THROUGH ROOF DRAIN ITSELF.
2. SECONDARY OVERFLOW STORM DRAIN DOWN TO FLOOR BELOW.
3. PRIMARY STORM DRAIN DOWN TO FLOOR BELOW.
4. 6" STORM DOWN TO FLOOR BELOW.



ERG# 15-28.2

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

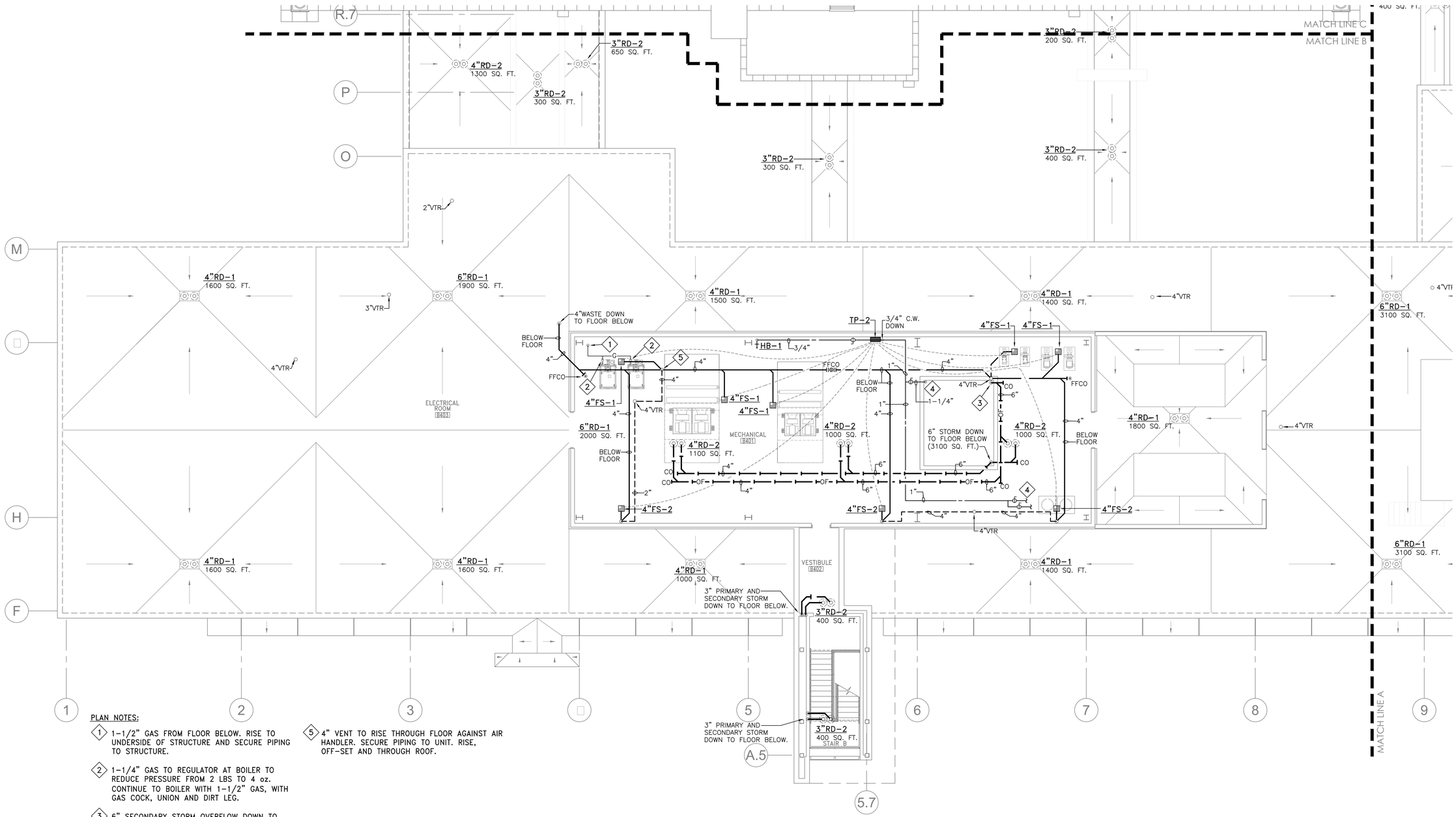
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CHAD E. MCCLESKEY ENGINEER 20102 1/13/2017 STATE OF MISSISSIPPI

P1.□a

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350 Edgewood Terrace Drive
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PLAN NOTES:

1. 1-1/2" GAS FROM FLOOR BELOW. RISE TO UNDERSIDE OF STRUCTURE AND SECURE PIPING TO STRUCTURE.
2. 1-1/4" GAS TO REGULATOR AT BOILER TO REDUCE PRESSURE FROM 2 LBS TO 4 oz. CONTINUE TO BOILER WITH 1-1/2" GAS, WITH GAS COCK, UNION AND DIRT LEG.
3. 6" SECONDARY STORM OVERFLOW DOWN TO FLOOR BELOW.
4. 1-1/4" COLD WATER FROM FLOOR BELOW.
4. 3/4" COLD WATER MAKE-UP TO HOT WATER SYSTEM AND CHILLED WATER SYSTEM.
5. 4" VENT TO RISE THROUGH FLOOR AGAINST AIR HANDLER. SECURE PIPING TO UNIT. RISE, OFF-SET AND THROUGH ROOF.

ROOF PLAN PART B – PLUMBING

SCALE: 1/8" = 1'-0"

HATTIESBURG PUBLIC SAFETY COMPLEX

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HPSC Police and Court Building

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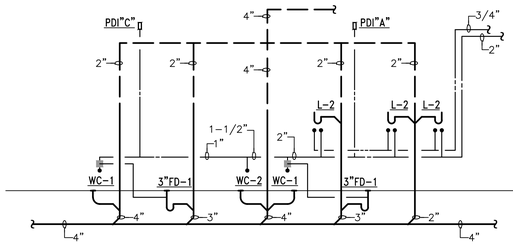
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Albert & Associates:	12575

RICHARD E. MOORE
REGISTERED
ENGINEER
20102
1/13/2017
STATE OF MISSISSIPPI

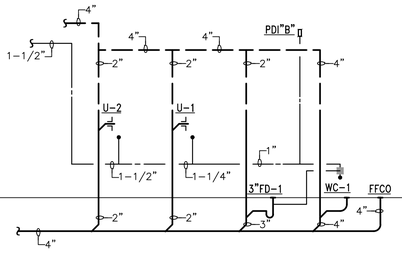
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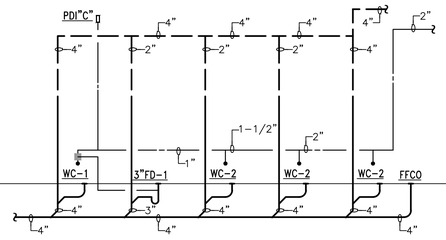
Engineering Resource Group, Inc.
350 Edgewood Terrace Drive
Jackson, MS 39206
Phone: (601) 362-3552
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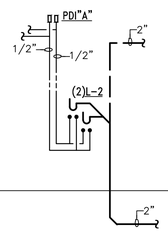
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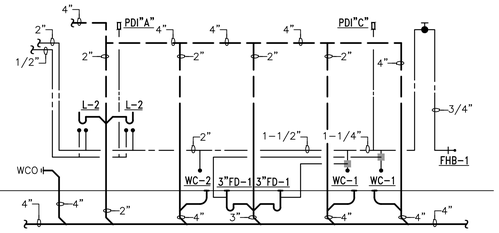
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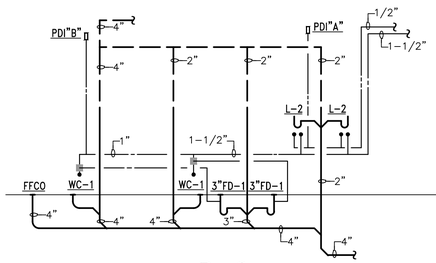
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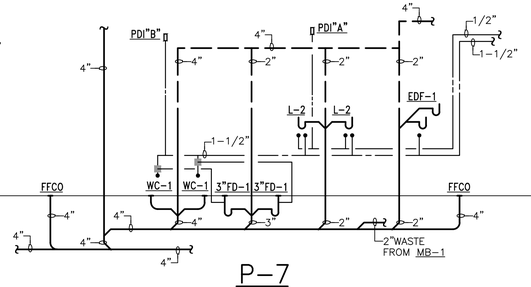
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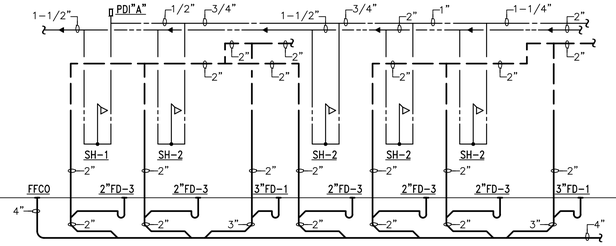
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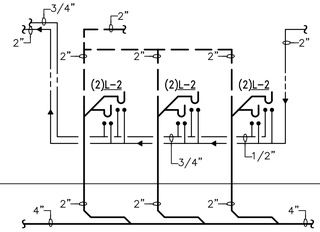
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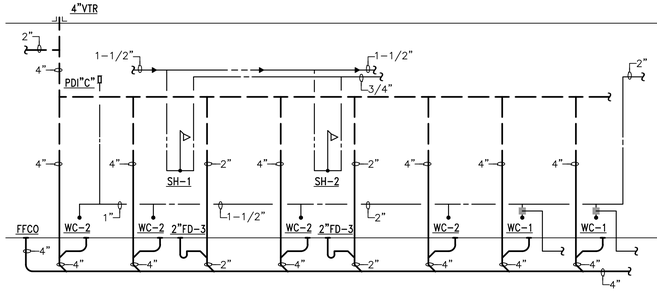
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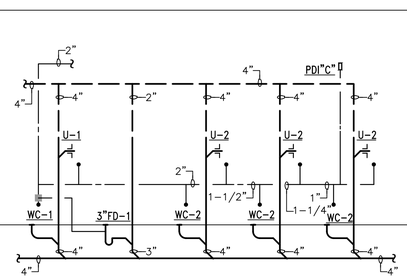
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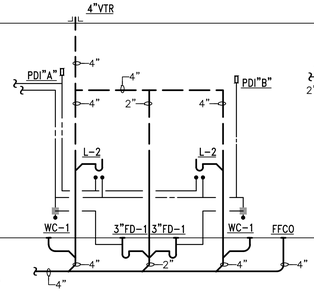
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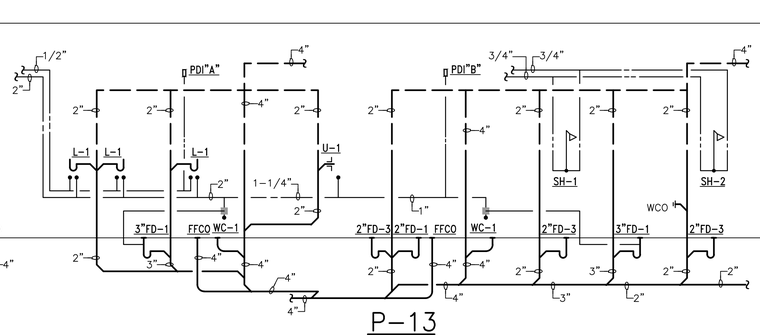
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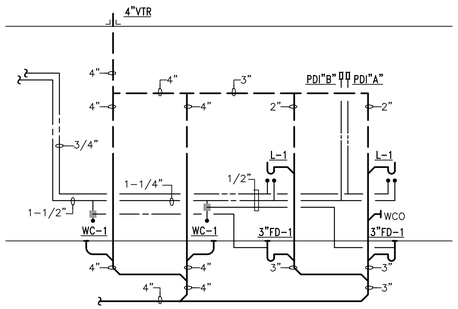
P-11



P-12



P-13



P-14

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT

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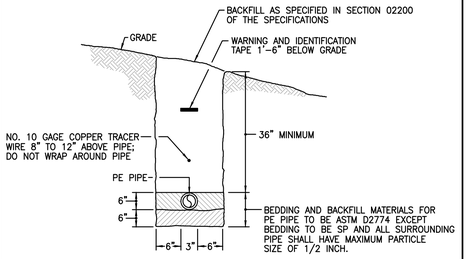
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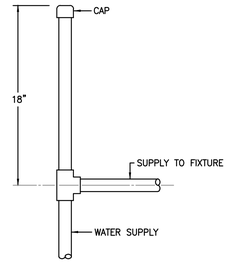
WILLIAM E. MCCLESKEY, REGISTERED ENGINEER, 20102, 1/13/2017, STATE OF MISSISSIPPI

P□.1

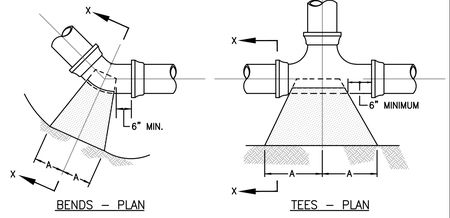
Engineering Resource Group, Inc.
350 Edgewood Terrace Drive
Jackson, MS 39206
Phone: (601) 362-3552
Fax: (601) 366-6418
ERG# 15-28.2



1 DETAIL OF PE GAS MAIN INSTALLATION — NO SCALE



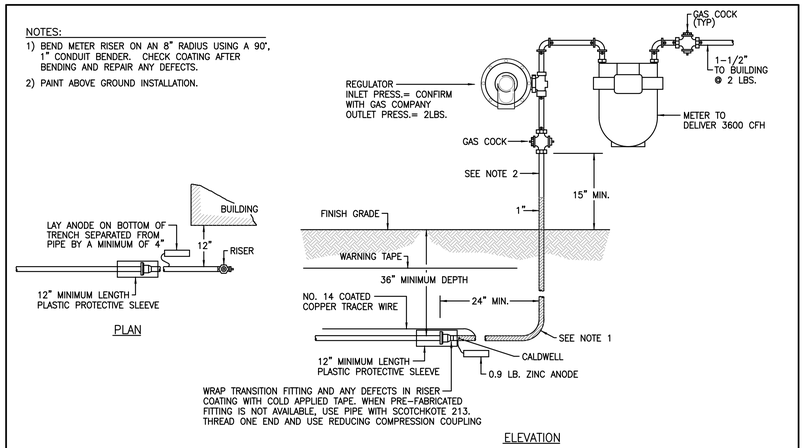
2 TYPICAL WATER SUPPLY AIR CHAMBER AT PLUMBING FIXTURE CONNECTION — NO SCALE



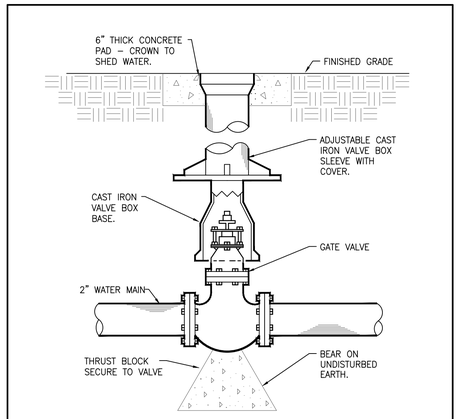
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3	8	6	8	6	8	8	10	12	8	16
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6	8	10	8	8	8	8	10	12	8	16
8	12	12	8	10	8	9	10	12	12	20

4 TYPICAL THRUST BLOCKS FOR WATER MAINS DETAIL — NO SCALE

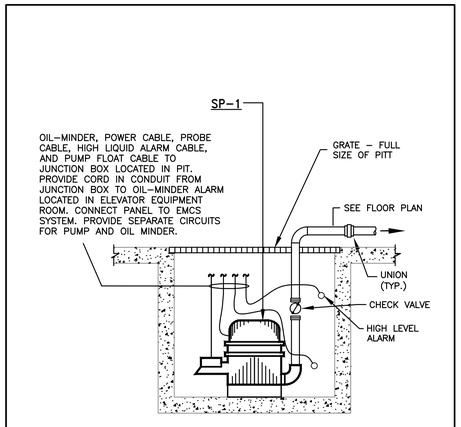
NOTES:
1) BEND METER RISER ON AN 8" RADIUS USING A 90°, 1" CONDUIT BENDER. CHECK COATING AFTER BENDING AND REPAIR ANY DEFECTS.
2) PAINT ABOVE GROUND INSTALLATION.



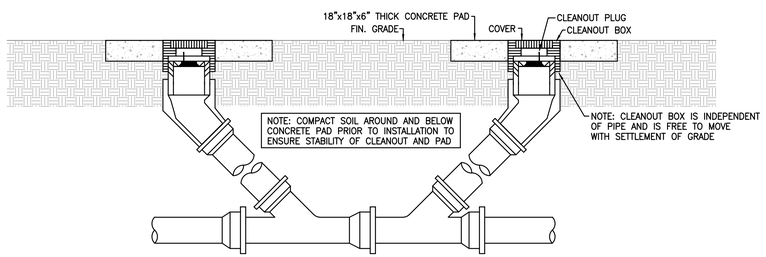
3 DETAIL OF GAS SERVICE RISER — NO SCALE



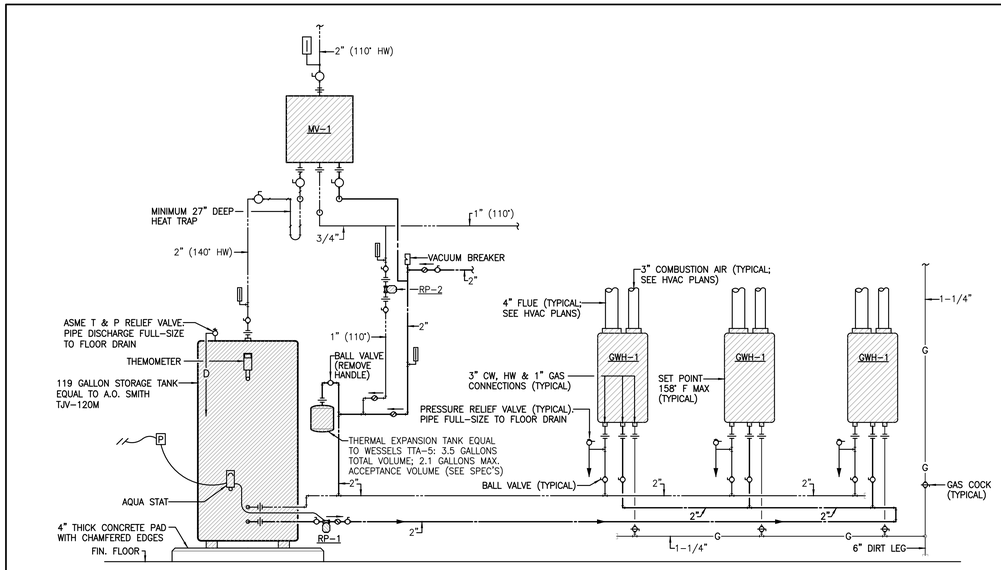
5 CUT-OFF VALVE IN HEAVY DUTY BOX DETAIL — NO SCALE



6 SUMP PUMP DETAIL — NO SCALE



7 DETAIL OF EXTERIOR 2-WAY FLUSH GRADE CLEANOUT — NO SCALE



8 GAS WATER HEATER (GWH-1) AND STORAGE TANK INSTALLATION DETAIL — NO SCALE

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

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Drawn By: DB,CM
Checked By: CM,TP
Client No: -------
Albert & Associates: 12575

RICHARD E. MOORE — REGISTERED — ENGINEER — 20102 — 11/3/2015 — STATE OF MISSISSIPPI

P5.1

Engineering Resource Group, Inc.
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Jackson, MS 39206
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Fax: (601) 366-6418
ERG# 15-28.2

PLUMBING FIXTURE SCHEDULE

MARK	DESCRIPITION	MAKE	MODEL	SUPPLY FITTING	SUPPLY PIPE(S)	DRAIN	TRAP	ROUGH-IN SIZES				REMARKS
								C.W.	H.W.	WASTE	VENT	
WC-1	WATER CLOSET, FLR MTD. F.V., A.D.A. TRAP PRIMER	KOHLER	K-4302	ZURN Z-6000-WS1 -YB-YC-TP	---	---	---	1"	--	4"	4"	W/ KOHLER K-4670-C OPEN FRONT SEAT, W/ TRAP PRIMER(TP-3) AND BOLT CAPS. DUAL FLUSH
WC-2	WATER CLOSET, FLR MTD. FLUSH VALVE	KOHLER	K-4330	ZURN Z-6000-WS1 -YB-YC	---	---	---	1"	--	4"	4"	W/ KOHLER K-4670-C OPEN FRONT SEAT, AND BOLT CAPS. DUAL FLUSH.
U-1	URINAL, WALL HUNG F.V., A.D.A	KOHLER	K-4904-ET	ZURN Z-6003-WS1 -YB-YC	---	---	---	3/4"	--	2"	2"	PROVIDE ZURN FIXTURE SUPPORT MOUNT AT A.D.A. HEIGHT
U-2	URINAL, WALL HUNG	KOHLER	K-4904-ET	ZURN Z-6003-WS1 -YB-YC	---	---	---	3/4"	--	2"	2"	PROVIDE ZURN FIXTURE SUPPORT
L-1	LAVATORY, COUNTER MOUNTED	KOHLER	K-2196	KOHLER K-310-4M	ZURN Z8804-XL LRCE-PC	ZURN Z8743-PC	ZURN Z8700B-PC	1/2"	1/2"	2"	2"	COORDINATE ROUGH-IN WITH DRAIN ASSEMBLY. INSULATE P-TRAP AND SUPPLY PIPES W/ TRUEBRO 102G/105.
L-2	LAVATORY, COUNTER MOUNTED	KOHLER	K-2196	KOHLER K-15243-4	ZURN Z8804-XL LRCE-PC	ZURN Z8743-PC	ZURN Z8700B-PC	1/2"	1/2"	2"	2"	COORDINATE ROUGH-IN WITH DRAIN ASSEMBLY. INSULATE P-TRAP AND SUPPLY PIPES W/ TRUEBRO 102G/105.
S-1	BREAKROOM/KITCHEN SINK	ELKAY	DLR-2222-10	DELTA 27C1152	ZURN Z8804-XL LRCE-PC	LK-35	ZURN Z8700B-PC	1/2"	1/2"	2"	2"	
S-2	LAB SINK	ELKAY	DLR-2222-10	DELTA 23T644-R7	ZURN Z8804-XL LRCE-PC	LK-35	ZURN Z8700B-PC	1/2"	1/2"	2"	2"	
IMB-1	ICE MACHINE BOX	GUY GRAY	88133	---	---	---	---	1/2"	--	--	--	
FHB-1	HOSE BIBB, FREEZEPROOF	WOODFORD	B65	---	---	---	---	3/4"	--	--	--	WITH VACUUM BREAKER
HB-1	HOSE BIBB	WOODFORD	24P	---	---	---	---	3/4"	--	--	--	WITH VACUUM BREAKER
FD-1	FLOOR DRAIN-POLISHED BRONZE WITH TRAP PRIMER CONNECTION	ZURN	ZB-415-B-P	---	---	---	---	--	--	SEE PLAN	SEE PLAN	WITH TRAP PRIMER CONNECTION
FD-2	FLOOR DRAIN-POLISHED BRONZE WITH RECESSED RIM	ZURN	ZB-415-I	---	---	---	---	--	--	SEE PLAN	SEE PLAN	
FD-3	SHOWER FLOOR DRAIN	ZURN	ZB-415-B	---	---	---	---	--	--	2"	2"	
SH-1	A.D.A. SHOWER	DELTA	T13H333-ADA	---	---	---	---	1/2"	1/2"	--	--	WITH UNIVERSAL ROUGH VALVE BODY R10700-UNWS SERIES
SH-2	SHOWER	DELTA	T13291	---	---	---	---	1/2"	1/2"	--	--	WITH UNIVERSAL ROUGH VALVE BODY R10000 SERIES
DST-1	DEEP SEAL P-TRAP	ZURN	Z1000	---	---	---	---	-	-	SEE PLAN	SEE PLAN	D.C.C.I. BODY & BRONZE FUNNEL DRAIN
MB-1	SERVICE SINK	ZURN	Z1996-24-SDL -BS-MH-WG	Z843M1-CS	---	---	---	1/2"	1/2"	2"	2"	
RD-1	LARGE PRIMARY/SECONDARY COMBO ROOF DRAIN	ZURN	Z164-C-GD	---	---	---	---	--	--	--	--	FURNISH TO ROOFER FOR INSTALLATION
RD-2	SMALL PRIMARY/SECONDARY COMBO ROOF DRAIN	ZURN	Z165-C-GD	---	---	---	---	--	--	--	--	FURNISH TO ROOFER FOR INSTALLATION
RD-3	SECONDARY ROOF DRAIN DISCHARGE OUTLET	ZURN	Z-199-ZAB	---	---	---	---	--	--	--	--	DISCHARGE 18" ABOVE GRADE
TP-1	TRAP PRIMER	PPP	P1-500	---	---	---	---	-	-	--	--	DISCHARGE FROM PRIMER TO DROP IN WALL DOWN TO BELOW FLOOR. CONTINUE TO FLR. DRAIN AND CONNECT TO PRIMER CONNECTION
TP-2	TRAP PRIMER	ZURN	Z1020-10	---	---	---	---	-	-	--	--	INSTALL (8) 1/2" CONNETIONS TO PRIMER UNIT AND PIPE DOWN TO BELOW FLOOR, & CONTINUE TO EACH FS-1 IN PENTHOUSE MECHANICAL RM.
TP-3	TRAP PRIMER	PPP	FVP-1VB	---	---	---	---	-	-	--	--	INSTALL WITH FLUSH VALVE FOR WC-1 AND PIPE TO FLOOR DRAIN
EDF-1	ELECTRIC DRINKING FOUNTAIN	ELKAY	LRPBGRNM28K	---	ZURN Z8804-XL LRCE-PC	---	ZURN Z8700B-PC	1/2"	--	2"	2"	
EDF-2	ELECTRIC DRINKING FOUNTAIN WITH BOTTLE FILLER	ELKAY	LZWS-SFGRN28K	---	ZURN Z8804-XL LRCE-PC	---	ZURN Z8700B-PC	1/2"	--	2"	2"	
ES-1	EMERGENCY SHOWER	HAWS	8330	---	---	---	---	1-1/4"	1-1/4"	--	--	INSTALL WITH MV-2
EW-1	EMERGENCY EYE WASH	HAWS	7260BT	---	---	---	---	3/4"	3/4"	--	--	INSTALL WITH MV-3
FS-1	FLOOR SINK - NICKEL BRONZE 12x12x8" DEEP, 3/4 GRATE	ZURN	ZN-1902-K-3	---	---	---	---	--	--	SEE PLAN	SEE PLAN	
FS-2	FLOOR SINK - NICKEL BRONZE 8x8x6" DEEP, 3/4 GRATE	ZURN	ZN-1910-K-3	---	---	---	---	--	--	SEE PLAN	SEE PLAN	

MIXING VALVE SCHEDULE

MARK	DESCRIPITION	MAKE	MODEL	MINIMUM FLOW (GPM)	MAXIMUM FLOW (GPM)	REMARKS
MV-1	WATER HEATER MIXING VALVE	LEONARD	TM-820B-LF-DT-IT-TC	1	89	
MV-2	EMERGENCY SHOWER MIXING VALVE	LEONARD	TM-800-LF	3	56	
MV-3	EMERGENCY EYE WASH MIXING VALVE	LEONARD	TA-350-LF	2	9	

PUMPS

MARK	MAKE AND MODEL	DUTY	TYPE	LOCATION	GPM EACH	PSI	PUMP HEAD	VOLTAGE/ PHASE	MOTOR HP	RPM	EMERGENCY POWER	REMARKS
SP-1	HYDROMATIC SHEF40	SUMP PIT DRAINAGE	SUMP PUMP	ELEVATOR PITS	50	50	12	115/1ø	4/10	1550	NO	SEE SPECIFICATIONS
RP-1	TACO 138	DOMESTIC HW WATER	RECIRC PUMP	FIRE RISER B343	30	40	39	115/1ø	1	1725	NO	SEE WATER HEATER DETAIL
RP-2	TACO 133	DOMESTIC HW WATER	RECIRC PUMP	FIRE RISER B343	15	40	32	115/1ø	3/4	1725	NO	SEE WATER HEATER DETAIL

WATER HEATER SCHEDULE

MARK	MAKE	MODEL	INPUT (MBH)	H.W. CAPACITY RANGE	VENT DIA.	CONTROLS	EFFICIENCY	REMARKS
GWH-1	RINNAI TANKLESS	RUC98	15.2-199	0.4 - 9.8 GPM	5"	120V/1PH	94%	TOTAL OF THREE (3) TANKLESS HEATERS WITH 119 GALLON STORAGE TANK EQUAL TO A.O. SMITH TJV-120M. INSTALL WITH MV-1 FURNISH VENT KITS & CONTROLS (SEE SPEC'S)

CITY OF HATTIESBURG MISSISSIPPI 1884

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

Drawing Issued:

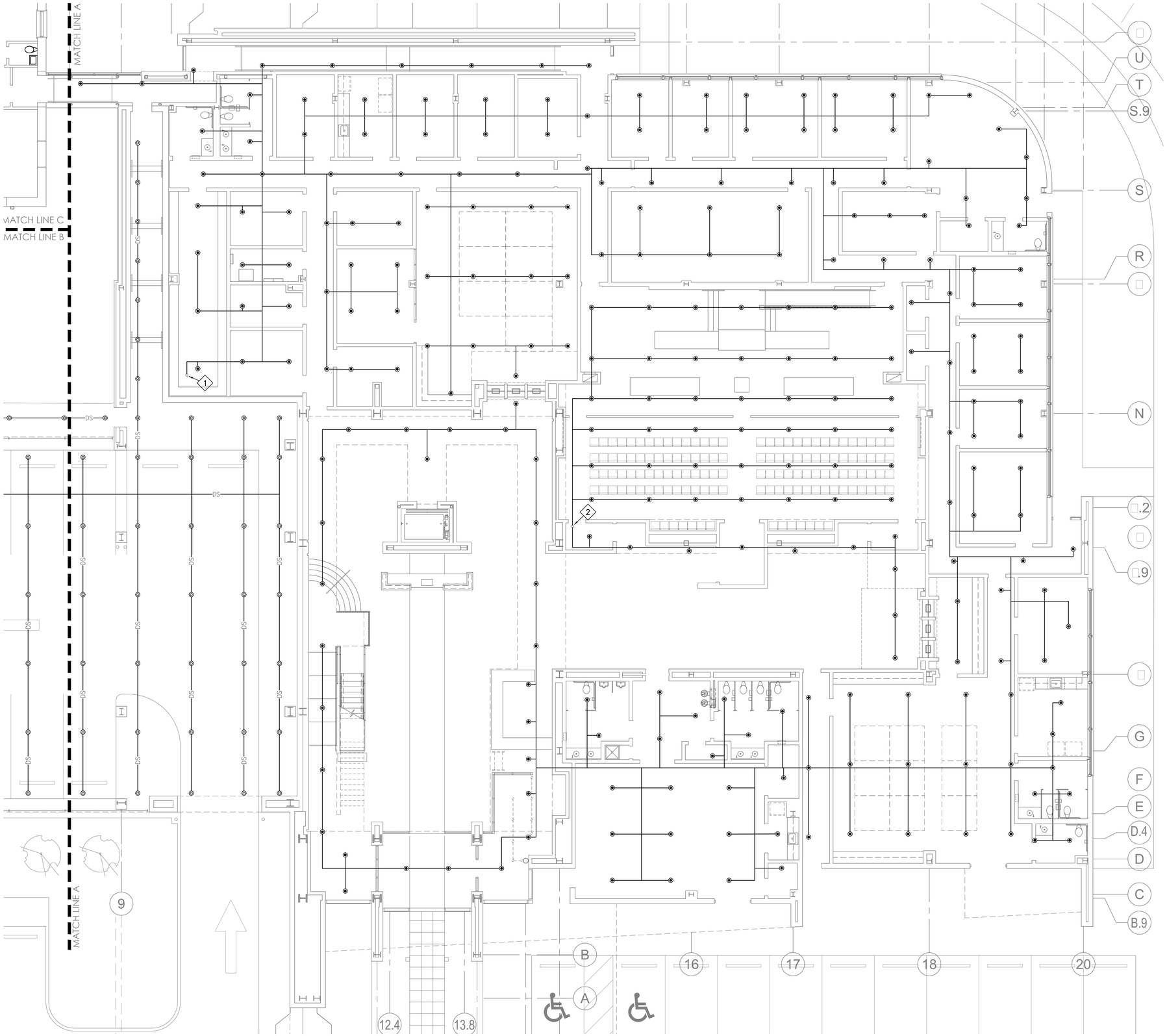
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Client No: -------
Albert & Associates: 12575

EDWARD E. MCCLESKEY REGISTERED PROFESSIONAL ENGINEER 20102 1/13/2017 STATE OF MISSISSIPPI

P6.1

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ERG# 15-28.2



PLAN NOTES:

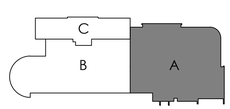
1. FIRE PROTECTION PIPING FROM FLOOR ABOVE. (ZONE 2)
2. SPRINKLER SYSTEM FOR THIS UPPER CEILING FROM FLOOR ABOVE. (ZONE 2)

GENERAL NOTE:

FIRE PROTECTION SPRINKLER SYSTEM IS FOR SUGGESTION ONLY AND DOES NOT REPRESENT THE ACTUAL SPRINKLER SYSTEM LAYOUT. DRAWINGS INDICATE WHICH AREAS ARE "DRY PIPE" SYSTEMS AND WET SYSTEMS, EXPOSED PENDANTS OR RECESSED. FIRE SPRINKLER CONTRACTOR WILL SUBMIT CALCULATED SPRINKLER SHOP DRAWINGS FOR APPROVAL.

FIRST FLOOR PLAN
PART A – FIRE PROTECTION

SCALE: 1/8" = 1'-0"



HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT

HPSC Police and Court Building

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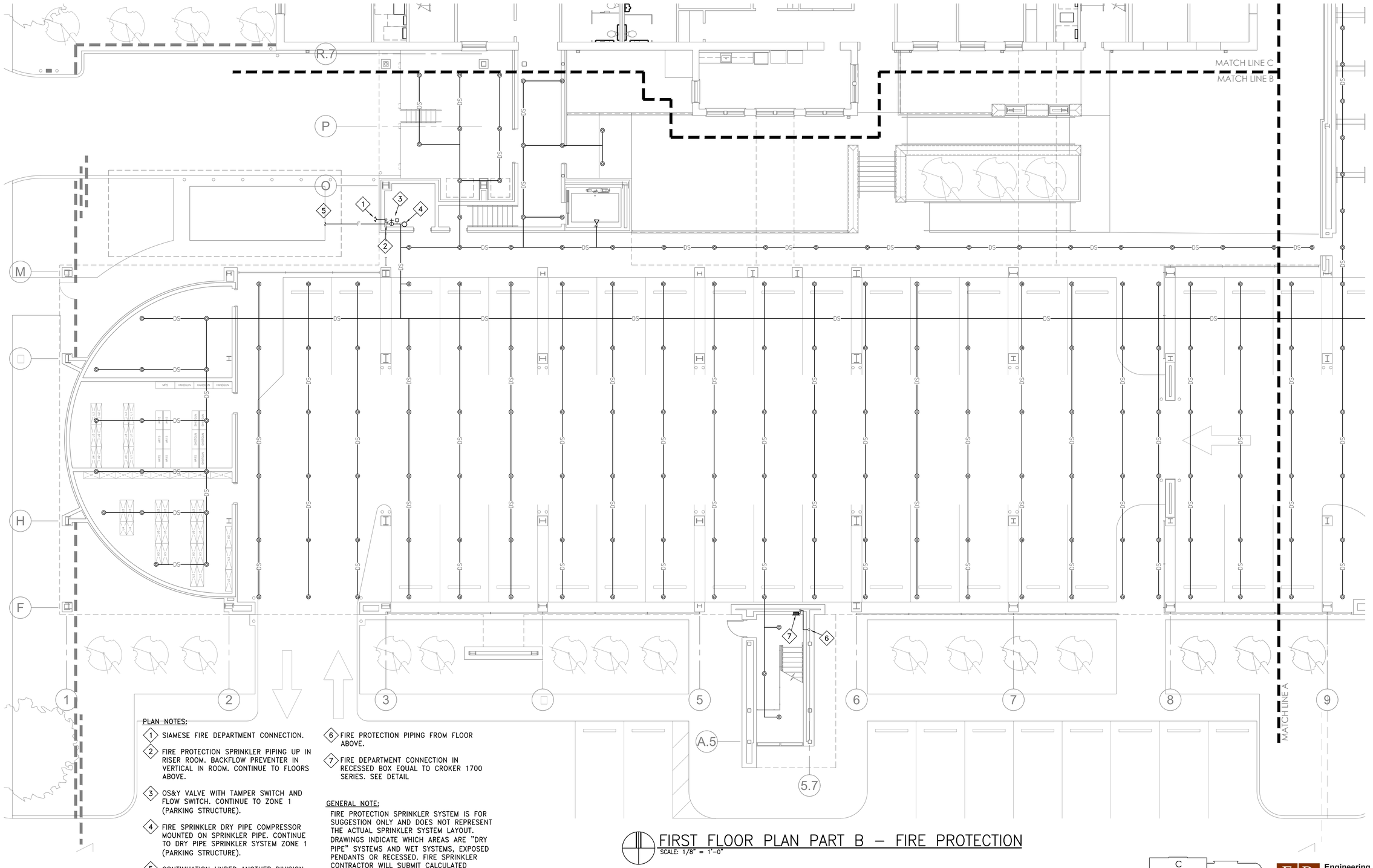
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Client No:	-------
Albert & Associates:	12575

RICHARD E. MOORE — REGISTERED — ENGINEER — 20102 — 11/3/2017 — STATE OF MISSISSIPPI

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PLAN NOTES:

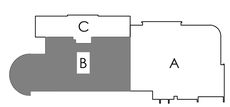
1. SIAMESE FIRE DEPARTMENT CONNECTION.
2. FIRE PROTECTION SPRINKLER PIPING UP IN RISER ROOM. BACKFLOW PREVENTER IN VERTICAL IN ROOM. CONTINUE TO FLOORS ABOVE.
3. OS&Y VALVE WITH TAMPER SWITCH AND FLOW SWITCH. CONTINUE TO ZONE 1 (PARKING STRUCTURE).
4. FIRE SPRINKLER DRY PIPE COMPRESSOR MOUNTED ON SPRINKLER PIPE. CONTINUE TO DRY PIPE SPRINKLER SYSTEM ZONE 1 (PARKING STRUCTURE).
5. CONTINUATION UNDER ANOTHER DIVISION.
6. FIRE PROTECTION PIPING FROM FLOOR ABOVE.
7. FIRE DEPARTMENT CONNECTION IN RECESSED BOX EQUAL TO CROKER 1700 SERIES. SEE DETAIL

GENERAL NOTE:

FIRE PROTECTION SPRINKLER SYSTEM IS FOR SUGGESTION ONLY AND DOES NOT REPRESENT THE ACTUAL SPRINKLER SYSTEM LAYOUT. DRAWINGS INDICATE WHICH AREAS ARE "DRY PIPE" SYSTEMS AND WET SYSTEMS, EXPOSED PENDANTS OR RECESSED. FIRE SPRINKLER CONTRACTOR WILL SUBMIT CALCULATED SPRINKLER SHOP DRAWINGS FOR APPROVAL.

FIRST FLOOR PLAN PART B – FIRE PROTECTION

SCALE: 1/8" = 1'-0"



HATTIESBURG PUBLIC SAFETY COMPLEX

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HPSC Police and Court Building

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CHAD E. MCCLESKEY — ENGINEER — 20102 — 1/13/2017 — STATE OF MISSISSIPPI

FP1.1b

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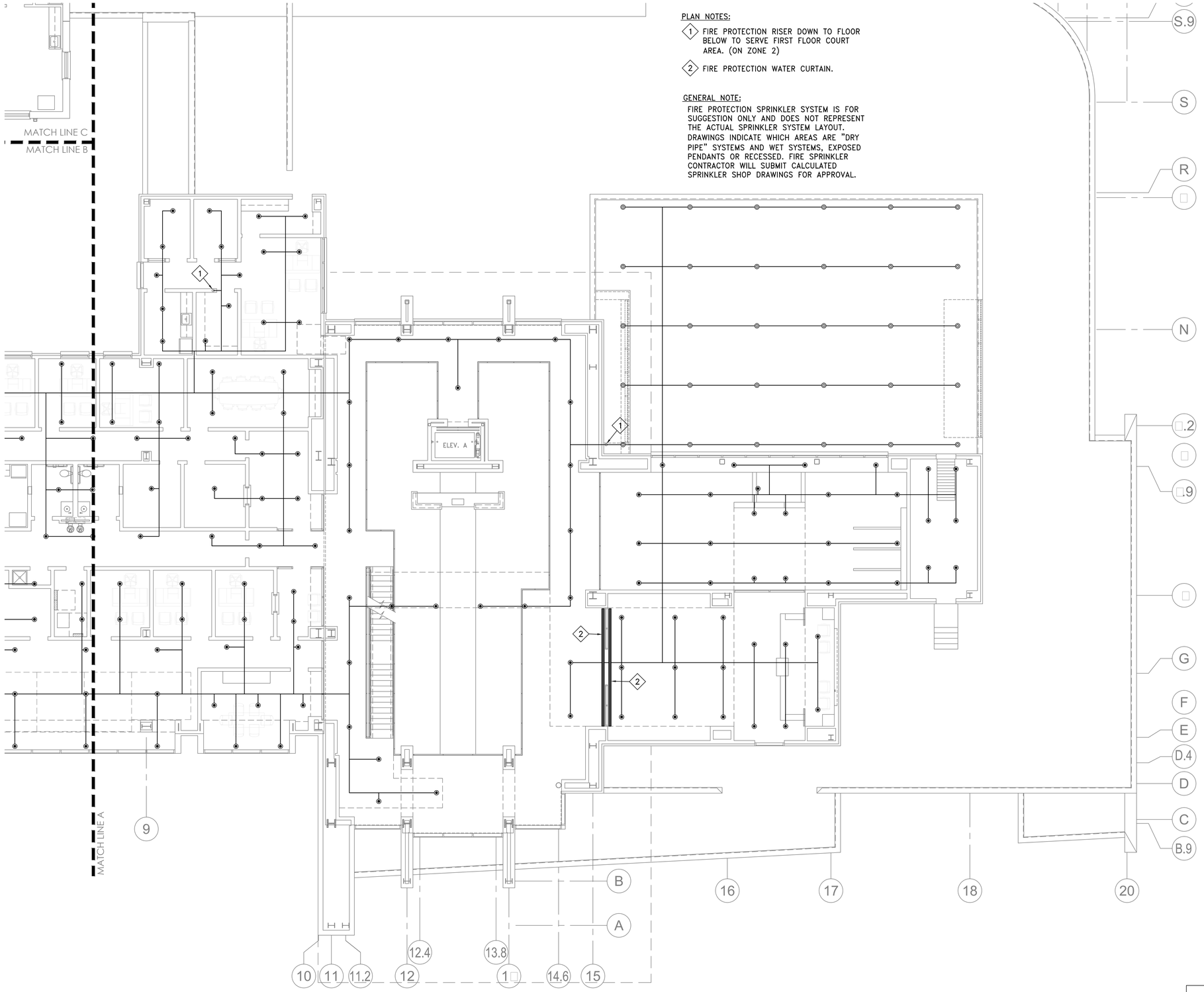
514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com
Albert & McCleskey Associates Architects

PLAN NOTES:

1. FIRE PROTECTION RISER DOWN TO FLOOR BELOW TO SERVE FIRST FLOOR COURT AREA. (ON ZONE 2)
2. FIRE PROTECTION WATER CURTAIN.

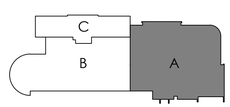
GENERAL NOTE:

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SECOND FLOOR PLAN PART A – FIRE PROTECTION

SCALE: 1/8" = 1'-0"



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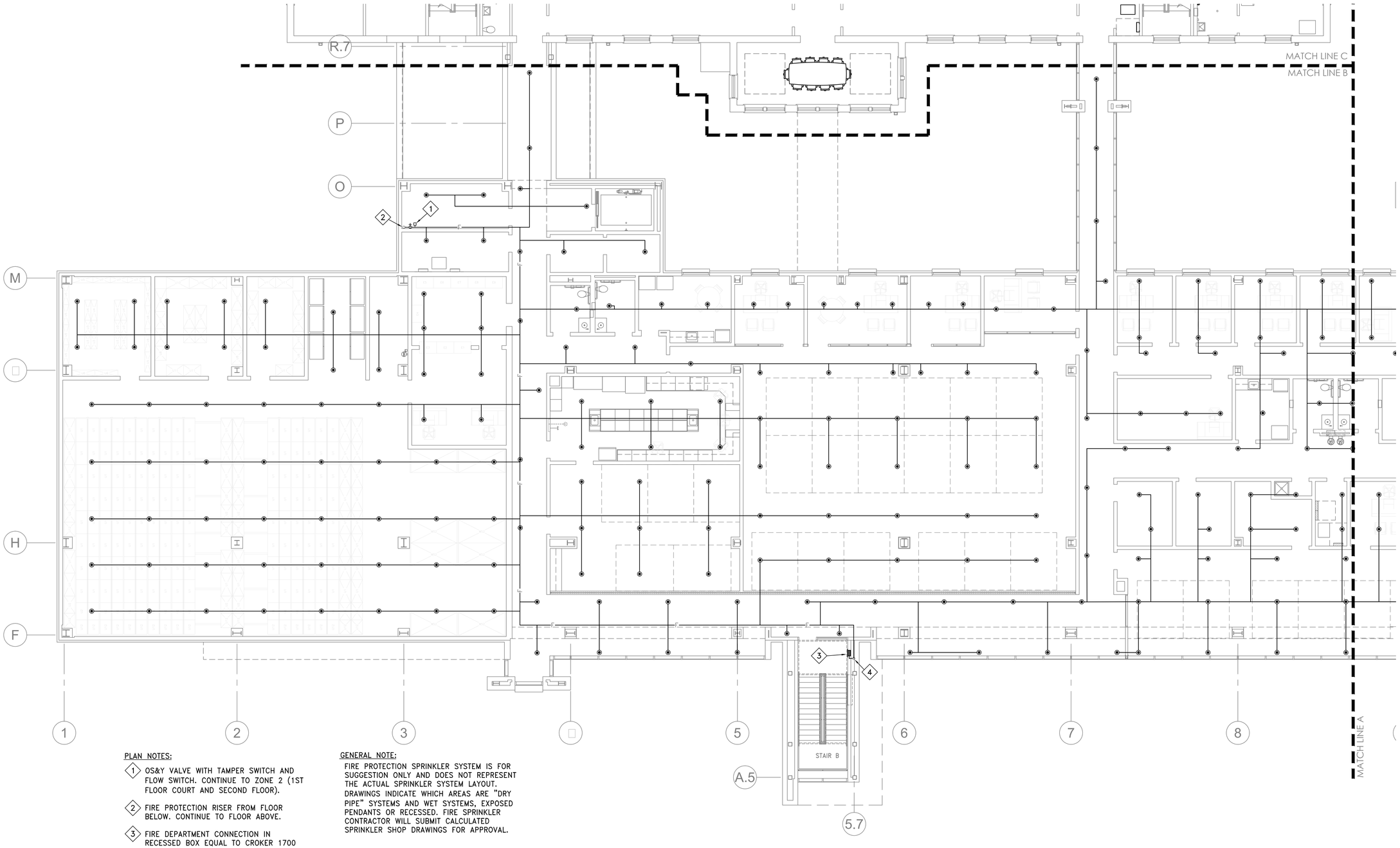
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Client No:	-------
Albert & Associates:	12575

RICHARD E. MOORE — REGISTERED — ENGINEER — 20102 — 1/13/2017 — STATE OF MISSISSIPPI

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ERG# 15-28.2



PLAN NOTES:

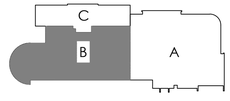
1. OS&Y VALVE WITH TAMPER SWITCH AND FLOW SWITCH. CONTINUE TO ZONE 2 (1ST FLOOR COURT AND SECOND FLOOR).
2. FIRE PROTECTION RISER FROM FLOOR BELOW. CONTINUE TO FLOOR ABOVE.
3. FIRE DEPARTMENT CONNECTION IN RECESSED BOX EQUAL TO CROKER 1700 SERIES. SEE DETAIL.
4. FIRE PROTECTION RISER DOWN TO FLOOR BELOW.

GENERAL NOTE:

FIRE PROTECTION SPRINKLER SYSTEM IS FOR SUGGESTION ONLY AND DOES NOT REPRESENT THE ACTUAL SPRINKLER SYSTEM LAYOUT. DRAWINGS INDICATE WHICH AREAS ARE "DRY PIPE" SYSTEMS AND WET SYSTEMS, EXPOSED PENDANTS OR RECESSED. FIRE SPRINKLER CONTRACTOR WILL SUBMIT CALCULATED SPRINKLER SHOP DRAWINGS FOR APPROVAL.

SECOND FLOOR PLAN PART B – FIRE PROTECTION

SCALE: 1/8" = 1'-0"



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HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

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Client No:	-------
Albert & Associates:	12575

RICHARD E. MCCLESKEY — REGISTERED ENGINEER — 20102 — 1/13/2017 — HATTIESBURG, MISSISSIPPI

FP1.2b

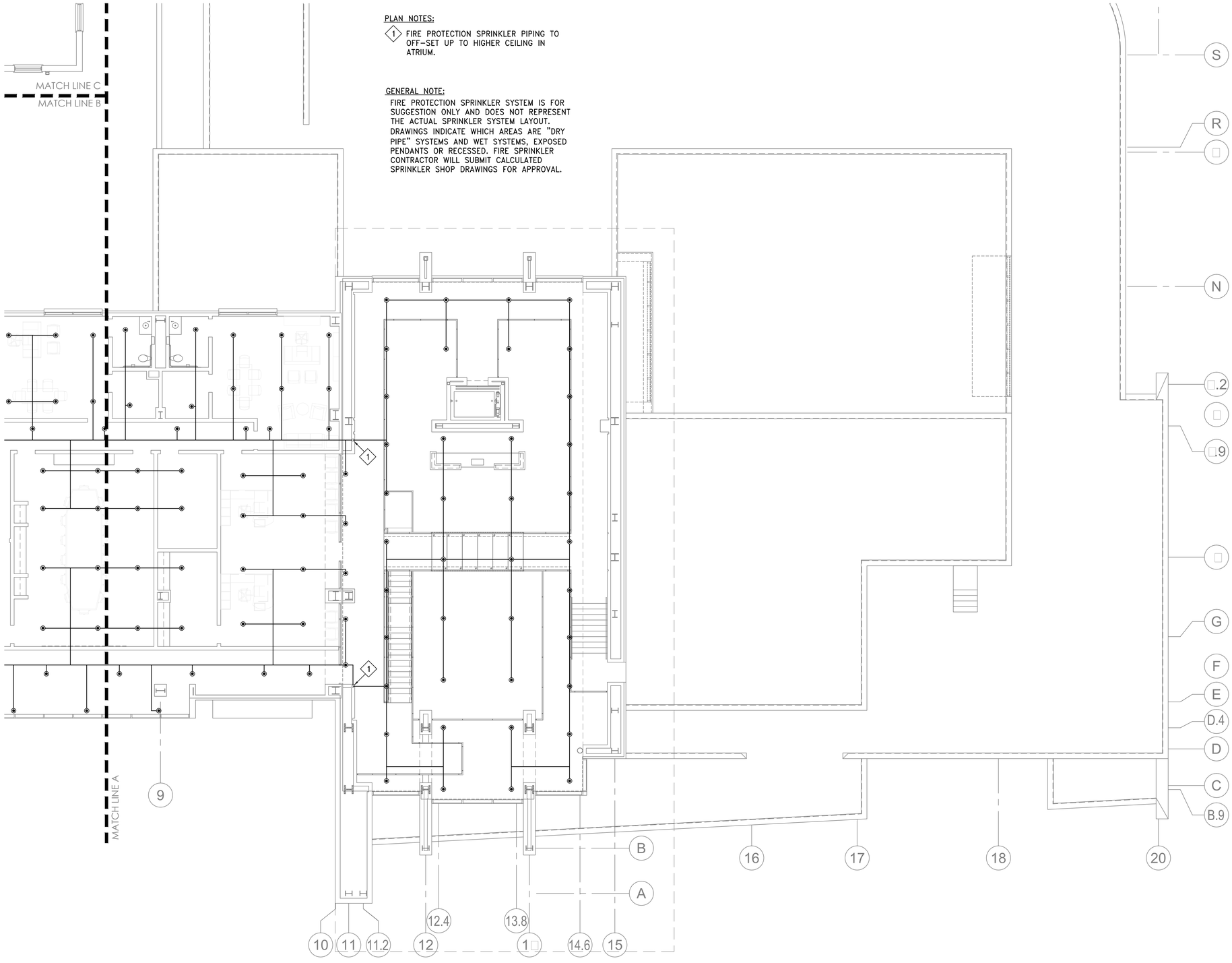
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Phone: (601) 362-3552
Fax: (601) 366-6418
ERG# 15-28.2

PLAN NOTES:

1. FIRE PROTECTION SPRINKLER PIPING TO OFF-SET UP TO HIGHER CEILING IN ATRIUM.

GENERAL NOTE:

FIRE PROTECTION SPRINKLER SYSTEM IS FOR SUGGESTION ONLY AND DOES NOT REPRESENT THE ACTUAL SPRINKLER SYSTEM LAYOUT. DRAWINGS INDICATE WHICH AREAS ARE "DRY PIPE" SYSTEMS AND WET SYSTEMS, EXPOSED PENDANTS OR RECESSED. FIRE SPRINKLER CONTRACTOR WILL SUBMIT CALCULATED SPRINKLER SHOP DRAWINGS FOR APPROVAL.



THIRD FLOOR PLAN PART A – FIRE PROTECTION
SCALE: 1/8" = 1'-0"

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

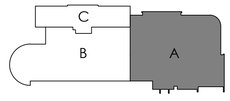
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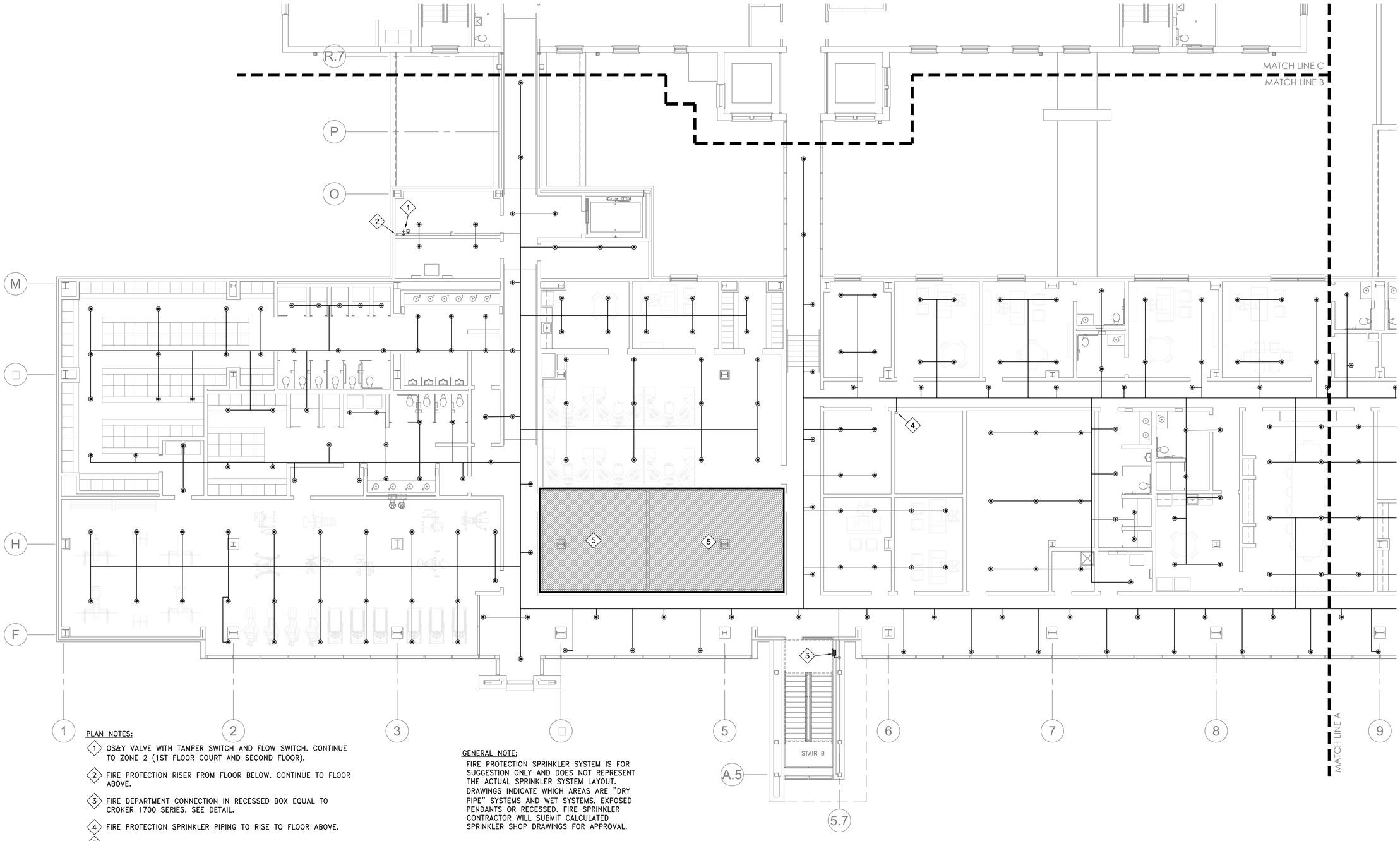
FRED E. MOSLEY JR. REGISTERED PROFESSIONAL ENGINEER 20102 1/13/2017 STATE OF MISSISSIPPI

FP1.3a



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ERG# 15-28.2



PLAN NOTES:

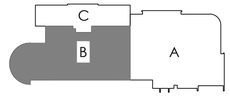
1. OS&Y VALVE WITH TAMPER SWITCH AND FLOW SWITCH. CONTINUE TO ZONE 2 (1ST FLOOR COURT AND SECOND FLOOR).
2. FIRE PROTECTION RISER FROM FLOOR BELOW. CONTINUE TO FLOOR ABOVE.
3. FIRE DEPARTMENT CONNECTION IN RECESSED BOX EQUAL TO CROKER 1700 SERIES. SEE DETAIL.
4. FIRE PROTECTION SPRINKLER PIPING TO RISE TO FLOOR ABOVE.
5. INSTALL FIRE SUPPRESSION CLEAN AGENT SYSTEM WITHIN THESE 2 ROOMS. INSTALL SYSTEM ACCORDING TO NFPA.

GENERAL NOTE:

FIRE PROTECTION SPRINKLER SYSTEM IS FOR SUGGESTION ONLY AND DOES NOT REPRESENT THE ACTUAL SPRINKLER SYSTEM LAYOUT. DRAWINGS INDICATE WHICH AREAS ARE "DRY PIPE" SYSTEMS AND WET SYSTEMS, EXPOSED PENDANTS OR RECESSED. FIRE SPRINKLER CONTRACTOR WILL SUBMIT CALCULATED SPRINKLER SHOP DRAWINGS FOR APPROVAL.

THIRD FLOOR PLAN PART B – FIRE PROTECTION

SCALE: 1/8" = 1'-0"



HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

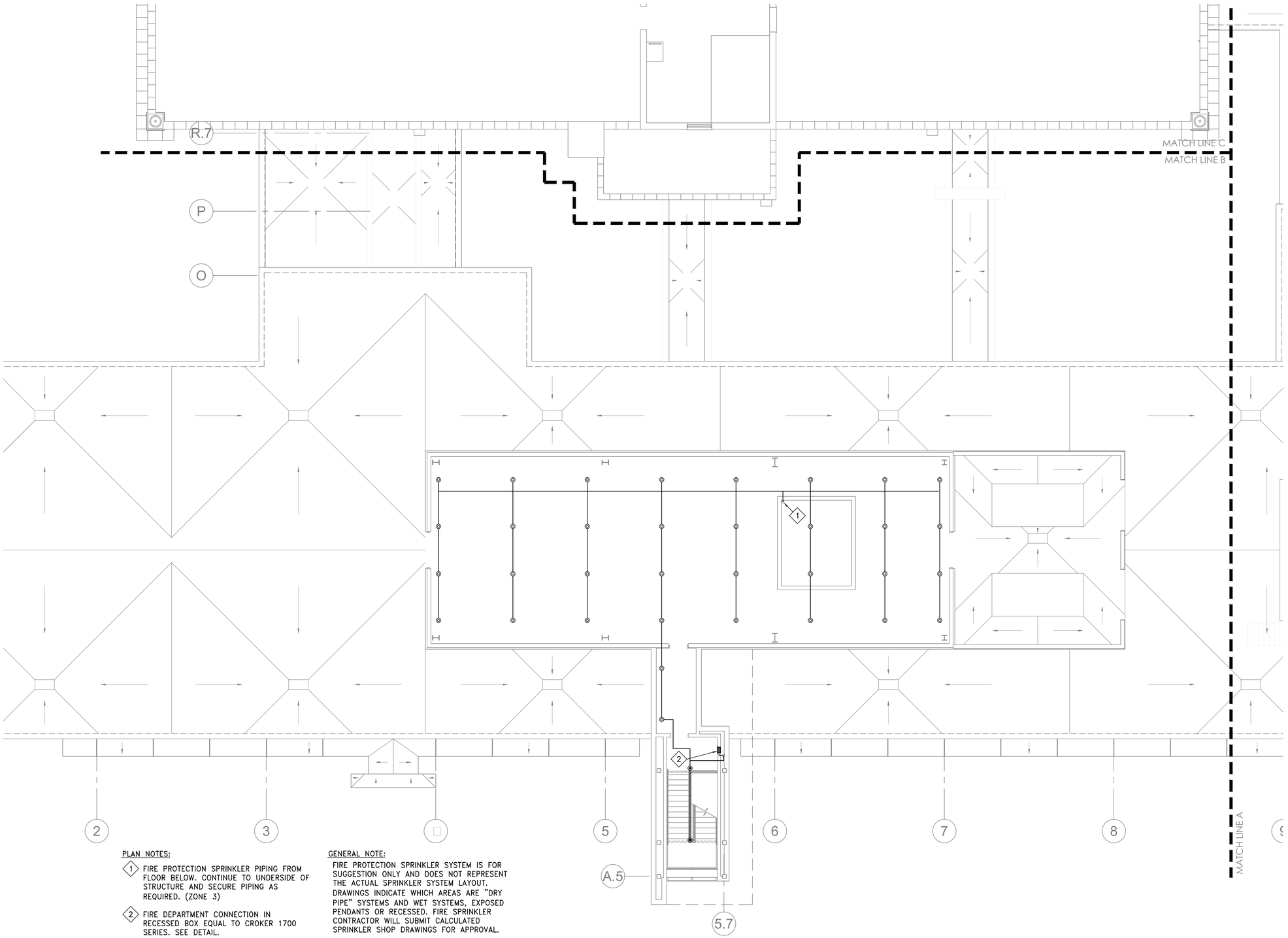
Drawing Issued:		
Date	Rev	Description
08-31-2015		DD Check Set
10-20-2015		75% Progress Set
11-02-2015		90% Pricing Set
11-19-2018		100% Bid Docs

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Checked By:	CM,TP
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RICHARD E. MCCLESKEY — REGISTERED PROFESSIONAL — ENGINEER — 20102 — 1/13/2017 — STATE OF MISSISSIPPI

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ERG# 15-28.2



PLAN NOTES:

1. FIRE PROTECTION SPRINKLER PIPING FROM FLOOR BELOW. CONTINUE TO UNDERSIDE OF STRUCTURE AND SECURE PIPING AS REQUIRED. (ZONE 3)
2. FIRE DEPARTMENT CONNECTION IN RECESSED BOX EQUAL TO CROKER 1700 SERIES. SEE DETAIL.

GENERAL NOTE:

FIRE PROTECTION SPRINKLER SYSTEM IS FOR SUGGESTION ONLY AND DOES NOT REPRESENT THE ACTUAL SPRINKLER SYSTEM LAYOUT. DRAWINGS INDICATE WHICH AREAS ARE "DRY PIPE" SYSTEMS AND WET SYSTEMS, EXPOSED PENDANTS OR RECESSED. FIRE SPRINKLER CONTRACTOR WILL SUBMIT CALCULATED SPRINKLER SHOP DRAWINGS FOR APPROVAL.

ROOF PLAN PART B – FIRE PROTECTION

SCALE: 1/8" = 1'-0"

HATTIESBURG PUBLIC SAFETY COMPLEX

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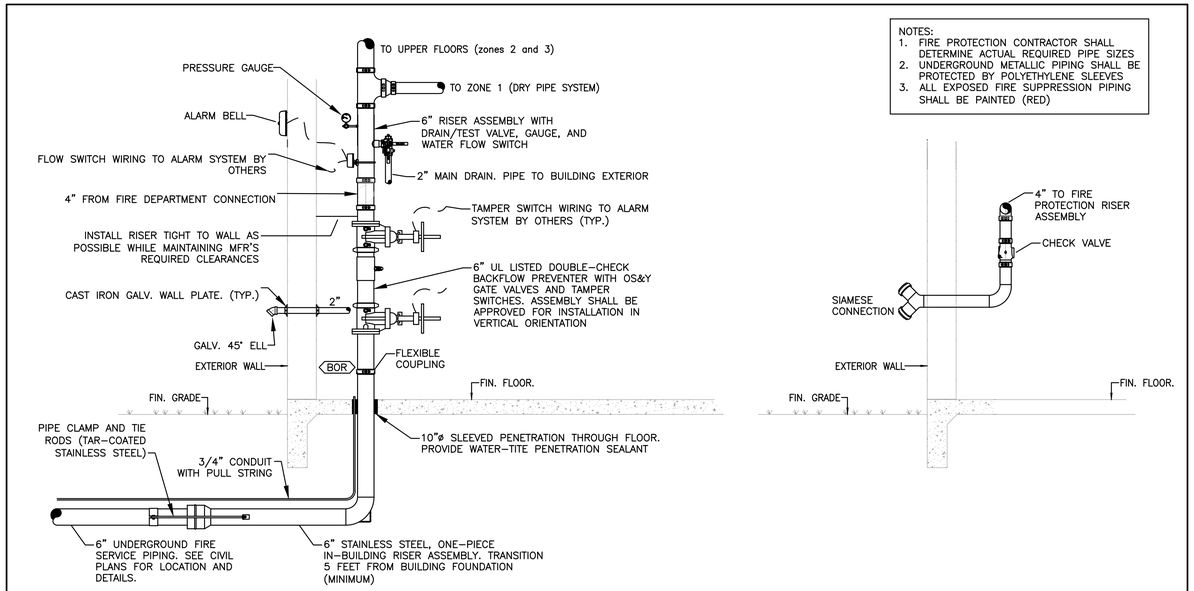
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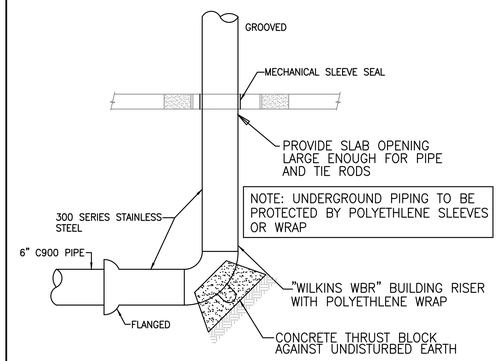
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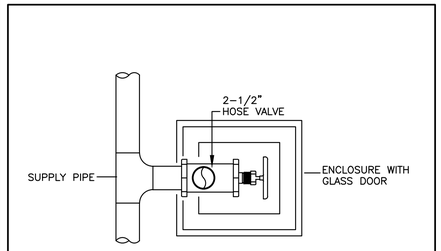


NOTES:
1. FIRE PROTECTION CONTRACTOR SHALL DETERMINE ACTUAL REQUIRED PIPE SIZES
2. UNDERGROUND METALLIC PIPING SHALL BE PROTECTED BY POLYETHYLENE SLEEVES
3. ALL EXPOSED FIRE SUPPRESSION PIPING SHALL BE PAINTED (RED)

1 DETAIL OF WET PIPE FIRE PROTECTION RISER — NO SCALE



2 DETAIL OF ANCHOR FOR FIRE PROTECTION WATER ENTRY — NO SCALE



3 FIRE DEPARTMENT CONNECTION IN RECESSED BOX. — NO SCALE

FIRE PROTECTION GENERAL NOTES

1. INCLUDE ALL LABOR, MATERIAL, E□UIPMENT AND SER□ICE NECESSARY FOR AND REASONABLY INCIDENTAL TO THE DESIGN, FABRICATION AND INSTALLATION OF THE COMPLETE AUTOMATIC FIRE PROTECTION SYSTEMS AS INDICATED ON THE CONTRACT DRA□INGS AND AS SPECIFIED IN THE CONTRACT SPECIFICATIONS.

2. THE FIRE SPRIN□LER SYSTEM DESCRIBED ON THE DRA□INGS AND IN THE SPECIFICATIONS SHALL BE FULLY DESIGNED BY THE FIRE PROTECTION CONTRACTOR S□ THE FIRE SUPPRESSION SYSTEM DRA□INGS AND SPECIFICATIONS ARE PERFORMANCE BASED ONLY. THE DESIGN BUILD CONTRACTOR S□ SHALL BE FULLY RESPONSIBLE FOR THE DESIGN AND TO PRO□IDE ALL NECESSARY E□UIPMENT, HARD□ ARE, CONTROLS, SENSOR, ETC. PER LOCAL FIRE PROTECTION CODES.

3. IN GENERAL, □ OR□ SHALL INCLUDE, BUT NOT BE LIMITED TO:
   A. COMPLETE O□ERHEAD AUTOMATIC SPRIN□LER SYSTEMS AS INDICATED ON THE CONTRACT DRA□INGS AND CONTRACT SPECIFICATIONS.
   B. CONNECTION TO UNDERGROUND FIRE SER□ICE.
   C. SYSTEMS AND DE□ICE TESTING.
   D. ALL NECESSARY PERMITS.

□□ THE FIRE SPRIN□LER SYSTEMS FOR PROTECTION OF THE SHOP BUILDING SHALL BE HYDRAULICALLY DESIGNED □ ET PIPE SPRIN□LER SYSTEMS AS SPECIFIED IN THE FOLLO□ ING
   A. OFFICES, INCLUDING CORRIDORS, LOUNGES, AND SIMILAR SPACES SHALL BE DESIGNED FOR A LIGHT HA□ARD OCCUPANCY TO PRO□IDE A MINIMUM DESIGN DISCHARGE DENSITY OF 0.10 GPM PER S□ FT O□ER THE HYDRAULIC CALCULATION AREA OR ROOM.
   B. SHOP AREA, MECHANICAL, MINOR STORAGE, AND SIMILAR AREAS OF THE BUILDINGS SHALL BE DESIGNED FOR AN ORDINARY HA□ARD GROUP 1 OCCUPANCY. MA□IMUM SPRIN□LER SPACING SHALL BE 130 S□ FT.
   C. ALL SPRIN□LERS □ ITHIN THE PRO□ECT AREA SHALL BE NE□ , □UIC□ RESPONSE, ORDINARY TEMPERATURE RATING □E□CEPT AS RE□UIRED BY NFPA 13 - 2010 SECTION 8.3.2.□.
   D. CALCULATIONS SHALL INCLUDE AN INSIDE HOSE STREAM ALLO□ ANCE OF 100 GPM.

5. PIPE SI□ES INDICATED ON THE CONTRACT DRA□INGS SHALL NOT BE REDUCED.

6. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ESTABLISHING AND IMPLEMENTING ALL SAFETY PROGRAMS AND PROCEDURES FOR THIS PRO□ECT AND SHALL COMPLY □ ITH ALL FEDERAL, STATE AND LOCAL SAFETY AND HEALTH REGULATIONS.

7. THE CONTRACT DRA□INGS ARE DIAGRAMMATIC ONLY. PIPE LENGTHS □IF SHO□ N□ ARE APPRO□IMATE CENTER TO CENTER LENGTHS BET□EEN FITTINGS. THE CONTRACTOR SHALL DETERMINE THE ACTUAL MEASUREMENTS AND MA□E ANY AND ALL SUCH LENGTH AND OFFSET AD□USTEMENTS AS MAY BE NECESSARY TO COMPLETE THE INSTALLATION AT NO CHANGE IN THE CONTRACT PRICE. THE CONTRACT DRA□INGS ARE NOT INTENDED TO RELIE□E THE CONTRACTOR OF ANY RESPONSIBILITY FOR A□OIDING CONFLICTS OR OBSTRUCTIONS, OR FOR INSTALLING THE NUMBER OF SPRIN□LERS AND SUPPLY PIPING AS RE□UIRED TO PRO□IDE COMPLETE PROTECTION OF THE DESIGNATED AREAS IN ACCORDANCE □ ITH THE RE□UIREMENTS OF THE REFERENCED STANDARDS AND THESE SPECIFICATIONS. □ RITTEN APPRO□AL SHALL BE OBTAINED FROM THE PROFESSIONAL PRIOR TO MA□ING ANY MA□OR DE□IATIONS FROM THE ARRANGEMENT AND LAYOUT SHO□ N ON THE CONTRACT DRA□INGS.

8. ALL E□UIPMENT SHALL BE LISTED BY UNDER□ RITER'S LABORATORIES AND□OR FACTORY MUTAL APPRO□ED.

9. SYSTEM, E□UIPMENT, INSTALLATION AND MATERIALS AND METHODS USED SHALL COMPLY □ ITH THE FOLLO□ ING:
   A. NATIONAL FIRE PROTECTION ASSOCIATION □NFPA□1 FIRE CODE 2012 EDITION.
   B. NFPA 13 STANDARD FOR THE INSTALLATION OF SPRIN□LER SYSTEMS 2010 EDITION.
   C. INTERNATIONAL BUILDING CODE - 2012
   D. MANUFACTURER'S RECOMMENDATIONS AND GUIDELINES.

10. ALL MATERIALS AND E□UIPMENT FURNISHED BY THE CONTRACTOR SHALL BE NE□ , FIRST GRADE STANDARD, CURRENT PRODUCTS OF A MANUFACTURER REGULARLY ENGAGED IN THE PRODUCTION OF SUCH MATERIALS AND E□UIPMENT. □ HERE T□ O OR MORE PIECES OF E□UIPMENT PERFORMING THE SAME FUNCTION ARE RE□UIRED, THEY SHALL BE THE PRODUCT OF ONE MANUFACTURER AND E□ACT DUPLICATES.

11. PIPING SHALL BE NE□ , DESIGNED FOR 300 PSI □ OR□ING PRESSURE, CONFORMING TO ASTM SPECIFICATIONS, AND HA□E THE MANUFACTURER'S NAME OR BRAND ALONG □ ITH THE PIPE APPLICABLE ASTM STANDARD MAR□ED ON EACH LENGTH OF PIPE.

12. PIPING 2" DIAMETER AND SMALLER SHALL BE SCHEDULE 40 BLACK STEEL PIPE. PIPE SHALL BE MANUFACTUERED IN ACCORDANCE □ ITH SPECIFICATIONS ASTM A53 AND A135.

13. PIPING 2-1/2" DIAMETER AND LARGER SHALL BE SCHEDULE 10 BLACK STEEL PIPE MANUFACTURED IN ACCORDANCE WITH SPECIFICATION ASTM A135.

1□. OTHER THIN-□ ALLED PIPING MATERIALS □SUCH AS SCHEDULE, 5, □L AND BLT THREADABLE THIN□ ALLS, ETC.□□ ILL NOT BE PERMITTED.

15. ALL FIRE PROTECTION SYSTEM PIPING SHALL BE PRO□IDED □ ITH FACTORY APPLIED ANTIMICROBIAL COATINGS TOINHIBIT MICROBIOLOGICALLY INFLUENCED CORROSION (MIC). ALLIED TUBE AND CONDUIT "ABF II", WHEATLAND TUBE COMPANY "MIC SHIELD" OR EQUAL.

16. THREADED FITTINGS SHALL BE CLASS 125 CAST IRON, BLAC□, AND IN ACCORDANCE □ ITH ANSI B16.□OR DUCTILE OR MALLEABLE IRON, 150 LB CLASS, BLAC□, AND IN ACCORDANCE □ ITH ANSI B16.3. SCRE□ ED □OINTS SHALL BE MADE UP □ ITH APPRO□ED TEFLON □OINT COMPOUND OR TAPE.

17. BOLT ON OR STRAP ON BRANCH AND OUTLET FITTINGS □ ILL NOT BE PERMITTED. SIMILARLY, HOLE CUT PIPING SYSTEM OR STRAPLESS OUTLETS □ ILL NOT BE PERMITTED.

18. GROO□ED COUPLINGS SHALL BE UL LISTED AND□OR FM APPRO□ED FOR FIRE PROTECTION SER□ICE. PLAIN-END TYPE PIPE FITTINGS AND COUPLINGS SHALL NOT BE USED.

19. ALL PENDENT AND SIDE□ ALL SPRIN□LERS LOCATED □ ITHIN 7 FT OF THE FLOOR OR SUB□ECT TO MECHANICAL DAMAGE SHALL BE PRO□IDED □ ITH LISTED SPRIN□LER GUARDS COMPATIBLE □ ITH THE SPRIN□LER MODELS AND TYPES ON □ HICH THEY ARE INSTALLED.

20. E□TRA SPRIN□LERS IN THE □UANTIES RE□UIRED BY NFPA 13, CABINETS, AND □ RENCHES SHALL BE SUPPLIED AND DELI□ERED TO THE PROFESSIONAL.

21. INSTALL HANGERS, FLE□IBLE CONNECTIONS, S□ ING □OINTS AND BRACING IN ACCORDANCE □ ITH NFPA 13.

22. SYSTEM PIPING SHALL BE INSTALLED SUCH THAT NO □OINTS, FITTINGS OR DE□ICES OCCUR DIRECTLY O□ER ELECTRICAL E□UIPMENT OR □ ITHIN THE CLEARANCE SPACE AS RE□UIRED BY THE NATIONAL ELECTRIC CODE □NEC□

23. IMPAIRMENTS OF E□ISTING FIRE PROTECTION SYSTEMS SHALL BE MINIMI□ED, COORDINATED □ ITH THE PROFESSIONAL AND PERFORMED IN ACCORDANCE □ ITH NFPA 25. ALL E□ISTING FIRE PROTECTION SYSTEMS SHALL BE RESTORED TO SER□ICE AT THE END OF EACH □ OR□ING DAY.

2□. THE □ OR□ PERFORMED ON THIS PRO□ECT OCCURS □ ITHIN AN E□ISTING BUILDING. ALL E□UIPMENT AND MATERIAL TO BE FURNISHED AND INSTALLED ON THE PRO□ECT SHALL BE COORDINATED □ ITH THE SPACE CONSTRAINTS. ALL E□UIPMENT AND MATERIAL SHALL BE FABRICATED SUCH THAT COMPLETE SYSTEMS MAY BE BRO□EN DO□ NI INTO SECTION SUITABLE FOR LIFTING AND FITTING THROUGH PASSAGE□AYS □ ITHOUT MODIFCATION TO THE BUILDING UNLESS OTHER□ISE NOTED, OR OTHER ARRANGEMENTS ARE MADE □ ITH THE PROFESSIONAL.

25. THE CONTACTOR SHALL BE RESPONSIBLE FOR ALL OPENINGS AND PENETRATIONS RE□UIRED FOR THE FIRE PROTECTION PIPING.

26. CUTTING STRUCTURAL MEMBERS FOR THE PASSING OF FIRE PROTECTION PIPING OR PIPE HANGER FASTENING □ ILL NOT BE PERMITTED E□CEPT □ ITH APPRO□AL OF THE PROFESSIONAL.

27. SUITABLE MEANS SHALL BE PRO□IDED AT EACH HOLE OR PENETRATION TO MAINTAIN THE DESIGNED FIRE RESISTANCE RATING OF THE □ ALL, CEILING, OR FLOOR ASSEMBLY.

28. INSTALL SPLIT □ ALL PLATES OR ESCUTCHEONS □ HERE E□POSED PIPING PASSES THROUGH A FINISHED FLOOR, □ ALL OR CEILING. THEY SHALL FIT SNUGLY AROUND PIPING. THE FINISH OF ESCUTCHEONS OR □ ALL PLATES SHALL MATCH THE COLOR OF AD□ACENT □ ALLS, CEILINGS, OR FLOORS.

29. UPON COMPLETION OF INSTALLATION AND □ HILE PIPING IS STILL E□POSED, HYDROSTATICALLY TEST THE SYSTEMS AT 200 PSI □OR 50 PSI IN E□CES OF THE SYSTEM □ OR□ING PRESSURE, □ HICHE□ER IS GREATER□FOR A PERIOD OF 2 HOURS. PORTIONS OF THE SYSTEM MAY BE TESTED AS THEY ARE COMPLETED. SE□ENTY-T□ O HOUR NOTICE SHALL BE GI□EN TO THE PROFESSIONAL AND THE AUTHORITY HA□ING □URISDICTION PRIOR TO ANY TEST. A PRE-INSTALLATION INSPECTION OF PIPE, FITTINGS, AND DE□ICES IS RE□UIRED.

30. SPRIN□LER HEADS INSTALLED IN TILE CEILINGS SHALL BE INSTALLED IN THE CENTER OF THE TILES.

31. SPRIN□LER SYSTEM DRAIN LINES SHALL BE ROUTED AS INDICATED ON FLOOR PLANS AND FULLY COORDINATED □ ITH ALL TRADES SUCH THAT IT A□OIDS THE TRA□EL PATH OF THE O□ERHEAD CRANE . REFER TO SECTION 2 ON SHEET A30□.

32. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL LEA□S.

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HVAC LEGEND AND ABBREVIATIONS

PIPING LEGEND

	CONCRETE THRUST BLOCK
FM	FLOW METER
FS	FLOW SWITCH
	FIRESTOPPING
	PIPE SLEEVE
	BEAM PENETRATION
	PIPE CAP
	PIPE BLIND FLANGE
	HOT WATER FLOW DESIGNATION
CWS / CWS	CONDENSER WATER SUPPLY
CWR / CWR	CONDENSER WATER RETURN
HWS / HWS	HOT WATER SUPPLY
HWR / HWR	HOT WATER RETURN
CHS / CHS	CHILLED WATER SUPPLY
CHR / CHR	CHILLED WATER RETURN
G	GAS (NATURAL)
LP	GAS (PROPANE)
RS	REFRIGERANT SUCTION
RL	REFRIGERANT LIQUID
	ARROW INDICATES DIRECTION OF FLOW
	PITCH PIPE DOWN IN DIRECTION OF ARROW
D / D	CONDENSATE DRAIN LINE
	PIPE GUIDE
	EXPANSION COMPENSATOR
	CONCENTRIC REDUCER (INCREASER)
	ECCENTRIC REDUCER (INCREASER)
	UNION
	CAPPED PIPE WITH SHUT-OFF VALVE
	"Y" TYPE STRAINER WITH HOSE END BLOW OFF VALVE
	"Y" TYPE STRAINER
	ELBOW TURNED UP
	ELBOW TURNED DOWN
	BOTTOM PIPE CONNECTION
	TOP PIPE CONNECTION
	SLOPED CHANGE IN PIPE ELEVATION

PIPING LEGEND (CONT.)

	SHUT-OFF VALVE
	AUTOMATIC FLOW CONTROL VALVE
	ORIFICE TYPE FLOW MEASURING DEVICE
	VENTURI TYPE FLOW MEASURING DEVICE
	BALL VALVE WITH HOSE THREAD CONNECTION
	GAS COCK
	BALANCING VALVE
	GLOBE VALVE
	CHECK VALVE
	AUTOMATIC THREE-WAY CONTROL VALVE
	AUTOMATIC TWO-WAY CONTROL VALVE
	RELIEF VALVE
	ANGLE RELIEF VALVE
	PRESSURE REDUCING VALVE (PRV)
	LUBRICATED PLUG VALVE
	SOLENOID VALVE
	BUTTERFLY VALVE (MANUAL)
	BALL VALVE
	BALL VALVE, NORMALLY CLOSED
	SIGHT GLASS
	MANUAL AIR VENT
A	AUTOMATIC AIR VENT
	THERMOMETER
	PIPE SENSOR WELL (THERMOMETER)
	PRESSURE GAUGE AND COCK
	PRESSURE GAUGE WITH LOOP
	TEMPERATURE-PRESSURE TEST FITTING

DUCTWORK LEGEND

	RADIUS ELBOW
	ELBOW WITH TURNING VANES
	RECTANGULAR BRANCH TAKEOFF WITH BALANCING DAMPER
	RECTANGULAR SUPPLY DUCT UP
	RECTANGULAR SUPPLY DUCT DOWN
	RECTANGULAR RETURN OR EXHAUST DUCT UP
	RECTANGULAR RETURN OR EXHAUST DUCT DOWN
	ROUND DUCT, UP
	ROUND DUCT, DOWN
R	SLOPING RISE IN DUCTWORK
D	SLOPING DROP IN DUCTWORK
18x12 / 18x12	DUCT SIZE (CLEAR INSIDE DIMENSION) FIRST FIGURE INDICATES PLAN SIZE
18ϕ / 18ϕ	ROUND DUCT DIAMETER SIZE (CLEAR INSIDE DIMENSION)
18/12 / 18/12	OVAL DUCT SIZE
	SIDE, TOP OR BOTTOM DUCT ACCESS DOOR
	RECTANGULAR OR SQUARE TO ROUND OR OVAL TRANSITION
	DOUBLE-WALL DUCT IS INDICATED BY SHADING
	FLEXIBLE DUCT
	VOLUME DAMPER IN DUCT
M	MOTORIZED DAMPER
F	FIRE DAMPER
S	SMOKE DAMPER
	1A - 1 WAY
	2A - 2 WAY
	3A - 3 WAY
	4A - 4 WAY
	2C - 2 WAY CORNER
	4C - 4 WAY CORNER
	LINEAR DIFFUSER
	LINEAR DIFFUSER WITH PLENUM

DUCTWORK LEGEND (CONT.)

	RETURN/EXHAUST REGISTER OR GRILLE
	FIRE RATED ENCASED DUCT
→	SUPPLY REGISTER WITH AIR OUTLET DEVICE DESIGNATION
←	RETURN OR EXHAUST REGISTER OR GRILLE WITH AIR INLET DEVICE DESIGNATION
	DUCT END/CAP

CONTROLS LEGEND

CO2	CARBON DIOXIDE SENSOR
H	HUMIDITY SENSOR
T	TEMPERATURE SENSOR/THERMOSTAT
TP	PROGRAMMABLE THERMOSTAT
S	TEMPERATURE SENSOR
P #	STATIC PRESSURE SENSOR WITH DESIGNATION
TN	NIGHT SET-BACK THERMOSTAT
WS	WALL SWITCH
RC	REMOTE CONTROLLER
ORT	0-6 HOUR OVERRIDE TIMER
T/C	TIME CLOCK
E/S	EMERGENCY SHUTOFF SWITCH
	WALL OR CEILING MOTION HEAT SENSOR

MISCELLANEOUS

DP	DIFFERENTIAL PRESSURE SENSOR
DP	DIFFERENTIAL PRESSURE SWITCH
ϕ	DIAMETER
HW / 1	RISER DESIGNATION (RISER SERVICE / RISER NUMBER)
2 / M3.1	SECTION DESIGNATION (SECTION NUMBER / DRAWING NUMBER)
1 / M2.1	DETAIL DESIGNATION (DETAIL NUMBER / DRAWING NUMBER)
CT / 1-1	EQUIPMENT DESIGNATION (EQUIPMENT TYPE / EQUIPMENT NUMBER)
T-3.24	TERMINAL DESIGNATION (3-24: THE NUMBER ON SYSTEM / SYSTEM)
	EXISTING EQUIPMENT, PIPING, OR DUCTWORK TO REMAIN IN SERVICE.
	EXISTING EQUIPMENT, PIPING, OR DUCTWORK TO BE REMOVE.
	NEW CONNECTION TO EXISTING PIPING, DUCTWORK AND/OR EQUIPMENT

TAG (SEE SCHEDULE) — NECK SIZE; CFM OR "--" (-- MEANS NO BALANCE REQUIRED)

DIFFUSER, RETURN, & EXHAUST GRILLE TAG

ABBREVIATIONS - MECHANICAL

AAV	AIR ADMITTANCE VALVE
ACU	AIR CONDITIONING UNIT
AD	ACCESS DOOR
AHU	AIR HANDLING UNIT
AS	AIR SEPARATOR
AVTR	ACID VENT THRU ROOF
B	BOILER
BMS	BUILDING MANAGEMENT SYSTEM
BHP	BRAKE HORSE POWER
BTU	BRITISH THERMAL UNIT
CC	COOLING COIL
CD	CEILING DIFFUSER
CER	CEILING EXHAUST REGISTER
CRG	CEILING RETURN GRILLE
CH	CHILLER
CFM	CUBIC FEET PER MINUTE
CTG	CEILING TRANSFER GRILLE
CG	CEILING GRILLE
CO	CLEAN OUT
CRA	CONDITIONING RETURN AIR
CSA	CONDITIONING SUPPLY AIR
CT	COOLING TOWER
CHS	CHILLED WATER SUPPLY
CHR	CHILLED WATER RETURN
DB	DRY BULB
DG	DOOR GRILLE
DIA	DIAMETER
DN	DOWN
DX	DIRECT EXPANSION
EA	EXHAUST AIR
EAT	ENTERING AIR TEMPERATURE
EDB	ENTERING DRY BULB
EDH	ELECTRICAL DUCT HEATER
EF	EXHAUST FAN
EFF	EFFICIENCY
ET	EXPANSION TANK
EWB	ENTERING WET BULB
EWH	ELECTRIC WATER HEATER
EWT	ENTERING WATER TEMPERATURE
°F	DEGREES FAHRENHEIT
FC	FLEXIBLE CONNECTION (DUCT OR PIPE)

ABBREVIATIONS - MECHANICAL

FCU	FAN COIL UNIT
FD	FUSIBLE LINK FIRE DAMPER W/ DUCT ACCESS DOOR
FLR	FLOOR
FLA	FULL LOAD AMPS
FT	FEET
GF	GAS FURNACE
GPM	GALLONS PER MINUTE
GWH	GAS WATER HEATER
HC	HEATING COIL
HP	HORSE POWER
HR	HOUR
HRU	HEAT RECOVERY UNIT
HWS	HEATING WATER SUPPLY
HWR	HEATING WATER RETURN
ID	INSIDE DIMENSION
KW	KILOWATT
LAT	LEAVING AIR TEMPERATURE
LBS	POUNDS
LD	LINEAR DIFFUSER (CEILING, WALL, SILL OR FLOOR)
LRA	LOCK ROTOR AMPS
LFD	LOUVER FACE DIFFUSER
LWT	LEAVING WATER TEMPERATURE
MA	MIXED AIR
MAT	MIXED AIR TEMPERATURE
MAX	MAXIMUM
MBH	THOUSAND BTU PER HOUR
MFG	MANUFACTURER
MFS	MAXIMUM FUSE SIZE
MIN	MINIMUM
MUA	MAKE UP AIR UNIT
MOCP	MAXIMUM OVERCURRENT PROTECTION
NC	NORMALLY CLOSED
NFA	NET FREE AREA
NIC	NOT IN THIS CONTRACT
NO	NORMALLY OPEN
NTS	NOT TO SCALE
OA	OUTSIDE AIR INTAKE
OBD	OPPOSED BLADE DAMPER
OD	OUTSIDE DIMENSION
P	PUMP
PD	PRESSURE DROP

ABBREVIATIONS - MECHANICAL

PRV	PRESSURE REDUCING VALVE
PSI	POUNDS PER SQUARE INCH (GAUGE)
PSA	PRIMARY SUPPLY AIR
RA	RELIEF AIR
RH	RELATIVE HUMIDITY
RHC	REHEAT COIL
RPM	REVOLUTIONS PER MINUTE
RP	RECIRC PUMP
SA	SUPPLY AIR
SD	SMOKE DAMPER
SENS	SENSIBLE
SP	STATIC PRESSURE
SQFT	SQUARE FEET
TA	TRANSFER AIR DUCT
TYP	TYPICAL
VAV	VARIABLE AIR VOLUME
VD	VOLUME DAMPER
VEA	VENTILATION EXHAUST AIR
VFD	VARIABLE FREQUENCY DRIVE
VRF	VARIABLE REFRIGERANT FLOW
VSA	VENTILATION SUPPLY AIR
VTR	VENT THRU ROOF
W/	WITH
WSR	WALL SUPPLY REGISTER
WSHP	WATER SOURCE HEAT PUMP
WB	WET BULB
EW	EXISTING DOMESTIC WATER
ECS	EXISTING CONDENSER WATER SUPPLY
ECR	EXISTING CONDENSER WATER RETURN
ECHS	EXISTING CHILLED WATER SUPPLY
ECHR	EXISTING CHILLED WATER RETURN
EHWS	EXISTING HEATING WATER SUPPLY
EHWR	EXISTING HEATING WATER RETURN
ECHWS	EXISTING CHILLED/HEATING WATER SUPPLY
ECHWR	EXISTING CHILLED/HEATING WATER RETURN
EDCW	EXISTING DOMESTIC COLD WATER
EDHW	EXISTING DOMESTIC HOT WATER
EDHWR	EXISTING DOMESTIC HOT WATER RECIRC
EG	EXISTING GAS (NATURAL)
ERL	EXISTING REFRIGERANT LIQUID
ERS	EXISTING REFRIGERANT SUCTION

GENERAL NOTES - HVAC

GENERAL RENOVATION REQUIREMENTS

A. ALL PIPING SHOWN WITH DASHED LINES - DASHED LINES REPRESENT OUTSIDE DIMENSION OF PIPE INCLUDING INSULATION.
B. ANY INDICATED MOUNTING HEIGHTS ARE APPROXIMATE. FINAL MOUNTING HEIGHT SHALL BE DETERMINED IN FIELD.
C. INSTALLATION OF ALL EQUIPMENT AND SYSTEMS SHALL BE IN ACCORDANCE WITH, MANUFACTURER'S REQUIREMENTS, STANDARD DETAILS, SECTIONS AND ELEVATIONS SHOWN ON THE DRAWINGS.
D. CONTRACTOR SHALL MAINTAIN A CLEAR SERVICE AREA AROUND ALL EQUIPMENT FOR MAINTENANCE.

SHEET INDEX - HVAC

SHEET	TITLE
M□□□	MECHANICAL LEGEND AND ABBRE□IATIONS
M□□□□	FIRST FLOOR PLAN PART A □H□AC
M□□□□	FIRST FLOOR PLAN PART B □H□AC
M□□□□	SECOND FLOOR PLAN PART A □H□AC
M□□□□	SECOND FLOOR PLAN PART B □H□AC
M□□□□	THIRD FLOOR PLAN PART A □H□AC
M□□□□	THIRD FLOOR PLAN PART B □H□AC
M□□□□	ROOF PLAN PART A □H□AC
M□□□□	ROOF PLAN PART B □H□AC
M□□□□	FIRST FLOOR PLAN PART A □PIPING □E□HAUST
M□□□□	FIRST FLOOR PLAN PART B □PIPING □E□HAUST
M□□□□	SECOND FLOOR PLAN PART A □PIPING □E□HAUST
M□□□□	SECOND FLOOR PLAN PART B □PIPING □E□HAUST
M□□□□	THIRD FLOOR PLAN PART A □PIPING □E□HAUST
M□□□□	THIRD FLOOR PLAN PART B □PIPING □E□HAUST
M□□□□	ROOF PLAN PART A □PIPING □E□HAUST
M□□□□	ROOF PLAN PART B □PIPING □E□HAUST
M□□□	ENLARGED MECHANICAL PENTHOUSE ELE□ATION
M□□□	ENLARGED MECHANICAL PLANS
M□□□	ENLARGED MECHANICAL PLANS
M□□□	ENLARGED MECHANICAL PLANS
M□□□	ENLARGED MECHANICAL PLANS
M□□□	ENLARGED MECHANICAL PLANS
M□□□	MECHANICAL DETAILS
M□□□	MECHANICAL DETAILS
M□□□	MECHANICAL DETAILS
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M□□□	MECHANICAL DETAILS
M□□□	MECHANICAL DETAILS
M□□□	MECHANICAL SCHEDULES
M□□□	MECHANICAL SCHEDULES
M□□□	MECHANICAL SCHEDULES
M□□□	MECHANICAL SCHEDULES
M□□□	CONTROL SCHEMATIC
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M□□□	PIPING SCHEMATIC
M□□□	PIPING SCHEMATIC

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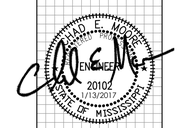
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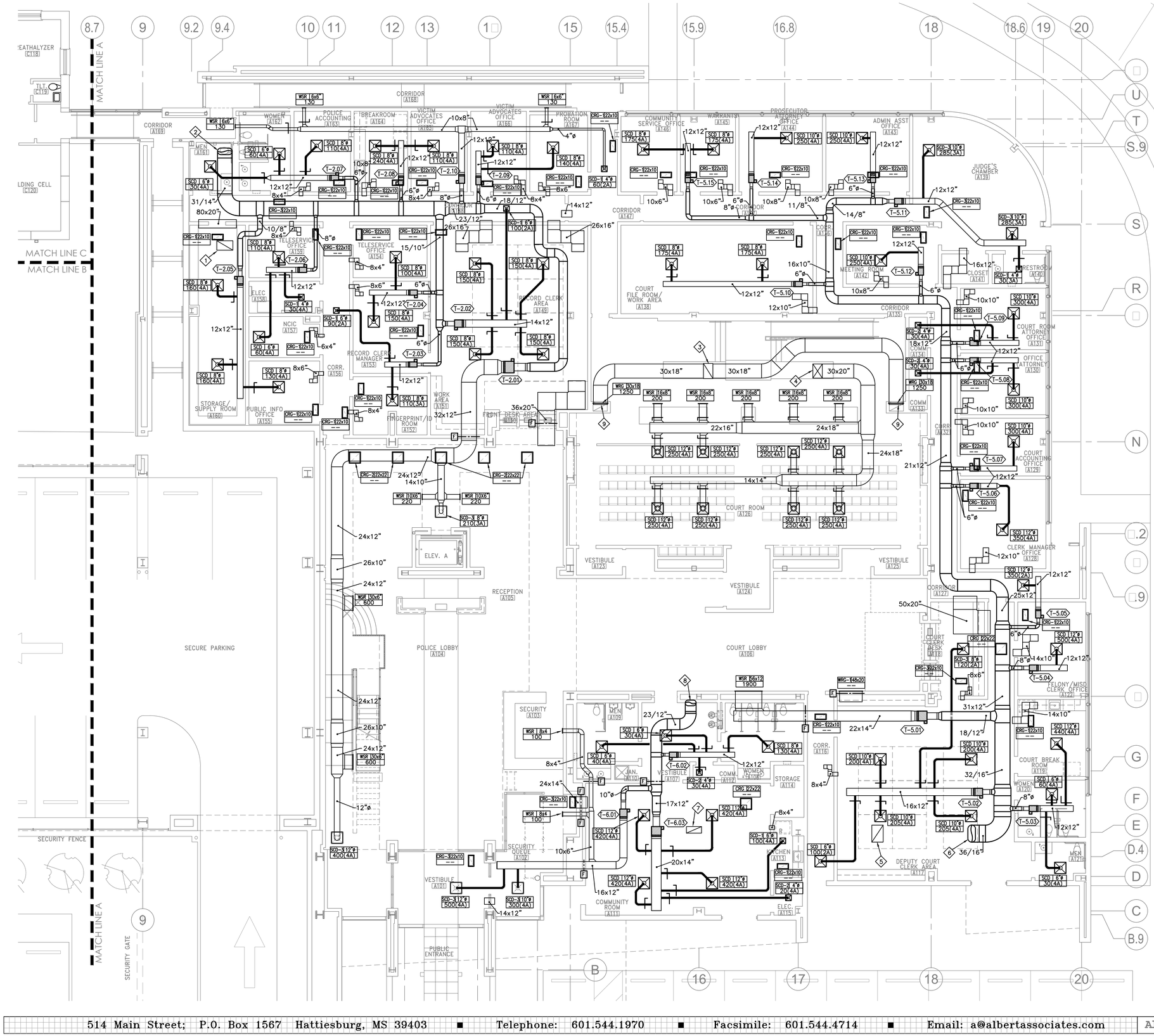
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ERG# 15-28.2



PLAN NOTES

1. 34x20" RETURN AIR DUCT UP TO AHU-2 ON ROOF.
2. 31/14" MEDIUM PRESSURE SUPPLY AIR DUCT DOWN FROM AHU-2 ON ROOF.
3. 32x20" RETURN AIR DUCT UP TO AHU-1 ON ROOF.
4. 30x20" LOW PRESSURE SUPPLY AIR DUCT DOWN FROM AHU-1 ON ROOF.
5. 36x24" RETURN AIR DUCT UP TO AHU-5 ON ROOF.
6. 36/16" MEDIUM PRESSURE SUPPLY AIR DUCT DOWN FROM AHU-5 ON ROOF.
7. 32x14" RETURN AIR DUCT UP TO FLOOR ABOVE. PROVIDE FIRE DAMPER AT FLOOR SLAB.
8. 23/12" MEDIUM PRESSURE SUPPLY AIR DUCT DOWN FROM FLOOR ABOVE. PROVIDE FIRE DAMPER AT FLOOR SLAB.
9. 30x18" RETURN AIR DUCT STUBBED INTO OPEN RETURN PLENUM CHASE PROVIDED BY ARCHITECT. RETURN AIR GRILLE MOUNTED NEAR FLOOR IN WALL.

FIRST FLOOR PLAN PART A – HVAC

SCALE: 1/8" = 1'-0"

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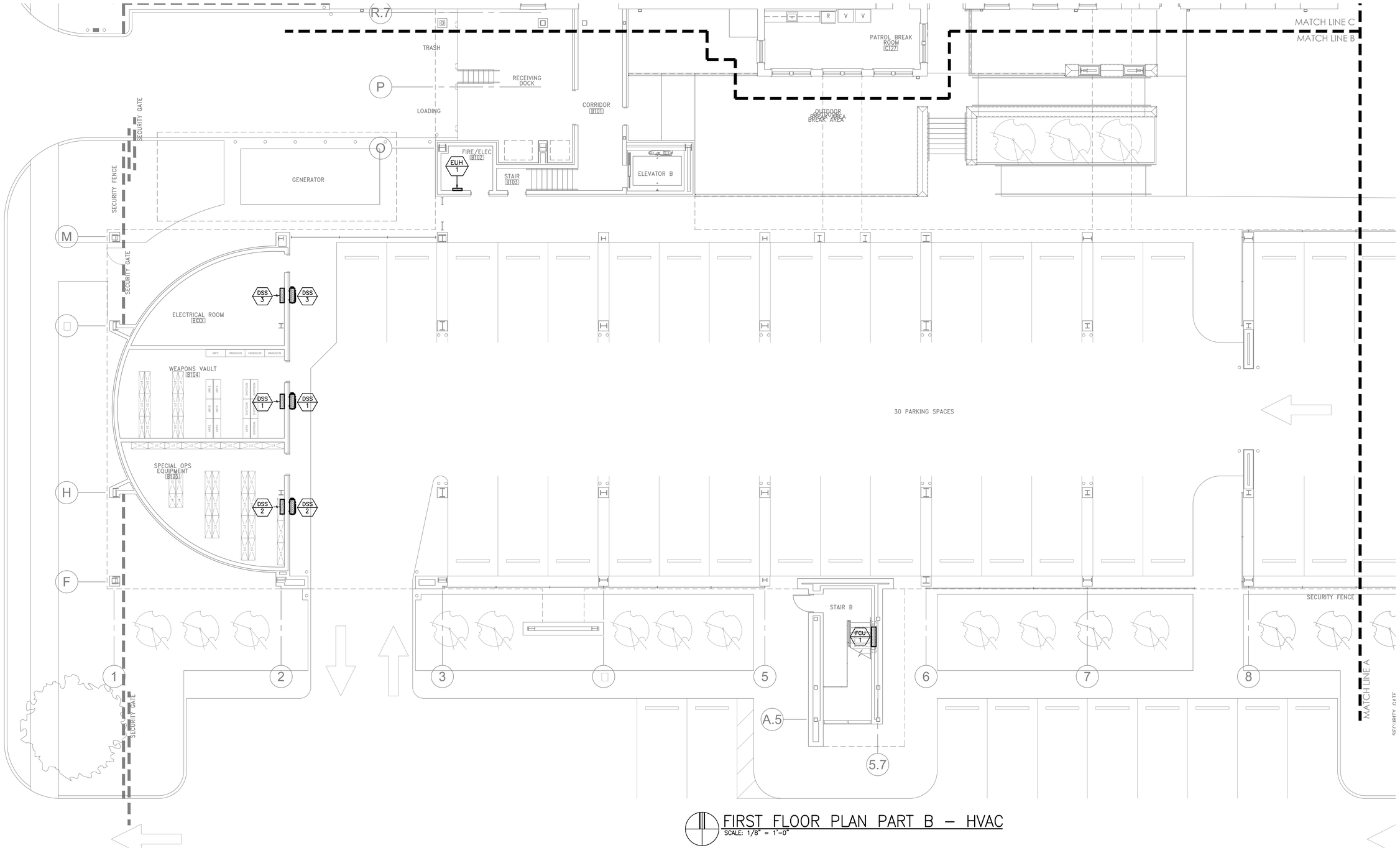
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FIRST FLOOR PLAN PART B – HVAC

SCALE: 1/8" = 1'-0"

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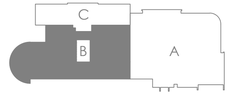
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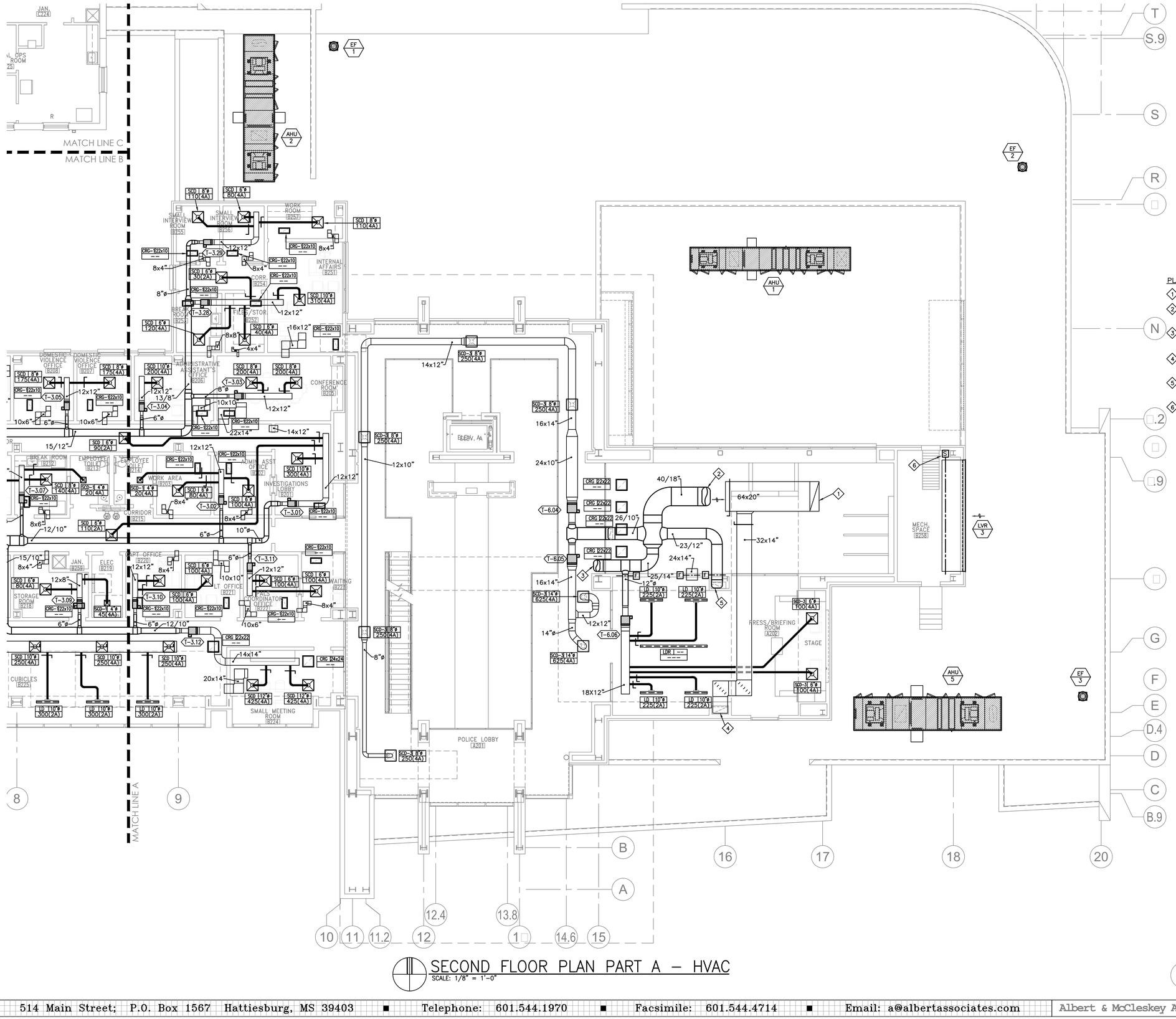
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PLAN NOTES

1. 64x20" RETURN AIR DUCT UP TO AHU-6 ON ROOF.
2. 40/18" MEDIUM PRESSURE SUPPLY AIR DUCT DOWN FROM AHU-6 ON ROOF.
3. 25/14" MEDIUM PRESSURE SUPPLY AIR DUCT UP TO FLOOR ABOVE. PROVIDE FIRE DAMPER AT FLOOR SLAB.
4. 32x14" RETURN AIR DUCT UP FROM FLOOR BELOW. PROVIDE FIRE DAMPED AT FLOOR SLAB.
5. 23/12" MEDIUM PRESSURE SUPPLY AIR DUCT DOWN TO FLOOR BELOW. PROVIDE FIRE DAMPER AT FLOOR SLAB.
6. PROVIDE (4) SMOKE DAMPERS IN PLENUM FOR SMOKE EVACUATION SYSTEM.

SECOND FLOOR PLAN PART A - HVAC

SCALE: 1/8" = 1'-0"

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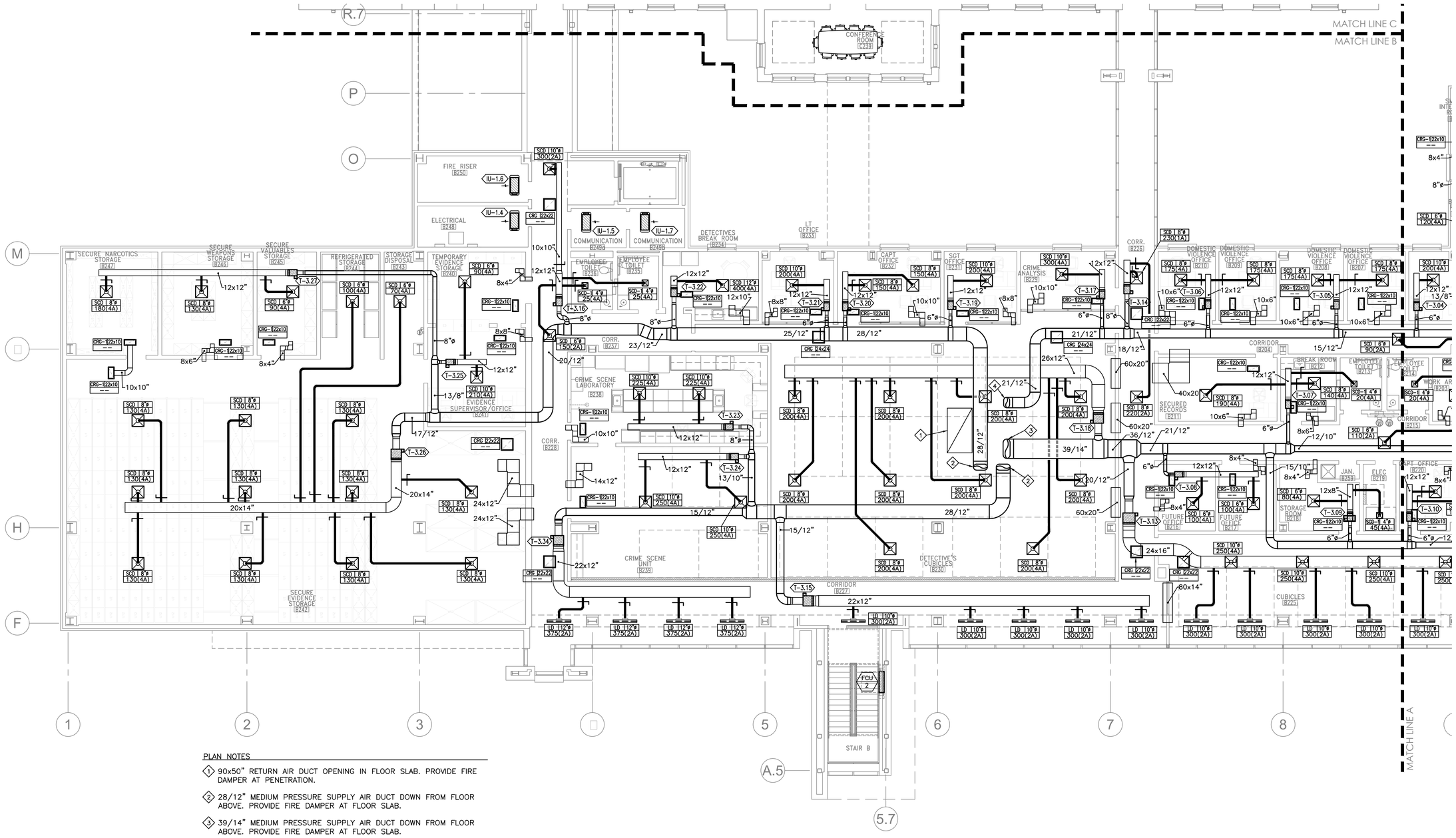
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PLAN NOTES

1. 90x50" RETURN AIR DUCT OPENING IN FLOOR SLAB. PROVIDE FIRE DAMPER AT PENETRATION.
2. 28/12" MEDIUM PRESSURE SUPPLY AIR DUCT DOWN FROM FLOOR ABOVE. PROVIDE FIRE DAMPER AT FLOOR SLAB.
3. 39/14" MEDIUM PRESSURE SUPPLY AIR DUCT DOWN FROM FLOOR ABOVE. PROVIDE FIRE DAMPER AT FLOOR SLAB.
4. 21/12" MEDIUM PRESSURE SUPPLY AIR DUCT DOWN FROM FLOOR ABOVE. PROVIDE FIRE DAMPER AT FLOOR SLAB.

SECOND FLOOR PLAN PART B – HVAC

SCALE: 1/8" = 1'-0"

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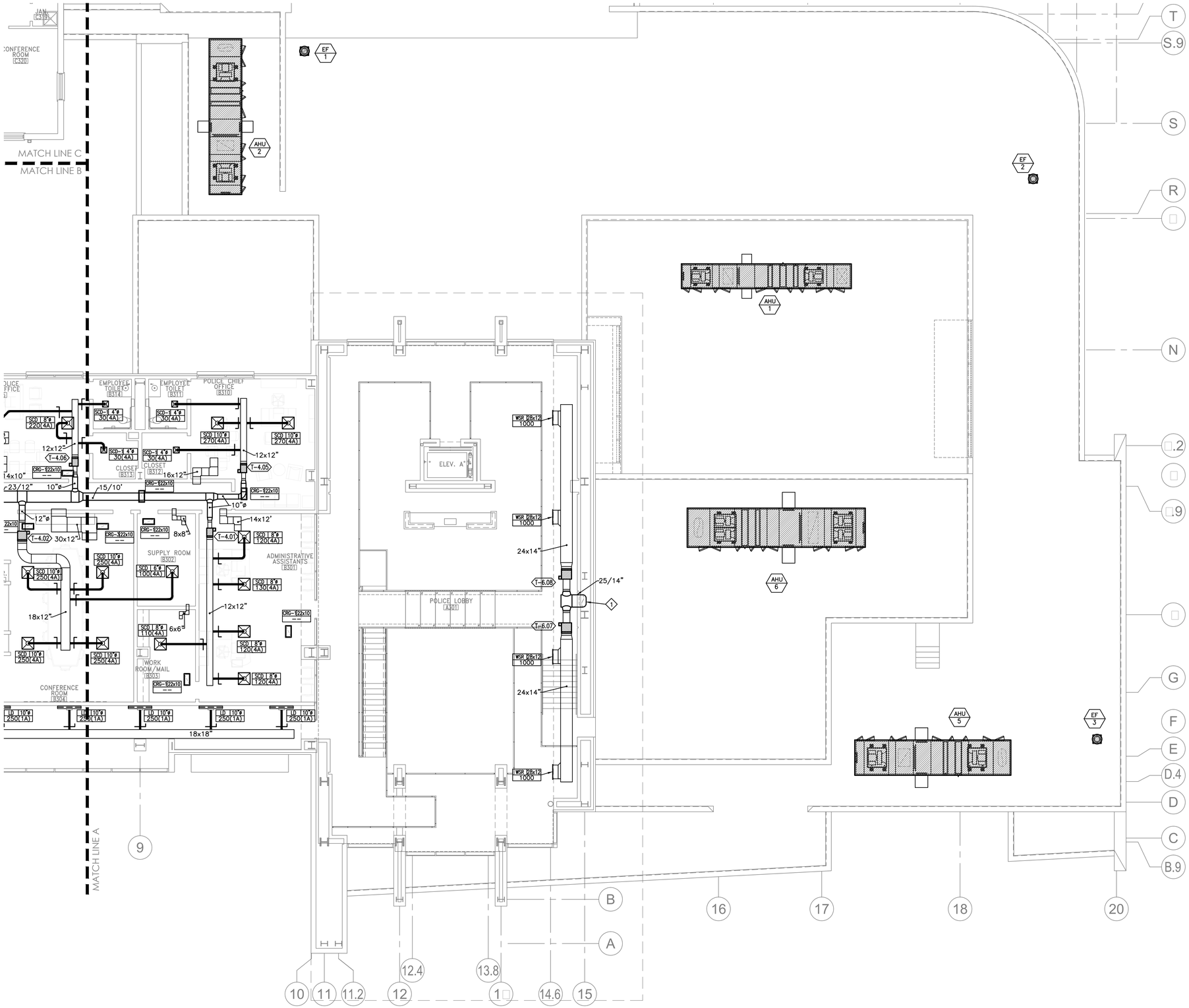
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THIRD FLOOR PLAN PART A – HVAC

SCALE: 1/8" = 1'-0"

PLAN NOTES

1. 25/14" MEDIUM PRESSURE SUPPLY AIR DUCT UP FROM FLOOR BELOW. PROVIDE FIRE DAMPER AT FLOOR SLAB.

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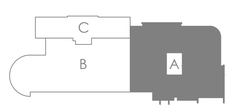
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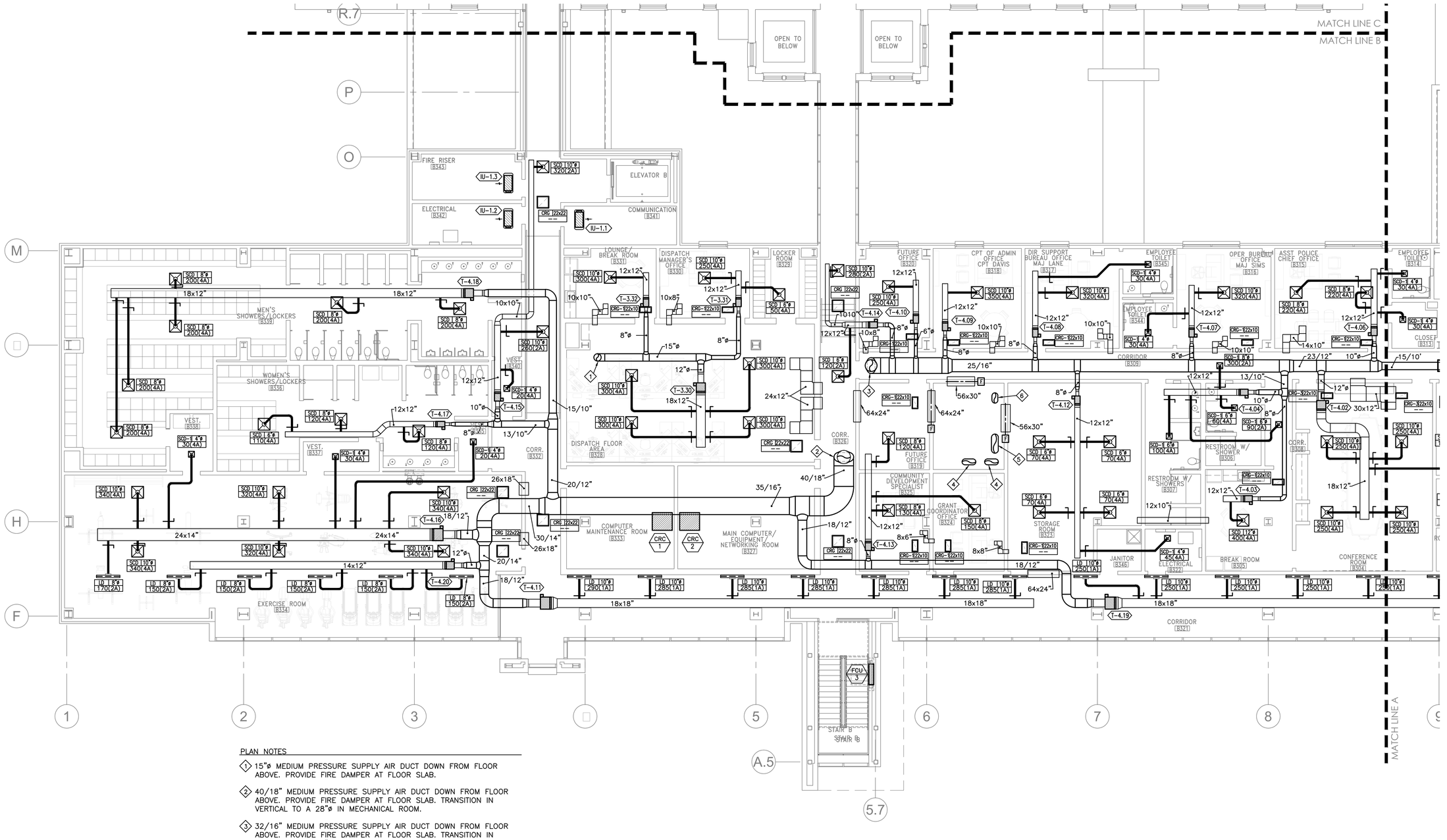
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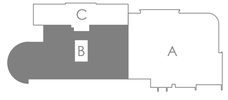


PLAN NOTES

1. 15"ø MEDIUM PRESSURE SUPPLY AIR DUCT DOWN FROM FLOOR ABOVE. PROVIDE FIRE DAMPER AT FLOOR SLAB.
2. 40/18" MEDIUM PRESSURE SUPPLY AIR DUCT DOWN FROM FLOOR ABOVE. PROVIDE FIRE DAMPER AT FLOOR SLAB. TRANSITION IN VERTICAL TO A 28"ø IN MECHANICAL ROOM.
3. 32/16" MEDIUM PRESSURE SUPPLY AIR DUCT DOWN FROM FLOOR ABOVE. PROVIDE FIRE DAMPER AT FLOOR SLAB. TRANSITION IN VERTICAL TO A 24"ø IN MECHANICAL ROOM.
4. 28/12" MEDIUM PRESSURE SUPPLY AIR DUCT DOWN FROM FLOOR ABOVE AND CONTINUE TO FLOOR BELOW.
5. 39/14" MEDIUM PRESSURE SUPPLY AIR DUCT DOWN FROM FLOOR ABOVE AND CONTINUE TO FLOOR BELOW.
6. 21/12" MEDIUM PRESSURE SUPPLY AIR DUCT DOWN FROM FLOOR ABOVE AND CONTINUE TO FLOOR BELOW.

THIRD FLOOR PLAN PART B – HVAC

SCALE: 1/8" = 1'-0"



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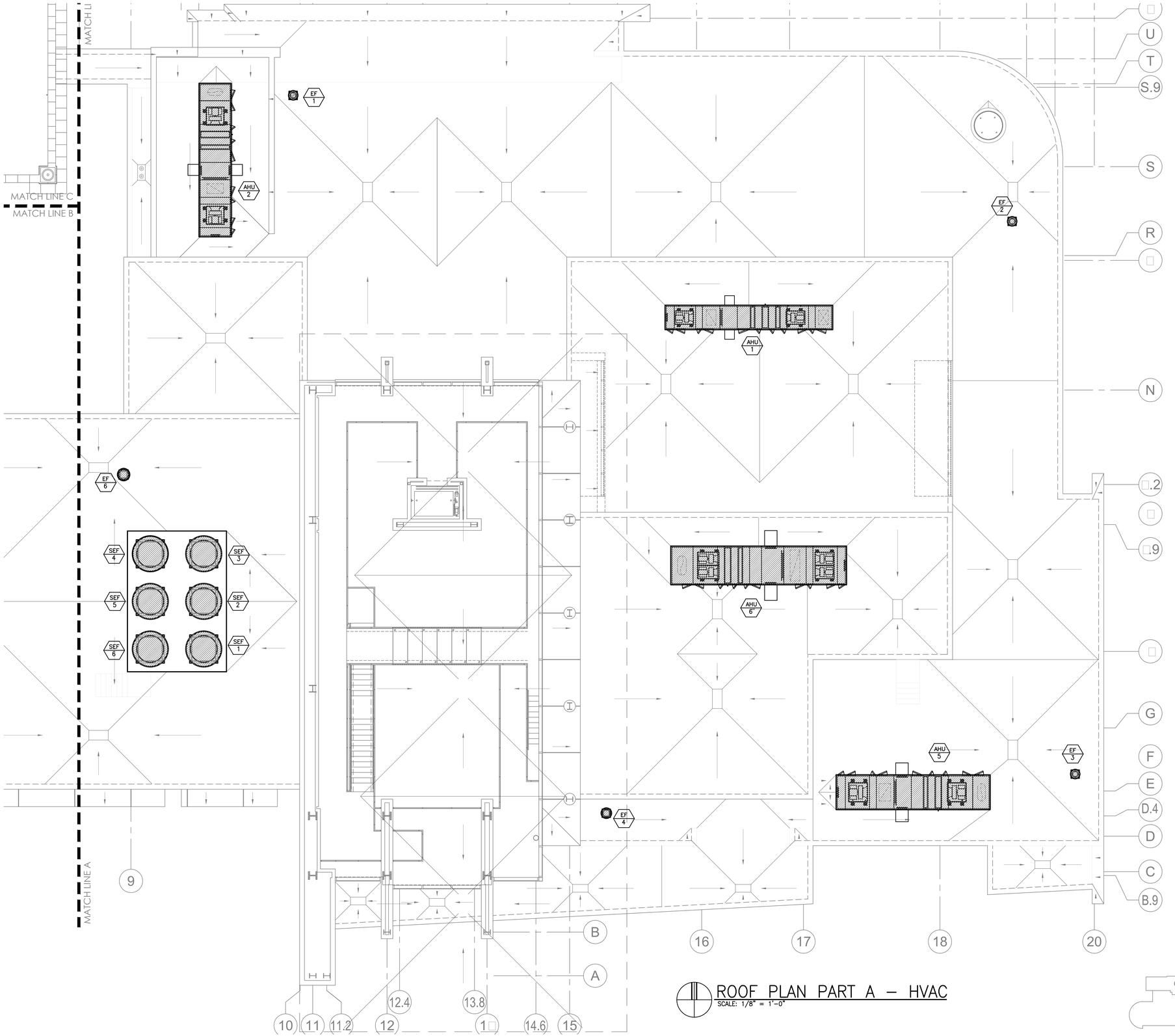
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ROOF PLAN PART A – HVAC
SCALE: 1/8" = 1'-0"

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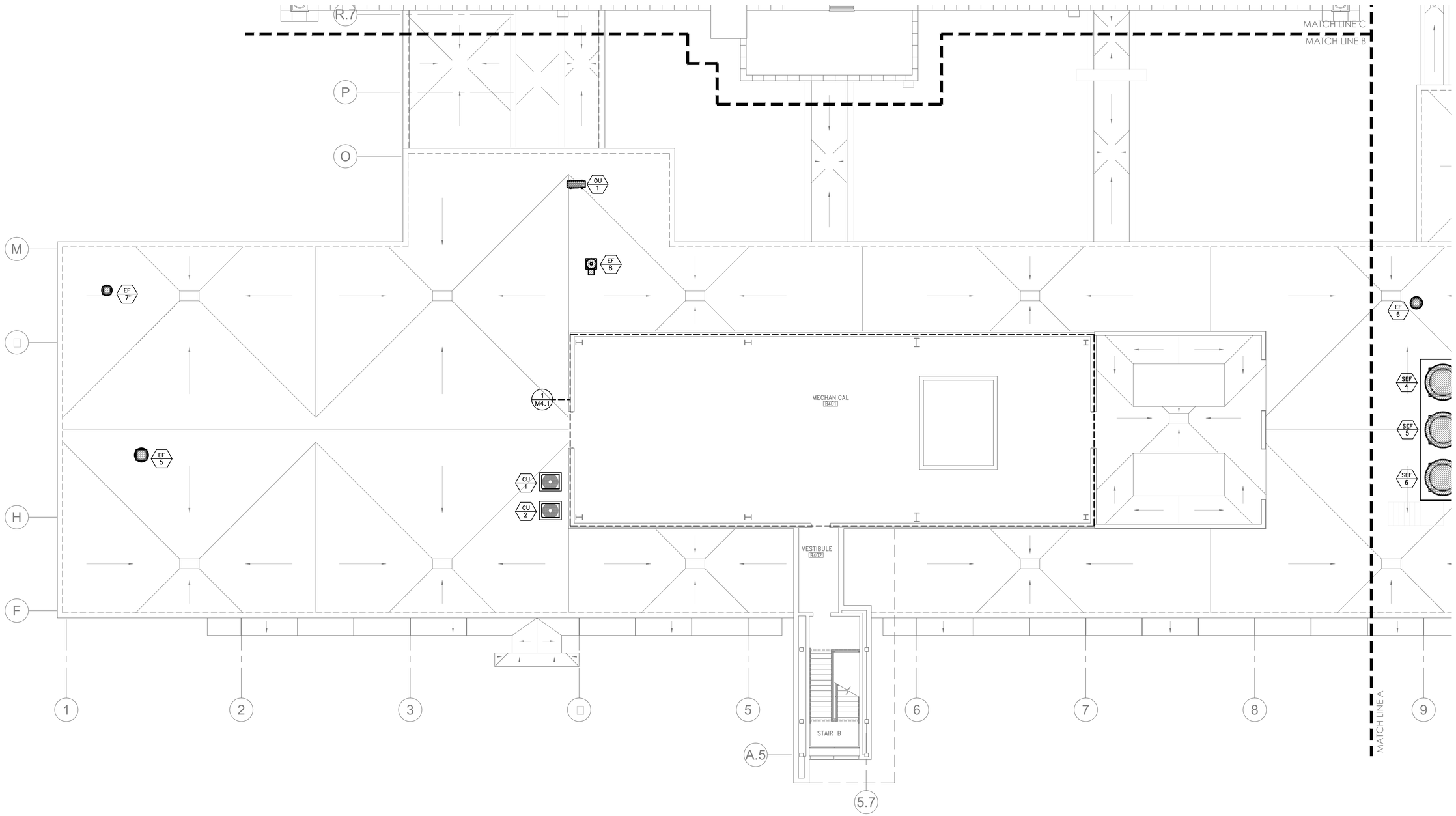
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M1.□a

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ROOF PLAN PART B – HVAC

SCALE: 1/8" = 1'-0"

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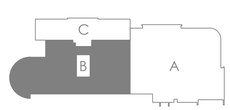
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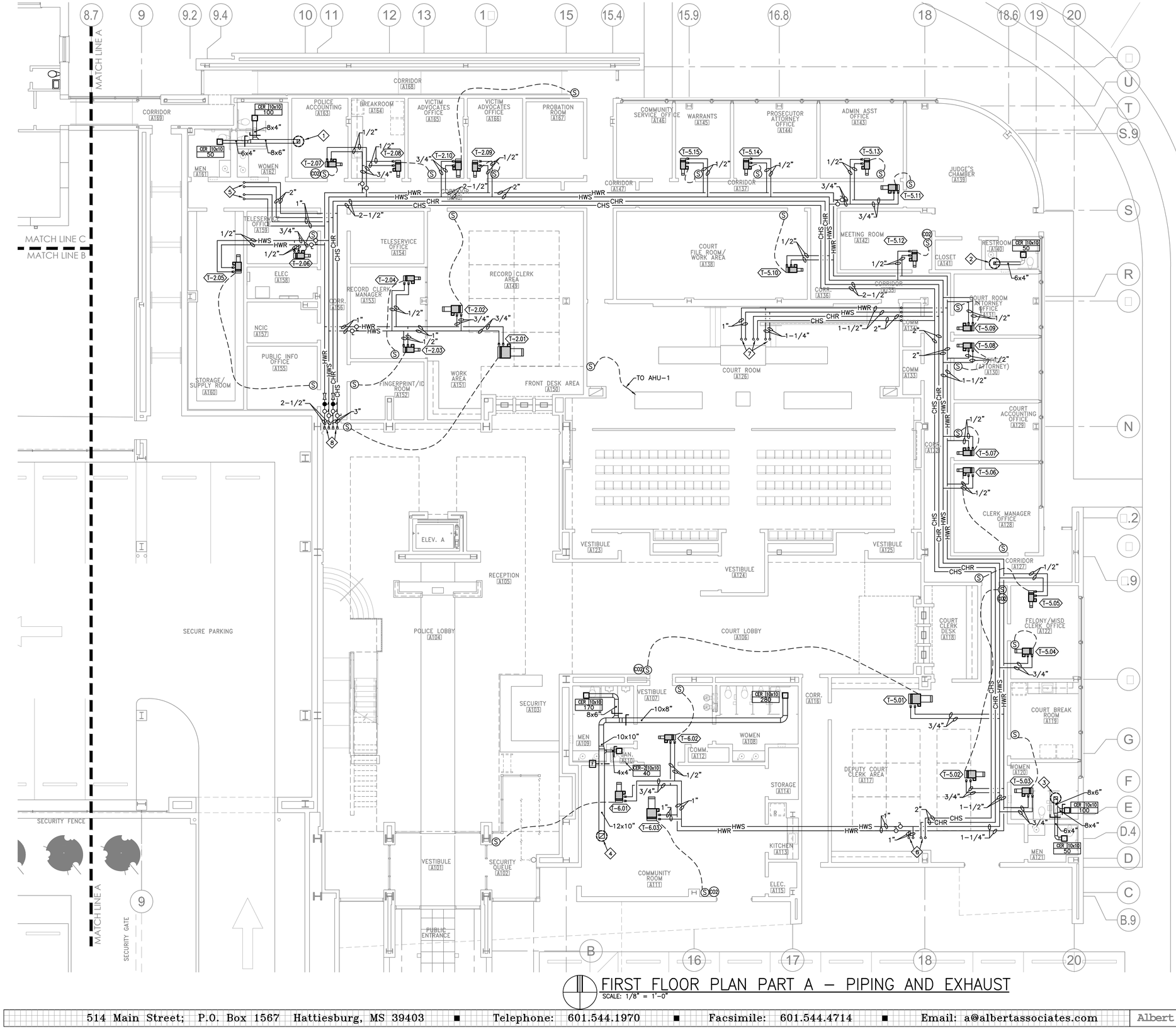
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RICHARD E. MOORE — REGISTERED — ENGINEER — 20102 — 11/3/2017 — STATE OF MISSISSIPPI

M1.□b



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FIRST FLOOR PLAN PART A – PIPING AND EXHAUST

SCALE: 1/8" = 1'-0"

PLAN NOTES

1. 8x6" EXHAUST DUCT UP TO EF-1 ON ROOF.
2. 6x4" EXHAUST DUCT UP TO EF-2 ON ROOF.
3. 8x6" EXHAUST DUCT UP TO EF-3 ON ROOF.
4. 12x10" EXHAUST DUCT UP TO EF-4 ON ROOF.
5. 1" HWS, 1" HWR, 2" CHS, 2" CHR UP TO AHU-2 ON ROOF.
6. 1" HWS, 1" HWR, 2" CHS, 2" CHR UP TO AHU-5 ON ROOF.
7. 2-1/2" HWS, 2-1/2" HWR, 3" CHS, 3" CHR DOWN FROM FLOOR ABOVE.

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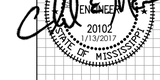
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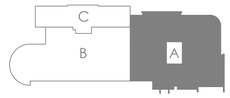
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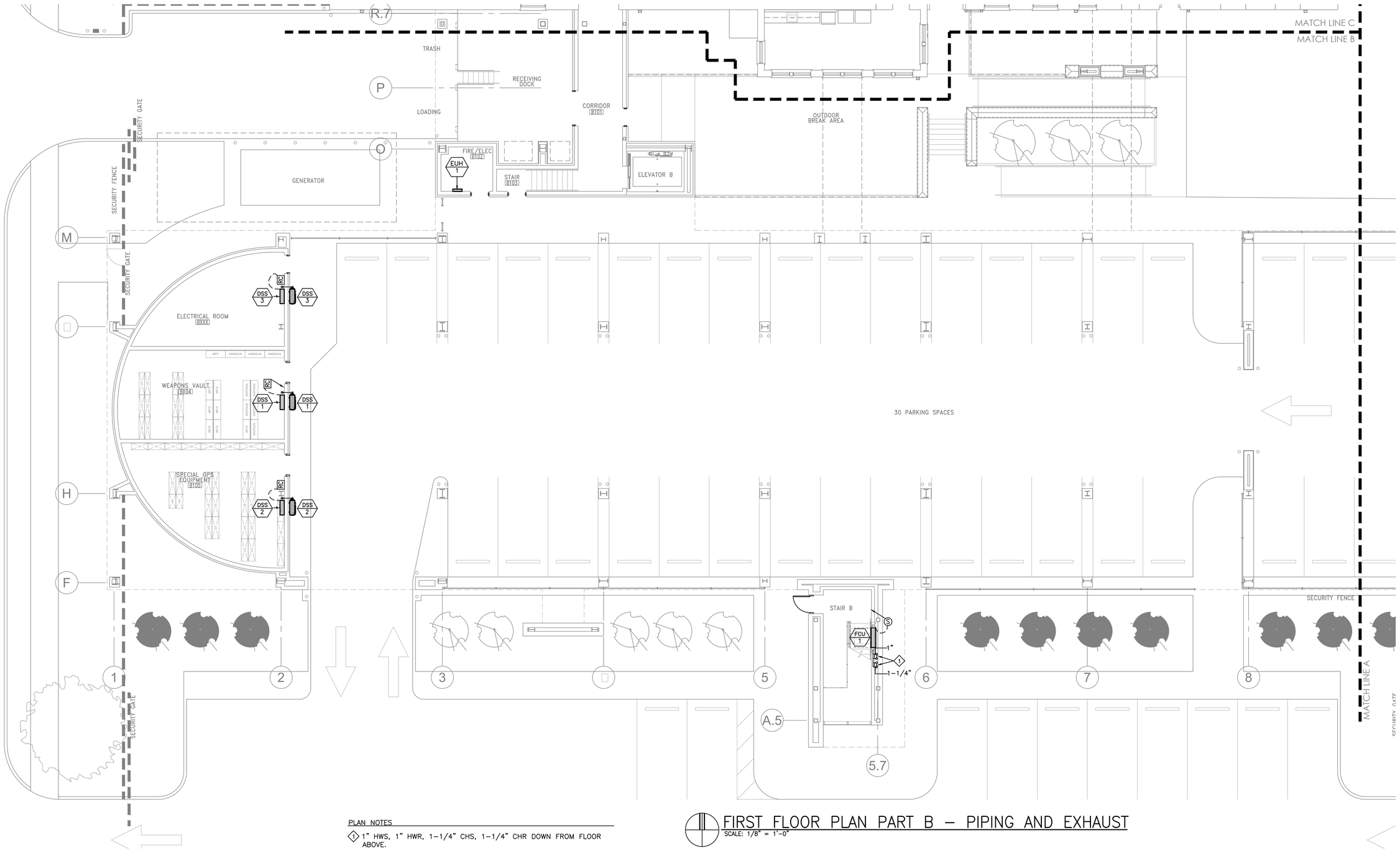
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PLAN NOTES

1. 1" HWS, 1" HWR, 1-1/4" CHS, 1-1/4" CHR DOWN FROM FLOOR ABOVE.

FIRST FLOOR PLAN PART B – PIPING AND EXHAUST

SCALE: 1/8" = 1'-0"

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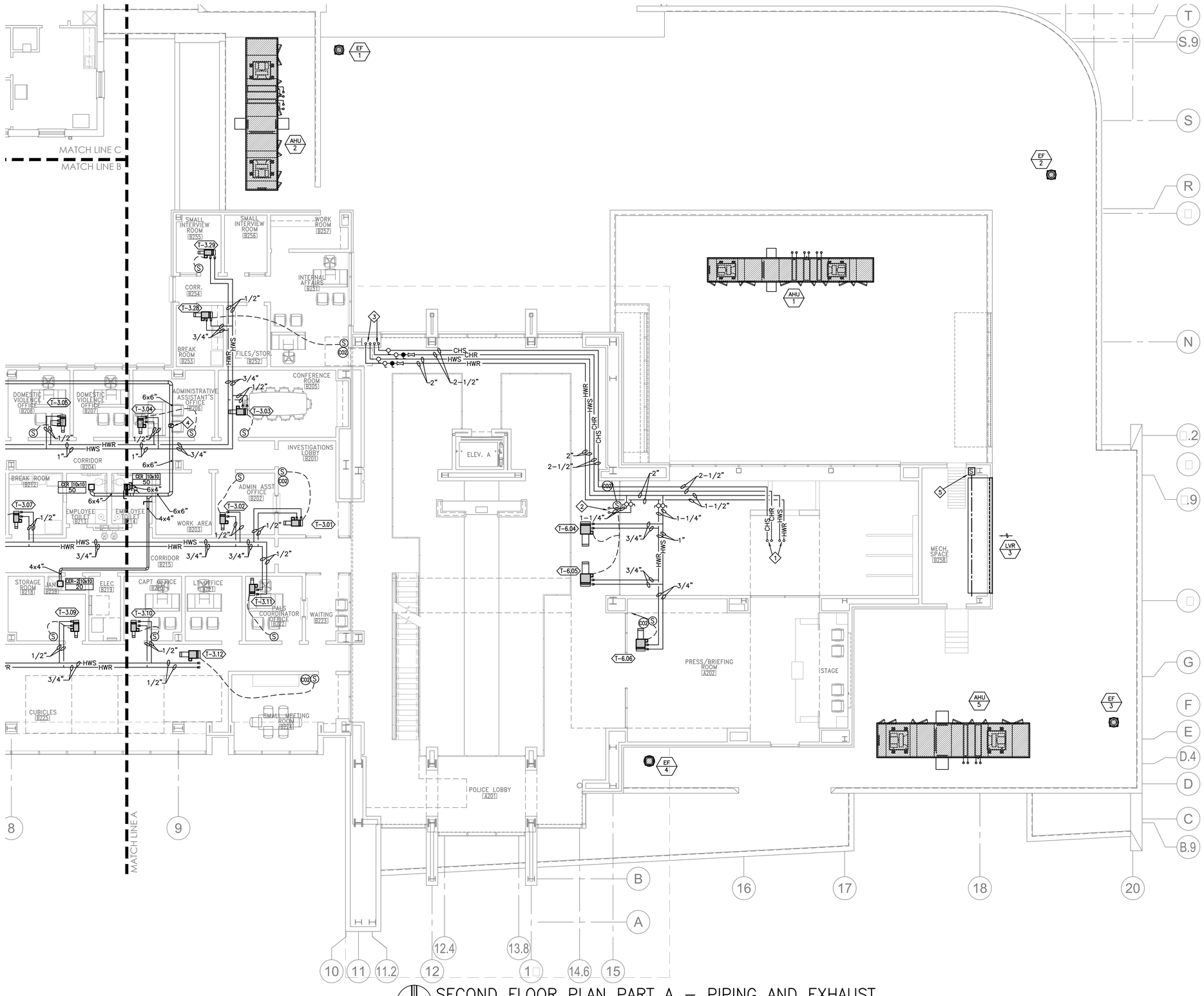
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M2.1b

C B A

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Fax: (601) 366-6418
ERG# 15-28.2



SECOND FLOOR PLAN PART A – PIPING AND EXHAUST

SCALE: 1/8" = 1'-0"

PLAN NOTES

1. 1-1/2" HWS, 1-1/2" HWR, 2-1/2" CHS, 2-1/2" CHR UP TO AHU-6 ON ROOF.
2. 1-1/4" HWS, 1-1/4" HWR UP TO FLOOR ABOVE.
3. 2-1/2" HWS, 2-1/2" HWR, 4" CHS, 4" CHR DOWN FROM FLOOR ABOVE AND CONTINUE 2-1/2" HWS, 2-1/2" HWR, 3" CHS, 3" CHR DOWN TO FLOOR BELOW.
4. 10x6" EXHAUST DUCT UP TO FLOOR ABOVE. PROVIDE FIRE DAMPER AT FLOOR SLAB.
5. PROVIDE (4) SMOKE DAMPERS IN PLENUM FOR SMOKE EVACUATION SYSTEM.

HATTIESBURG PUBLIC SAFETY COMPLEX

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HPSC Police and Court Building

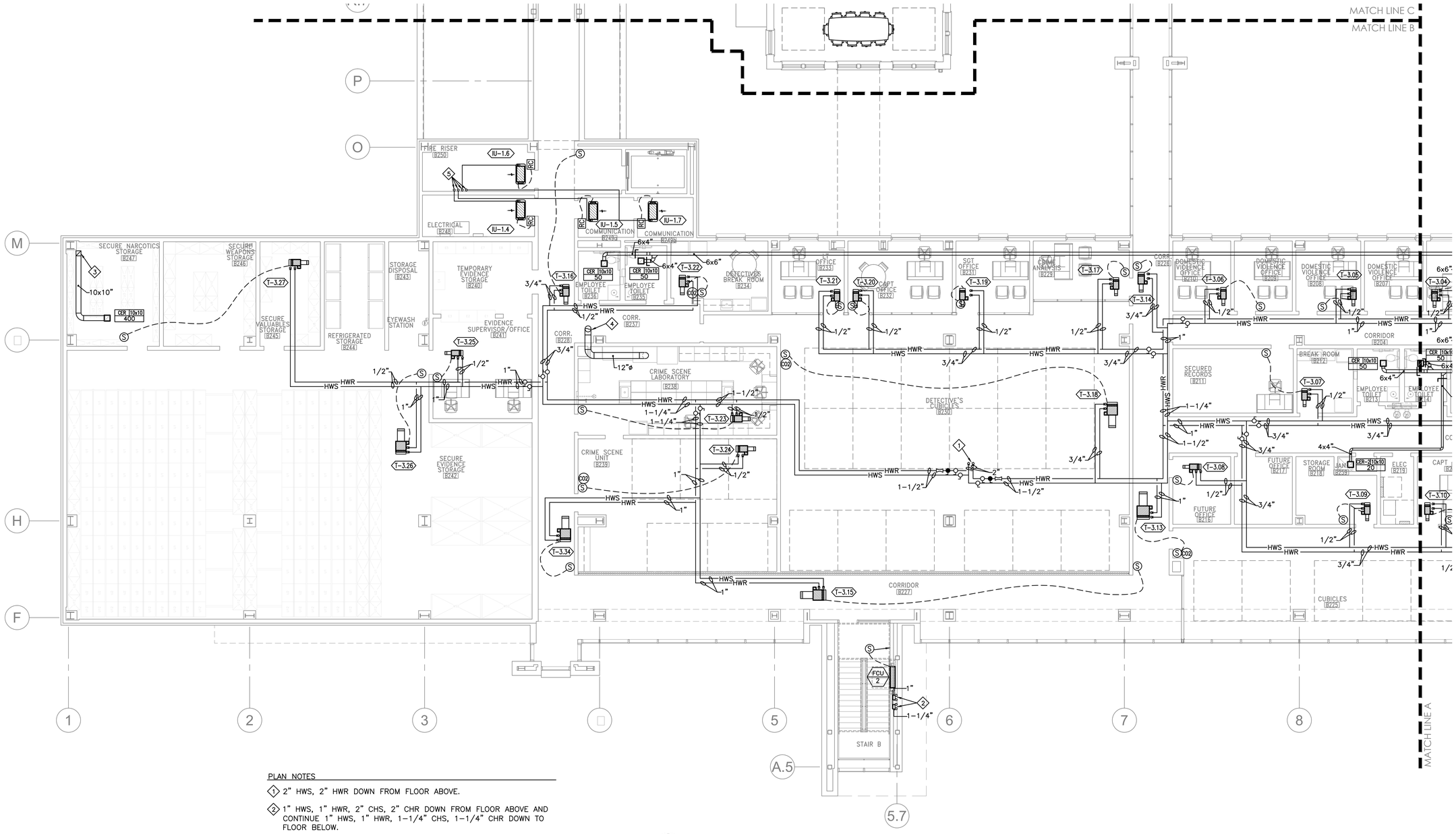
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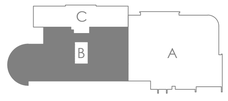


PLAN NOTES

1. 2" HWS, 2" HWR DOWN FROM FLOOR ABOVE.
2. 1" HWS, 1" HWR, 2" CHS, 2" CHR DOWN FROM FLOOR ABOVE AND CONTINUE 1" HWS, 1" HWR, 1–1/4" CHS, 1–1/4" CHR DOWN TO FLOOR BELOW.
3. 10x10" EXHAUST DUCT UP TO FLOOR ABOVE. PROVIDE FIRE DAMPER AT FLOOR SLAB.
4. 12"ø STAINLESS STEEL EXHAUST DUCT UP TO FLOOR ABOVE.
5. 1/4" RL, 1/2" RS REFRIGERANT LINES DOWN FROM FLOOR ABOVE.

SECOND FLOOR PLAN PART B – PIPING AND EXHAUST

SCALE: 1/8" = 1'-0"



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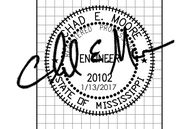
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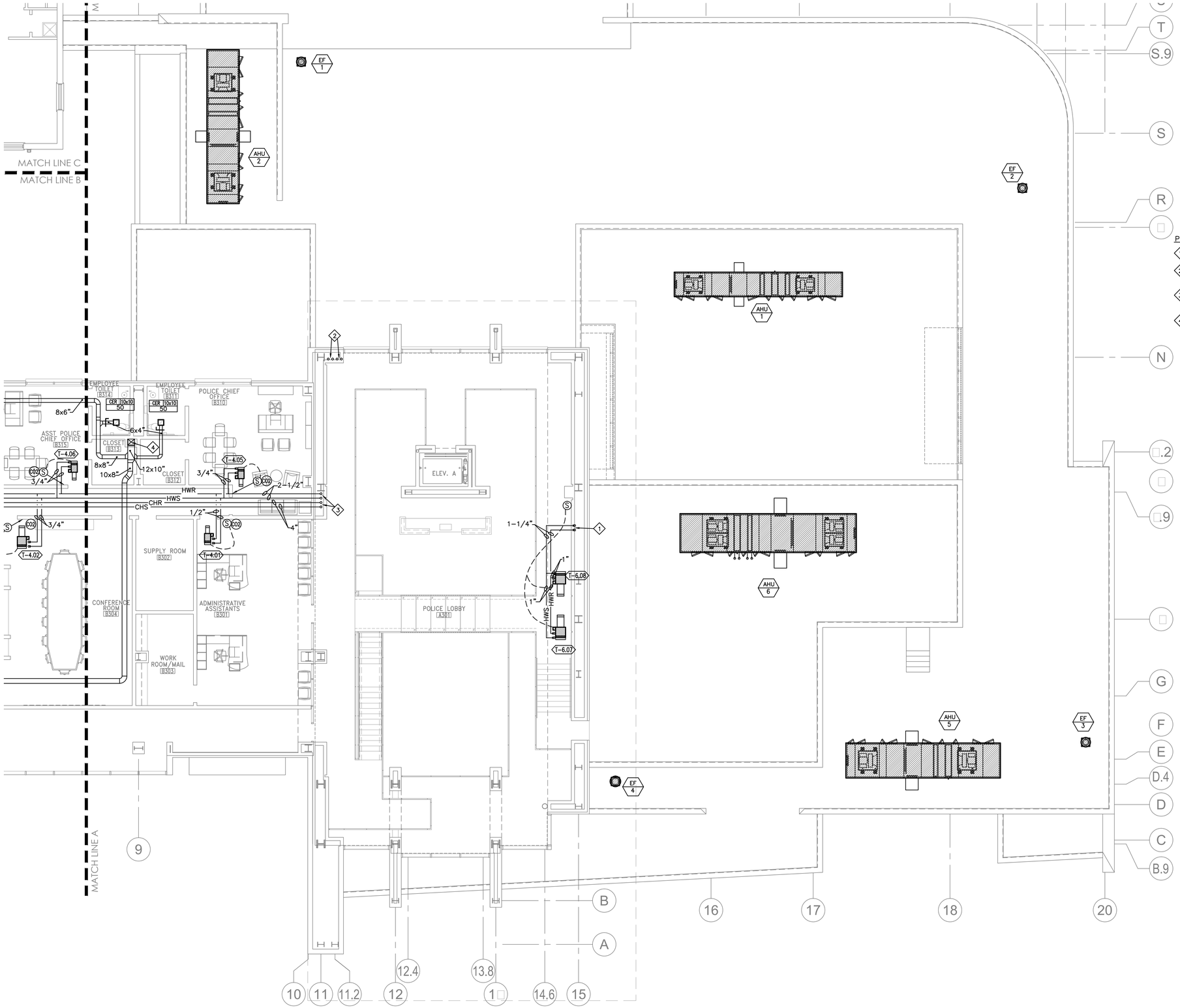
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M2.2b



PLAN NOTES

1. 1-1/4" HWS, 1-1/4" HWR UP FROM FLOOR BELOW.
2. 2-1/2" HWS, 2-1/2" HWR, 4" CHS, 4" CHR DOWN FROM POLICE LOBBY CEILING TO FLOOR BELOW.
3. 2-1/2" HWS, 2-1/2" HWR, 4" CHS, 4" CHR RISE FROM THIRD FLOOR CEILING TO POLICE LOBBY CEILING.
4. 10x6" EXHAUST DUCT UP FROM BELOW WITH FIRE DAMPER AT FLOOR SLAB. TRANSITION TO A 14x12" EXHAUST DUCT AND CONTINUE UP TO EF-6 ON ROOF.

THIRD FLOOR PLAN PART A - PIPING AND EXHAUST
SCALE: 1/8" = 1'-0"

HATTIESBURG PUBLIC SAFETY COMPLEX

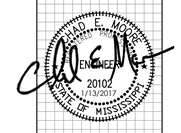
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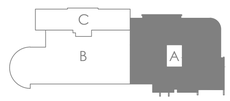
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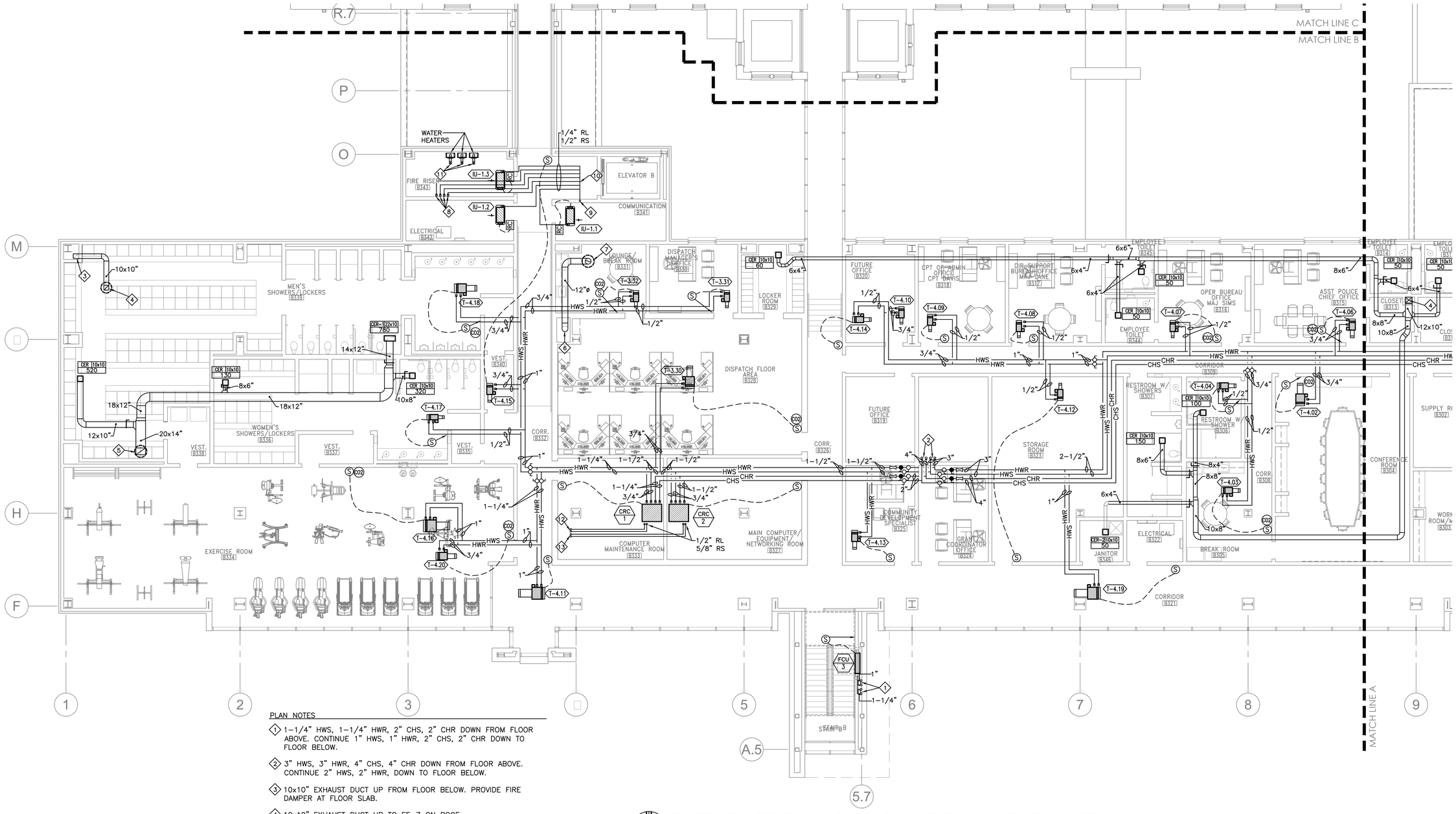


M2.3a



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Fax: (601) 366-6418

ERG# 15-28.2



PLAN NOTES

1. 1-1/4" HWS, 1-1/4" HWR, 2" CHS, 2" CHR DOWN FROM FLOOR ABOVE. CONTINUE 1" HWS, 1" HWR, 2" CHS, 2" CHR DOWN TO FLOOR BELOW.
2. 3" HWS, 3" HWR, 4" CHS, 4" CHR DOWN FROM FLOOR ABOVE. CONTINUE 2" HWS, 2" HWR, DOWN TO FLOOR BELOW.
3. 10x10" EXHAUST DUCT UP FROM FLOOR BELOW. PROVIDE FIRE DAMPER AT FLOOR SLAB.
4. 10x10" EXHAUST DUCT UP TO EF-7 ON ROOF.
5. 20x14" EXHAUST DUCT UP TO EF-5 ON ROOF.
6. 12"ø STAINLESS STEEL EXHAUST DUCT UP FROM FLOOR BELOW.
7. 12"ø STAINLESS STEEL EXHAUST DUCT UP TO EF-8 ON ROOF.
8. 1/4" RL, 1/2" RS REFRIGERANT LINES DOWN TO FLOOR BELOW.
9. 3/8" RL, 5/8" RS REFRIGERANT LINES DOWN FROM OU-1 ON ROOF.
10. MITSUBISHI BRANCH HEADER MODEL# CMY-Y68-G-E. CAP ALL UNUSED BRANCH TAPS.
11. 4"ø CONCENTRIC VENT UP THRU ROOF. SEE DETAIL.
12. 1/2" RL, 5/8" RS REFRIGERANT LINES DOWN FROM CU-1 ON ROOF.
13. 1/2" RL, 5/8" RS REFRIGERANT LINES DOWN FROM CU-2 ON ROOF.

THIRD FLOOR PLAN PART B - PIPING AND EXHAUST

SCALE: 1/8" = 1'-0"

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HPSC Police and Court Building

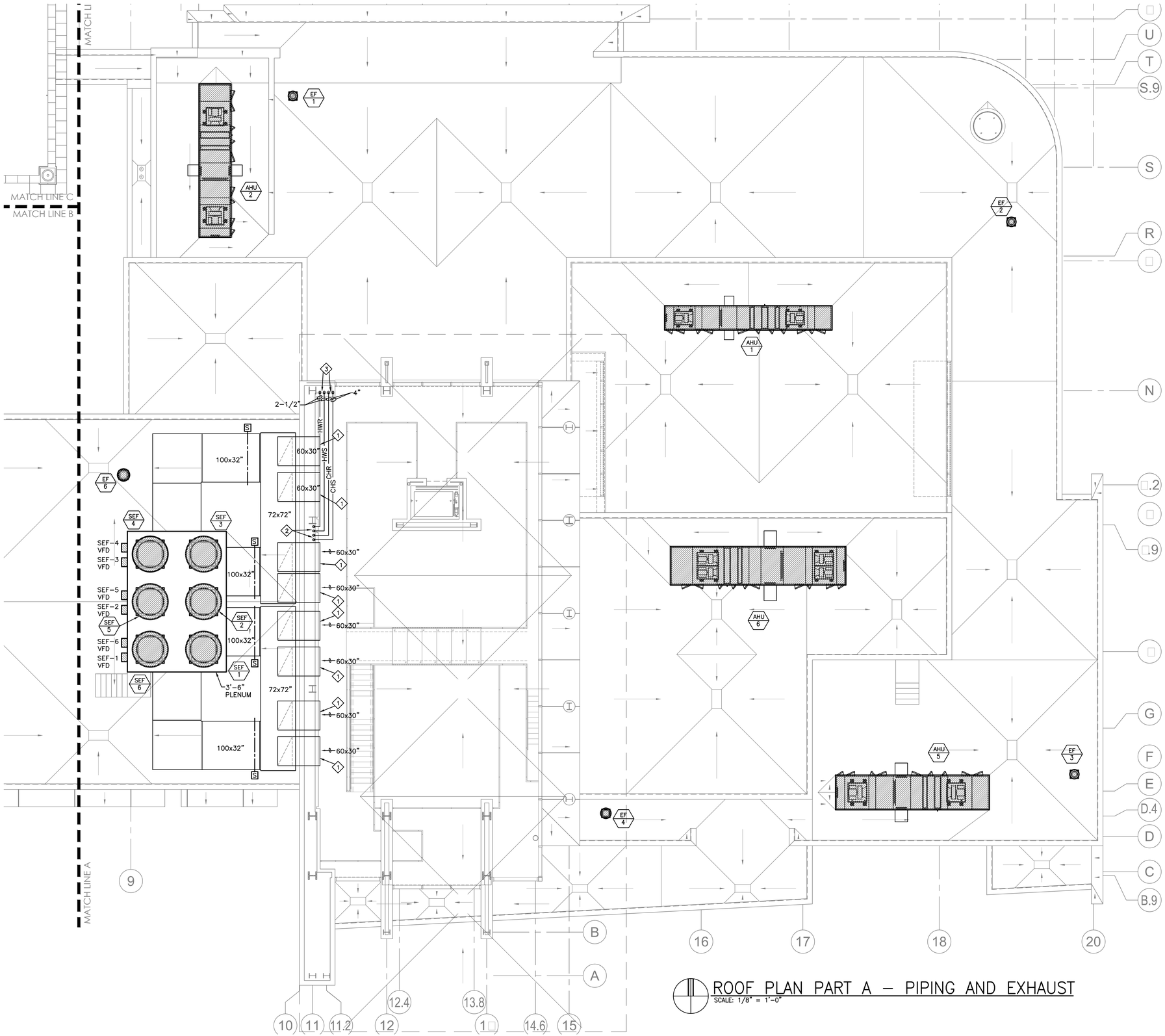
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RICHARD E. MCCLESKEY PROFESSIONAL ENGINEER 20102 1/13/2017 STATE OF MISSISSIPPI

M2.3b

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Fax: (601) 366-6418
ERG# 15-28.2



ROOF PLAN PART A – PIPING AND EXHAUST

SCALE: 1/8" = 1'-0"

PLAN NOTES

1. PROVIDE 1/2" x 1/2" HARDWARE CLOTH AT OPEN END OF DUCT.
2. 2-1/2" HWS, 2-1/2" HWR, 4" CHS, 4" CHR RISE FROM THIRD FLOOR CEILING TO POLICE LOBBY CEILING.
3. 2-1/2" HWS, 2-1/2" HWR, 4" CHS, 4" CHR DOWN FROM POLICE LOBBY CEILING TO FLOOR BELOW.

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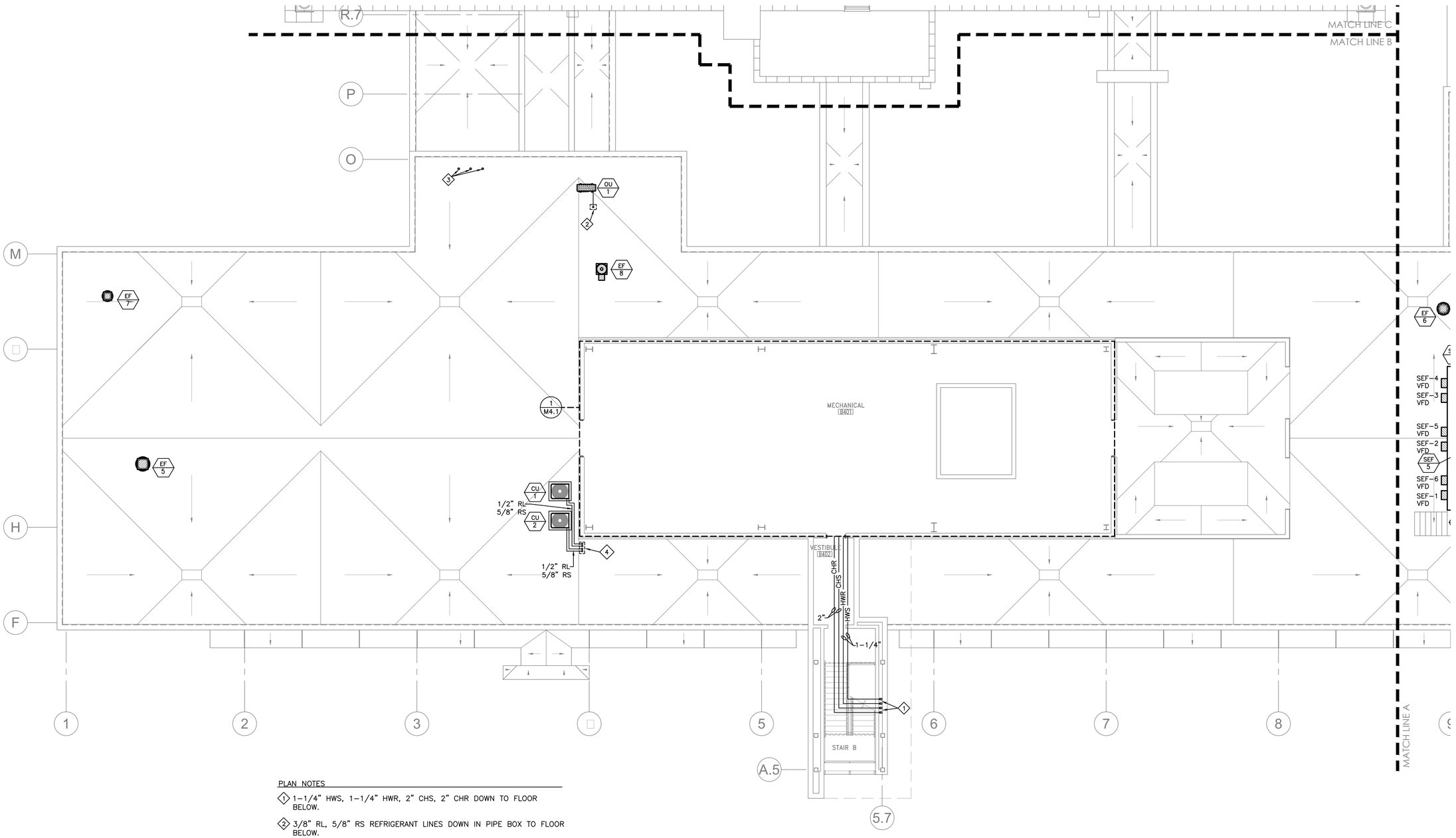
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CHAD E. MCCLESKEY ENGINEER 20102 1/13/2017 REGISTERED MISSISSIPPI

M2.□a

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PLAN NOTES

1. 1-1/4" HWS, 1-1/4" HWR, 2" CHS, 2" CHR DOWN TO FLOOR BELOW.
2. 3/8" RL, 5/8" RS REFRIGERANT LINES DOWN IN PIPE BOX TO FLOOR BELOW.
3. 4"ø CONCENTRIC VENT UP THRU ROOF FROM WATER HEATERS BELOW. SEE DETAIL.
4. REFRIGERANT PIPING DOWN THROUGH ROOF IN PIPE BOX TO COMPUTER ROOM UNITS.

ROOF PLAN PART B – PIPING AND EXHAUST

SCALE: 1/8" = 1'-0"

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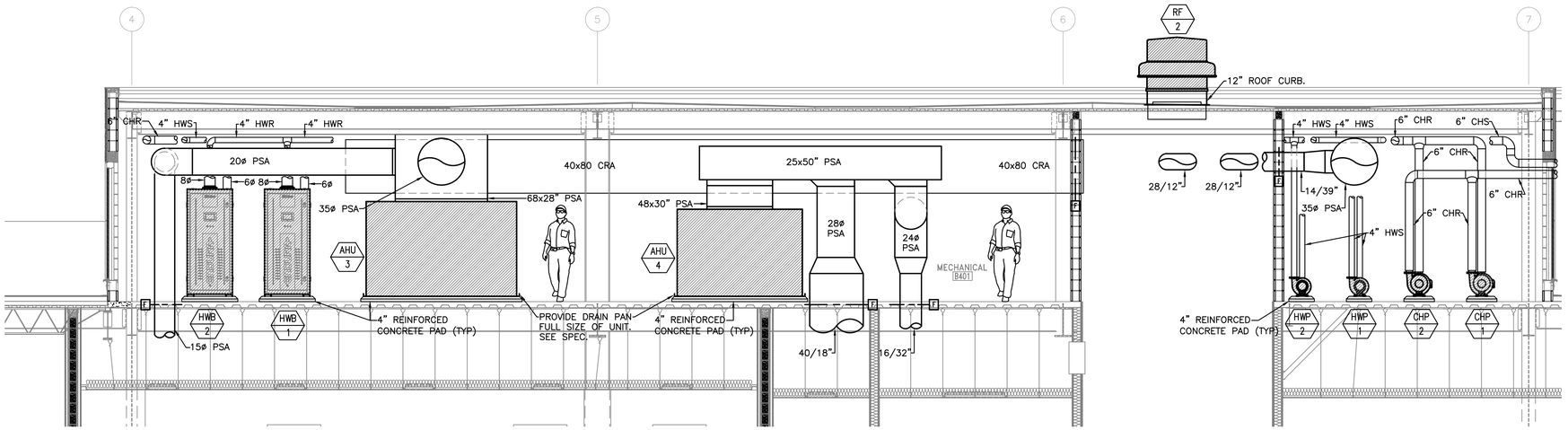
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DONALD E. MCCLESKEY — REGISTERED PROFESSIONAL ENGINEER — 20102 — 1/13/2017 — STATE OF MISSISSIPPI

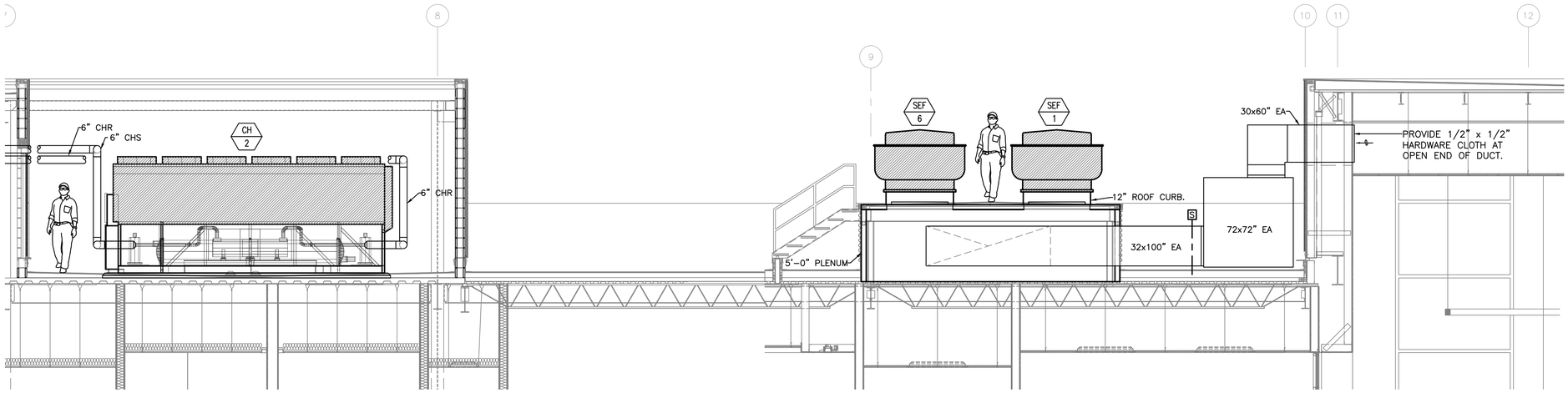
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ERG# 15-28.2



1 M3.1 ENLARGED MECHANICAL PENTHOUSE B401 – ELEVATION
SCALE: 1/4" = 1'-0"



2 M3.1 ENLARGED MECHANICAL AIR COOLED CHILLER – ELEVATION
SCALE: 1/4" = 1'-0"

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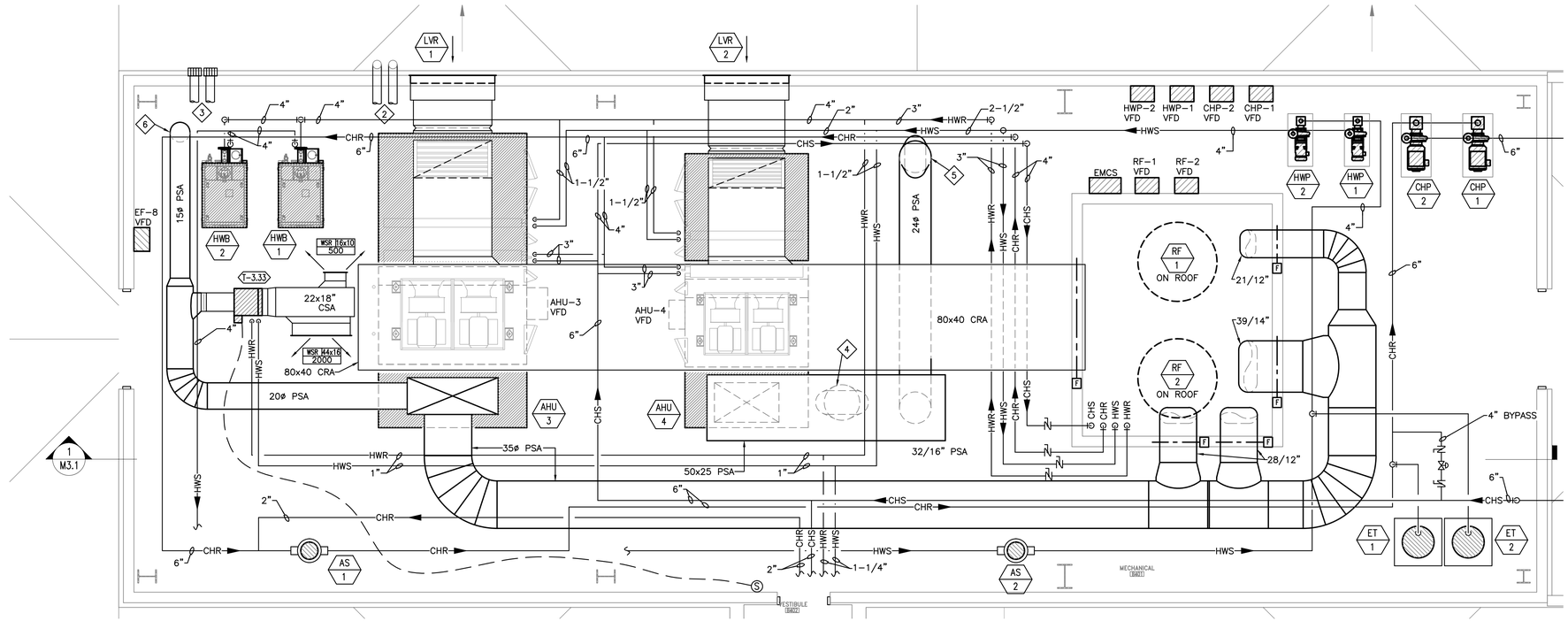
EDWARD E. MCCLESKEY JR. REGISTERED PROFESSIONAL ENGINEER 20102 1/13/2017 STATE OF MISSISSIPPI

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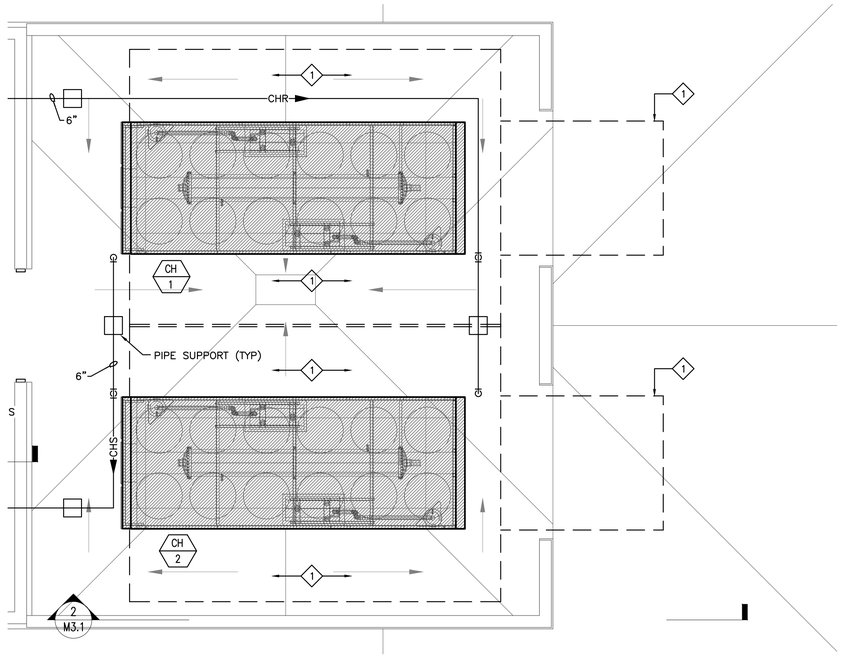
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1 M3.1

1 M4.1 ENLARGED PLAN OF MECHANICAL ROOM B401

SCALE: 1/4" = 1'-0"



1 M4.1 ENLARGED PLAN OF CHILLER YARD

SCALE: 1/4" = 1'-0"

PLAN NOTES:

1. MANUFACTURER RECOMMENDED SERVICE CLEARANCE.
2. PROVIDE 8" COMBUSTION AIR INTAKE FROM EACH BOILER. SEE DETAIL FOR WALL MOUNTED TERMINATION.
3. PROVIDE 6" EXHAUST VENT FROM EACH BOILER. SEE DETAIL FOR WALL MOUNTED TERMINATION.
4. 28"ø MEDIUM PRESSURE SUPPLY AIR DUCT DOWN TRANSITION TO A 40/18" AND DROP TO FLOOR BELOW. PROVIDE FIRE DAMPER AT FLOOR SLAB.
5. 24"ø MEDIUM PRESSURE SUPPLY AIR DUCT DOWN TRANSITION TO A 32/16" AND DROP TO FLOOR BELOW. PROVIDE FIRE DAMPER AT FLOOR SLAB.
6. 15"ø MEDIUM PRESSURE SUPPLY AIR DUCT DOWN TO FLOOR BELOW. PROVIDE FIRE DAMPER AT FLOOR SLAB.

CITY OF HATTIESBURG MISSISSIPPI 1884

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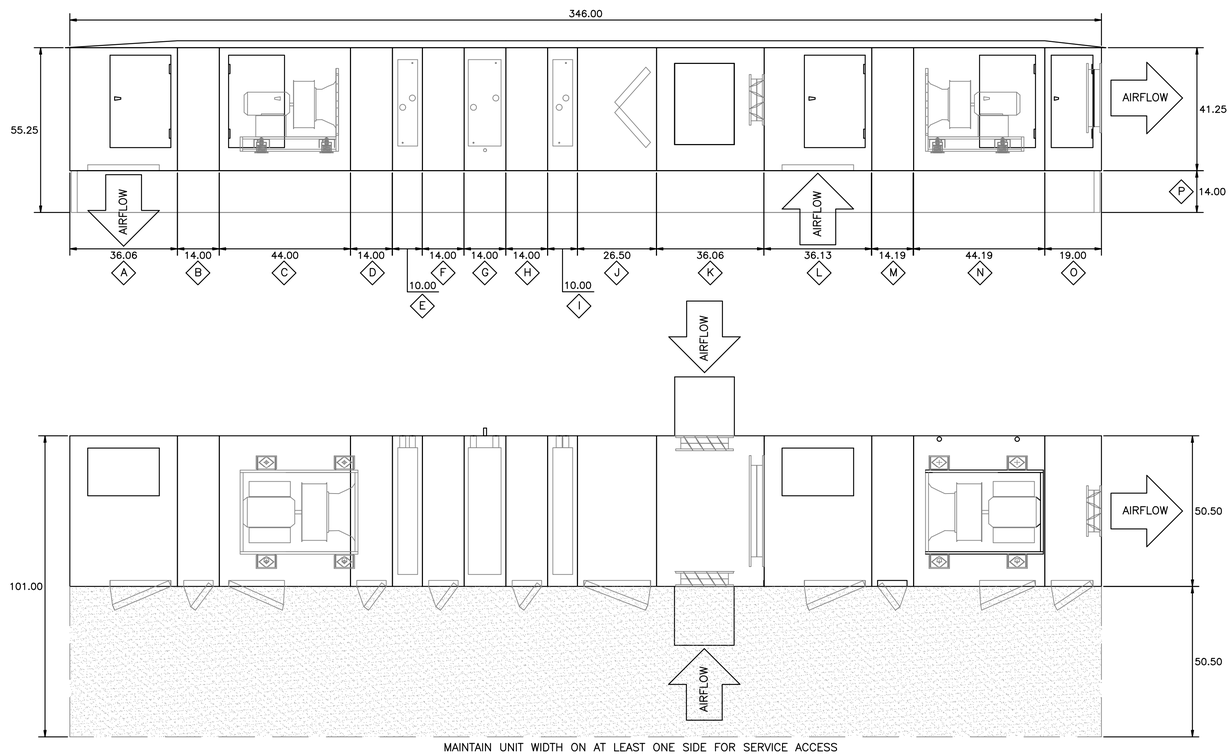
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M□.1

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com | Albert & McCleskey Associates Architects

ENLARGED MECHANICAL PLANS

- A CONTROLS SECTION (SUPPLY PLENUM)
- B ACCESS SECTION
- C SUPPLY FAN (DIRECT DRIVE PLENUM)
- D ACCESS SECTION
- E HOT WATER RE-HEAT COIL
- F ACCESS SECTION
- G CHILLED WATER COIL
- H ACCESS SECTION
- I HOT WATER PRE-HEAT COIL
- J FILTER SECTION
- K MIXING BOX (OA INTAKE)
- L CONTROLS SECTION (RET/RELIEF AIR)
- M ACCESS SECTION
- N RELIEF FAN (DIRECT DRIVE PLENUM)
- O EXHAUST DAMPER
- P ROOF CURB



MAINTAIN UNIT WIDTH ON AT LEAST ONE SIDE FOR SERVICE ACCESS

ACOUSTICAL DATA – SUPPLY FAN								
OCTAVE BAND(Hz)	63	125	250	500	1K	2K	4K	8K
CASING(dB)	74	74	75	73	72	65	62	56
RETURN(dB)	74	69	71	71	64	63	60	46
SUPPLY(dB)	74	80	75	79	73	73	73	69
OUTDOOR(dB)	73	70	74	70	63	62	59	44
EXHAUST	86	82	84	86	77	76	76	69

ACOUSTICAL DATA – EXHAUST FAN								
OCTAVE BAND(Hz)	63	125	250	500	1K	2K	4K	8K
CASING(dB)	72	72	75	70	69	62	59	50
RETURN(dB)	74	69	75	75	66	66	65	56
SUPPLY(dB)	70	66	71	67	61	62	58	42
OUTDOOR(dB)	73	70	77	73	65	65	63	54
EXHAUST	80	78	81	80	72	72	71	63

ACOUSTICAL DATA – OVERALL								
OCTAVE BAND(Hz)	63	125	250	500	1K	2K	4K	8K
CASING(dB)	76	76	78	75	74	67	64	57
RETURN(dB)	77	72	76	76	68	68	66	56
SUPPLY(dB)	75	80	76	79	73	73	73	69
OUTDOOR(dB)	76	73	79	75	67	67	65	54
EXHAUST	86	83	86	87	78	78	77	70

1 / M4.2 DETAIL OF MODULAR AHU-1

SCALE: 1/2" = 1'-0"

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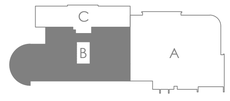
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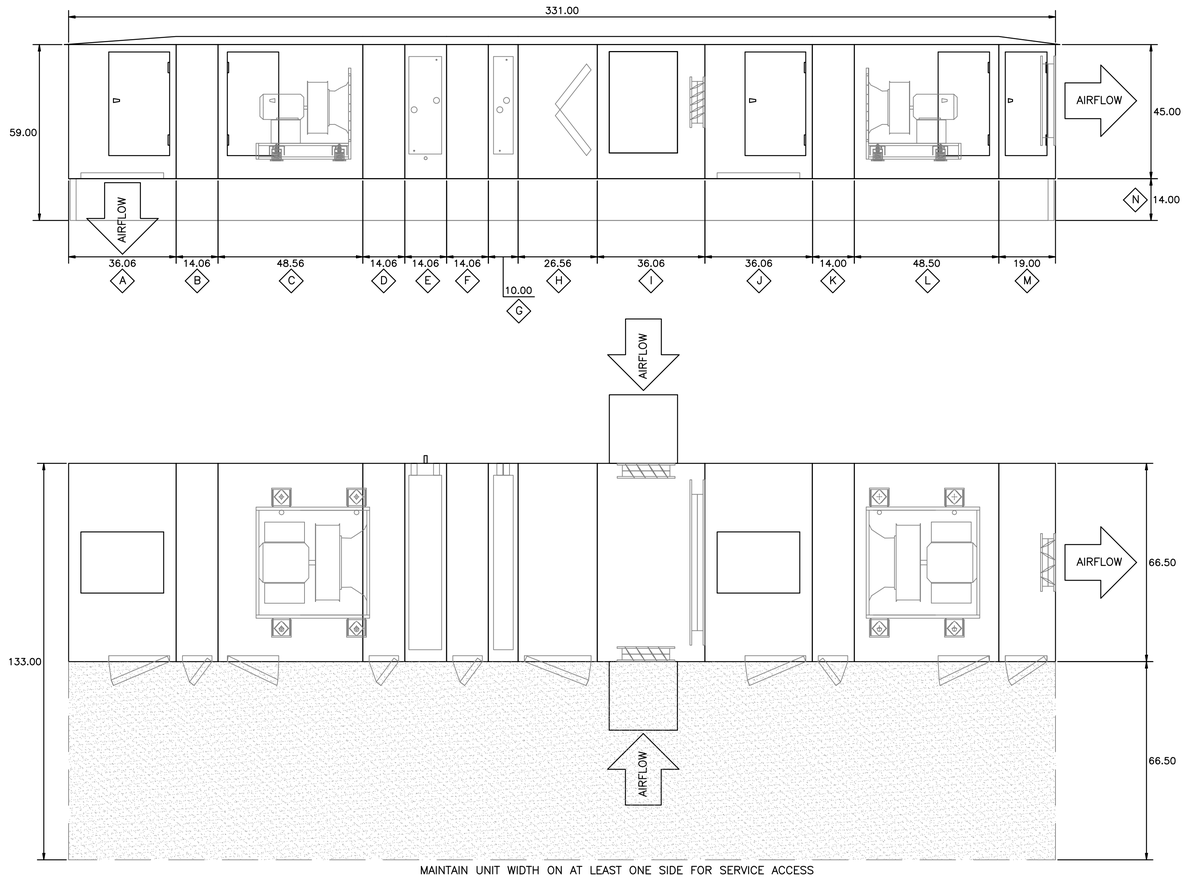
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- A CONTROLS SECTION (SUPPLY PLENUM)
- B ACCESS SECTION
- C SUPPLY FAN (DIRECT DRIVE PLENUM)
- D ACCESS SECTION
- E CHILLED WATER COIL
- F ACCESS SECTION
- G HOT WATER PRE-HEAT COIL
- H FILTER SECTION
- I MIXING BOX (OA INTAKE)
- J CONTROLS SECTION (RET/RELIEF AIR)
- K ACCESS SECTION
- L RELIEF FAN (DIRECT DRIVE PLENUM)
- M EXHAUST DAMPER
- N ROOF CURB



MAINTAIN UNIT WIDTH ON AT LEAST ONE SIDE FOR SERVICE ACCESS

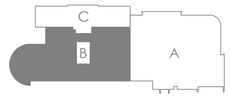
ACOUSTICAL DATA – SUPPLY FAN								
OCTAVE BAND(Hz)	63	125	250	500	1K	2K	4K	8K
CASING(dB)	76	75	72	72	72	56	49	46
RETURN(dB)	68	64	62	68	63	65	60	49
SUPPLY(dB)	77	76	71	74	74	72	69	65
OUTDOOR(dB)	68	65	65	67	63	64	59	48
EXHAUST	80	77	74	82	76	76	73	68

ACOUSTICAL DATA – EXHAUST FAN								
OCTAVE BAND(Hz)	63	125	250	500	1K	2K	4K	8K
CASING(dB)	70	68	75	65	66	51	49	45
RETURN(dB)	67	63	75	67	62	62	61	54
SUPPLY(dB)	65	61	71	61	57	59	56	44
OUTDOOR(dB)	67	64	77	66	61	62	60	52
EXHAUST	73	72	79	73	68	68	67	61

ACOUSTICAL DATA – OVERALL								
OCTAVE BAND(Hz)	63	125	250	500	1K	2K	4K	8K
CASING(dB)	77	76	77	73	73	57	52	49
RETURN(dB)	71	67	75	71	66	67	64	55
SUPPLY(dB)	77	76	74	74	74	72	69	65
OUTDOOR(dB)	70	67	78	69	65	66	62	54
EXHAUST	80	79	80	82	76	76	74	68

1 / M4.3 DETAIL OF MODULAR AHU-2

SCALE: 1/2" = 1'-0"



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M□.3

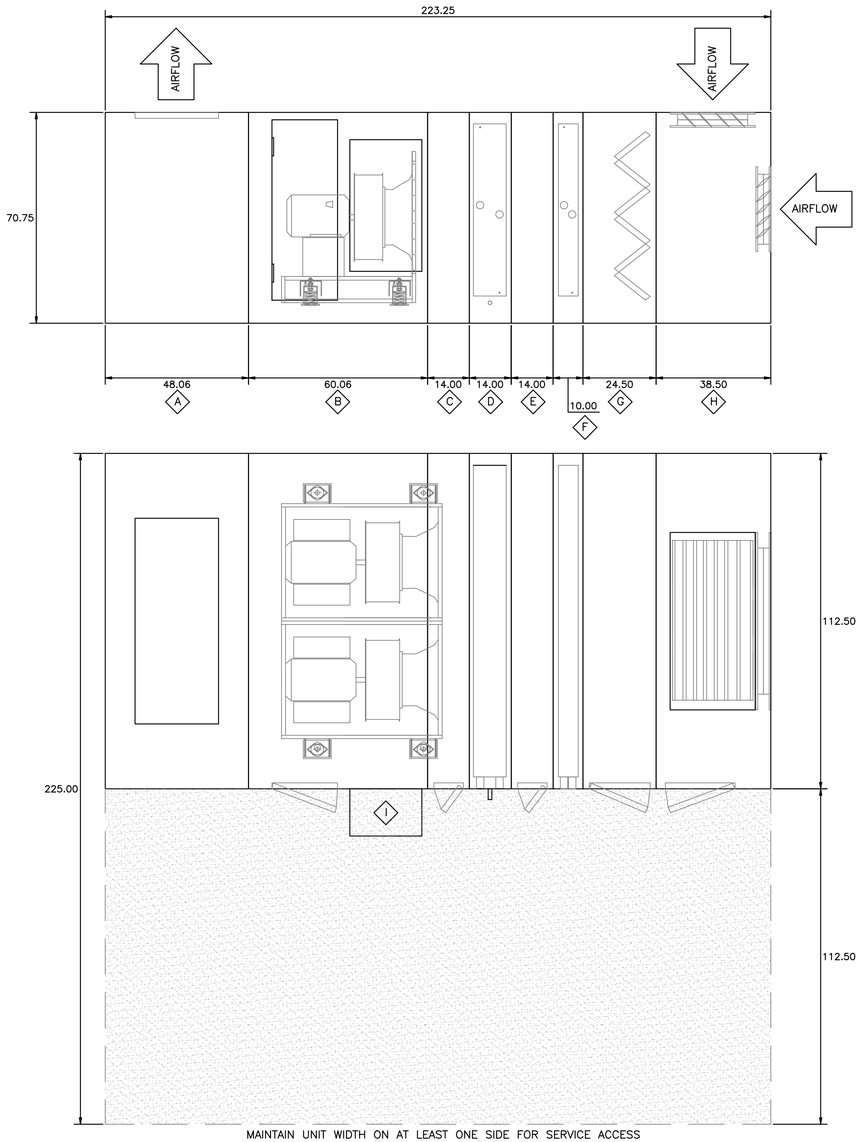
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350 Edgewood Terrace Drive
Jackson, MS 39206
Phone: (601) 362-3552
Fax: (601) 366-6418

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ENLARGED MECHANICAL PLANS

A SUPPLY PLENUM
B SUPPLY FAN (DIRECT DRIVE PLENUM)
C ACCESS SECTION
D CHILLED WATER COIL
E ACCESS SECTION
F HOT WATER PRE–HEAT COIL
G FILTER SECTION
H MIXING BOX (OA INTAKE)
I FACTORY MOUNTED VFD



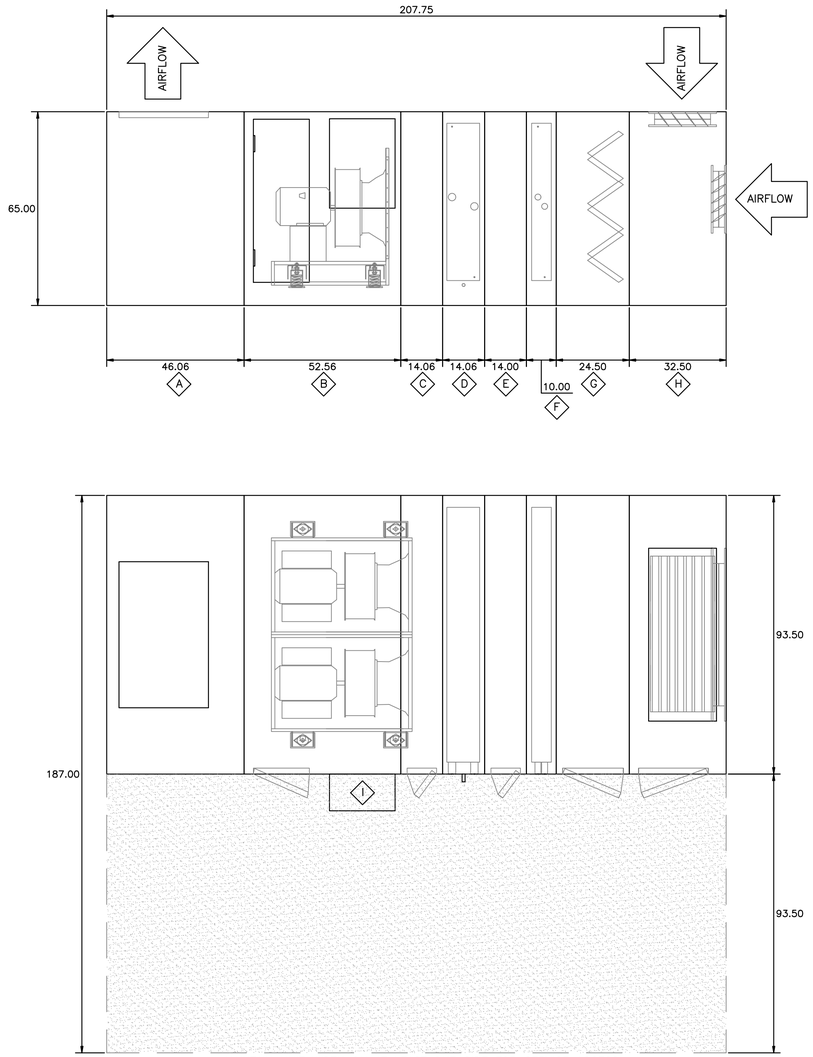
MAINTAIN UNIT WIDTH ON AT LEAST ONE SIDE FOR SERVICE ACCESS

ACOUSTICAL DATA – SUPPLY FAN								
OCTAVE BAND(Hz)	63	125	250	500	1K	2K	4K	8K
CASING(dB)	77	75	82	78	77	66	63	59
RETURN(dB)	68	69	85	70	70	70	68	57
SUPPLY BOT(dB)	81	79	86	84	81	77	76	72
SUPPLY FRNT(dB)	75	79	84	83	81	77	77	73
OUTDOOR(dB)	66	63	85	68	68	67	64	52

ACOUSTICAL DATA – OVERALL								
OCTAVE BAND(Hz)	63	125	250	500	1K	2K	4K	8K
CASING(dB)	77	75	82	78	77	66	63	59
RETURN(dB)	68	69	85	70	70	70	68	57
SUPPLY BOT(dB)	81	79	86	84	81	77	76	72
SUPPLY FRNT(dB)	75	79	84	83	81	77	77	73
OUTDOOR(dB)	66	63	85	68	68	67	64	52

1 / M4.4 DETAIL OF MODULAR AHU–3
SCALE: 1/2" = 1'–0"

A SUPPLY PLENUM
B SUPPLY FAN (DIRECT DRIVE PLENUM)
C ACCESS SECTION
D CHILLED WATER COIL
E ACCESS SECTION
F HOT WATER PRE–HEAT COIL
G FILTER SECTION
H MIXING BOX (OA INTAKE)
I FACTORY MOUNTED VFD

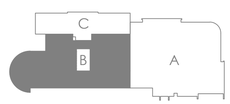


MAINTAIN UNIT WIDTH ON AT LEAST ONE SIDE FOR SERVICE ACCESS

ACOUSTICAL DATA – SUPPLY FAN								
OCTAVE BAND(Hz)	63	125	250	500	1K	2K	4K	8K
CASING(dB)	81	78	81	77	77	67	63	62
RETURN(dB)	70	73	81	71	67	68	65	56
SUPPLY BOT(dB)	81	79	86	83	81	77	77	73
SUPPLY FRNT(dB)	75	79	84	82	81	78	78	74
OUTDOOR(dB)	69	68	81	69	65	65	61	51

ACOUSTICAL DATA – OVERALL								
OCTAVE BAND(Hz)	63	125	250	500	1K	2K	4K	8K
CASING(dB)	81	78	81	77	77	67	63	62
RETURN(dB)	70	73	81	71	67	68	65	56
SUPPLY BOT(dB)	81	79	86	83	81	77	77	73
SUPPLY FRNT(dB)	75	79	84	82	81	78	78	74
OUTDOOR(dB)	69	68	81	69	65	65	61	51

2 / M4.4 DETAIL OF MODULAR AHU–4
SCALE: 1/2" = 1'–0"



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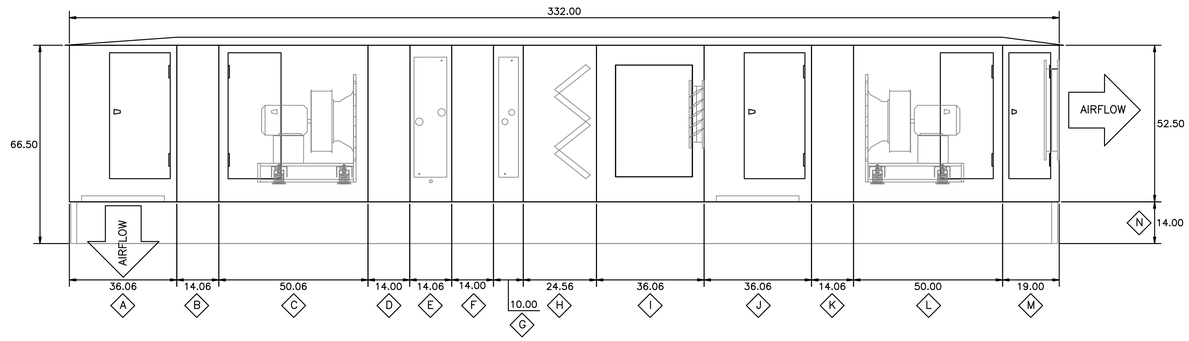
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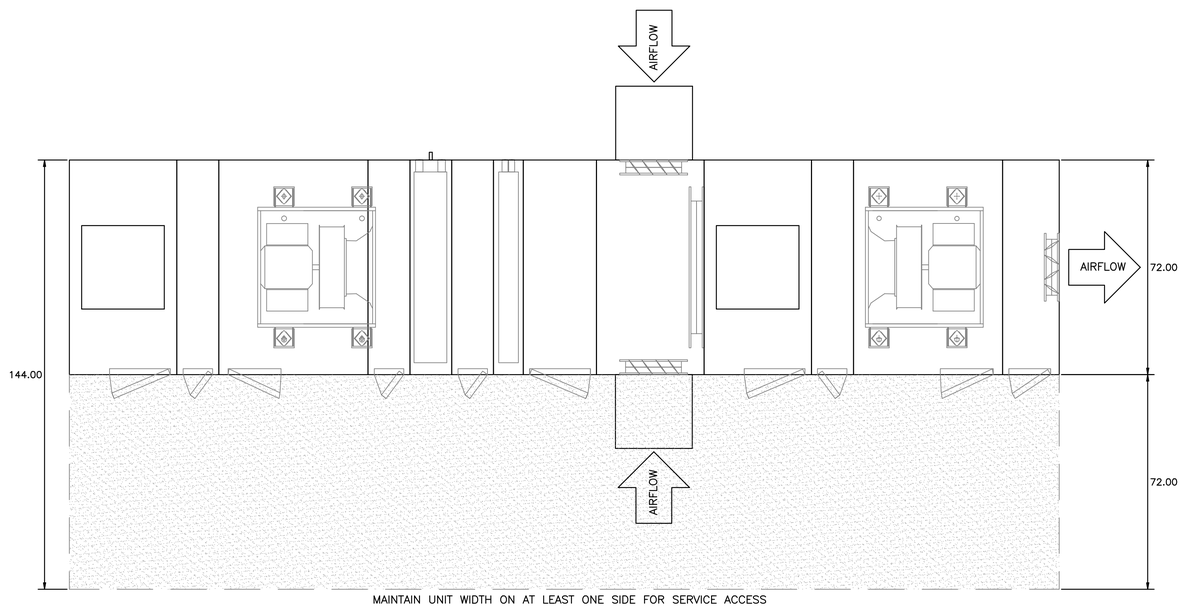
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M□.□

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- A CONTROLS SECTION (SUPPLY PLENUM)
- B ACCESS SECTION
- C SUPPLY FAN (DIRECT DRIVE PLENUM)
- D ACCESS SECTION
- E CHILLED WATER COIL
- F ACCESS SECTION
- G HOT WATER PRE–HEAT COIL
- H FILTER SECTION
- I MIXING BOX (OA INTAKE)
- J CONTROLS SECTION (RET/RELIEF AIR)
- K ACCESS SECTION
- L RELIEF FAN (DIRECT DRIVE PLENUM)
- M EXHAUST DAMPER
- N ROOF CURB





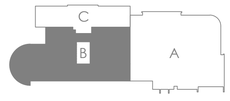
MAINTAIN UNIT WIDTH ON AT LEAST ONE SIDE FOR SERVICE ACCESS

ACOUSTICAL DATA – SUPPLY FAN								
OCTAVE BAND(Hz)	63	125	250	500	1K	2K	4K	8K
CASING(dB)	77	74	79	74	74	58	55	52
RETURN(dB)	71	67	76	70	65	65	62	51
SUPPLY(dB)	78	77	78	75	76	73	71	67
OUTDOOR(dB)	71	68	78	70	64	65	61	50
EXHAUST	82	80	87	84	77	76	75	70

ACOUSTICAL DATA – EXHAUST FAN								
OCTAVE BAND(Hz)	63	125	250	500	1K	2K	4K	8K
CASING(dB)	73	71	78	69	69	54	51	46
RETURN(dB)	70	66	78	71	65	65	64	57
SUPPLY(dB)	68	64	74	65	60	62	59	47
OUTDOOR(dB)	70	67	80	70	64	65	63	55
EXHAUST	76	75	83	76	71	71	70	64

ACOUSTICAL DATA – OVERALL								
OCTAVE BAND(Hz)	63	125	250	500	1K	2K	4K	8K
CASING(dB)	78	76	82	75	75	59	56	53
RETURN(dB)	74	70	80	74	68	68	66	58
SUPPLY(dB)	78	77	79	75	76	73	71	67
OUTDOOR(dB)	73	70	82	73	67	68	65	56
EXHAUST	83	82	89	84	78	78	77	71

1 / M4.5 DETAIL OF MODULAR AHU–5
SCALE: 1/2" = 1'-0"



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HPSC Police and Court Building

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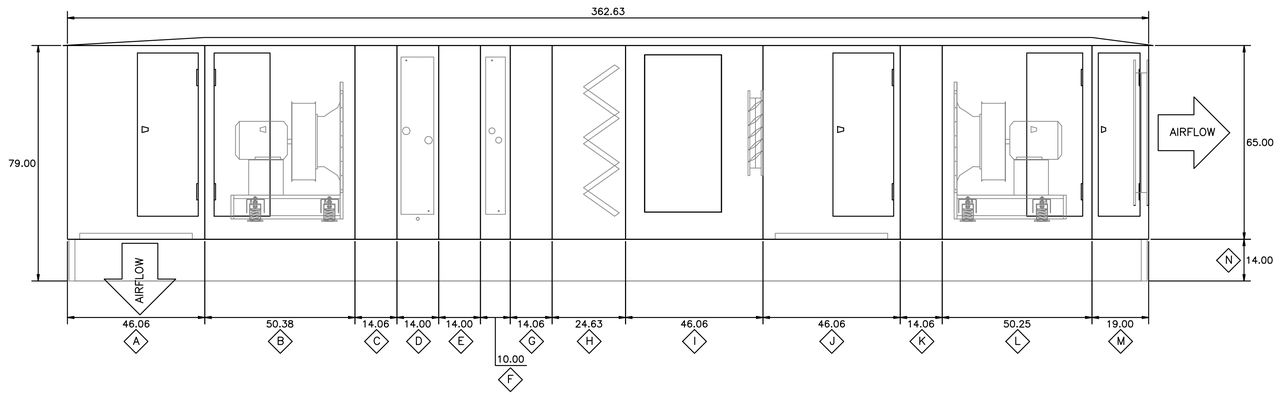
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Albert & Associates: 12575

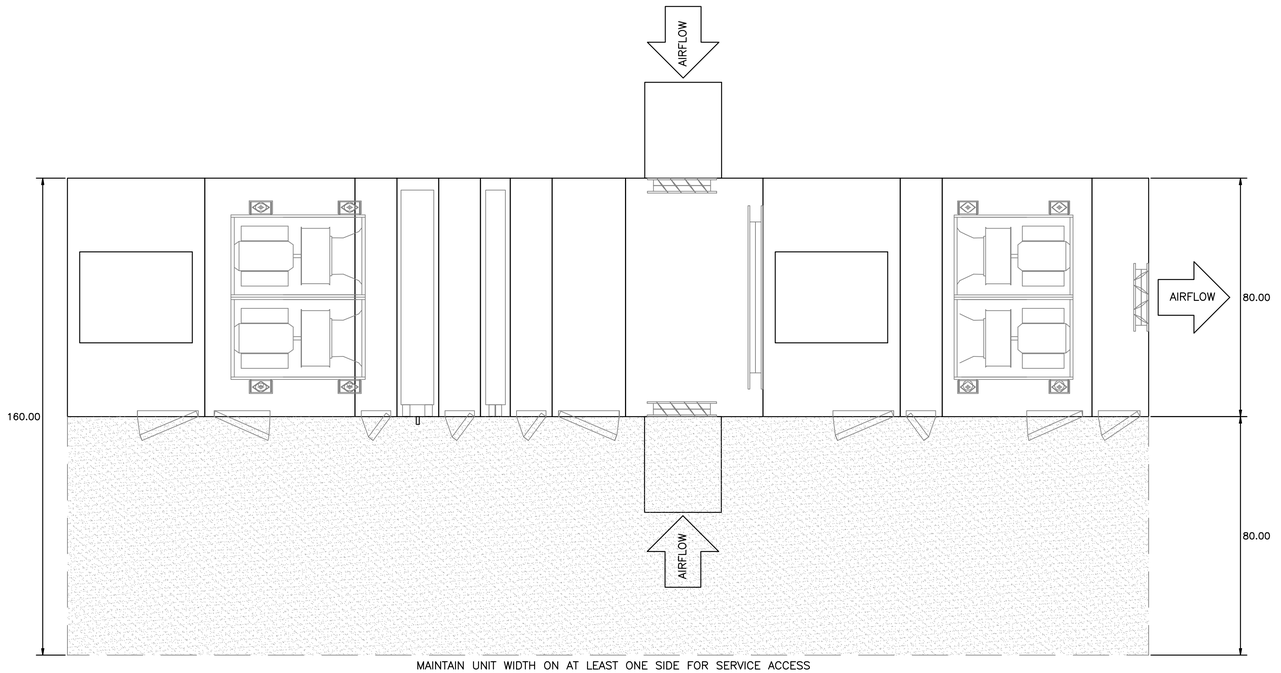
M□.5

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- C ACCESS SECTION
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- E ACCESS SECTION
- F HOT WATER PRE-HEAT COIL
- G ACCESS SECTION
- H FILTER SECTION
- I MIXING BOX (OA INTAKE)
- J CONTROLS SECTION (RET/RELIEF AIR)
- K ACCESS SECTION
- L RELIEF FAN (DIRECT DRIVE PLENUM)
- M EXHAUST DAMPER
- N ROOF CURB





MAINTAIN UNIT WIDTH ON AT LEAST ONE SIDE FOR SERVICE ACCESS

ACOUSTICAL DATA – SUPPLY FAN								
OCTAVE BAND(Hz)	63	125	250	500	1K	2K	4K	8K
CASING(dB)	79	77	79	76	76	66	61	60
RETURN(dB)	70	72	78	71	67	67	64	55
SUPPLY(dB)	77	80	84	81	80	77	77	73
OUTDOOR(dB)	70	73	80	70	66	67	63	53
EXHAUST	80	81	89	84	79	79	78	73

ACOUSTICAL DATA – EXHAUST FAN								
OCTAVE BAND(Hz)	63	125	250	500	1K	2K	4K	8K
CASING(dB)	60	76	73	77	72	62	58	57
RETURN(dB)	71	67	82	72	68	67	66	60
SUPPLY(dB)	67	64	78	66	63	64	60	50
OUTDOOR(dB)	70	68	85	71	67	67	65	58
EXHAUST	74	74	87	76	73	74	73	66

ACOUSTICAL DATA – OVERALL								
OCTAVE BAND(Hz	63	125	250	500	1K	2K	4K	8K
CASING(dB)	81	78	81	77	77	67	63	62
RETURN(dB)	74	73	83	75	71	70	68	61
SUPPLY(dB)	77	80	85	81	80	77	77	73
OUTDOOR(dB)	73	74	87	73	69	70	67	60
EXHAUST	80	82	91	84	80	80	79	74

1 / M4.6 DETAIL OF MODULAR AHU-6

SCALE: 1/2" = 1'-0"

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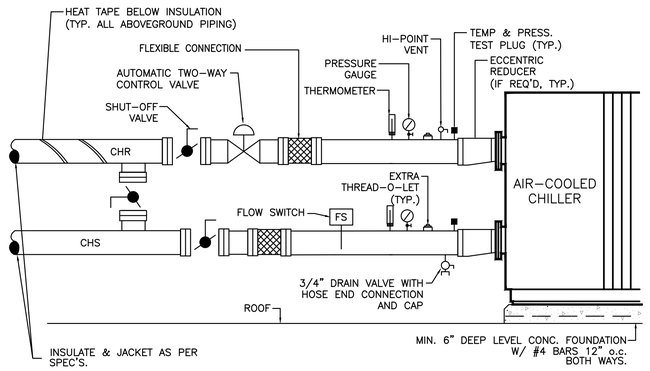
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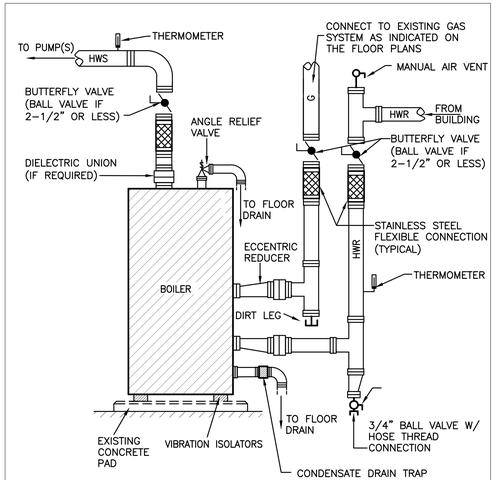
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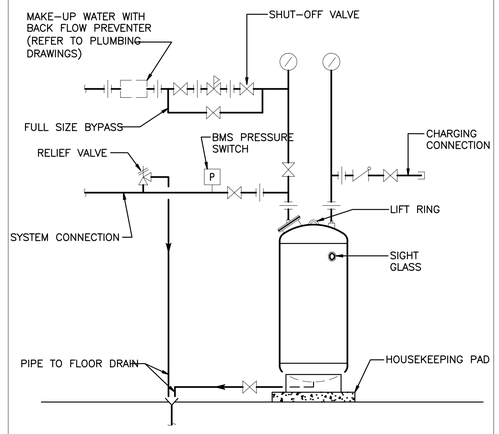


1 CHILLER PIPING DETAIL — NO SCALE

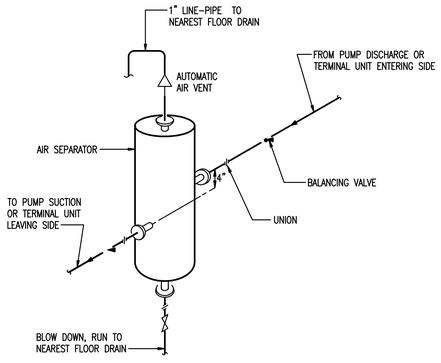


NOTES:
SEE FLOOR PLAN FOR PIPE SIZES

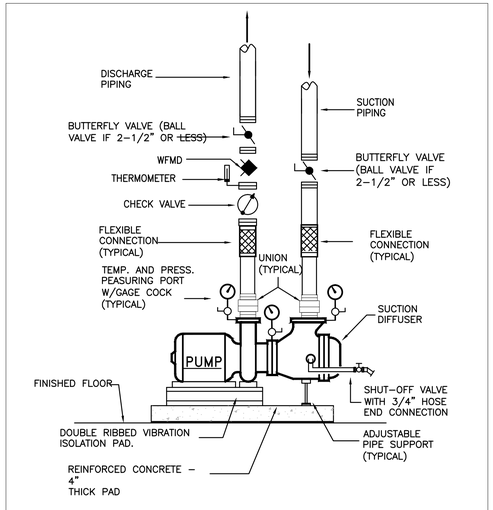
2 BOILER PIPING DETAIL — NO SCALE



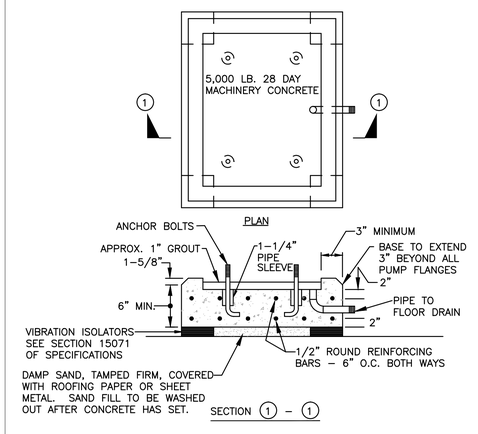
3 VERTICAL EXPANSION TANK — NO SCALE



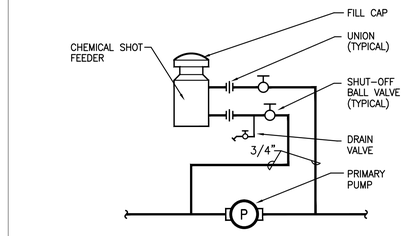
4 BYPASS AIR SEPARATOR — NO SCALE



5 CLOSE-COUPLED PUMP - HORIZONTAL END SUCTION — NO SCALE



6 TYPICAL PUMP FOUNDATION — NO SCALE



7 CHEMICAL SHOT FEEDER DETAIL — NO SCALE

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HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

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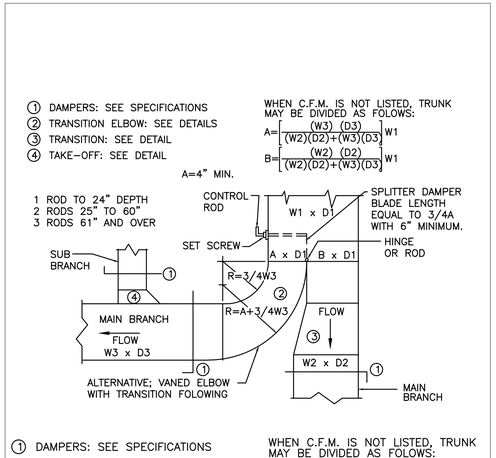
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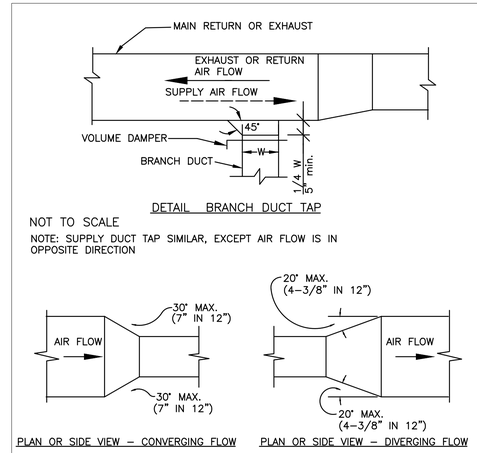
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20102
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STATE OF MISSISSIPPI

M5.1

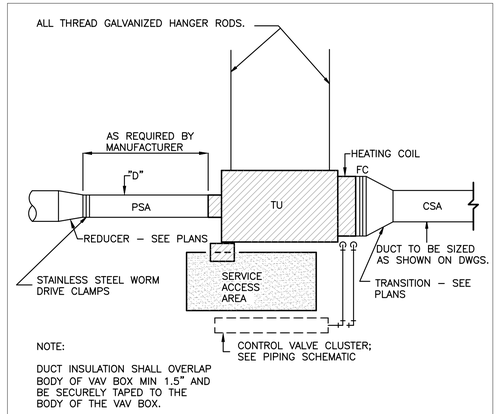
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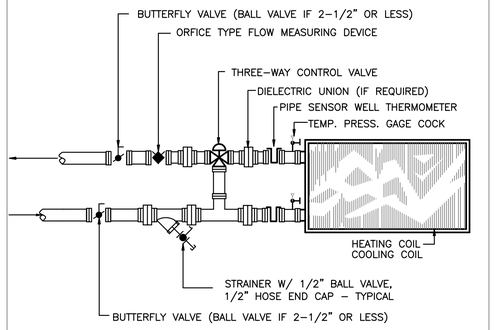
8 DETAIL OF SUPPLY DUCT BRANCH FITTINGS — NO SCALE



9 DETAIL OF BRANCH DUCT TAP AND TRANSITION FITTINGS
NOTE: DO NOT USE FLEXIBLE DUCT IN PA RUNOUT TO VAV'S — NO SCALE



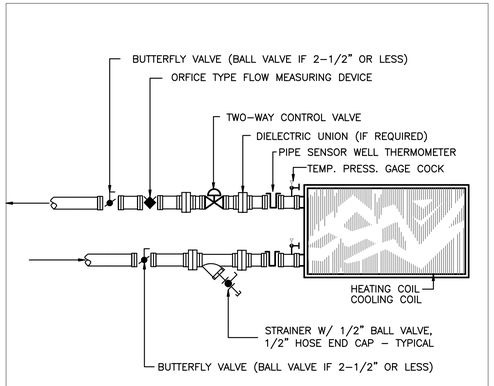
10 VARIABLE-AIR-VOLUME (VAV) TERMINAL UNIT — NO SCALE



NOTES:

1. SEE HVAC PIPING FLOOR PLAN AND EQUIPMENT SCHEDULES FOR RUNOUT SIZES
2. INSULATE COIL FRAME, TUBE BENDS, ETC. ON TERMINAL UNITS
3. TYPICAL FOR VAV TERMINAL UNIT AND AHU COILS

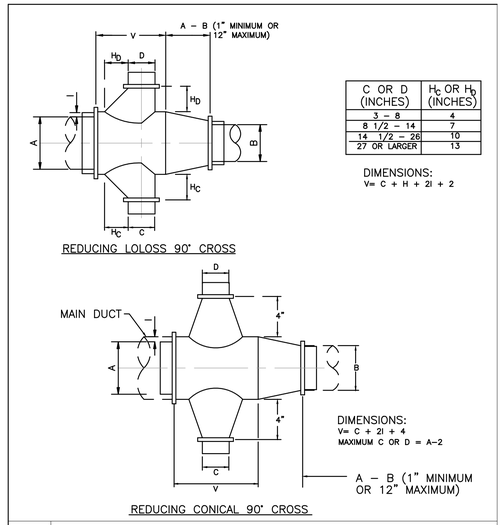
11 COIL DETAIL – THREE (3) WAY CONTROL VALVE — NO SCALE



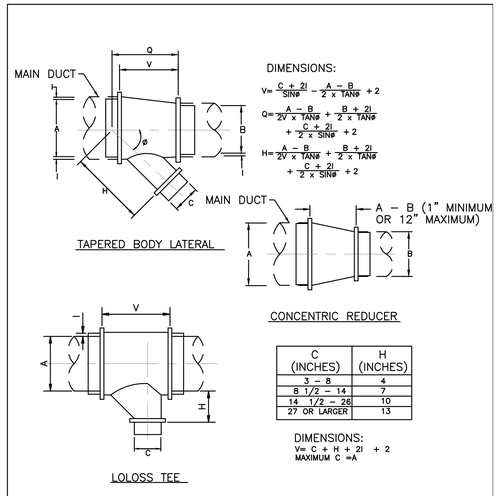
NOTES:

1. SEE HVAC PIPING FLOOR PLAN AND EQUIPMENT SCHEDULES FOR RUNOUT SIZES
2. INSULATE COIL FRAME, TUBE BENDS, ETC. ON TERMINAL UNITS
3. TYPICAL FOR VAV TERMINAL UNIT AND AHU COILS

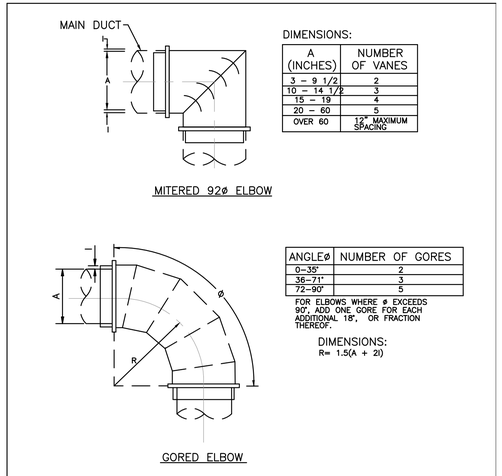
12 COIL DETAIL – TWO (2) WAY CONTROL VALVE — NO SCALE



13 BRANCH DUCT FITTINGS FOR DOUBLE WALL ROUND DUCT — NO SCALE



14 BRANCH DUCT FITTINGS FOR DOUBLE-WALL ROUND DUCT — NO SCALE



15 BRANCH DUCT FITTINGS FOR DOUBLE-WALL ROUND DUCT — NO SCALE

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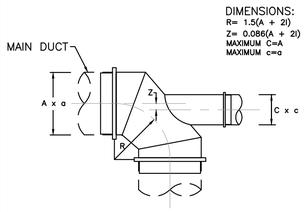
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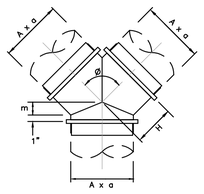
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ERG# 15-28.2



HEEL–TAPPED 90° ELBOW HARD BEND

DIMENSIONS:
R= 1.5(A + 2I)
Z= 0.086(A + 2I)
MAXIMUM C=A
MAXIMUM c=a

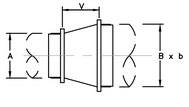


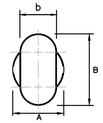
Y–BRANCH HARD BEND

DIMENSIONS:

$$H = \frac{A + 2I}{2 \times \tan(\theta/2)} + 1$$

$$m = \frac{A + 2I}{2} \times \tan(\theta/4)$$

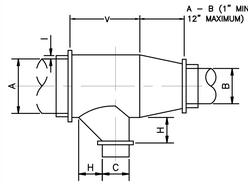




CONCENTRIC TRANSITION (ROUND–TO–FLAT–OVAL)

DIMENSIONS:
V= 12 IF GREATER OF (B–A) OR (b–a) ≤ 16
V= 24 IF GREATER OF (B–A) OR (b–a) > 16

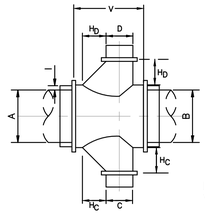
16 BRANCH DUCT FITTINGS FOR DOUBLE–WALL ROUND DUCT — NO SCALE



LOW PRESS LOSS TEE WITH REDUCER

C (INCHES)	H (INCHES)
3 – 8	4
8 1/2 – 14	7
14 1/2 – 26	10
27 OR LARGER	13

DIMENSIONS:
V= C + H + 2I + 2

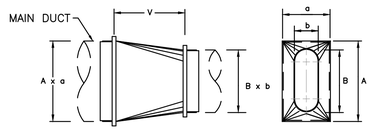


REDUCING LOW PRESSURE DROP 90° CROSS

C OR D (INCHES)	H_C OR H_D (INCHES)
3 – 8	4
8 1/2 – 14	7
14 1/2 – 26	10
27 OR LARGER	13

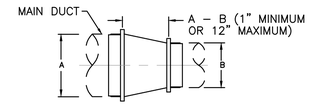
DIMENSIONS:
V= C + H_C + 2I + 2

17 BRANCH DUCT FITTINGS FOR DOUBLE–WALL ROUND DUCT — NO SCALE



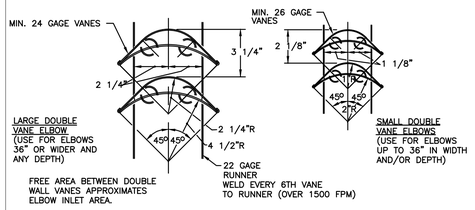
SQUARE–TO–FLAT–OVAL

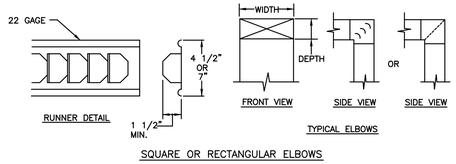
DIMENSIONS:
V= 12, 24, 36, OR 48



CONCENTRIC REDUCER

18 — NO SCALE

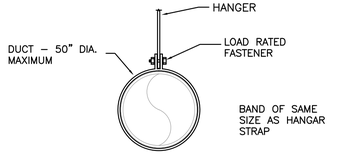




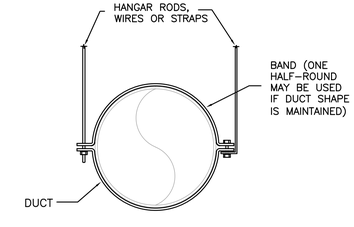
SQUARE OR RECTANGULAR ELBOWS

NOTES:
1. ALL SQUARE OR RECTANGULAR ELBOWS SHALL HAVE ONE OF THE TWO TYPES OF TURNING VANES SHOWN ABOVE. SINGLE VANE ELBOWS WILL NOT BE PERMITTED.
2. VANES SHALL BE CONSTRUCTED, SUPPORTED AND FASTENED AS RECOMMENDED BY SMACNA.
3. ALL ELBOWS SHOWN ON PLANS SHALL BE MADE RADIUS ELBOWS PROVIDED SPACE PERMITS RADIUS INSTALLATION. SQUARE OR RECTANGULAR ELBOWS SHALL BE USED ONLY WITH APPROVAL OF THE PROFESSIONAL.

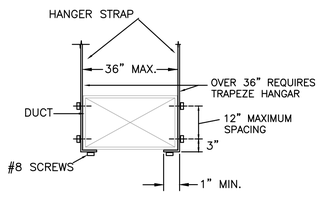
19 TURNING VANES – TYPICAL — NO SCALE



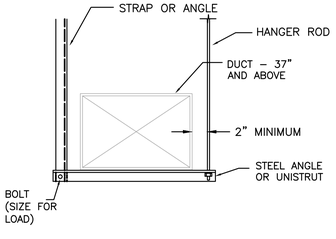
NOTE: HANGERS MUST NOT DEFORM DUCT SHAPE.



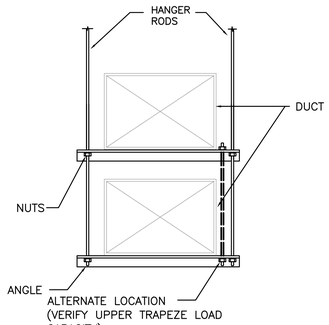
ROUND DUCT HANGERS



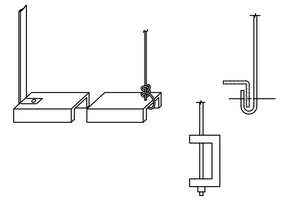
STRAP HANGERS



TRAPEZE HANGERS



SQUARE/RECTANGLE DUCT HANGERS



TYPICAL SUPPORT ATTACHMENTS

NOTE:
REFER TO HVAC DUCT CONSTRUCTION STANDARDS, SMACNA, TABLE 4–1 FOR RECTANGULAR DUCT AND TABLE 4–2 FOR ROUND DUCT HANGERS MINIMUM SIZE

20 DETAILS OF DUCTWORK LOWER HANGER ATTACHMENTS — NO SCALE

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HATTIESBURG PUBLIC SAFETY COMPLEX

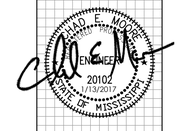
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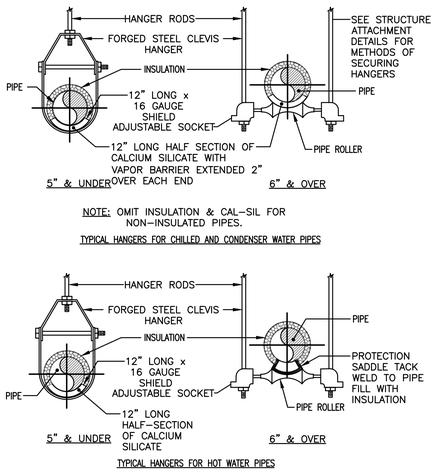
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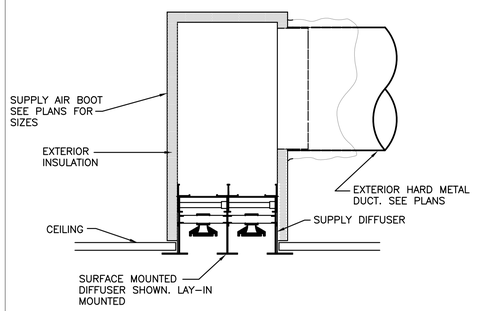
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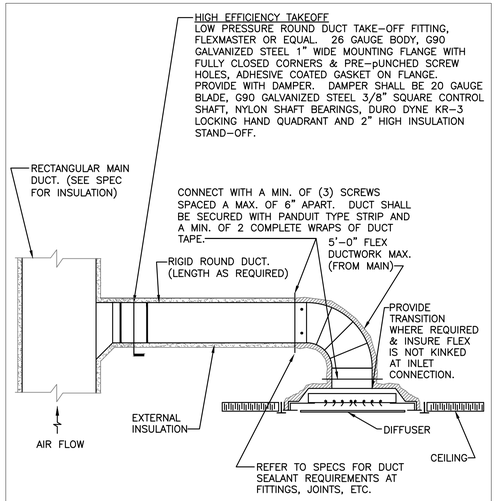
ERG# 15-28.2



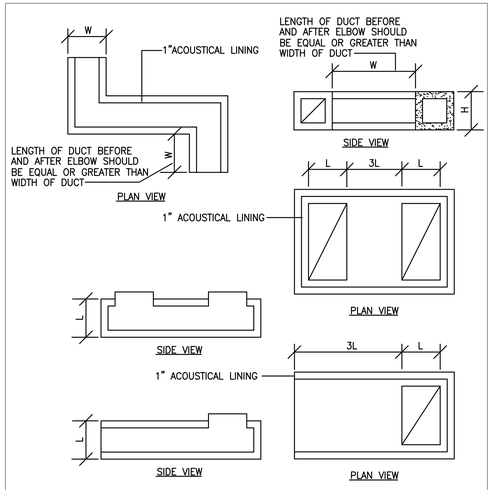
24 HOT AND CHILLED WATER PIPE HANGER — NO SCALE



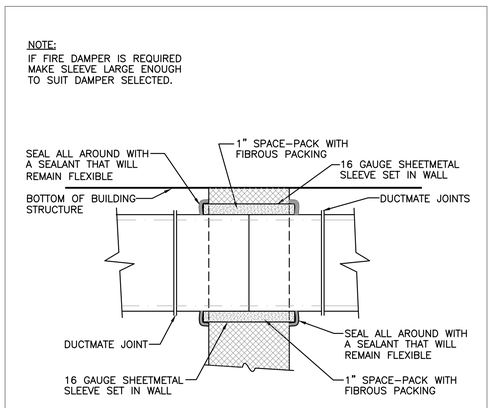
25 LINEAR DIFFUSER DETAIL — NO SCALE



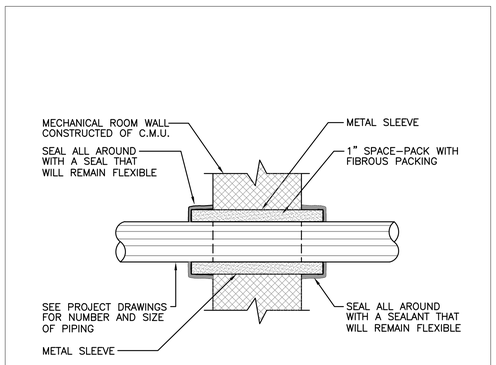
26 TYPICAL ROUND SUPPLY BRANCH DUCT DETAIL — NO SCALE



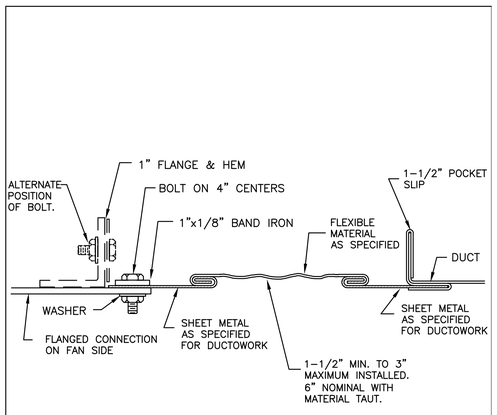
27 TRANSFER AIR DUCT DETAIL — NO SCALE



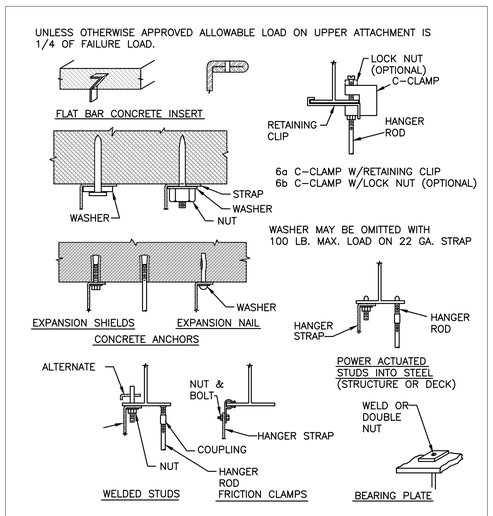
28 DUCT PASSING THRU WALLS — NO SCALE



29 PIPES AND CONDUITS PASSING THRU WALLS — NO SCALE



30 RECTANGULAR FLEXIBLE CONNECTION — NO SCALE



31 UPPER ATTACHEMENT DEVICES — NO SCALE

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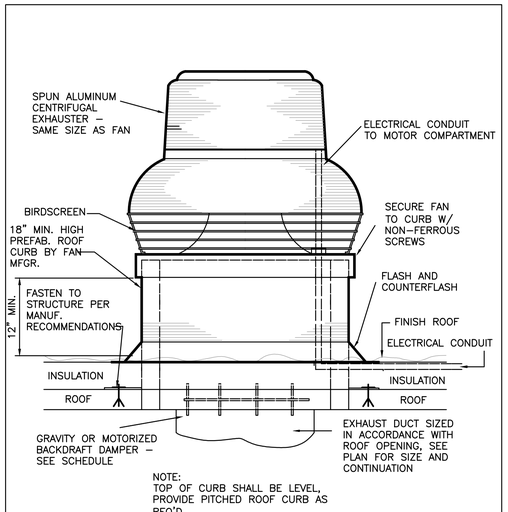
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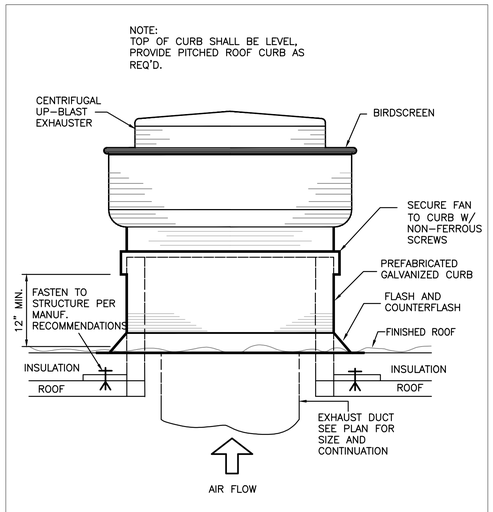
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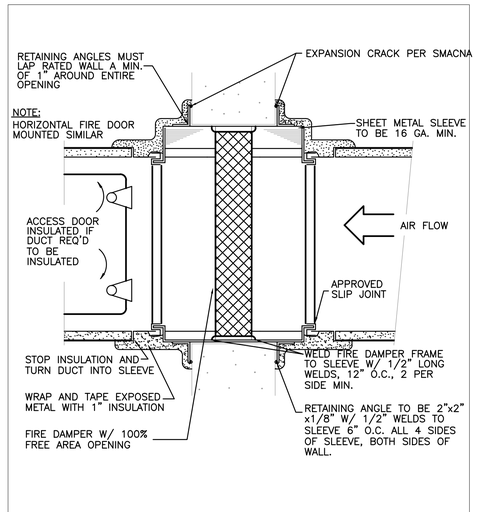
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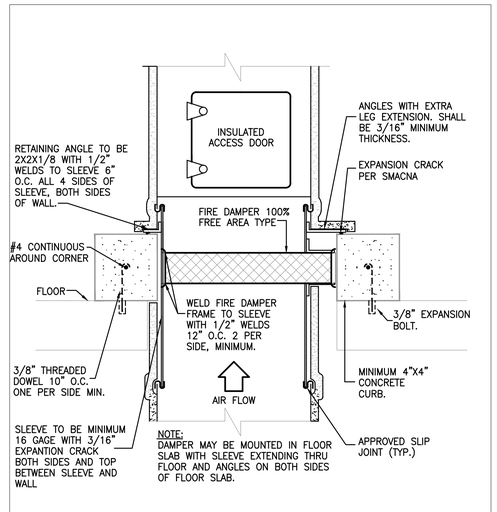
32 ROOF MOUNTED FAN DETAIL — NO SCALE



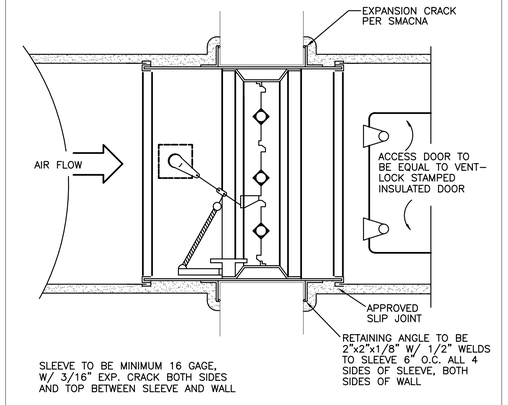
33 CENTRIFUGAL UP-BLAST EXHAUSTER — NO SCALE



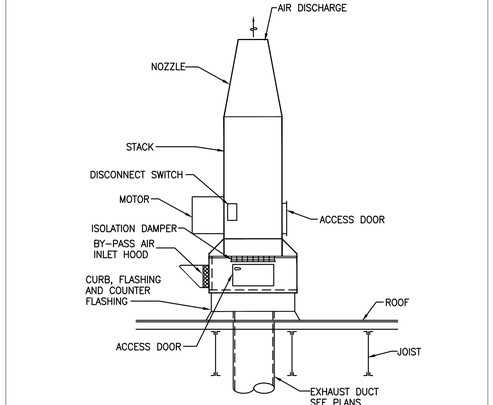
34 VERTICAL FIRE DAMPER – MEDUIM VELOCITY DUCT — NO SCALE



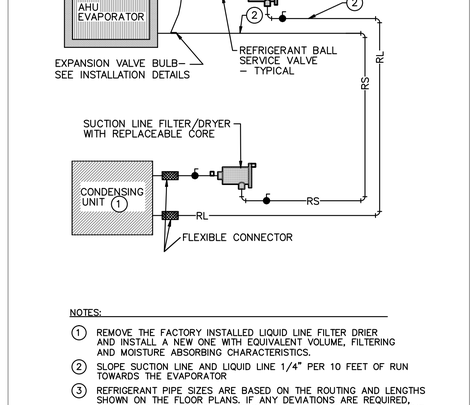
35 HORIZONTAL FIRE DAMPER – LOW VELOCITY DUCT — NO SCALE



36 VERTICAL SMOKE CONTROL DAMPER — NO SCALE



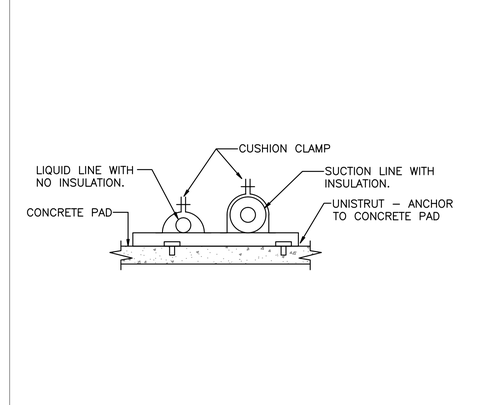
37 ELEVATION AT INDUCED FLOW UPBLAST FAN — NO SCALE



NOTES:

1. REMOVE THE FACTORY INSTALLED LIQUID LINE FILTER DRIER AND INSTALL A NEW ONE WITH EQUIVALENT VOLUME, FILTERING AND MOISTURE ABSORBING CHARACTERISTICS.
2. SLOPE SUCTION LINE AND LIQUID LINE 1/4" PER 10 FEET OF RUN TOWARDS THE EVAPORATOR
3. REFRIGERANT PIPE SIZES ARE BASED ON THE ROUTING AND LENGTHS SHOWN ON THE FLOOR PLANS. IF ANY DEVIATIONS ARE REQUIRED, CONTRACTOR SHALL SUBMIT DRAWINGS WITH THE DEVIATIONS TO THE EQUIPMENT MANUFACTURER FOR REVIEW AND APPROVAL.

38 TYPICAL REFRIGERANT CIRCUIT PIPING SCHEMATIC — NO SCALE



39 DETAIL OF EXTERIOR REFRIGERANT PIPE SUPPORT — NO SCALE

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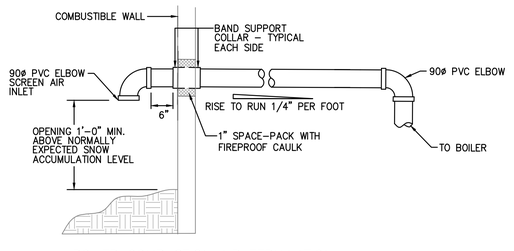
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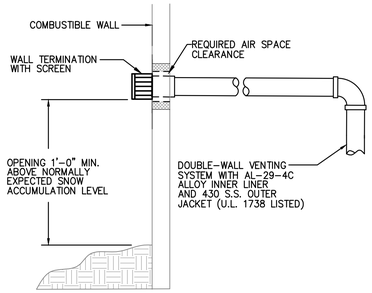
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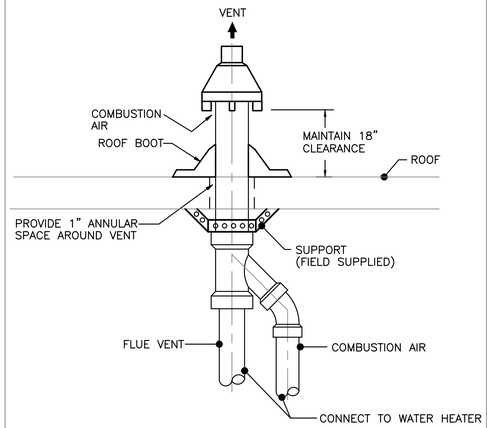


BOILER COMBUSTION AIR TERMINATION
NTS



BOILER EXHAUST TERMINATION
NTS

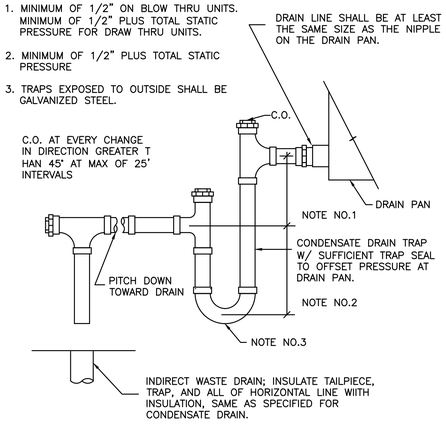
40 WALL MOUNTED BOILER VENTING DETAIL — NO SCALE



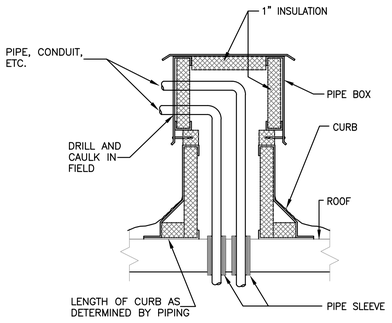
41 DETAIL OF CONCENTRIC VENT THRU ROOF INSTALLATION – TYPICAL — NO SCALE

NOTES:

1. MINIMUM OF 1/2" ON BLOW THRU UNITS. MINIMUM OF 1/2" PLUS TOTAL STATIC PRESSURE FOR DRAW THRU UNITS.
2. MINIMUM OF 1/2" PLUS TOTAL STATIC PRESSURE
3. TRAPS EXPOSED TO OUTSIDE SHALL BE GALVANIZED STEEL.



42 CONDENSATE DRAIN TRAP DETAIL — NO SCALE



43 PIPE BOX AND ROOF CURB DETAIL — NO SCALE

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MODULAR AIR HANDLING UNIT SCHEDULE (PART 1 OF 2)

TAG	MANUFACTURER AND MODEL NO.	SUPPLY FAN											RELIEF FAN										COOLING COIL											HEATING COIL (PREHEAT)										CONTINUED BELOW	TAG
		TYPE	FAN (QTY)	CFM	OUTDOOR AIR MAX	OUTDOOR AIR MIN	ESP TSP	RPM	ISOLATION TYPE	ISOLATION DEFL	ELEC (PER FAN) BHP	ELEC (PER FAN) HP	ELEC (PER FAN) V/ø	TYPE	FAN (QTY)	CFM	ESP TSP	RPM	ISOLATION TYPE	ISOLATION DEFL	ELEC (PER FAN) BHP	ELEC (PER FAN) HP	ELEC (PER FAN) V/ø	CFM	FV	EDB EWB	LDB LWB	APD	GPM	EWT	LWT	WPD	CAPACITY (MBH) TOTAL	CAPACITY (MBH) SENS	ROWS FPI	CFM	FV	EDB	LDB	APD	GPM	EWT	LWT	WPD	CAPACITY (MBH)	ROWS FPI		
AHU 1	TRANE CSAA	DIRECT–DRIVE PLENUM FAN	1	3000	1500	500	2.00 4.13	2462	SPRING	2	2.93	3.5	460/3	DIRECT–DRIVE PLENUM FAN	1	3000	2.00 2.70	2182	SPRING	2	2.03	3.5	460/3	3000	376	81.0 75.0	52.5 52.4	0.686	30	42.0	57.1	3.32	227.1	95.4	8 10	1600	200	15.0	58.4	0.027	5	140	109	0.05	75.4	2 6		AHU 1
AHU 2	TRANE CSAA	DIRECT–DRIVE PLENUM FAN	1	5000	1600	1000	2.00 3.93	2037	SPRING	2	4.87	5.5	460/3	DIRECT–DRIVE PLENUM FAN	1	4000	2.00 2.80	1758	SPRING	2	2.71	3.5	460/3	5000	406	77.0 68.0	51.3 51.2	0.689	35	42.0	56.5	4.28	255.3	142.2	8 10	2500	203	15.0	51.5	0.028	5	140	100	0.04	99.1	2 6		AHU 2
AHU 3	TRANE CSAA	DIRECT–DRIVE PLENUM FAN	2	18500	18500	3500	2.00 3.91	1684	SPRING	2	8.91	10.0	460/3	N/A	N/A	N/A	N/A N/A	N/A	N/A	N/A	N/A	N/A	N/A	18500	463	78.0 70.0	53.6 53.5	0.849	120	42.0	58.2	6.16	971.3	500.5	8 10	9650	242	15.0	54.3	0.038	15	140	85	0.17	410.9	2 6		AHU 3
AHU 4	TRANE CSAA	DIRECT–DRIVE PLENUM FAN	2	13500	13500	2000	2.00 3.81	2013	SPRING	2	6.05	6.5	460/3	N/A	N/A	N/A	N/A N/A	N/A	N/A	N/A	N/A	N/A	N/A	13500	452	75.0 68.0	54.2 53.9	0.687	75	42.0	57.7	9.29	591.8	310.3	8 6	7325	245	15.0	53.5	0.044	15	140	99	1.38	305.9	2 6		AHU 4
AHU 5	TRANE CSAA	DIRECT–DRIVE PLENUM FAN	1	7000	1500	1000	2.00 3.91	2029	SPRING	2	6.73	8.0	460/3	DIRECT–DRIVE PLENUM FAN	1	6000	2.00 2.76	1726	SPRING	2	4.11	5.5	460/3	7000	417	77.0 64.0	50.9 50.8	0.637	35	42.0	57.2	3.23	266.9	201.1	8 10	3450	205	15.0	51.4	0.033	5	140	95	0.53	136.2	2 6		AHU 5
AHU 6	TRANE CSAA	DIRECT–DRIVE PLENUM FAN	2	10000	2700	1000	2.00 3.78	2152	SPRING	2	4.45	4.5	460/3	DIRECT–DRIVE PLENUM FAN	2	9000	2.00 2.72	1884	SPRING	2	2.91	3.5	460/3	10000	400	79.0 65.0	50.3 50.2	0.610	55	42.0	57.6	4.70	429.7	316.1	8 10	5400	216	15.0	57.6	0.036	15	140	107	1.24	249.5	2 6		AHU 6

MODULAR AIR HANDLING UNIT SCHEDULE (PART 2 OF 2)

TAG	MANUFACTURER AND MODEL NO.	HEATING COIL (REHEAT)											FILTER			OP WT (LBS.)	REMARKS	TAG
		CFM	FV	EDB	LDB	APD	GPM	EWT	LWT	WPD	CAPACITY (MBH)	ROWS FPI	TYPE	DEPTH	MERV			
AHU 1	TRANE CSAA	3000	376	50.0	95.1	0.165	9	140	107	0.20	146.7	4 6	PLEATED	2"	8	4550	6" INTEGRAL BASE FRAME, PREMIUM EFF. INVERTER DUTY MOTOR, DOUBLE WALL ACCESS PANELS W/HINGES & LATCHES, TRAQ DAMPERS, OUTDOOR CONSTRUCTION, FACTORY MOUNTED VFD's	AHU 1
AHU 2	TRANE CSAA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A N/A	PLEATED	2"	8	5300	6" INTEGRAL BASE FRAME, PREMIUM EFF. INVERTER DUTY MOTOR, DOUBLE WALL ACCESS PANELS W/HINGES & LATCHES, TRAQ DAMPERS, OUTDOOR CONSTRUCTION, FACTORY MOUNTED VFD's	AHU 2
AHU 3	TRANE CSAA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A N/A	PLEATED	2"	8	7000	6" INTEGRAL BASE FRAME, PREMIUM EFF. INVERTER DUTY MOTOR, DOUBLE WALL ACCESS PANELS W/HINGES & LATCHES, TRAQ DAMPERS, FACTORY MOUNTED VFD's	AHU 3
AHU 4	TRANE CSAA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A N/A	PLEATED	2"	8	4500	6" INTEGRAL BASE FRAME, PREMIUM EFF. INVERTER DUTY MOTOR, DOUBLE WALL ACCESS PANELS W/HINGES & LATCHES, TRAQ DAMPERS, FACTORY MOUNTED VFD's	AHU 4
AHU 5	TRANE CSAA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A N/A	PLEATED	2"	8	5900	6" INTEGRAL BASE FRAME, PREMIUM EFF. INVERTER DUTY MOTOR, DOUBLE WALL ACCESS PANELS W/HINGES & LATCHES, TRAQ DAMPERS, OUTDOOR CONSTRUCTION, FACTORY MOUNTED VFD's	AHU 5
AHU 6	TRANE CSAA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A N/A	PLEATED	2"	8	7800	6" INTEGRAL BASE FRAME, PREMIUM EFF. INVERTER DUTY MOTOR, DOUBLE WALL ACCESS PANELS W/HINGES & LATCHES, TRAQ DAMPERS, OUTDOOR CONSTRUCTION, FACTORY MOUNTED VFD's	AHU 6

AIR COOLED CHILLER SCHEDULE

TAG	MANUFACTURER AND MODEL NO.	CAPACITY, TONS	FULL LOAD KW/TON	INTEGRATED PART LOAD VALUE	AMBIENT AIR TEMP. °F	EWT °F	LWT °F	FLOW (GPM) DESIGN	FLOW (GPM) MIN.	TOTAL EVAP. PRESS. DROP FT. HD.	FOULING FACTOR	COMPRESSOR (QTY.)RLA(EA.) – V – PH	CONDENSER FANS (QTY.)FLA(EA.) – V – PH	CIRCUIT AMPACITY AMPS	MOCP	APPROXIMATE OPERATING WT., LBS.	REMARKS	TAG
CH 1	TRANE RTAC 155	156	1.16	14.6	95.0	61	42	190	145	8.80	0.00010	(1)133 (1)113 – 460 – 3	(11)2.70 – 460 – 3	315	400	12500	SINGLE POINT POWER CONNECTION, 3–PASS EVAPORATOR W/1.25" INSULATION, SOUND ENHANCEMENT	CH 1
CH 2	TRANE RTAC 155	156	1.16	14.6	95.0	61	42	190	145	8.80	0.00010	(1)133 (1)113 – 460 – 3	(11)2.70 – 460 – 3	315	400	12500	SINGLE POINT POWER CONNECTION, 3–PASS EVAPORATOR W/1.25" INSULATION, SOUND ENHANCEMENT	CH 2

HYDRONIC PUMPS

TAG	MANUFACTURER AND MODEL NO.	DUTY	TYPE	GPM	TDH (FT)	EFFICEINCY	MOTOR HP	BHP	RPM	ELECTRICAL SERVICE	OPER. WT. (LBS)	REMARKS
CHP 1	GRUNDFOS (PACO) 30121 LC	CHILLED WATER	CLOSE–COUPLED HORIZONTAL	380	100	70.3	15.0	13.6	1760	460–3	400	PREMIMUM EFFICIENCY INVERTER DUTY MOTORS, GAUGE TAPS
CHP 2	GRUNDFOS (PACO) 30121 LC	CHILLED WATER	CLOSE–COUPLED HORIZONTAL	380	100	70.3	15.0	13.6	1760	460–3	400	PREMIMUM EFFICIENCY INVERTER DUTY MOTORS, GAUGE TAPS
HWP 1	GRUNDFOS (PACO) 25957 LC	HOT WATER	CLOSE–COUPLED HORIZONTAL	180	80	73.1	7.5	3.63	1775	460–3	250	PREMIMUM EFFICIENCY INVERTER DUTY MOTORS, GAUGE TAPS
HWP 2	GRUNDFOS (PACO) 25957 LC	HOT WATER	CLOSE–COUPLED HORIZONTAL	180	80	73.1	7.5	3.63	1775	460–3	250	PREMIMUM EFFICIENCY INVERTER DUTY MOTORS, GAUGE TAPS

MISCELLANEOUS EQUIPMENT SCHEDULE

TAG	MANUFACTURER AND MODEL NO.	SERVES	TYPE	TANK VOLUME (GALLONS)	ACCEPTANCE VOLUME (GALLONS)	DIMENSIONS (IN.) DIA(LENGTH)xHGT	WEIGHT, LBS	REMARKS	TAG
ET 1	WESSELS NLA–130	CHILLED WATER	EXPANSION TANK	35	35	20 x 37	125	FULL ACCEPTANCE, HEAVY DUTY REPLACEABLE BLADDER, AUTOMATIC AIR VENT	ET 1
AS 1	WESSELS WVA–6HV	CHILLED WATER	AIR & DIRT SEPARATOR	N/A	N/A	19 x 59	375	FLANGED CONNECTIONS, REMOVABLE LOWER HEAD, BLOWDOWN VALVE	AS 1
ET 2	WESSELS NLA–200	HOT WATER	EXPANSION TANK	53	53	24 x 43	210	FULL ACCEPTANCE, HEAVY DUTY REPLACEABLE BLADDER, AUTOMATIC AIR VENT	ET 2
AS 2	WESSELS WVA–4HV	HOT WATER	AIR & DIRT SEPARATOR	N/A	N/A	13–1/2 x 42	250	FLANGED CONNECTIONS, REMOVABLE LOWER HEAD, BLOWDOWN VALVE	AS 2

FAN COIL UNIT SCHEDULE

TAG	MANUFACTURER AND MODEL NO.	SERVES	TYPE	FAN TOTAL CFM	FAN OA CFM	FAN ESP TSP	FAN (NO.)HP	FAN VOLT/PH	COOLING CAPACITY EDB EWB	COOLING CAPACITY LDB LWB	COOLING CAPACITY APD	COOLING CAPACITY GPM	COOLING CAPACITY EWT	COOLING CAPACITY LWT	COOLING CAPACITY WPD	COOLING CAPACITY (MBH) TOTAL	COOLING CAPACITY (MBH) SENS	COOLING CAPACITY ROWS	HEATING CAPACITY EDB	HEATING CAPACITY LDB	HEATING CAPACITY APD	HEATING CAPACITY GPM	HEATING CAPACITY EWT	HEATING CAPACITY LWT	HEATING CAPACITY WPD	HEATING CAPACITY TOTAL (MBH)	HEATING CAPACITY POSITION ROWS	OP WT (LBS)	REMARKS	TAG
FCU 1	TRANE FCHB08	STAIR B	VERTICAL RECESSED	570	–0–	0.200 ––	0.220 ––	208/1	80.0 67.0	50.6 49.7	––	10.0	42.0	47.1	38.3	25.33	15.74	3	60.0	90.4	––	2.5	140	125	21.0	18.7	PREHEAT 1	130	STAMPED LOUVER INLET AND OUTLET, STAINLESS STEEL DRAIN PAN, CONDENSATE OVERFLOW, 1" MERV 8 FILTER	FCU 1
FCU 2	TRANE FCHB08	STAIR B	VERTICAL RECESSED	570	–0–	0.200 ––	0.220 ––	208/1	80.0 67.0	50.6 49.7	––	10.0	42.0	47.1	38.3	25.33	15.74	3	60.0	90.4	––	2.5	140	125	21.0	18.7	PREHEAT 1	130	STAMPED LOUVER INLET AND OUTLET, STAINLESS STEEL DRAIN PAN, CONDENSATE OVERFLOW, 1" MERV 8 FILTER	FCU 2
FCU 3	TRANE FCHB08	STAIR B	VERTICAL RECESSED	570	–0–	0.200 ––	0.220 ––	208/1	80.0 67.0	50.6 49.7	––	10.0	42.0	47.1	38.3	25.33	15.74	3	60.0	90.4	––	2.5	140	125	21.0	18.7	PREHEAT 1	130	STAMPED LOUVER INLET AND OUTLET, STAINLESS STEEL DRAIN PAN, CONDENSATE OVERFLOW, 1" MERV 8 FILTER	FCU 3

ELECTRIC UNIT HEATER SCHEDULE

NO.	MAKE AND MODEL	SERVES	TYPE	HEAT CAPACITY KW – V – PH	FAN (AMPS) HP – V – PH	REMARKS
EUH 1	MARKEL J3422T	FIRE/ELECTRICAL B102	HORIZONTAL	2 – 208 – 3	(5.6) – 208 – 3	BOTTOM OF UNIT TO BE 6'–0" AFF., WALL BOX, PROVIDE DISCONNECT SWITCH

HATTIESBURG PUBLIC SAFETY COMPLEX
HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT
HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

Drawing Issued:

Date	Rev.	Description
08-31-2015		DD Check Set
10-20-2015		75% Progress Set
11-02-2015		90% Pricing Set
11-19-2018		100% Bid Docs

Drawn By: DB,CM
Checked By: CM,TP
Client No: -------
Albert & Associates: 12575

CHAD E. MOORE REGISTERED ENGINEER 20102 1/13/2017 STATE OF MISSISSIPPI

M6.1

Engineering Resource Group, Inc.
350 Edgewood Terrace Drive
Jackson, MS 39206
Phone: (601) 362-3552
Fax: (601) 366-6418
ERG# 15-28.2

VARIABLE AIR VOLUME TERMINAL UNIT SCHEDULE (PART 1 OF 2)

TAG	MANUFACTURER AND MODEL NO	INLET SIZE	DESIGN CFM			TOTAL ΔP	NC	CO2 CONTROL	HEATING COIL								VOLT–ø	REMARKS
			COOL	MIN	HEAT				ROWS	CFM	EAT	LAT	GPM	EWT	LWT	MBH		
1–2.01	TRANE VCWF	16	2250	500	750	0.501	25	––	2	750	55	94	2.00	140	109	31.3	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–2.02	TRANE VCWF	8	700	150	250	0.616	27	––	2	250	55	92	2.00	140	120	5.9	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–2.03	TRANE VCWF	6	200	100	125	0.139	30	––	2	125	55	100	0.50	140	115	6.2	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–2.04	TRANE VCWF	6	250	100	125	0.207	31	––	2	125	55	100	0.50	140	115	6.2	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–2.05	TRANE VCWF	8	450	150	175	0.277	25	––	2	175	55	89	0.50	140	114	6.5	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–2.06	TRANE VCWF	6	200	100	125	0.139	30	––	2	125	55	100	0.50	140	115	6.2	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–2.07	TRANE VCWF	6	200	100	125	0.139	30	YES	2	125	55	100	0.50	140	115	6.2	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–2.08	TRANE VCWF	6	350	100	125	0.393	32	––	2	125	55	100	0.50	140	115	6.2	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–2.09	TRANE VCWF	6	250	100	125	0.207	31	––	2	125	55	100	0.50	140	115	6.2	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–2.10	TRANE VCWF	8	450	150	225	0.277	25	––	2	225	55	94	1.00	140	120	9.6	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–3.01	TRANE VCWF	8	500	150	150	0.334	26	YES	2	150	55	92	0.50	140	115	6.1	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–3.02	TRANE VCWF	6	200	100	125	0.139	30	––	2	125	55	101	0.50	140	115	6.2	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–3.03	TRANE VCWF	8	400	100	150	0.511	34	––	2	150	55	97	0.50	140	113	6.2	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–3.04	TRANE VCWF	6	200	100	125	0.139	30	––	2	125	55	101	0.50	140	115	6.2	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–3.05	TRANE VCWF	6	350	100	175	0.393	32	––	2	175	55	93	0.50	140	111	7.2	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–3.06	TRANE VCWF	6	350	100	175	0.393	32	––	2	175	55	93	0.50	140	111	7.2	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–3.07	TRANE VCWF	6	350	100	125	0.393	32	––	2	125	55	101	0.50	140	115	6.2	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–3.08	TRANE VCWF	6	200	100	125	0.139	30	––	2	125	55	101	0.50	140	115	6.2	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–3.09	TRANE VCWF	6	125	100	125	0.054	30	––	2	125	55	101	0.50	140	115	6.2	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–3.10	TRANE VCWF	6	200	100	125	0.139	30	––	2	125	55	101	0.50	140	115	6.2	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–3.11	TRANE VCWF	6	200	100	125	0.139	30	––	2	125	55	101	0.50	140	115	6.2	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–3.12	TRANE VCWF	10	850	200	425	0.412	24	YES	2	425	55	95	0.50	140	115	18.5	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–3.13	TRANE VCWF	16	2500	500	1250	0.412	24	YES	2	1250	55	92	3.50	140	112	49.2	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–3.14	TRANE VCWF	8	450	150	225	0.247	25	––	2	225	55	94	1.00	140	120	9.6	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–3.15	TRANE VCWF	12	1500	300	750	0.247	25	––	2	750	55	91	2.50	140	116	29.2	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–3.16	TRANE VCWF	8	500	150	250	0.334	26	––	2	250	55	92	1.00	140	120	10.0	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–3.17	TRANE VCWF	6	300	100	150	0.302	32	––	2	150	55	97	0.50	140	113	6.7	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–3.18	TRANE VCWF	14	2000	400	750	0.537	27	YES	2	750	55	91	2.00	140	111	29.1	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–3.19	TRANE VCWF	6	200	100	125	0.139	30	––	2	125	55	101	0.50	140	115	6.2	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–3.20	TRANE VCWF	6	300	100	150	0.302	32	––	2	150	55	97	0.50	140	113	6.7	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–3.21	TRANE VCWF	6	200	100	125	0.139	30	––	2	125	55	101	0.50	140	115	6.2	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–3.22	TRANE VCWF	8	400	150	200	0.223	25	YES	2	200	55	92	0.75	140	119	7.9	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–3.23	TRANE VCWF	8	450	150	150	0.277	25	––	2	150	55	92	0.50	140	116	6.1	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–3.24	TRANE VCWF	8	500	150	150	0.334	26	––	2	150	55	92	0.50	140	116	6.1	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–3.25	TRANE VCWF	6	300	100	125	0.302	32	––	2	125	55	101	0.50	140	115	6.2	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–3.26	TRANE VCWF	12	1600	350	800	0.763	25	––	2	800	55	90	2.50	140	116	30.1	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–3.27	TRANE VCWF	8	400	150	200	0.223	25	––	2	200	55	92	0.75	140	119	7.9	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–3.28	TRANE VCWF	8	500	150	250	0.334	26	YES	2	250	55	92	1.00	140	120	10.0	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–3.29	TRANE VCWF	6	300	100	150	0.302	32	––	2	150	55	97	0.50	140	113	6.7	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–3.30	TRANE VCWF	12	1200	250	350	0.463	22	YES	2	350	55	92	1.00	140	112	14.0	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–3.31	TRANE VCWF	6	300	100	150	0.302	32	––	2	150	55	97	0.50	140	113	6.7	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–3.32	TRANE VCWF	6	300	100	150	0.302	32	YES	2	150	55	97	0.50	140	113	6.7	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–3.33	TRANE VCWF	16	2500	500	1250	0.616	27	––	2	1250	55	90	3.25	140	110	47.8	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–3.34	TRANE VCWF	12	1500	300	750	0.680	25	––	2	750	55	91	2.50	140	116	29.2	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–4.01	TRANE VCWF	8	600	150	200	0.465	26	YES	2	200	55	92	0.75	140	119	7.9	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–4.02	TRANE VCWF	10	1100	200	400	0.537	27	YES	2	400	55	91	1.00	140	109	8.9	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–4.03	TRANE VCWF	8	400	150	150	0.223	25	YES	2	150	55	93	0.50	140	115	6.1	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–4.04	TRANE VCWF	8	550	150	200	0.402	25	––	2	200	55	92	0.75	140	119	7.9	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–4.05	TRANE VCWF	8	600	150	300	0.465	26	YES	2	300	55	91	1.25	140	121	11.8	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–4.06	TRANE VCWF	8	500	150	250	0.334	26	YES	2	250	55	92	1.00	140	120	10.0	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–4.07	TRANE VCWF	6	350	100	175	0.393	32	YES	2	175	55	93	0.50	140	111	7.2	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–4.08	TRANE VCWF	6	350	100	175	0.393	32	––	2	175	55	93	0.50	140	111	7.2	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–4.09	TRANE VCWF	6	350	100	175	0.393	32	––	2	175	55	93	0.50	140	111	7.2	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–4.10	TRANE VCWF	6	250	100	125	0.207	31	––	2	125	55	101	1.00	140	115	6.2	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–4.11	TRANE VCWF	14	2000	400	1000	0.537	27	––	2	1000	55	91	3.00	140	115	39.1	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER

VARIABLE AIR VOLUME TERMINAL UNIT SCHEDULE (PART 2 OF 2)

TAG	MANUFACTURER AND MODEL NO	INLET SIZE	DESIGN CFM			TOTAL ΔP	NC	CO2 CONTROL	HEATING COIL								VOLT–ø	REMARKS
			COOL	MIN	HEAT				ROWS	CFM	EAT	LAT	GPM	EWT	LWT	MBH		
1–4.12	TRANE VCWF	6	325	100	150	0.347	32	––	2	150	55	97	0.50	140	113	6.7	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–4.13	TRANE VCWF	8	400	125	150	0.223	25	––	2	150	55	92	0.50	140	116	6.1	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–4.14	TRANE VCWF	8	400	150	200	0.223	25	––	2	200	55	92	0.75	140	119	7.9	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–4.15	TRANE VCWF	8	600	150	300	0.465	26	––	2	300	55	91	1.25	140	121	11.8	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–4.16	TRANE VCWF	16	2250	450	1000	0.501	25	YES	2	1000	55	89	2.25	140	107	37.1	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–4.17	TRANE VCWF	6	350	100	175	0.393	32	––	2	175	55	93	0.50	140	111	7.2	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–4.18	TRANE VCWF	12	1200	250	600	0.463	22	YES	2	600	55	93	2.00	140	115	24.5	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–4.19	TRANE VCWF	14	2000	400	1000	0.537	27	––	2	1000	55	91	3.00	140	115	39.1	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–4.20	TRANE VCWF	10	750	200	500	0.328	22	YES	2	500	55	95	2.00	140	118	21.7	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–5.01	TRANE VCWF	14	1900	400	750	0.489	26	YES	2	750	55	91	2.00	140	111	29.1	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–5.02	TRANE VCWF	10	1000	200	500	0.552	26	YES	2	500	55	92	1.50	140	114	19.9	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–5.03	TRANE VCWF	8	530	125	250	0.334	26	––	2	250	55	92	1.00	140	120	10.0	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–5.04	TRANE VCWF	8	500	125	250	0.334	26	––	2	250	55	92	1.00	140	120	10.0	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–5.05	TRANE VCWF	6	350	100	125	0.393	32	––	2	125	55	101	0.50	140	115	6.2	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–5.06	TRANE VCWF	6	350	100	175	0.393	32	––	2	175	55	93	0.50	140	111	7.2	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–5.07	TRANE VCWF	6	300	100	150	0.302	32	––	2	150	55	97	0.50	140	113	6.7	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–5.08	TRANE VCWF	6	330	100	150	0.302	32	––	2	150	55	97	0.50	140	113	6.7	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–5.09	TRANE VCWF	6	330	100	150	0.302	32	––	2	150	55	97	0.50	140	113	6.7	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–5.10	TRANE VCWF	6	350	100	125	0.393	32	––	2	125	55	101	0.50	140	115	6.2	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–5.11	TRANE VCWF	8	600	150	300	0.465	26	––	2	300	55	91	1.25	140	121	11.8	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–5.12	TRANE VCWF	6	250	100	125	0.307	31	YES	2	125	55	101	0.50	140	115	6.2	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–5.13	TRANE VCWF	6	250	100	125	0.307	31	––	2	125	55	101	0.50	140	115	6.2	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–5.14	TRANE VCWF	6	250	100	125	0.307	31	––	2	125	55	101	0.50	140	115	6.2	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–5.15	TRANE VCWF	6	350	100	150	0.393	32	––	2	150	55	97	0.50	140	113	6.7	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–6.01	TRANE VCWF	10	1000	250	500	0.552	26	––	2	500	55	95	2.00	140	118	21.7	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–6.02	TRANE VCWF	6	230	230	230	0.139	30	––	2	200	55	89	0.50	140	110	7.6	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–6.03	TRANE VCWF	14	1800	400	900	0.442	26	YES	2	900	55	91	2.50	140	112	34.7	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–6.04	TRANE VCWF	12	1250	250	625	0.572	22	YES	2	625	55	92	2.00	140	115	24.9	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–6.05	TRANE VCWF	12	1250	250	625	0.572	22	––	2	625	55	92	2.00	140	115	24.9	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–6.06	TRANE VCWF	10	1100	250	550	0.657	27	YES	2	550	55	90	1.50	140	112	20.6	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–6.07	TRANE VCWF	14	2000	500	1000	0.537	27	––	2	1000	55	88	2.50	140	111	36.1	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER
1–6.08	TRANE VCWF	14	2000	500	1000	0.537	27	––	2	1000	55	88	2.50	140	111	36.1	120–1	SINGLE DUCT WITH HEATING COIL, FLOW RING, 24 VAC CONTROL TRANSFORMER

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT

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Date	Rev.	Description
08-31-2015		DD Check Set
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Checked By: CM,TP

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Albert & Associates: 12575

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M6.2

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CONDENSING GAS FIRED HEATING BOILER SCHEDULE

TAG	MANUFACTURER AND MODEL NO.	FUEL	INPUT (MBH)	OUTPUT (MBH)	MINIMUM EFFICIENCY (LOW FIRE, 110° EWT)	GAS PRESS. WC	EWT	LWT	GPM	ELECTICAL				APPROXIMATE OPERATING WT. (LBS)	REMARKS
										FLA	MOP	VOLTS	PH		
HWB 1	FULTON EDR-1500	NATURAL GAS	1500	1400	95	4-28"	140	110	90	10	20	115	1	3500	CONDENSATE NEUTRALIZATION TRAP
HWB 2	FULTON EDR-1500	NATURAL GAS	1500	1400	95	4-28"	140	110	90	10	20	115	1	3500	CONDENSATE NEUTRALIZATION TRAP

POWER VENTILATOR SCHEDULE

TAG	BASIS OF DESIGN	TYPE	SERVES	CAPACITY, CFM	STATIC PRESS., IN. W.C.	MOTOR HP(AMPS) - V - PH	FAN SPEED RPM	SOUND POWER dBA	ON/OFF	INTERLOCK	APPROXIMATE OPERATING WEIGHT, LBS	REMARKS
EF 1	GREENHECK G-065-VG	DIRECT DRIVE CENTRIFUGAL ROOF EXHAUST	ROOM A161,A162	150	0.125	1/6 - 115 - 1	1195	39	EMCS	--	21	EC MOTOR, FACTORY WIRED DISCONNECT, ROOF CURB, BIRDSCREEN
EF 2	GREENHECK G-060-VG	DIRECT DRIVE CENTRIFUGAL ROOF EXHAUST	ROOM A140	50	0.125	1/6 - 115 - 1	970	33	EMCS	--	20	EC MOTOR, FACTORY WIRED DISCONNECT, ROOF CURB, BIRDSCREEN
EF 3	GREENHECK G-065-VG	DIRECT DRIVE CENTRIFUGAL ROOF EXHAUST	ROOM A120,A121	150	0.15	1/6 - 115 - 1	1254	40	EMCS	--	21	EC MOTOR, FACTORY WIRED DISCONNECT, ROOF CURB, BIRDSCREEN
EF 4	GREENHECK G-090-VG	DIRECT DRIVE CENTRIFUGAL ROOF EXHAUST	ROOM A108,A109,A110	490	0.20	1/6 - 115 - 1	1262	49	EMCS	--	26	EC MOTOR, FACTORY WIRED DISCONNECT, ROOF CURB, BIRDSCREEN
EF 5	GREENHECK G-143-VG	DIRECT DRIVE CENTRIFUGAL ROOF EXHAUST	ROOM - B336,B339	1,750	0.30	1/2 - 115 - 1	1088	59	EMCS	--	52	EC MOTOR, FACTORY WIRED DISCONNECT, ROOF CURB, BIRDSCREEN
EF 6	GREENHECK G-099-VG	DIRECT DRIVE CENTRIFUGAL ROOF EXHAUST	GENERAL EXHAUST	780	0.50	1/4 - 115 - 1	1417	58	EMCS	--	37	EC MOTOR, FACTORY WIRED DISCONNECT, ROOF CURB, BIRDSCREEN
EF 7	GREENHECK G-090-VG	DIRECT DRIVE CENTRIFUGAL ROOF EXHAUST	ROOM - B247	400	0.20	1/6 - 115 - 1	1125	47	EMCS	--	26	EC MOTOR, FACTORY WIRED DISCONNECT, ROOF CURB, BIRDSCREEN
EF 8	GREENHECK VEKTOR-H-10-5	MIXED DILUTION	ROOM - B234 LAB	500	1.0	3/4 - 460 - 3	2468	66	FUME HOOD ON/OFF SWITCH	--	410	UL705, L10-250K BEARINGS, AMCA "C" SPARK RESISTANT, OPERATED DAMPERS, INDIVIDUAL FAN MOTOR OPERATED ISOLATION DAMPERS. NEMA 3R DISCONNECT MOUNTED AND WIRED, A BELT DRIVE AND MOTOR COVER. ISOLATION AND BY-PASS DAMPER SHALL BE COMPLETE WITH DAMPERS OPERATORS. TRANSFORMERS ETC. AND ALL OTHER ITEMS REQUIRED TO INTERFACE WITH BUILDING CONTROL SYSTEM. POWER FOR CONTROL TRANSFORMER SHALL BE TAKEN FROM FAN POWER SERVICE. PROVIDE AIR FLOW MONITORING STATION ON EACH FAN ACCURATE TO WITHIN ±2%, CAPABLE OF INTERFACING WITH EMCS AND WITH A DIRECT READOUT AT FAN. GREENHECK SURE-AIR OR EQUAL
RF 1	GREENHECK GB-360HP-75	BELT DRIVEN CENTRIFUGAL DOWNBLAST	BUILDING PRESSURE RELIEF	12,500	1.50	7.5 - 460 - 3	792	75	EMCS	BUILDING PRESSURE RELIEF	350	ROOF CURB W/DAMPER TRAY, VFD RATED MOTOR, FACTORY WIRED DISCONNECT, MOTORIZED BACK-DRAFT DAMPER
RF 2	GREENHECK GB-360HP-75	BELT DRIVEN CENTRIFUGAL DOWNBLAST	BUILDING PRESSURE RELIEF	12,500	1.50	7.5 - 460 - 3	792	75	EMCS	BUILDING PRESSURE RELIEF	350	ROOF CURB W/DAMPER TRAY, VFD RATED MOTOR, FACTORY WIRED DISCONNECT, MOTORIZED BACK-DRAFT DAMPER
SEF 1	GREENHECK CUBE-480-75	BELT DRIVEN CENTRIFUGAL UPBLAST	LOBBY SMOKE CONTROL	25,000	0.75	7.5 - 460 - 3	481	72	EMCS	SMOKE DAMPER	485	DISCONNECT, GRAVITY BACKDRAFT DAMPR, PRE-FAB ROOF CURB, BIRD SCREEN, MOTOR/BELT COVER, VFD RATED MOTOR.
SEF 2	GREENHECK CUBE-480-75	BELT DRIVEN CENTRIFUGAL UPBLAST	LOBBY SMOKE CONTROL	25,000	0.75	7.5 - 460 - 3	481	72	EMCS	MOTORIZED DAMPER, ENTRY DOORS	485	DISCONNECT, GRAVITY BACKDRAFT DAMPR, PRE-FAB ROOF CURB, BIRD SCREEN, MOTOR/BELT COVER, VFD RATED MOTOR.
SEF 3	GREENHECK CUBE-480-75	BELT DRIVEN CENTRIFUGAL UPBLAST	LOBBY SMOKE CONTROL	25,000	0.75	7.5 - 460 - 3	481	72	EMCS	MOTORIZED DAMPER, ENTRY DOORS	485	DISCONNECT, GRAVITY BACKDRAFT DAMPR, PRE-FAB ROOF CURB, BIRD SCREEN, MOTOR/BELT COVER, VFD RATED MOTOR.
SEF 4	GREENHECK CUBE-480-75	BELT DRIVEN CENTRIFUGAL UPBLAST	LOBBY SMOKE CONTROL	25,000	0.75	7.5 - 460 - 3	481	72	EMCS	MOTORIZED DAMPER, ENTRY DOORS	485	DISCONNECT, GRAVITY BACKDRAFT DAMPR, PRE-FAB ROOF CURB, BIRD SCREEN, MOTOR/BELT COVER, VFD RATED MOTOR.
SEF 5	GREENHECK CUBE-480-75	BELT DRIVEN CENTRIFUGAL UPBLAST	LOBBY SMOKE CONTROL	25,000	0.75	7.5 - 460 - 3	481	72	EMCS	MOTORIZED DAMPER, ENTRY DOORS	485	DISCONNECT, GRAVITY BACKDRAFT DAMPR, PRE-FAB ROOF CURB, BIRD SCREEN, MOTOR/BELT COVER, VFD RATED MOTOR.
SEF 6	GREENHECK CUBE-480-75	BELT DRIVEN CENTRIFUGAL UPBLAST	LOBBY SMOKE CONTROL	25,000	0.75	7.5 - 460 - 3	481	72	EMCS	MOTORIZED DAMPER, ENTRY DOORS	485	DISCONNECT, GRAVITY BACKDRAFT DAMPR, PRE-FAB ROOF CURB, BIRD SCREEN, MOTOR/BELT COVER, VFD RATED MOTOR.

(VRF) SPLIT SYSTEM HEAT PUMP EQUIPMENT SCHEDULE

SYSTEM NO.	OUTDOOR UNIT: MANUFACTURER AND MODEL NO.	AMBIENT TEMPERATURE: SUMMER °Fdb - °Fwb	AMBIENT TEMPERATURE: WINTER °Fdb - °Fwb	CAPACITY, MBH: COOLING	CAPACITY, MBH: HEATING	ELECTRICAL DATA: VOLTAGE-PHASE	ELECTRICAL DATA: MCA, AMPS	ELECTRICAL DATA: MOCP, AMPS	ELECTRICAL DATA: CRANKCASE HEATER, WATTS	ELECTRICAL DATA: UNIT RLA COOLING	ELECTRICAL DATA: UNIT RLA HEATING	UNIT OPERATING WEIGHT
OU 1	MITSUBISHI PUMY-P48NHMU	95.0 75.0	47.0 43.0	48.0	54.0	208 - 1	26	40	--	--	--	290

INDOOR UNIT (AIR HANDLING UNIT)																	
TAG	SERVES	TYPE	BASIS OF DESIGN	INDOOR AIR TEMP.: SUMMER °Fdb °Fwb	INDOOR AIR TEMP.: WINTER °Fdb	MIN. CAPACITY, MBH: COOLING	MIN. CAPACITY, MBH: HEATING	ELECTRICAL DATA: VOLTAGE-PHASE	ELECTRICAL DATA: MCA, AMPS	ELECTRICAL DATA: MOCP, AMPS	FAN: AIRFLOW, CFM LOW	FAN: AIRFLOW, CFM HIGH	FINAL PIPING RUNOUT SIZE: RL(IN)	FINAL PIPING RUNOUT SIZE: RS(IN)	REMARKS
IU-1.1	B341 COMMUNICATION	CEILING CASSETTE	MITSUBISHI PMFY-P06NBMU-ER5	80.0 - 67.0	70.0	6.0	6.7	208 - 1	0.25	15	230	300	1/4	1/2	R410A REFRIGERANT, INTEGRAL CONDENSATE PUMP
IU-1.2	B342 ELECTRICAL	CEILING CASSETTE	MITSUBISHI PMFY-P06NBMU-ER5	80.0 - 67.0	70.0	6.0	6.7	208 - 1	0.25	15	230	300	1/4	1/2	R410A REFRIGERANT, INTEGRAL CONDENSATE PUMP
IU-1.3	B343 FIRE RISER	CEILING CASSETTE	MITSUBISHI PMFY-P06NBMU-ER5	80.0 - 67.0	70.0	6.0	6.7	208 - 1	0.25	15	230	300	1/4	1/2	R410A REFRIGERANT, INTEGRAL CONDENSATE PUMP
IU-1.4	B248 ELECTRICAL	CEILING CASSETTE	MITSUBISHI PMFY-P06NBMU-ER5	80.0 - 67.0	70.0	6.0	6.7	208 - 1	0.25	15	230	300	1/4	1/2	R410A REFRIGERANT, INTEGRAL CONDENSATE PUMP
IU-1.5	B249a COMMUNICATION	CEILING CASSETTE	MITSUBISHI PMFY-P06NBMU-ER5	80.0 - 67.0	70.0	6.0	6.7	208 - 1	0.25	15	230	300	1/4	1/2	R410A REFRIGERANT, INTEGRAL CONDENSATE PUMP
IU-1.6	B250 FIRE RISER	CEILING CASSETTE	MITSUBISHI PMFY-P06NBMU-ER5	80.0 - 67.0	70.0	6.0	6.7	208 - 1	0.25	15	230	300	1/4	1/2	R410A REFRIGERANT, INTEGRAL CONDENSATE PUMP
IU-1.7	B249b COMMUNICATION	CEILING CASSETTE	MITSUBISHI PMFY-P06NBMU-ER5	80.0 - 67.0	70.0	6.0	6.7	208 - 1	0.25	15	230	300	1/4	1/2	R410A REFRIGERANT, INTEGRAL CONDENSATE PUMP

DUCTLESS SPLIT SYSTEM AIR CONDITIONING UNIT SCHEDULE

INDOOR UNIT: TAG	BASIS OF DESIGN	SERVES	TOTAL COOLING CAP. BTUH	HEATING CAPACITY-BTUH (47'DB/43'WB OAT)	AIR DELIVERY: LOW	AIR DELIVERY: MED.	AIR DELIVERY: HIGH	FAN MOTORS: FLA - V - PH	AUXILLIARY HEAT (KW)	MIN. CIRCUIT AMPACITY, AMPS	MOCP, AMPS	INDOOR UNIT OPERATING WEIGHT, LBS.
DSS 1	MITSUBISHI MSZ-GE12NA-8	B104 WEAPONS VAULT	12,000	14,400	170	237	320	0.76 - 208 - 1	--	1.0	15.0	22
DSS 2	MITSUBISHI MSZ-GE12NA-8	B105 SPECIAL OPS EQUIPMENT	12,000	14,400	170	237	320	0.76 - 208 - 1	--	1.0	15.0	22
DSS 3	MITSUBISHI MSZ-GE12NA-8	BXXX ELECTRICAL ROOM	12,000	14,400	170	237	320	0.76 - 208 - 1	--	1.0	15.0	22

OUTDOOR UNIT: TAG	BASIS OF DESIGN	COMPRESSOR(S): NO.	COMPRESSOR(S): V - PH	CONDENSER FANS: NO.	CONDENSER FANS: FLA	CONDENSER FANS: V - PH	MIN. CIRCUIT AMPACITY, AMPS	MOCP, AMPS	AMBIENT TEMPERATURE: °Fdb	AMBIENT TEMPERATURE: °Fwb	OUTDOOR UNIT OPERATING WEIGHT, LBS.	REMARKS
DSS 1	MUZ-GE12NA	1	208 - 1	1	0.50	208 - 1	12.0	15.0	95.0	75.0	77	MOUNT OUTDOOR/INDOOR WALL UNIT AT 8'-0" AFF. PROVIDE WALL MOUNTING BRACKET FOR OUTDOOR UNIT.
DSS 2	MUZ-GE12NA	1	208 - 1	1	0.50	208 - 1	12.0	15.0	95.0	75.0	77	MOUNT OUTDOOR/INDOOR WALL UNIT AT 8'-0" AFF. PROVIDE WALL MOUNTING BRACKET FOR OUTDOOR UNIT.
DSS 3	MUZ-GE12NA	1	208 - 1	1	0.50	208 - 1	12.0	15.0	95.0	75.0	77	MOUNT OUTDOOR/INDOOR WALL UNIT AT 8'-0" AFF. PROVIDE WALL MOUNTING BRACKET FOR OUTDOOR UNIT.

CITY OF HATTIESBURG MISSISSIPPI 1884

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

Drawing Issued:

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Checked By: CM,TP
Client No: -------
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RICHARD E. MOORE REGISTERED ENGINEER 20102 1/13/2017 STATE OF MISSISSIPPI

M6.3

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VARIABLE FREQUENCY DRIVE (VFD) SCHEDULE

SERVES	MANUFACTURER AND MODEL NO.	ELECTRICAL VOLTS–PH	ELECTRICAL HP	REMARKS	SERVES
CHP 1	YASKAWA	460–3	15	NEMA–1 ENCLOSURE, BYPASS, FIELD MOUNTED	CHP 1
CHP 2	YASKAWA	460–3	15	NEMA–1 ENCLOSURE, BYPASS, FIELD MOUNTED	CHP 2
HWP 1	YASKAWA	460–3	7.5	NEMA–1 ENCLOSURE, BYPASS, FIELD MOUNTED	HWP 1
HWP 2	YASKAWA	460–3	7.5	NEMA–1 ENCLOSURE, BYPASS, FIELD MOUNTED	HWP 2
AHU 1 SUPPLY FAN	TRANE	460–3	3.5	FACTORY MOUNTED IN CONTROLS SECTION, BYPASS	AHU 1 SUPPLY FAN
AHU 1 RELIEF FAN	TRANE	460–3	3.5	FACTORY MOUNTED IN CONTROLS SECTION, BYPASS	AHU 1 RELIEF FAN
AHU 2 SUPPLY FAN	TRANE	460–3	5.5	FACTORY MOUNTED IN CONTROLS SECTION, BYPASS	AHU 2 SUPPLY FAN
AHU 2 RELIEF FAN	TRANE	460–3	3.5	FACTORY MOUNTED IN CONTROLS SECTION, BYPASS	AHU 2 RELIEF FAN
AHU 3 SUPPLY FAN	TRANE	460–3	25.0	NEMA–1 ENCLOSURE, BYPASS, FACTORY MOUNTED	AHU 3 SUPPLY FAN
AHU 4 SUPPLY FAN	TRANE	460–3	20.0	NEMA–1 ENCLOSURE, BYPASS, FACTORY MOUNTED	AHU 4 SUPPLY FAN
AHU 5 SUPPLY FAN	TRANE	460–3	8.0	FACTORY MOUNTED IN CONTROLS SECTION, BYPASS	AHU 5 SUPPLY FAN
AHU 5 RELIEF FAN	TRANE	460–3	5.5	FACTORY MOUNTED IN CONTROLS SECTION, BYPASS	AHU 5 RELIEF FAN
AHU 6 SUPPLY FAN	TRANE	460–3	10.0	FACTORY MOUNTED IN CONTROLS SECTION, BYPASS	AHU 6 SUPPLY FAN
AHU 6 RELIEF FAN	TRANE	460–3	7.5	FACTORY MOUNTED IN CONTROLS SECTION, BYPASS	AHU 6 RELIEF FAN
RF 1	YASKAWA	460–3	7.5	NEMA–1 ENCLOSURE, BYPASS, FIELD MOUNTED	RF 1
RF 2	YASKAWA	460–3	7.5	NEMA–1 ENCLOSURE, BYPASS, FIELD MOUNTED	RF 2
SEF 1	YASKAWA	460–3	7.5	NEMA–3 ENCLOSURE, BYPASS, FIELD MOUNTED	SEF 1
SEF 2	YASKAWA	460–3	7.5	NEMA–3 ENCLOSURE, BYPASS, FIELD MOUNTED	SEF 2
SEF 3	YASKAWA	460–3	7.5	NEMA–3 ENCLOSURE, BYPASS, FIELD MOUNTED	SEF 3
SEF 4	YASKAWA	460–3	7.5	NEMA–3 ENCLOSURE, BYPASS, FIELD MOUNTED	SEF 4
SEF 5	YASKAWA	460–3	7.5	NEMA–3 ENCLOSURE, BYPASS, FIELD MOUNTED	SEF 5
SEF 6	YASKAWA	460–3	7.5	NEMA–3 ENCLOSURE, BYPASS, FIELD MOUNTED	SEF 6
EF 8	YASKAWA	460–3	3/4	NEMA–1 ENCLOSURE, BYPASS, FIELD MOUNTED	EF 8

AIR DISTRIBUTION DEVICE SCHEDULE

TAG	BASIS OF DESIGN	DESCRIPTION	FACE SIZE	MOUNT	DAMPER	FINISH	PATTERN	REMARKS	TAG
LD	PRICE TBD4	LINEAR SLOT DIFFUSER	48" x 6"	LAY–IN	––	WHITE	2 WAY	THREE(3) 1" SLOT – HORIZONTAL THROW, PROVIDE INSULATED ENGINEERED PLENUM	LD
LDR	PRICE JS	LINEAR JET SLOT RETURN DIFFUSER	144" x 6"	LAY–IN	––	WHITE	100% OPEN	TWO(2) 1" SLOT – 100% OPEN	LD
SCD	PRICE SCD	SQUARE CONE DIFFUSER	24" x 24"	LAY–IN	––	WHITE	SEE PLAN		SCD
SCD–1	PRICE SCD	SQUARE CONE DIFFUSER	12" x 12"	LAY–IN	––	WHITE	SEE PLAN		SCD–1
SCD–2	PRICE SCD	SQUARE CONE DIFFUSER	12" x 12"	SURFACE	––	WHITE	SEE PLAN		SCD–2
SCD–3	PRICE SCD	SQUARE CONE DIFFUSER	24" x 24"	SURFACE	FACE OPERATED	WHITE	SEE PLAN		SCD–3
WSR	PRICE 620	LOUVERED SUPPLY	VARIES	SURFACE	FACE OPERATED	WHITE	DOUBLE DEFLECTION	FRONT BLADES PARALLEL TO SHORT DIMENSION AND 22.5° DEFLECTION.	WSR
CRG	PRICE 80	EGG CRATE RETURN GRILLE	24" x 24"	LAY–IN	––	WHITE	––		CRG
CRG–1	PRICE 80	EGG CRATE RETURN GRILLE	24" x 12"	LAY–IN	––	WHITE	––		CRG–1
CRG–2	PRICE 80	EGG CRATE RETURN GRILLE	24" x 24"	SURFACE	––	WHITE	––		CRG–2
CRG–3	PRICE 80	EGG CRATE RETURN GRILLE	24" x 12"	SURFACE	––	WHITE	––		CRG–3
WRG	PRICE 96	HEAVY DUTY GYM GRILLE	VARIES	SURFACE	FACE OPERATED	WHITE	45° DEFLECTION	FRONT BLADES PARALLEL TO SHORT DIMENSION. MOUNT GRILLE 8" ABOVE FINISHED FLOOR.	WRG
WRG–1	PRICE 530	LOUVERED RETURN	VARIES	SURFACE	FACE OPERATED	WHITE	45° DEFLECTION	FRONT BLADES PARALLEL TO SHORT DIMENSION.	WRG–1
CER	PRICE 80	EGG CRATE EXHAUST GRILLE	12" x 12"	LAY–IN	––	WHITE	––		CER
CER–1	PRICE 80	EGG CRATE EXHAUST GRILLE	24" x 12"	LAY–IN	––	WHITE	––		CER–1
CER–2	PRICE 80	EGG CRATE EXHAUST GRILLE	12" x 12"	SURFACE	––	WHITE	––		CER

WALL LOUVER SCHEDULE

TAG	BASIS OF DESIGN	LOCATION	SERVES	CAPCITY, CFM	MINIMUM FREE AREA, FT²	MAXIMUM P.D., IN. W.G.	OVERALL SIZE, WxH, IN.	REMARKS
LVR 1	GRENHECK EHH–601	MECHANICAL ROOM B401	AHU 3	18,500	18.5	0.21	64 x 84	BAKED ENAMEL FINISH IN COLOR SELECTED BY ARCHITECT, BIRDSCREEN
LVR 2	GRENHECK EHH–601	MECHANICAL ROOM B401	AHU 4	13,500	18.5	0.11	64 x 84	BAKED ENAMEL FINISH IN COLOR SELECTED BY ARCHITECT, BIRDSCREEN
LVR 3	GRENHECK EHH–601	MECHANICAL SPACE B258	SMOKE EVACUATION FANS	100,000	102.2	0.19	240 x 120	BAKED ENAMEL FINISH IN COLOR SELECTED BY ARCHITECT, BIRDSCREEN

COMPUTER ROOM AIR–CONDITIONING UNIT (INDOOR UNIT) SCHEDULE (PART 1 OF 2)

TAG	MANUFACTURER AND MODEL NO.	SERVES	TYPE	FAN TOTAL CFM	FAN OA CFM	FAN ESP TSP	FAN (NO.)HP	FAN VOLT/PH	CHILLED WATER COOLING CAPACITY EDB EWB	LDB LWB	APD	GPM	EWT	LWT	WPD	CAPACITY (MBH) TOTAL	CAPACITY (MBH) SENS	ROWS FPI	DX COOLING COIL OA TEMP	DX COOLING COIL EDB EWB	LDB LWB	CAPACITY (MBH) TOTAL	CAPACITY (MBH) SENS	HOT WATER HEATING CAPACITY EDB	LDB	APD	GPM	EWT	LWT	WPD	CAPACITY TOTAL (MBH)	ROWS FPI	HUMIDIFIER TYPE	CAPACITY (LBS/HR)	KW	CONTINUED BELOW	TAG
CRC 1	DATA AIRE GTAU–00734–C	COMP. MAINT. RM B333	VERTICAL UPFLOW	1000	–0–	0.500 ––	(1)1.30	460/3	72.0 60.0	49.9 49.8	––	9.6	45.0	50.7	7.00	27.6	24.0	4 12	95	72.0 60.0	53.1 51.0	28.1	23.7	60.0	79.0	––	1.0	140	100	10.0	20.5	4 12	STEAM	10.0	3.4		CRC 1
CRC 2	DATA AIRE GTAU–01834–C	MAIN COMP. RM B327	VERTICAL UPFLOW	2500	–0–	0.500 ––	(1)1.30	460/3	72.0 60.0	52.6 51.8	––	17.5	45.0	52.7	20.1	68.0	64.2	4 12	95	72.0 60.0	53.6 52.5	63.0	61.1	60.0	75.2	––	2.0	140	100	10.0	40.9	4 12	STEAM	10.0	3.4		CRC 2

COMPUTER ROOM AIR–CONDITIONING UNIT (INDOOR UNIT) SCHEDULE (PART 2 OF 2)

TAG	MANUFACTURER AND MODEL NO.	SERVES	TYPE	CABINET DIMENSIONS DEPTH	LENGTH	HEIGHT	FILTER DATA TYPE	DEPTH	MERV	ELECTRICAL MCA	MOP	OP WT (LBS)	REMARKS	TAG
CRC 1	DATA AIRE GTAU–00734–C	COMP. MAINT. RM B333	VERTICAL UPFLOW	40.5	36.0	102.0	PLEATED	4	8	11.3	15.0	850	INTEGRAL CONDENSATE PUMP, FACTORY MOUNTED DISCONNECT, 3–WAY CHILLED AND HOT WATER VALVES, DISCHARGE PLENUM	CRC 1
CRC 2	DATA AIRE GTAU–01834–C	MAIN COMP. RM B327	VERTICAL UPFLOW	40.5	36.0	102.0	PLEATED	4	8	11.3	15.0	950	INTEGRAL CONDENSATE PUMP, FACTORY MOUNTED DISCONNECT, 3–WAY CHILLED AND HOT WATER VALVES, DISCHARGE PLENUM	CRC 2

COMPUTER ROOM AIR–CONDITIONING UNIT (OUTDOOR UNIT) SCHEDULE

TAG	MANUFACTURER AND MODEL NO	SERVES	NOM TONS	REFR TYPE	ELECTRICAL FLA	MCA	MOCP	VOLT/PH	OP WT (LBS)	REMARKS
CU 1	DATA AIRE GHRC–01134	CRC–1	2	410A	1.7	2.2	15	460/3	200	REMOTE CONDENSER, EC FAN MOTOR
CU 2	DATA AIRE GHRC–01834	CRC–2	5	410A	1.7	2.2	15	460/3	240	REMOTE CONDENSER, EC FAN MOTOR

CITY OF HATTIESBURG MISSISSIPPI 1884

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

Drawing Issued:

Date	Rev	Description
08-31-2015		DD Check Set
10-20-2015		75% Progress Set
11-02-2015		90% Pricing Set
11-19-2018		100% Bid Docs

Drawn By: DB,CM
Checked By: CM,TP
Client No: -------
Albert & Associates: 12575

RICHARD E. MOORE REGISTERED ENGINEER 20102 1/13/2017 STATE OF MISSISSIPPI

M6.□

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ERG# 15-28.2

CONTROL POINTS

Points List Table Column Definitions:

1. Point Description.
2. Type (number in point list schedule after each type refers to tag on schematics).
   - 2.1. AO: analog output
   - 2.2. AI: analog input
   - 2.3. DO: digital or binary output
   - 2.4. DI: digital or binary input
3. Device description.
   - 3.1. See Specification Section 230913 EMCS Basic Materials and Devices for device definitions and specifications.
4. Trend Logging.
   - 4.1. Commissioning: Where listed, point is to be trended at the basis listed for commissioning and performance verification purposes.
   - 4.2. Continuous: Where listed, point is to be trended at the basis listed continuously, initiated after system acceptance, for the purpose of future diagnostics.
   - 4.3. Trend Basis
     - 4.3.1. Where range of engineering units is listed, trend on a change of value (COV) basis (in other words record time stamp and value when point value changes by engineering unit listed).
     - 4.3.2. Where time interval is listed, trend on a time basis (in other words record time stamp and value at interval listed). All points related to a specific piece of equipment shall be trended at the same initiation time of day so data can be compared in text format.
5. Calibration.
   - 5.1. F = factory calibration only is required (no field calibration)
   - 5.2. HH = field calibrate with handheld device. Test/calibration equipment shall be at least twice as accurate as respective field device (for example if field device is ±0.5% accurate, test equipment shall be ±0.25% accurate over same range).

Note that points lists herein are for each system of like kind. Refer to Drawings for quantity of each.

SEQUENCES OF OPERATION – GENERAL

1. General:
   - 1.1. Contractor shall review sequences prior to programming and suggest modifications where required to achieve the design intent. Contractor may also suggest modifications to improve performance and stability or to simplify or reorganize logic in a manner that provides equal or better performance. Proposed changes in sequences shall be included as a part of Submittal Package 2.
   - 1.2. Include costs for program modifications if required to provide proper performance of the system.
   - 1.3. Unless otherwise indicated in SOOs, control loops shall be enabled and disabled based on the status of the system being controlled to prevent wind-up. Loops shall be initiated with the output set to a neutral (deadband) condition, e.g. valves and dampers close, VFDs at minimum speed, etc.
   - 1.4. When SOOs use outdoor air temperature present value and there are multiple outdoor air sensors, the physically closest sensor reading shall be used.
   - 1.5. The term "proven" (i.e. "proven on" / "proven off") shall mean that the equipment's DI status point matches the state set by the equipment's DO command point.
   - 1.6. The term "PID loop" or "control loop" is used generically for all control loops and shall not be interpreted as requiring proportional plus integral plus derivative gains on all loops. Unless specifically indicated otherwise, the following guidelines shall be followed:
     - 1.6.1. Use proportional only (P-only) loops for limiting loops (such as zone CO2 limiting loops, etc.) to ensure there is no integral windup.
     - 1.6.2. Do not use the derivative term on any loops unless field tuning is not possible without it.
   - 1.7. All setpoints, timers, deadbands, PID gains, etc. listed in sequences shall be capable of being adjusted by the operator (with full administrative access) without having to access programming whether indicated as adjustable in sequences or not. Software (virtual) points shall be used for these setpoints. Fixed scalar numbers shall not be imbedded in programs unless the value will never need to be adjusted.
   - 1.8. Values for all points, including real (hardware) points used in control sequences shall be capable of being overridden by the user (e.g. for testing and commissioning). If hardware design prevents this for hardware points, they shall be equated to a software point and the software point shall be used in all sequences. Exception: Not required for ASC hardware points.
   - 1.9. VFD speed points:
     - 1.9.1. The speed analog output sent to VFDs shall be configured such that 0% speed corresponds to 0 HZ and 100% speed corresponds to maximum speed configured in the VFD.
     - 1.9.2. Minimum speed setpoints for all VFD-driven equipment shall be determined in accordance with the following:
       - 1.9.2.1. Tests shall be done for each piece of equipment, except that for multiple pieces of identical equipment used for identical applications, only one piece of equipment need be tested with results applied to all. Note that for fans, there is no minimum speed required for motor cooling. Power drops with cube of speed, causing motor losses to be minimal at low speeds.
       - 1.9.2.2. The work shall be done only after fan system is fully installed and operational.
       - 1.9.2.3. Determine minimum speed setpoint as follow:
         - 1.9.2.3.1. Start the fan.
         - 1.9.2.3.2. Manually set speed to 6 Hz (10%) unless otherwise indicated in control sequences. For cooling towers with gear boxes, use 20% or whatever minimum speed is recommended by tower manufacturer.
         - 1.9.2.3.3. Observe fan in field to ensure it is visibly rotating. If not, gradually increase speed until it is.
         - 1.9.2.3.4. The speed at this point shall be the minimum speed setpoint for this piece of equipment.
         - 1.9.2.3.5. Record minimum speeds in log and store in software point as indicated in Specifications.
     - 1.9.3. For each piece of equipment the minimum speed shall be stored in a single software point. This value shall be written to the VFD's minimum speed setpoint via the drive's network interface. In this way there is only one minimum setpoint, rather than setpoints both in the drive and in software which could differ.
   - 1.10. Trim & Respond Setpoint Reset Logic:
     - 1.10.1. Trim & Respond setpoint reset logic and zone/system reset requests where referenced in sequences shall be implemented as described below.
     - 1.10.2. "Requests" are pressure, cooling, or heating setpoint reset requests generated by zones or air handling systems.
       - 1.10.2.1. For each zone or system, and for each setpoint reset request type listed for the zone/system, provide he following software points:
         - 1.10.2.1.1. Importance Multiplier (default = 1). This point is used to scale the number of requests the zone/system is generating. A value of zero causes the zone/system's requests to be ignored. A value greater than zero can be used to effectively increase the number of requests from the zone/system based on the critical nature of the spaces served, or to increase the requests beyond the number of ignored requests (defined below) in the Trim & Respond reset block.
         - 1.10.2.1.2. Request-hours:
           - 1.10.2.1.2.1. This point accumulates the integral of requests (prior to adjustment of Importance Multiplier) to help identify zones/systems that are driving the reset logic. Every x minutes (adjustable, default 5 minutes), add x/60 times the current number of requests to this request-hours accumulator point.
           - 1.10.2.1.2.2. The request-hours point is reset to zero upon a global command from the system serving the zone/system – this global point simultaneously resets the request-hours point for all zones/systems served by this system/plant.
           - 1.10.2.1.2.3. Cumulative %-request-hours is the zone request-hours divided by the zone run-hours (the hours in any Mode other than Unoccupied Mode) since the last reset, expressed as a percentage.
           - 1.10.2.1.2.4. A Level 4 alarm is generated if the zone Importance Multiplier is greater than zero, the zone %-request-hours exceeds 70%, and the total number of zone run-hours exceeds 40.
       - 1.10.2.2. See zone and air handling system control sequences for logic to generate requests.
       - 1.10.2.3. Multiply the number of requests determined from zone/system logic times the Importance Multiplier and send to the system/plant that serves the zone/system. See system/plant logic to see how requests are used in Trim & Respond logic.
     - 1.10.3. Variables. All variables below shall be adjustable from a reset graphic accessible from a hyperlink on the associated system/plant graphic. Initial values are defined in system/plant sequences herein. Values from trim, respond, time step, etc. shall be tuned to provide stable control.

Variable	Definition
Device	Associated device (e.g. fan)
SP0	Initial setpoint
SPmin	Minimum setpoint
SPmax	Maximum setpoint
Td	Delay timer
T	Time step
I	Number of ignored requests
R	Number of requests from zones/systems
SPtrim	Trim amount
SPres	Respond amount
SPres–max	Maximum response per time interval

     - 1.10.4. Trim & Respond logic shall reset setpoint within the range SPmin to SP max. When the associated device is off, the setpoint shall be SP0. The reset logic shall be active while the associated device is proven on, starting Td after initial device start command. When active, every time step T, trim the setpoint by SPtrim. If there are more than I Requests, respond by changing the setpoint by SPres times (R – I), i.e. (the number of Requests minus the number of Ignored requests). But the net response shall be no more than SPres–max. The sign of SPtrim must be the opposite of SPres and SPres–max. For example, if SPtrim = –0.1, SPres = +0.15, SPres–max = +0.35, R = 3, I = 2, then each time step, the setpoint change = –0.1 + (3 – 2)*0.15 = +0.05. If R = 10, then setpoint change = –0.1 + (10 – 2)*0.15 = 1.1 but limited to a maximum of 0.35. If R = 2, the setpoint change is –0.1.
   - 1.11. Lead/lag and lead/standby alternation:
     - 1.11.1. Even wear:
       - 1.11.1.1. Lead/lag: Unless otherwise noted, parallel staged devices (such as fans, pumps, towers) shall be lead/lag alternated when more than one is off or more than one is on so that the device with the most operating hours is made the later stage device and the one with the least number of hours is made the earlier stage device. For example, assuming there are three devices, if all three are off or all are on, the staging order will simply be based on run hours from lowest to highest. If two devices are on, the one with the most hours will be set to be stage 2 while the other is set to stage 1; this may be the reverse of the operating order when the devices were started. If two devices are off, the one with the most hours will be set to be stage 3 while the other is set to stage 2; this may be the reverse of the operating order when the devices were stopped.
       - 1.11.1.2. Lead/standby: Unless otherwise noted, parallel devices (such as pumps, towers) that are 100% redundant shall be lead/standby alternated when more than one is off so that the device with the most operating hours is made the later stage device and the one with the least number of hours is made the earlier stage device. For example, assuming there are three devices, if all three are off, the staging order will be based on run hours from lowest to highest. If devices run continuously, lead/standby shall switch at an adjustable runtime; standby device shall first be started and proven on before former lead device is changed to standby and shut off.

SEQUENCES OF OPERATION – GENERAL CONT'D

   - 1.11.2. Exceptions:
     - 1.11.2.1. Operators shall be able to manual fix staging order via software points on graphics overriding the Even Wear logic above, but not overriding the Failure or Hand Operation logic below.
     - 1.11.2.2. Failure: If the lead device fails or has been manually switched off, the device shall be placed into high level alarm (Level 2) and set to the last stage position in the lead/lag order until alarm is reset by operator. Staging position of remaining devices shall follow the Even Wear logic. A failed device in alarm can only automatically move up in the staging order if another device fails. Note that a device in alarm will be commanded to run if the sequence calls for it to run. In this way the EMCS will keep trying to run device(s) until if finds enough that will operate. Failure is determined by:
       - 1.11.2.2.1. Variable Speed Fans and Pumps:
         - 1.11.2.2.1.1. VFD critical fault is ON.
         - 1.11.2.2.1.2. Status point not matching its on/off point for 15 seconds when device is commanded on.
         - 1.11.2.2.1.3. Supervised HOA at control panel is OFF position.
         - 1.11.2.2.1.4. Loss of power (e.g. VFD DC Bus voltage = zero).
       - 1.11.2.2.2. Constant Speed Fans and Pumps:
         - 1.11.2.2.2.1. Status point not matching its on/off point for 15 seconds when device is commanded on.
         - 1.11.2.2.2.2. Supervised HOA at control panel is OFF position.
     - 1.11.2.3. Hand Operation. If a device is on in Hand (for example via an HOA switch or local control of VFD), the device shall be set to the lead device and a low level alarm (Level 4) shall be generated. The device will remain as lead until the alarm is reset by the operator. Hand operation is determined by:
       - 1.11.2.3.1. Variable Speed Fans and Pumps:
         - 1.11.2.3.1.1. Status point not matching its on/off point for 15 seconds.
         - 1.11.2.3.1.2. VFD in local "hand" mode.
         - 1.11.2.3.1.3. Supervised HOA at control panel in ON position.
       - 1.11.2.3.2. Constant Speed Fans and Pumps:
         - 1.11.2.3.2.1. Status point not matching its on/off point for 15 seconds when device is commanded off.
         - 1.11.2.3.2.2. Supervised HOA at control panel in ON position.
   - 1.12. VAV Box Controllable Minimum:
     - 1.12.1. This section is used to determine the lowest possible VAV box airflow setpoint allowed by the controls (Vm) used in VAV box control sequences. The minimums shall be stored as software points that may be adjusted by the user but need not be adjustable via the graphical user interface.
     - 1.12.2. Option 1: If the VAV box controls simply stop moving the damper when the airflow reading becomes too low to register and then re-enables the damper when the airflow reading rises above that threshold, Vm shall be equal to zero.
     - 1.12.3. Option 2: The minimum setpoint Vm shall be determined as follows:
       - 1.12.3.1. Determine the velocity pressure sensor reading VPm in inches H20 that results in a digital reading from the transducer and A/D converter of 12 bits or counts (assuming a 10 bit A/D converter). This is considered sufficient resolution for stable control. See Specification Section 230929.
       - 1.12.3.2. Using the velocity pressure sensor amplification factor provided by the sensor manufacturer for each VAV box sensor size, calculate the minimum velocity vm for each VAV box size as:

$$vm = 4005*sqrt(VPm/F)$$

Where F is not known it can be calculated from the measured CFM at 1 inch signal from the VP sensor:

$$F = (4005*A/CFM)^2$$

where A is the nominal duct area (square feet), equal to:

$$A = \pi(D/24)^2$$

where D is the nominal duct diameter (inches).

       - 1.12.3.3. Calculate the minimum airflow setpoint allowed by the controls (Vm) for each VAV box size as:

$$Vm = vm*A$$

2. Zones:
   - 2.1. This section applies to all single zone systems and sub-zones of air handling systems, such as VAV boxes, fan-powered boxes, etc.
   - 2.2. Setpoints:
   - 2.3.
     - 2.3.1. Each zone shall have separate unoccupied and occupied setpoints, and separate heating and cooling setpoints. As a default:

Zone Type	Occupied		Unoccupied	
	Heat	Cool	Heat	Cool
Exterior	70°F	74°F	60°F	90°F
Interior	70°F	73°F	60°F	90°F
Circulation	69°F	76°F	60°F	90°F
Mech/Elec Rooms	60°F	85°F	60°F	85°F
Network/IT	65°F	75°F	65°F	75°F

     - 2.3.2. The software shall prevent:
       - 2.3.2.1. The heating setpoint from exceeding the cooling setpoint minus 1°F (in other words the minimum deadband shall be 1°F).
       - 2.3.2.2. The cooling setpoint from exceeding the occupied heating setpoint; and
       - 2.3.2.3. The unoccupied cooling setpoint from being less than the occupied cooling setpoint.
     - 2.3.3. Where the zone has a local occupant adjustable setpoint adjustment knob/button:
       - 2.3.3.1. The adjustment shall be capable of being limited in software.
         - 2.3.3.1.1. As a default, occupied cooling setpoint shall be limited between 72°F and 80°F.
         - 2.3.3.1.2. As a default, occupied heating setpoint shall be limited between 65°F and 72°F.
       - 2.3.3.2. The adjustment shall move both the existing heating and cooling setpoints upwards or downwards by the same amount unless the limit has been reached.
       - 2.3.3.3. The adjustment shall only be active in Occupied mode.
     - 2.3.4. The operative setpoint shall be determined by the Zone Group's mode:
       - 2.3.4.1. The setpoints shall be the occupied setpoint during Occupied mode, Warm-up mode, and Cool-down mode.
       - 2.3.4.2. The setpoints shall be the unoccupied setpoints during Unoccupied mode, Setback mode, and Setup mode.
     - 2.3.5. Hierarchy of Setpoint Adjustments: The following adjustment restrictions shall prevail in order from highest to lowest priority:
       - 2.3.5.1. Setpoint overlap restriction specified herein.
       - 2.3.5.2. Local setpoint adjustment.
       - 2.3.5.3. Scheduled setpoints based on Zone Group mode.
   - 2.4. Local override: When thermostat override buttons are depressed, the request for Occupied Mode operation shall be sent up to the Zone Group control for 60 minutes. (This will cause all zones in the Zone Group to operate in Occupied Mode to ensure that the system has adequate load to operate stably.)
   - 2.5. Control Loops:
     - 2.5.1. Two separate control loops shall operate to maintain space temperature at setpoint, the Cooling Loop and the Heating Loop. Both loops shall be continuously active.
     - 2.5.2. The Cooling Loop shall maintain the space temperature at the active cooling setpoint. The output of the loop shall be a virtual point ranging from 0% (no cooling) to 100% (full cooling).
     - 2.5.3. The Heating Loop shall maintain the space temperature at the active heating setpoint. The output of the loop shall be a virtual point ranging from 0% (no heating) to 100% (full heating).
     - 2.5.4. Loops shall use proportional + integral logic or fuzzy logic. Proportional-only control is not acceptable, although the integral gain shall be small relative to the proportional gain. P and I gains shall be adjustable from the Operator Workstation.
     - 2.5.5. See other sections for how the outputs from these loops are used.
   - 2.6. Zone Modes:
     - 2.6.1. Heating Mode: when the output of the space heating control loop is greater than zero.
     - 2.6.2. Cooling Mode: when the output of the space cooling control loop is greater than zero and the output of the heating loop is equal to zero.
     - 2.6.3. Deadband Mode: when not in either the Heating or Cooling Mode.

SEQUENCES OF OPERATION – GENERAL CONT'D

   - 2.7. Alarms:
     - 2.7.1. Zone temperature alarms:
       - 2.7.1.1. If the zone is 3°F above cooling or below heating setpoints for 10 minutes, generate Level 3 alarm.
       - 2.7.1.2. If the zone is 5°F above cooling or below heating setpoints for 10 minutes, generate Level 2 alarm.
       - 2.7.1.3. Suppress zone temperature alarms as follows:
         - 2.7.1.3.1. After zone setpoint is changed for a period of 10 minutes per degree of difference between the zone temperature at the time of the change and the new setpoint. This suppression period applies any time that the zone setpoint is changed.
         - 2.7.1.3.2. While Zone Group is in Warm-up or Cool-down Modes.
         - 2.7.1.3.3. For zones with an Importance multiplier (see Trim & Respond sequences above) of zero.
     - 2.7.2. For zones with CO2 sensors:
       - 2.7.2.1. If the CO2 concentration is less than 300 ppm, or the zone is in unoccupied mode for more than 2 hours and zone CO2 concentration exceeds 600 ppm, generate a Level 4 alarm, indicating sensor may be out of calibration.
       - 2.7.2.2. If the CO2 concentration exceeds setpoint plus 10% for more than 10 minutes generate a Level 3 alarm.
3. Zone Groups (aka Isolation Areas):
   - 3.1. Each system shall be broken into separate Zone Groups composed of a collection of one or more zones served by the air handling system.
   - 3.2. Each Zone Group shall have separate occupancy schedules and operating modes from other Zone Groups served by the air handling system. All zones in the Zone Group shall be in the same operating mode.
   - 3.3. Individual Zone Groups shall be as follows:

Zone Group Name	AHU Tag	Terminal Unit Tags	Default Schedule
Offices, Restrooms	AHU–1	VAV–1–1 thru VAV–1–20	WD: 6am to 8pm WE: 8 am to 10pm HOL: off
Classrooms	AHU–2	VAV–2–1 thru VAV–2–20	WD: 6am to 8pm WE: 8 am to 10pm HOL: off
Laboratories	AHU–3	VAV–3–1 thru VAV–3–20	WD: 6am to 8pm WE: 8 am to 10pm HOL: off

   - 3.4. Provide testing/commissioning software switches to override all zones served by the Zone Group. Provide a single software switch for each of the zone override switches listed under terminal box control above. When the Zone Group override switch value is changed, the terminal box zone override switch value for each zone in the Zone Group shall change to the same value. This only occurs when the switch changes value; the switch at each zone shall be capable of being changed to a different value from the Zone Group switch. These software switches are for commissioning and need not be shown on graphics.
   - 3.5. Zone Group Operating Modes: Each Zone Group shall have the following modes:
     - 3.5.1. Occupied Mode: A Zone Group is in the occupied mode when any of the following is true:
       - 3.5.1.1. The time of day is between the Zone Group's scheduled occupied start and stop times.
       - 3.5.1.2. Manual override from zone temperature sensor.
     - 3.5.2. Warm-up mode. Warm-up start time shall be determined based on the zone in the Zone Group whose space temperature is furthest below its occupied heating temperature setpoint, the outside air temperature (using global outdoor air temperature sensor, not any associated with AHUs), and a building mass/capacity factor. This factor shall be manually adjusted or self-tuned by the program based on internal trending so that all zones in the Zone Group are brought up to their occupied setpoint by the scheduled occupied start hour. The tuning period mode shall be turned on or off by a software switch (to allow tuning to be stopped after the system has been trained). Warm-up mode shall start no earlier than 3 hours before the scheduled occupied start hour and shall end at the scheduled occupied start hour. occupied start hour
     - 3.5.3. Cool-down mode. Cool-down shall be determined based on the zone in the Zone Group whose space temperature is furthest above its occupied cooling temperature setpoint, the outside air temperature (using global outdoor air temperature sensor, not any associated with AHUs), and a building mass/capacity factor. This factor shall be manually adjusted or self-tuned by the program based on internal trending so that all zones in the Zone Group are brought down to their occupied setpoint by the scheduled occupied start hour. The tuning period mode shall be turned on or off by a software switch (to allow tuning to be stopped after the system has been trained). Cool-down mode shall start no earlier than 3 hours before the scheduled occupied start hour and shall end at the scheduled occupied start hour.
     - 3.5.4. Setback mode. During other than normal mode, and warm-up mode, if any 2 (adjustable; set to all zones if there are fewer in Zone Group) zone(s) in the Zone Group falls 2°F below its active unoccupied setback setpoint, until all spaces in the Zone Group are above their active setback setpoints.
     - 3.5.5. Setup mode. During other than normal mode, warm-up mode, and setback mode, if any 2 (adjustable; set to all zones if there are fewer in Zone Group) zone(s) in the Zone Group rises 2°F above its active unoccupied setup setpoint until all spaces in the Zone Group are below their active setup setpoints.
     - 3.5.6. Unoccupied Mode: When the Zone Group is not in any other mode.
4. Air Handling Unit, Fan Coil Unit, Blower Coil Unit, Split-System Unit System Modes:
   - 4.1. AHU, FCU, BCU, and/or Split-System modes are the same as the mode of the Zone Groups served by the system. When Zone Groups served by an air handling system are in different modes, the following hierarchy applies (highest one sets AHU mode):
     - 4.1.1. Occupied mode.
     - 4.1.2. Cool-down mode.
     - 4.1.3. Setup mode.
     - 4.1.4. Warm-up mode.
     - 4.1.5. Setback mode.
     - 4.1.6. Unoccupied mode.
5. Miscellaneous Alarms:
   - 5.1. Points in Hand (Operator Override) via Workstation command (including name of operator who made the command) or via supervised HOA switch at output: Level 4.
   - 5.2. Equipment alarm (for equipment with alarm contacts such as VFDs): Level 2.
   - 5.3. Failure or disconnection of a sensor as indicated by signal widely out of range: Level 2.
   - 5.4. Panel or LAN failure: Level 2.
   - 5.5. Loss of communication with any device via Gateway (e.g. VFD) for more than 30 seconds: Level 2 (alarm shall indicate which specific device is not responding).

CONTROLS LEGEND

GENERAL

- SA — SUPPLY AIR
- OA — OUTSIDE/OUTDOOR AIR
- RA — RETURN AIR
- EA — EXHAUST AIR

EQUIPMENT

- 2–WAY VALVE
- 3–WAY VALVE
- SD — SMOKE DETECTOR
- FAN – PROPELLER
- FAN – CENTRIFUGAL HOUSED
- FAN – PLUG / PLENUM
- FURNACE
- FILTER
- AFMS–X — AIR FLOW MEASURING STATION
- C / C — COIL
- OPPOSED BLADE DAMPER
- PARALLEL BLADE DAMPER
- ENABLE / RUN / SPEED / NETWORK / VFD — VARIABLE SPEED DRIVE

SENSORS

- STATIC PRESSURE TIP
- SENSOR WELL
- T — TEMPERATURE SENSOR & SENSOR WELL
- HT–X / TS–X — HUMIDITY TRANSMITTER (HT) OR TEMPERATURE SENSOR (TS) – DUCT MTD. (SINGLE POINT)
- TS–X — AVERAGING TEMPERATURE SENSOR
- M — MODULATING ACTUATOR
- M2 — 2–POSITION ACTUATOR
- DPS–X — DIFFERENTIAL PRESSURE SWITCH
- DPT–X — DIFFERENTIAL PRESSURE TRANSMITTER
- FM–X — FLOW METER
- TS–X — TEMPERATURE SENSOR – WALL MTD.
- HT–X — HUMIDITY TRANSMITTER – WALL MTD.
- CO2–X — CARBON DIOXIDE SENSOR – WALL MTD.
- OCC — OCCUPANCY SENSOR
- CS — CURRENT SWITCH
- CT — CURRENT TRANSFORMER
- WLD–X — WATER LEAK DETECTOR
- RC — VARIABLE REFRIGERANT FLOW SYSTEM INDOOR UNIT REMOTE CONTROLLER

CONTROLS LEGEND

- DIGITAL POINT — DO — HARDWIRED DIGITAL OUTPUT (DO) OR DIGITAL INPUT (DI)
- ANALOG POINT — AO — HARDWIRED ANALOG OUTPUT (AO) OR ANALOG INPUT (AI)
- NETWORK CONNECTION BETWEEN CONTROLLER AND DEVICE — NETWORK

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HPSC Police and Court Building

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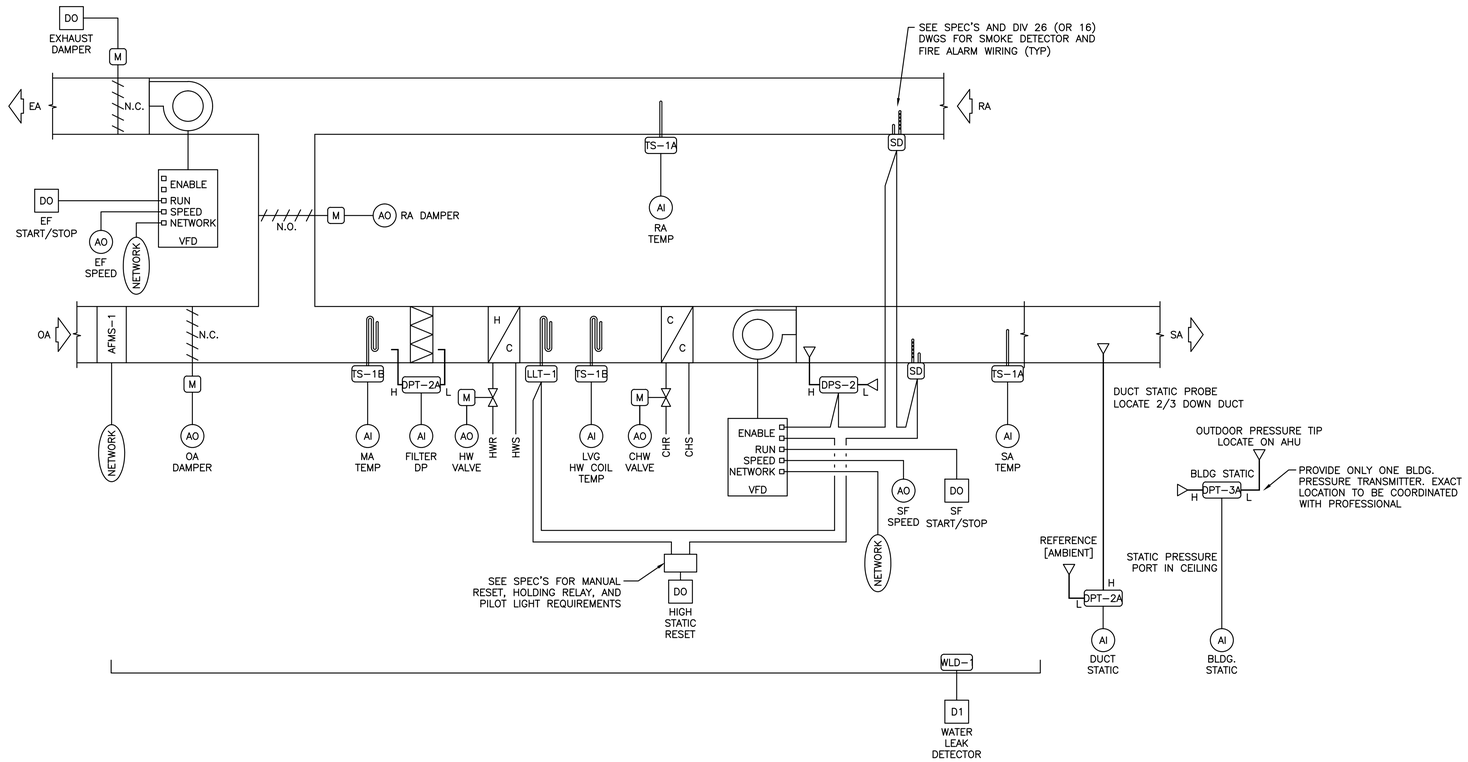
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Albert & McCleskey Associates Architects

CONTROL SCHEMATIC



1 M7.2 VAV AHU CONTROL SCHEMATIC
NO SCALE

AHU HARDWIRED POINTS LIST

Description	Type	Device	Trend Logging: Comm-issioning	Trend Logging: Contin-uous	Calibra-tion
Supply Fan Start/Stop	DO	Connect to VFD "Run"	COV	COV	–
Exhaust Fan Start/Stop	DO	Connect to VFD "Run"	COV	COV	–
Exhaust Damper	DO	Two position actuator	COV	COV	–
Supply fan high static alarm reset	DO	Dry contact to 120V or 24V control circuit	COV	COV	–
Water Leak Detector	DI	WLD-1	COV	COV	–
Economizer Outdoor Air Damper	AO	Modulating actuator	1 min	15 min	–
Return Air Damper	AO	Modulating actuator	1 min	15 min	–
Return Fan Speed	AO	Connect to VFD Speed	1 min	15 min	–
Supply Fan Speed	AO	Connect to VFD Speed	1 min	15 min	–
Hot Water Control Valve	AO	Modulating 2-way vavle	1 min	15 min	–
Chilled Water Control Valve	AO	Modulating 2-way valve	1 min	15 min	–
Mixed Air Temperature	AI	TS-1B, across filter bank	1 min	15 min	–
Filter Pressure Drop	AI	DPT-2A, 0 to 1 inch	–	60 min	–
Return Air Temperature	AI	TS-1A	1 min	15 min	–
Lvg. HW Coil Temperature	AI	TS-1B	1 min	15 min	–
Supply Air Temperature	AI	TS-1A	1 min	15 min	–
Duct Static Pressure	AI	DPT-2A, 0 to 2 inches	1 min	15 min	–
Building Pressure	AI	DPT-3A, +/-0.25"	1 min	15 min	–

POINTS MAPPED FROM AFMS-1 BACNET CARD

Description	Type	Device	Trend Logging: Comm-issioning	Trend Logging: Contin-uous	Calibra-bration
Average flow	AI	Through network	1 min	60 min	–
Average temp	AI	Through network	1 min	60 min	–
Alarm Status	DI	Through network	COV	COV	–
Area	AV	Through network	–	–	–
Traverse data status	AV	Through network	–	–	–
Flow traverse	AV	Through network	–	–	–
Temp traverse	AV	Through network	–	–	–

POINTS MAPPED FROM VFD BACNET CARD

Description	Type	Device	Trend Logging: Comm-issioning	Trend Logging: Contin-uous	Calibra-tion
Fault reset	DO	Through network	COV	COV	–
On/off status	DI	Through network	COV	COV	–
Fault (Critical Alarm)	DI	Through network	COV	COV	–
Minor Alarm	DI	Through network	COV	COV	–
Fault Text	DI	Through network (convert code to plain English text)	COV	COV	–
Alarm Text	DI	Through network (convert code to plain English text)	COV	COV	–
Keypad in hand/auto	DI	Through network	COV	COV	–
Minimum frequency setpoint	AO	Through network	±5%	±5%	–
Maximum frequency setpoint	AO	Through network	±5%	±5%	–
Acceleration rate	AO	Through network	±5%	±5%	–
Deceleration rate	AO	Through network	±5%	±5%	–
Actual frequency	AI	Through network	1 min	15 min	–
AC output voltage	AI	Through network	±10%	±10%	–
Current	AI	Through network	15 min	60 min	–
VFD temperature	AI	Through network	60 min	60 min	–
Power, kW	AI	Through network	1 min	15 min	–
Energy, MWh	AI	Through network	15 min	60 min	–
DC Bus Voltage	AI	Through network	±10%	±10%	–

AHU SEQUENCE OF OPERATION

General: Variable Air Volume (VAV) Air Handling Unit (AHU) with pre-heat coil, chilled water coil, supply fan(s), exhaust/relief fan(s).

AHU System Modes: AHU system modes are the same as the mode of the Zone Group served by the system. When Zone Groups served by an air handling system are in different modes, the following hierarchy applies (highest one sets AHU mode):

1. Occupied mode
2. Cool-down mode
3. Setup mode
4. Warm-up mode
5. Setback mode
6. Unoccupied mode

Supply Fan Control:

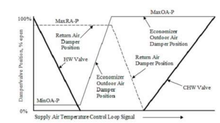
1. Supply Fan Start/Stop
   - 1.1. AHU supply fan(s) shall run when system is in any mode other than Unoccupied Mode.
   - 1.2. Fan VFD's shall be hard-wire interlocked through smoke detectors, high discharge pressure, and low mixed air temperature safety relay mounted in the control panel in each AHU control panel. The relay energizes when high-limit DP switches sense pressure above 3.0 inches (adjustable) at the fan discharge, smoke detector auxiliary contacts are energized or the low-limit thermostat tripped, locking out the fans until they are reset by the reset DO point or a push button on the panel face. A pilot light on the panel face indicates static pressure safety lockout is in effect.
   - 1.3. Totalize current airflow rate from VAV boxes and display on AHU graphic at discharge duct.
2. Static Pressure Setpoint Reset
   - 2.1. Static pressure setpoint: Setpoint shall be reset using Trim & Respond Logic (see Trim & Respond description herein) with the following parameters.

Variable	Value
Device	Supply Fan
SPtl	0.5 inches
SPmin	0.1 inches
SPmax	Per 230593
Td	10 minutes
T	2 minutes
I	2
R	Zone Static Pressure Reset Requests
SPtrim	-0.5 inches
SPres	+0.06 inches
SPres-max	+0.13 inches

3. Static Pressure Control
   - 3.1. Fan speed shall be controlled to rise very slowly to prevent high pressure trips in case all VAV boxes are closed (they should close during unoccupied periods) or in case fire/smoke dampers are closed (in some FSD designs, the dampers are interlocked to the fan status rather than being controlled by smoke detectors). This can be configuring the VFD ramp rate or controlling ramp rate in EMCS software.
   - 3.2. Supply fan speed is controlled to maintain duct static pressure at setpoint when the fan is proven on. See Specifications for minimum speed setpoint. Where the Zone Groups served by the system are small, provide multiple sets of PID gains that are used in the PID loop as a function of a load indicator (such as supply fan airflow rate, the area of the Zone Groups that are occupied, etc.).

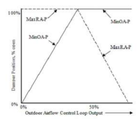
Supply Air Temperature Control

1. Control loop is enabled when the supply air fan is proven on and disabled and output set to zero otherwise.
2. Supply Air Temperature Setpoint: 55 °F.
3. Supply air temperature shall be controlled to setpoint using a PID loop whose output is mapped to sequence the hot water valve, economizer/outdoor air damper, return air damper, and chilled water valve as shown in the diagram below. Outdoor air and return air dampers are sequenced rather than complementary (as per most standard sequences) to reduce fan power at part loads.
   - 3.1. For units with a single common minimum outdoor air and economizer damper: MaxRA-P and MinOA-P are modulated to control minimum outdoor air volume, as described below.
   - 3.2. The points of transition along the x-axis show and described below are representative. Separate gains shall be provided for each section of the control map (hot water, economizer, chilled water), that are determined by the Contractor to provide stable control. Alternatively, Contractor shall adjust the precise value of the x-axis thresholds shown in the figure to provide stable control.



Economizer/Outdoor Air Damper Control:

1. Minimum Outdoor Air Control Loop:
   - 1.1. See zone CO2 controls under VAV zone controls.
   - 1.2. Outdoor air minimum and maximum setpoints for systems with multiple Zone Groups.
     - 1.2.1. AbsMinOA* is the sum of Vareq-min for all zones in all Zone Groups that are in Occupied Mode, but shall be no larger than the absolute minimum outdoor air rate, 'Abs Min OA' scheduled on Drawings.
     - 1.2.2. DesMinOA* is the sum of OA-min for all zones in all Zone Groups that are in Occupied Mode, but shall be no larger than the design minimum outdoor air rate, 'Occ Min OA' scheduled on Drawings.
   - 1.3. OA Setpoint (MinOAsp). The minimum outdoor air setpoint (MinOAsp) shall be reset based on the highest zone CO2 PID loop signal from AbsMinOA* at 50% signal to DesMinOA* at 100% signal.
   - 1.4. Minimum Outdoor Air Control Loop:
     - 1.4.1. Minimum outdoor air control loop is enabled when the supply fan is proven on and the AHU is in Occupied Mode and disabled and output set to zero otherwise.
     - 1.4.2. The outdoor airflow rate shall be maintained at the minimum outdoor air setpoint MinOAsp by a reverse-acting control loop whose output is mapped to economizer damper minimum position, MinOA-P, and return air damper maximum position, MaxRA-P, as indicated in the figure below.



   - 1.5. Economizer High Limit Lockout:
     - 1.5.1. The normal sequencing of the economizer dampers (above) shall be disabled when TOA > 65°F.
     - 1.5.2. When economizer is enabled, MaxOA-P = 100%.
     - 1.5.3. Once the economizer is disabled, it shall not be re-enabled within 10 minutes, and vice versa.
     - 1.5.4. When the economizer is disabled:
       - 1.5.4.1. Return air damper shall be fully opened.
       - 1.5.4.2. Wait 15 seconds, then set MaxOA-P equal to MinOA-P.
       - 1.5.4.3. Wait 3 minutes, then release return air damper for minimum outdoor air control.

Exhaust/Relief Fan Control:

1. All operating relief fans that serve a common/shared air volume shall be grouped and controlled as if they were one system, running at the same speed and using the same control loop, even if they are associated with different air handling units.
2. A relief fan shall be enabled when its associated supply fan is proven on, and shall be disabled otherwise.
3. Building static pressure shall be time averaged with a sliding 5 minute window (to dampen fluctuations). The averaged value shall be that displayed and used for control.
4. A P-only control loop maintains the building pressure at a setpoint of 0.05 inches with an output ranging from 0 to 100%. The loop is disabled and output set to zero when all fans in the relief system group are disabled.
   - 4.1. Stage 0 (barometric relief): When relief system is enabled and the control loop output is above 5%, open the motorized dampers to all relief fans serving the relief system group that are enabled; close the dampers when the loop output drops to 0% for 5 minutes.
   - 4.2. Stage Up: When control loop is above minimum speed plus 15%, enable relief fans.
   - 4.3. Stage Down: When control loop is below minimum speed disable relief fans. If all fans are off go to Stage 0 (all dampers open and all fans off).
5. For fans in a Level 2 alarm and status is off, discharge damper shall be closed when stage is above Stage 0.

AHU SEQUENCE OF OPERATION CON'T

Freeze Protection:

1. If the leaving pre-heat coil air temperature drops below 40°F for 5 minutes, send two (or more, as required to ensure that heating plant is active) Hot Water Requests, override the outside air damper to the minimum position, and modulate the pre-heat coil to maintain a leaving pre-heat coil air temperature of at least 42°F. Disable this function when leaving pre-heat coil air temperature rises above 45°F for 5 minutes.
2. If the leaving pre-heat coil air temperature drops below 38°F for 5 minutes, fully close the outdoor air damper for one hour, and set a Level 3 alarm noting that minimum ventilation was interrupted. After one hour, the unit shall resume minimum outdoor air ventilation and enter the previous stage of freeze protection (see 0).
3. Upon signal from the freezestat or if supply air temperature drops below 38°F for 15 minutes or below 34°F for 5 minutes, shut down supply and return/relief fan(s), close outdoor air damper, make the minimum cooling coil valve position 20%, and energize the hot water and chilled water pump systems. Also send two (or more, as required to ensure that heating plant is active) Hot Water Requests, modulate the heating coil to maintain the higher of the supply air temperature or the mixed air temperature at 80°F, and set a Level 2 alarm indicating the unit is shut down by freeze protection.
   - 3.1. If a freeze protection shutdown is triggered by a low air temperature sensor reading, it shall remain in effect until it is reset by a software switch from the operator's workstation. (If a freeze stat with a physical reset switch is used instead, there shall be no software reset switch.)

Safeties and Interlocks:

1. Supply fan shall be hardwire interlocked through the unit smoke detector(s), low-limit thermostat and high static pressure switch to shut down the unit upon smoke detection.

EMCS Alarms: Provide the following EMCS alarms:

1. Maintenance interval alarm when unit has operated for more than 1500 hours: Level 5. Reset interval counter when alarm is acknowledged.
2. Fan alarm is indicated by the status being different from the command for a period of 60 seconds.
   - 2.1. Commanded on, status off: Level 2
   - 2.2. Commanded off, status on: Level 4
3. Filter pressure drop exceeds alarm limit: Level 5. The alarm limit shall vary with fan speed as follows:

$$DPx = DP100(x)^{1.4}$$

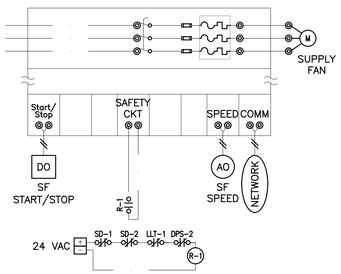
Where DP100 is the high limit pressure drop at design cfm (determine limit from filter manufacturer) and DPx is the high limit at speed signal x (expressed as a fraction of full signal). For instance, the setpoint at 50% of full speed would be (0.5)^1.4 or 38% of the design high limit pressure drop.

4. High supply air temperature (more than 5 °F above setpoint) when control loop is active for longer than 15 minutes: Level 3.
5. If the outside air temperature is above the supply air temperature setpoint and the economizer is enabled and the mixed air temperature is more than 2 °F different from the outside air temperature for more than 30 minutes continuously; OR if the outdoor air temperature is more than 5 °F below the supply air temperature setpoint and the chilled water valve is open: Level 4 indicating economizer damper control problems.
6. Low static pressure (more than 0.25 inches below setpoint) when fan control loop is active for longer than 5 minutes: Level 3.
7. High building pressure (more than 0.1") for 5 minutes. Level 3.
8. Low building pressure (less than 0.0") for 5 minutes. Level 4.
9. Outdoor airflow less than setpoint by 10% for 10 minutes when loop is active: Level 3.

Testing/Commissioning Overrides: Provide software points that interlock to a chilled water and hot water plant level point to:

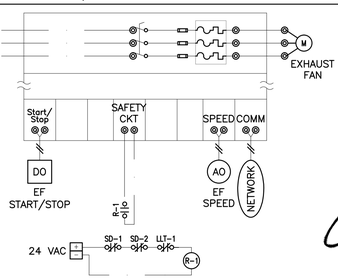
Force chilled water valve full open.
Force chilled water valve full closed.
Force hot water valve full open.
Force hot water valve full closed.

AHU SUPPLY FAN LADDER DIAGRAMS



SUPPLY FAN(S) VFD

AHU EXHAUST/RELIEF FAN LADDER DIAGRAMS



EXHAUST/RELIEF FAN(S) VFD

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HATTIESBURG PUBLIC SAFETY COMPLEX
HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT

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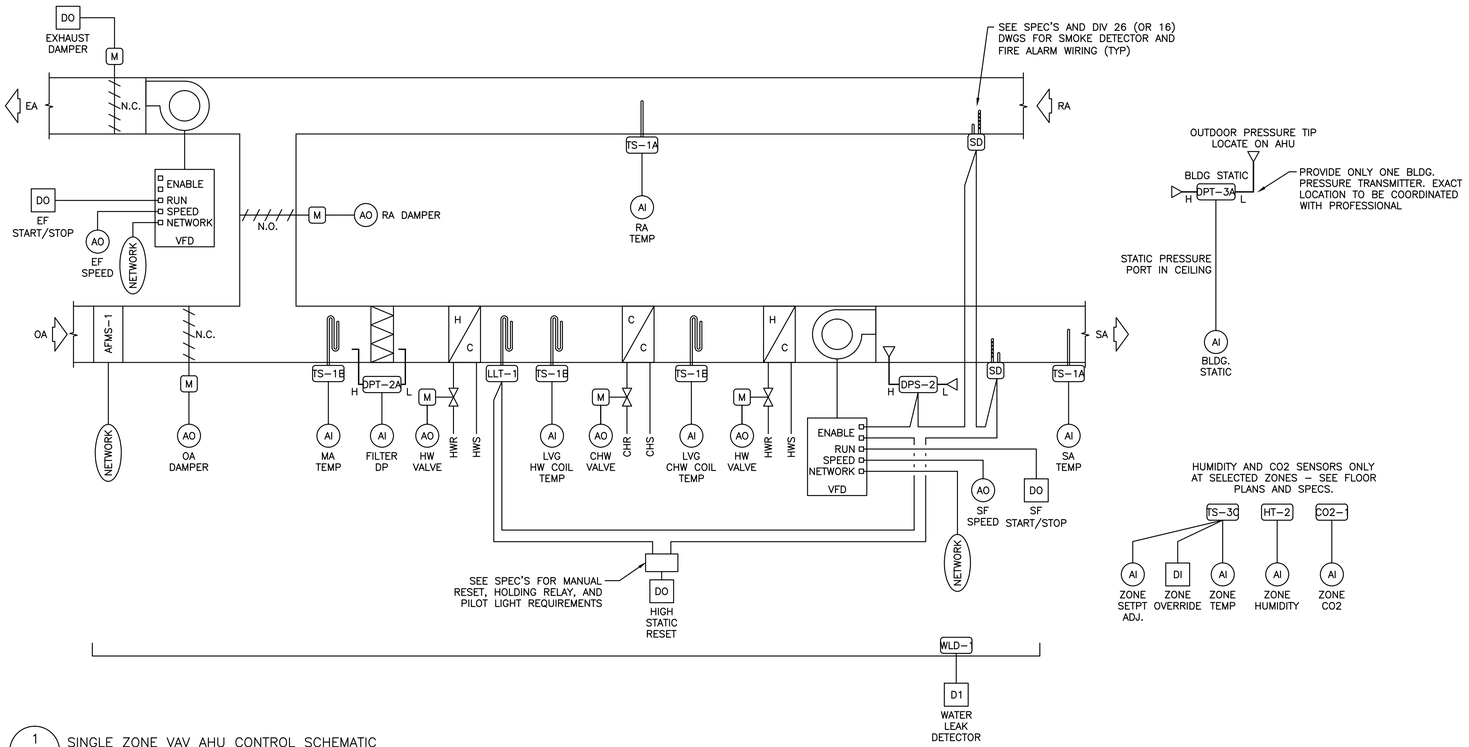
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CONTROL SCHEMATIC



1 / M7.3 SINGLE ZONE VAV AHU CONTROL SCHEMATIC

NO SCALE

AHU HARDWIRED POINTS LIST

Description	Type	Device	Trend Logging: Comm-issioning	Trend Logging: Contin-uous	Calibra-tion
Supply Fan Start/Stop	DO	Connect to VFD "Run"	COV	COV	–
Exhaust Fan Start/Stop	DO	Connect to VFD "Run"	COV	COV	–
Exhaust Damper	DO	Two position actuator	COV	COV	–
Supply Fan High Static Alarm Reset	DO	Dry contact to 120V or 24V control circuit	COV	COV	–
Zone Override	DI	TS-3C	COV	COV	–
Water Leak Detector	DI	WLD-1	COV	COV	–
Economizer Outdoor Air Damper	AO	Modulating actuator	1 min	15 min	–
Return Air Damper	AO	Modulating actuator	1 min	15 min	–
Return Fan Speed	AO	Connect to VFD Speed	1 min	15 min	–
Supply Fan Speed	AO	Connect to VFD Speed	1 min	15 min	–
Hot Water Control Valve (Pre-heat)	AO	Modulating 2-way vavle	1 min	15 min	–
Chilled Water Control Valve	AO	Modulating 2-way valve	1 min	15 min	–
Hot Water Control Valve (Re-heat)	AO	Modulating 2-way valve	1 min	15 min	–
Mixed Air Temperature	AI	TS-1B, across filter bank	1 min	15 min	–
Filter Pressure Drop	AI	DPT-2A, 0 to 1 inch	–	60 min	–
Return Air Temperature	AI	TS-1A	1 min	15 min	–
Lvg. HW Coil Temperature	AI	TS-1B	1 min	15 min	–
Supply Air Temperature	AI	TS-1A	1 min	15 min	–
Zone Temperature	AI	TS-3C	1 min	15 min	–
Zone Temperature Setpoint Adjustment	AI	TS-3C	1 min	15 min	–
Building Pressure	AI	DPT-3A, +/-0.25"	1 min	15 min	–
Zone Humidity	AI	HT-2	1 min	15 min	–
Zone CO2	AI	CO2-1	1 min	15 min	–

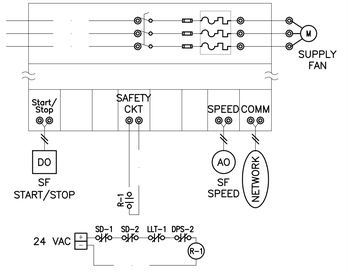
POINTS MAPPED FROM AFMS-1 BACNET CARD

Description	Type	Device	Trend Logging: Comm-issioning	Trend Logging: Contin-uous	Calibra-bration
Average flow	AI	Through network	1 min	60 min	–
Average temp	AI	Through network	1 min	60 min	–
Alarm Status	DI	Through network	COV	COV	–
Area	AV	Through network	–	–	–
Traverse data status	AV	Through network	–	–	–
Flow traverse	AV	Through network	–	–	–
Temp traverse	AV	Through network	–	–	–

POINTS MAPPED FROM VFD BACNET CARD

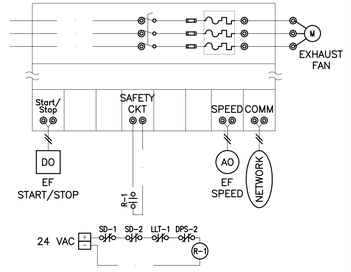
Description	Type	Device	Trend Logging: Comm-issioning	Trend Logging: Contin-uous	Calibra-tion
Fault reset	DO	Through network	COV	COV	–
On/off status	DI	Through network	COV	COV	–
Fault (Critical Alarm)	DI	Through network	COV	COV	–
Minor Alarm	DI	Through network	COV	COV	–
Fault Text	DI	Through network (convert code to plain English text)	COV	COV	–
Alarm Text	DI	Through network (convert code to plain English text)	COV	COV	–
Keypad in hand/auto	DI	Through network	COV	COV	–
Minimum frequency setpoint	AO	Through network	±5%	±5%	–
Maximum frequency setpoint	AO	Through network	±5%	±5%	–
Acceleration rate	AO	Through network	±5%	±5%	–
Deceleration rate	AO	Through network	±5%	±5%	–
Actual frequency	AI	Through network	1 min	15 min	–
AC output voltage	AI	Through network	±10%	±10%	–
Current	AI	Through network	15 min	60 min	–
VFD temperature	AI	Through network	60 min	60 min	–
Power, kW	AI	Through network	1 min	15 min	–
Energy, MWh	AI	Through network	15 min	60 min	–
DC Bus Voltage	AI	Through network	±10%	±10%	–

AHU SUPPLY FAN LADDER DIAGRAMS



SUPPLY FAN(S) VFD

AHU EXHAUST/RELIEF FAN LADDER DIAGRAMS



EXHAUST/RELIEF FAN(S) VFD

AHU SEQUENCE OF OPERATION

General: Variable Air Volume (VAV) Air Handling Unit (AHU) with pre-heat coil, chilled water coil, reh-heat coil, supply fan(s), exhaust/relief fan(s).

AHU System Modes: AHU system modes are the same as the mode of the Zone Group served by the system. When Zone Groups served by an air handling system are in different modes, the following hierarchy applies (highest one sets AHU mode):

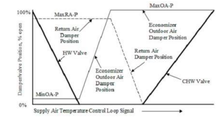
1. Occupied mode
2. Cool-down mode
3. Setup mode
4. Warm-up mode
5. Setback mode
6. Unoccupied mode

Design airflow rates shall be as scheduled on plans:

1. Zone maximum cooling airflow setpoint (Vcool-max)
2. Zone maximum heating airflow setpoint (Vheat-max)

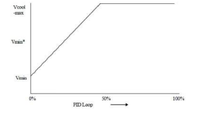
Supply Fan Control:

1. Supply Fan Start/Stop
   - 1.1. AHU supply fan(s) shall run when system is in any mode other than Unoccupied Mode.
   - 1.2. Fan VFD's shall be hard-wire interlocked through smoke detectors and low mixed air temperature safety relay mounted in the control panel in each AHU control panel. The relay energizes when smoke detector auxiliary contacts are energized or the low-limit thermostat tripped, locking out the fans until they are reset by the reset DO point or a push button on the panel face. A pilot light on the panel face indicates static pressure safety lockout is in effect.
2. Supply Fan Speed Control
   - 2.1. Provide a ramp function to prevent changes in fan speed of more than 10% per minute (adjustable).
   - 2.2. When the supply fan is proven on, fan speed and supply air temperature setpoints are controlled as described below.
     - 2.2.1. Heating Mode:
       - 2.2.1.1. Fan control: For a Heating Loop signal of 100% – 51%, fan speed is reset from the maximum heating fan speed to the minimum fan speed. For a Heating Loop signal of 50% – 0%, fan speed setpoint is the minimum fan speed.
       - 2.2.1.2. Supply air temperature control: For a Heating Loop signal of 100% – 51%, Supply Air Temperature Setpoint (SATsp) is at its maximum value. For a Heating Loop signal of 50% – 0%, SATsp is reset from the maximum value of SATsp to the Deadband value.
     - 2.2.2. Deadband Mode:
       - 2.2.2.1. Fan control: In Deadband, fan speed setoint is the minimum fan speed.
       - 2.2.2.2. Supply air temperature control: In Deadband, SATsp equals 55°F (adjustable).
     - 2.2.3. Cooling Mode:
       - 2.2.3.1. Fan control: For a Cooling Loop signal of 0% – 100%, fan speed is reset from minimum fan speed to maximum cooling fan speed.
       - 2.2.3.2. Supply air temperature control: For a Cooling Loop signal of 0% – 100%, SATsp equals 55°F (adjustable).
     - 2.2.4. Dehumidification Mode:
       - 2.2.4.1. Dehumidification mode shall be enabled when zone relative humidity is greater than 60% RH for more than 20 minutes.
       - 2.2.4.2. Dehumidification mode shall be disabled when zone relative humidity is less than 55% RH for more than 20 minutes.
       - 2.2.4.3. Fan control: Fan shall be controlled same as Heating, Deadband and Cooling control described above.
       - 2.2.4.4. Supply air temperature control: Chilled water control valve shall be fully open in each of the following control modes.
         - 2.2.4.4.1. Heating control: SATsp shall be controlled same as heating described above.
         - 2.2.4.4.2. Deadband control: Uncontrolled.
         - 2.2.4.4.3. Cooling control: Uncontrolled.
       - 2.2.4.5. Note: When system is in the Dehumidification mode, the zone temperature setpoint shall be equal to the Occupied Cooling setpoint.
   - 2.3. Minimum and maximum fan speeds shall be as follows:
     - 2.3.1. Minimum fan speed shall be the speed, determined in conjunction with the TAB Agency, that provides supply airflow equal to minimum airflow scheduled on Construction Drawings.
     - 2.3.2. In Heating, maximum fan speed shall be the speed, determined in conjunction with the TAB Agency, that provides supply airflow equal to the design heating airflow scheduled on Construction Drawings.
     - 2.3.3. In Cooling, maximum fan speed shall be the speed , determined in conjunction with the TAB Agency, that provides supply airflow equal to the design cooling airflow scheduled on Construction Drawings.
     - 2.3.4. In Dehumidification, maximum and minimum fan speed shall be same as heating and cooling described above.
   - 2.4. Minimum and maximum supply air temperature setpoints shall be as follows:
     - 2.4.1. In Heating the maximum value of SATsp shall be the lesser of 95°F or 20°F above space temperature.
     - 2.4.2. In Deadband and Cooling SATsp shall be 55°F (adjustable).
     - 2.4.3. In Dehumidification chilled water control valve fully open, the maximum value of SATsp shall be the lesser of 85°F or 20°F above space temperature.
   - 2.5. Supply Air Temperature Control:
     - 2.5.1. The SATsp control loop is enabled when the supply air fan is proven on, and disabled and set to Neutral otherwise.
     - 2.5.2. Supply air temperature shall be controlled to setpoint using a PID loop whose output is mapped to sequence the hot water valve, economizer/outdoor air damper, return air damper, and chilled water valve as shown in the diagram below. Outdoor air and return air dampers are sequenced rather than complementary (as per most standard sequences) to reduce fan power at part loads.
       - 2.5.2.1. For units with a single common minimum outdoor air and economizer damper: MaxRA–P and MinOA–P are modulated to control minimum outdoor air volume. as described below.
       - 2.5.2.2. The points of transition along the x–axis show and described below are representative. Separate gains shall be provided for each section of the control map (hot water, economizer, chilled water), that are determined by the Contractor to provide stable control. Alternatively, Contractor shall adjust the precise value of the x–axis thresholds shown in the figure to provide stable control.

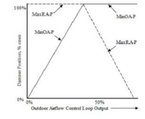


Economizer/Outdoor Air Damper Control:

1. Minimum Outdoor Air Control Loop:
   - 1.1. During Occupied Mode, a P–only loop shall maintain CO2 concentration at 1000 ppm; reset 0% at 800 ppm and 100% at 1000 ppm of CO2. The output of this loop (0 to 100%) shall be mapped as shown below. The loop output from 0 to 50% shall reset the minimum airflow setpoint to the zone from Vmin up to maximum cooling airflow setpoint Vcool–max. The loop output from 50% to 100% will be used at the system level to reset outdoor air minimum; see AHU controls. Loop is disabled and output set to zero when the zone is not in Occupied Mode.



   - 1.2. Minimum outdoor air control loop is enabled when the supply fan is proven on and the AHU is in Occupied Mode and disabled and output set to zero otherwise.
   - 1.3. The outdoor airflow rate shall be maintained at the minimum outdoor air setpoint MinOAsp by a reverse–acting control loop whose output is mapped to economizer damper minimum position, MinOA–P, and return air damper maximum position, MaxRA–P, as indicated in the figure below.



AHU SEQUENCE OF OPERATION CON'T

   - 1.4. Economizer High Limit Lockout:
     - 1.4.1. The normal sequencing of the economizer dampers (above) shall be disabled when TOA > 65°F.
     - 1.4.2. When economizer is enabled, MaxOA–P = 100%.
     - 1.4.3. Once the economizer is disabled, it shall not be re–enabled within 10 minutes, and vice versa.
     - 1.4.4. When the economizer is disabled:
       - 1.4.4.1. Return air damper shall be fully opened.
       - 1.4.4.2. Wait 15 seconds, then set MaxOA–P equal to MinOA–P.
       - 1.4.4.3. Wait 3 minutes, then release return air damper for minimum outdoor air control.

Exhaust/Relief Fan Control:

1. All operating relief fans that serve a common/shared air volume shall be grouped and controlled as if they were one system, running at the same speed and using the same control loop, even if they are associated with different air handling units.
2. A relief fan shall be enabled when its associated supply fan is proven on, and shall be disabled otherwise.
3. Building static pressure shall be time averaged with a sliding 5 minute window (to dampen fluctuations). The averaged value shall be that displayed and used for control.
4. A P–only control loop maintains the building pressure at a setpoint of 0.05 inches with an output ranging from 0 to 100%. The loop is disabled and output set to zero when all fans in the relief system group are disabled.
   - 4.1. Stage 0 (barometric relief): When relief system is enabled and the control loop output is above 5%, open the motorized dampers to all relief fans serving the relief system group that are enabled; close the dampers when the loop output drops to 0% for 5 minutes.
   - 4.2. Stage Up: When control loop is above minimum speed plus 15%, enable relief fans.
   - 4.3. Stage Down: When control loop is below minimum speed disable relief fans. If all fans are off go to Stage 0 (all dampers open and all fans off).
5. For fans in a Level 2 alarm and status is off, discharge damper shall be closed when stage is above Stage 0.

Freeze Protection:

1. If the leaving pre–heat coil air temperature drops below 40°F for 5 minutes, send two (or more, as required to ensure that heating plant is active) Hot Water Requests, override the outside air damper to the minimum position, and modulate the pre–heat coil to maintain a leaving pre–heat coil air temperature of at least 42°F. Disable this function when leaving pre–heat coil air temperature rises above 45°F for 5 minutes.
2. If the leaving pre–heat coil air temperature drops below 38°F for 5 minutes, fully close the outdoor air damper for one hour, and set a Level 3 alarm noting that minimum ventilation was interrupted. After one hour, the unit shall resume minimum outdoor air ventilation and enter the previous stage of freeze protection (see 0).
3. Upon signal from the freezestat or if supply air temperature drops below 38°F for 15 minutes or below 34°F for 5 minutes, shut down supply and return/relief fan(s), close outdoor air damper, make the minimum cooling coil valve position 20%, and energize the hot water and chilled water pump systems. Also send two (or more, as required to ensure that heating plant is active) Hot Water Requests, modulate the heating coil to maintain the higher of the supply air temperature or the mixed air temperature at 80°F, and set a Level 2 alarm indicating the unit is shut down by freeze protection.
   - 3.1. If a freeze protection shutdown is trigsered by a low air temperature sensor reading, it shall remain in effect until it is reset by a software switch from the operator's workstation. (If a freeze stat with a physical reset switch is used instead, there shall be no software reset switch.)

Safeties and Interlocks:

1. Supply fan shall be hardwire interlocked through the unit smoke detector(s), low–limit thermostat and high static pressure switch to shut down the unit upon smoke detection.

EMCS Alarms: Provide the following EMCS alarms:

1. Maintenance interval alarm when unit has operated for more than 1500 hours: Level 5. Reset interval counter when alarm is acknowledged.
2. Fan alarm is indicated by the status being different from the command for a period of 60 seconds.
   - 2.1. Commanded on, status off: Level 2
   - 2.2. Commanded off, status on: Level 4
3. Filter pressure drop exceeds alarm limit: Level 5. The alarm limit shall vary with fan speed as follows:

$$DPx = DP100(x)^{1.4}$$

Where DP100 is the high limit pressure drop at design cfm (determine limit from filter manufacturer) and DPx is the high limit at speed signal x (expressed as a fraction of full signal). For instance, the setpoint at 50% of full speed would be (0.5)^1.4 or 38% of the design high limit pressure drop.

4. High supply air temperature (more than 5 °F above setpoint) when control loop is active for longer than 15 minutes: Level 3.
5. If the outside air temperature is above the supply air temperature setpoint and the economizer is enabled and the mixed air temperature is more than 2 °F different from the outside air temperature for more than 30 minutes continuously; OR if the outdoor air temperature is more than 5 °F below the supply air temperature setpoint and the chilled water valve is open: Level 4 indicating economizer damper control problems.
6. Low static pressure (more than 0.25 inches below setpoint) when fan control loop is active for longer than 5 minutes: Level 3.
7. High building pressure (more than 0.1") for 5 minutes. Level 3.
8. Low building pressure (less than 0.0") for 5 minutes. Level 4.
9. Outdoor airflow less than setpoint by 10% for 10 minutes when loop is active: Level 3.

Testing/Commissioning Overrides: Provide software points that interlock to a chilled water and hot water plant level point to:

Force chilled water valve full open.
Force chilled water valve full closed.
Force hot water valve full open.
Force hot water valve full closed.

CITY OF HATTIESBURG, MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

Drawing Issued:

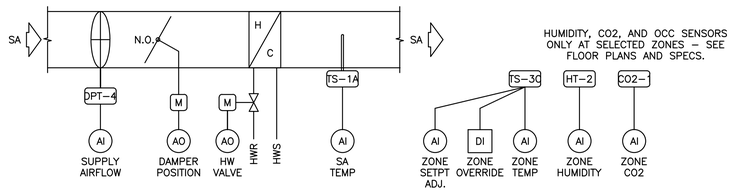
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08-31-2015		DD Check Set
10-20-2015		75% Progress Set
11-02-2015		90% Pricing Set
11-19-2018		100% Bid Docs

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Client No: ------
Albert & Associates: 12575

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M7.3

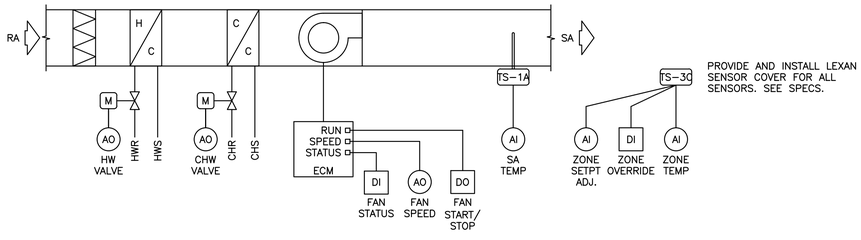
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Phone: (601) 362-3552
Fax: (601) 366-6418
ERG# 15-28.2



1 M7.4 VAV REHEAT CONTROL SCHEMATIC

NO SCALE

COORDINATE STATUS & START/STOP WITH FINAL EQUIPMENT SUBMITTAL. PROVIDE AUXILARY RELAYS AND CURRENT SWITCHES TO INTERFACE WITH BAS IF POINTS ARE NOT AVAILABLE ON EC MOTOR INTERFACE



PROVIDE AND INSTALL LEXAN SENSOR COVER FOR ALL SENSORS. SEE SPECS.

2 M7.4 VARIABLE SPEED 4–PIPE FAN COIL CONTROL SCHEMATIC

NO SCALE

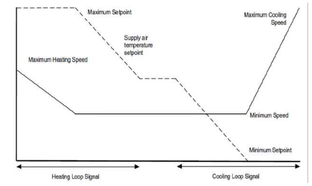
FCU SEQUENCE OF OPERATION

General: Variable speed 4–pipe fan coil unit.

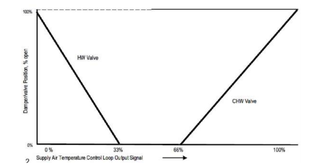
FCU System Modes: AHU system modes are the same as the mode of the Zone Group served by the system.

Supply Fan Control:

1. Supply Fan Start/Stop
   1.1. FCU supply fan shall run when system is in any mode other than Unoccupied Mode.
2. Supply Fan Speed and Supply Air Temperature Setpoint Control:
   2.1. When supply fan is proven on, heating, cooling, and fan speed shall be controlled as follows:



   2.1.1. Maximum cooling speed is that required to deliver design airflow to the zone; coordinate with air balancer. Minimum speed shall be 30% (adjustable) of maximum cooling speed.
   2.1.2. When the zone served by the system is in the Deadband Mode, supply air temperature setpoint shall be average of the active heating and cooling setpoints and the fan shall operate at minimum speed.
   2.1.3. When the zone served by the system is in the Cooling Mode, supply air temperature shall be reset from Deadband setpoint at 0% cooling PID signal down to Minimum Setpoint T–min at 50% PID signal. T–min shall be 53°F (adjustable). Fan speed shall be reset from minimum speed at 50% cooling PID signal and below, proportionally up to maximum cooling speed at 100% cooling PID signal.
   2.1.4. When the zone served by the system is in the Heating Mode, supply air temperature shall be reset from Deadband setpoint at 0% heating PID signal up to 90°F (adjustable) at 50% PID signal. Fan speed shall be reset from minimum speed at 50% heating PID signal and below, proportionally up to maximum heating speed at 100% heating PID signal.
   2.2. Supply Air Temperature Control:
   2.2.1. Control loop is enabled when the supply air fan is proven on and disabled and output set to zero otherwise. When loop is disabled, slowly reduce loop output to zero to prevent sudden pressure changes in the CHW flow distribution system.
   2.2.2. Supply air temperature shall be controlled to setpoint using a PID loop whose output is the chilled water valve and hot water valve positions as shown in the figure below:



3. Alarms
   3.1. Maintenance interval alarm when unit has operated for more than 1500 hours: Level 5. Reset interval counter when alarm is acknowledged.
   3.2. Fan alarm is indicated by the status being different from the command for a period of 60 seconds.
      3.2.1. Commanded on, status off: Level 2.
      3.2.2. Commanded off, status on: Level 4.
   3.3. High supply air temperature (more than 5°F above setpoint) when cooling control loop is active for longer than 15 minutes: Level 3.
   3.4. Low supply air temperature (more than 5°F below setpoint) when heating control loop is active for longer than 15 minutes: Level 3.
4. Testing/Commissioning Overrides: Provide software points that interlock to a chilled water plant level to:
   4.1. Force chilled water valve full open.
   4.2. Force chilled water valve full closed.
   4.3. Force heating water valve full open.
   4.4. Force heating water valve full closed.
5. Plant Requests
   5.1. Heating HWST Reset Requests.
      5.1.1. If the HW valve is less than 85%, send 0 requests.
      5.1.2. If the HW valve is greater than 95%, send 1 request.
      5.1.3. If the supply air temperature is below setpoint sufficient to generate a Level 3 alarm (see alarms above), send 2 requests.

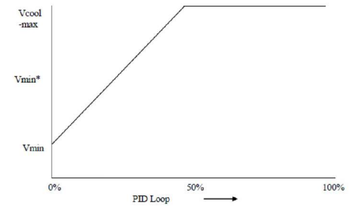
AHU HARDWIRED POINTS LIST

Description	Type	Device	Trend Logging: Comm–issioning	Trend Logging: Contin–uous	Calibra–tion
Supply Fan Start/Stop	DO	Dry contact to ECM or Dry contact to starter control circuit (coordinate with final equipment submittal)	COV	COV	–
Fan Status	DI	From ECM or CS–1 (coordinate with final equipment submittal)	COV	COV	–
Zone Override	DI	TS–3C	COV	COV	–
Water Leak Detector	DI	WLD–1	COV	COV	–
Hot Water Control Valve	AO	Modulating 2–way vavle	1 min	15 min	–
Chilled Water Control Valve	AO	Modulating 2–way valve	1 min	15 min	–
Fan Speed	AO	0–10 Vdc to ECM	1 min	15 min	–
Supply Air Temperature	AI	TS–1A	1 min	15 min	–
Zone Temperature	AI	TS–3C	1 min	15 min	–
Zone Temperature Setpoint Adjustment	AI	TS–3C	15 min	60 min	–

VAV TERMINAL UNIT SEQUENCE OF OPERATION

General: Variable Air Volume (VAV) Terminal Unit with hot water reheat.

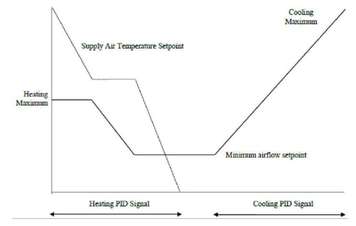
1. See Sequence of Operation – General for setpoints, loops, control modes, alarms, etc.
2. Design airflow rates shall be as scheduled on plans:
   2.1. Zone maximum cooling airflow setpoint (Vcool–max).
   2.2. Zone minimum airflow setpoint (Vmin).
   2.3. Zone maximum heating airflow setpoint (Vheat–max).
   2.4. Zone occupant component of minimum outdoor air setpoint (Voc–min).
   2.5. Zone building area component of minimum outdoor air setpoint (Vora–min).
3. Zone minimum outdoor air setpoints (used at AHU level minimum outdoor air controls).
   3.1. Zone–Abs–OA–min is equal to:
      3.1.1. Vora–min if the zone has a CO2 sensor.
      3.1.2. Zone–Des–OA–min otherwise.
   3.2. Zone–Des–OA–min is equal to the larger of Vora–min and Voc–min.
4. The occupied minimum Vmin* shall be equal to Vmin except as follows:
   4.1. If Vmin is non–zero and less than the lowest possible airflow setpoint allowed by the controls (Vm), Vmin* shall be set equal to Vm determined in accordance with the Sequence of Operation – General (VAV Box Controllable Minimum).
   4.2. If the zone has a CO2 sensor, during Occupied Mode, a P–only loop shall maintain CO2 concentration at 1000 ppm; reset 0% at 800 ppm and 100% at 1200 ppm of CO2. The output of this loop (0 to 100%) shall be mapped as shown below. The loop output from 0 to 50% shall reset the minimum airflow setpoint to the zone from Vmin up to maximum cooling airflow setpoint Vcool–max. The loop output from 50% to 100% will be used at the system level to reset outdoor air minimum; see AHU controls. Loop is disabled and output set to zero when the zone is not in Occupied Mode.



5. Active maximum and minimum setpoints shall vary depending on the mode of the Zone Group the zone is a part of:

Setpoint	Occupied	Cool–down	Setup	Warm–up	Setback	Unoccupied
Cooling maximum	Vcool–max	Vcool–max	Vcool–max	0	0	0
Minimum	Vmin*	0	0	0	0	0
Heating Maximum	Max(Vheat–max, Vmin*)	Vheat–max	0	Vcool–max	Vcool–max	0

6. Control logic is depicted schematically in the figure below and described in the following sections.



   6.1. When the zone is in the Cooling Mode, the Cooling Loop output shall be mapped to the airflow setpoint from the cooling maximum to the minimum airflow setpoints.
   6.2. When the zone is in the Deadband Mode, the airflow setpoint shall be the minimum airflow setpoint.
   6.3. When the zone is in the Heating mode, the Heating Loop shall be mapped as follows:
      6.3.1. From 0–33%, the Heating Loop output shall reset the discharge temperature from 50°F to 95°F.
      6.3.2. From 33–66%, the Heating Loop output shall reset the zone airflow setpoint from the minimum airflow setpoint to the maximum heating airflow setpoint.
      6.3.3. From 66–100%, the Heating Loop output shall reset the discharge temperature from 95°F to 115°F.
   6.4. The hot water valve shall be modulated using P+I loop to maintain the discharge temperature at setpoint. (Directly controlling HW valve off zone temperature PID loop is not acceptable.)
   6.5. The VAV damper shall be modulated to maintain the measured airflow at setpoint.
7. Alarms:
   7.1. Low airflow:
      7.1.1. If the measured airflow is less than 70% of setpoint for 5 minutes, generate a Level 3 alarm.
      7.1.2. If the measured airflow is less than 50% of setpoint for 5 minutes, generate a Level 2 alarm.
      7.1.3. Suppress alarms for zones with an Importance Multiplier of 0.
   7.2. Low supply air temperature:
      7.2.1. If boiler plant is proven on and the supply air temperature is 15°F less than setpoint for 10 minutes, generate a Level 3 alarm.
      7.2.2. If boiler plant is proven on and the supply air temperature is 30°F less than setpoint for 10 minutes, generate a Level 2 alarm.
   7.3. Airflow sensor calibration. If the fan serving the zone has been shut off for 10 minutes and airflow sensor reading is above 20 cfm, generate a Level 3 alarm.
8. Testing/Commissioning Overrides: Provide software points that interlock to a system level point to:
   8.1. Force zone airflow setpoint to zero.
   8.2. Force zone airflow setpoint to Vcool–max.
   8.3. Force zone airflow setpoint to Vmin.
   8.4. Force zone airflow setpoint to Vheat–max.
   8.5. Force damper full closed/open.
   8.6. Force heating to off/closed.
   8.7. Reset request–hours accumulator point to zero (provide one point for each reset type listed below).

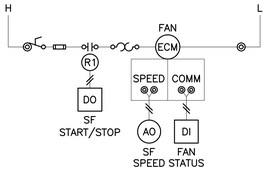
VAV TERMINAL UNIT SEQUENCE OF OPERATION

9. System Requests:
   9.1. Cooling SAT Reset Requests:
      9.1.1. If the Cooling Loop is less than 85%, send 0 requests.
      9.1.2. If the Cooling Loop is greater than 95%, send 1 request.
      9.1.3. If the zone temperature exceeds the zone's cooling setpoint by 3°F for 2 minutes, send 2 requests.
      9.1.4. If the zone temperature exceeds the zone's cooling setpoint by 5°F for 2 minutes, send 3 requests.
   9.2. Static Pressure Reset Requests:
      9.2.1. If the Damper Loop is less than 85%, send 0 requests.
      9.2.2. If the Damper Loop is greater than 95%, send 1 request.
      9.2.3. If the measured airflow is less than 70% of setpoint for 1 minute, send 2 requests.
      9.2.4. If the measured airflow is less than 50% of setpoint for 1 minute, send 3 requests.
   9.3. Heating HWST Reset Requests:
      9.3.1. If the HW valve is less than 85%, send 0 requests.
      9.3.2. If the HW valve is greater than 95%, send 1 request.
      9.3.3. If the supply air temperature is 15°F less than setpoint for 5 minutes, send 2 requests.
      9.3.4. If the supply air temperature is 30°F less than setpoint for 5 minutes, send 3 requests.
   9.4. Boiler Plant Requests. Send the boiler plant that serves the zone a Boiler Plant Request as follows:
      9.4.1. If the HW valve is less than 10% send 0 requests.
      9.4.2. If the HW valve is greater than 95%, send 1 request.

VAV HARDWIRED POINTS LIST

Description	Type	Device	Trend Logging: Comm–issioning	Trend Logging: Contin–uous	Calibra–tion
Zone Override	DI	TS–3C	COV	COV	–
Zone Occupancy	DI	Occupancy Sensor	COV	COV	–
VAV Box Damper Position	AO	Modulating actuator	1 min	15 min	–
HW Valve Signal	AO	2–way valve	1 min	15 min	–
Supply Airflow	AI	DPT–4 connected to box manufacturer supplied flow cross	1 min	15 min	–
Supply Air Temperature	AI	TS–1A	1 min	15 min	–
Zone Temperature Setpoint Adjustment	AI	TS–3C	15 min	15 min	–
Zone Temperature	AI	TS–3C	1 min	15 min	–
Zone Humidity	AI	HT–2	1 min	15 min	–
Zone CO2	AI	CO2–1	5 min	15 min	–

FCU SUPPLY FAN LADDER DIAGRAMS



(Actual wiring configuration to be confirmed by installer)

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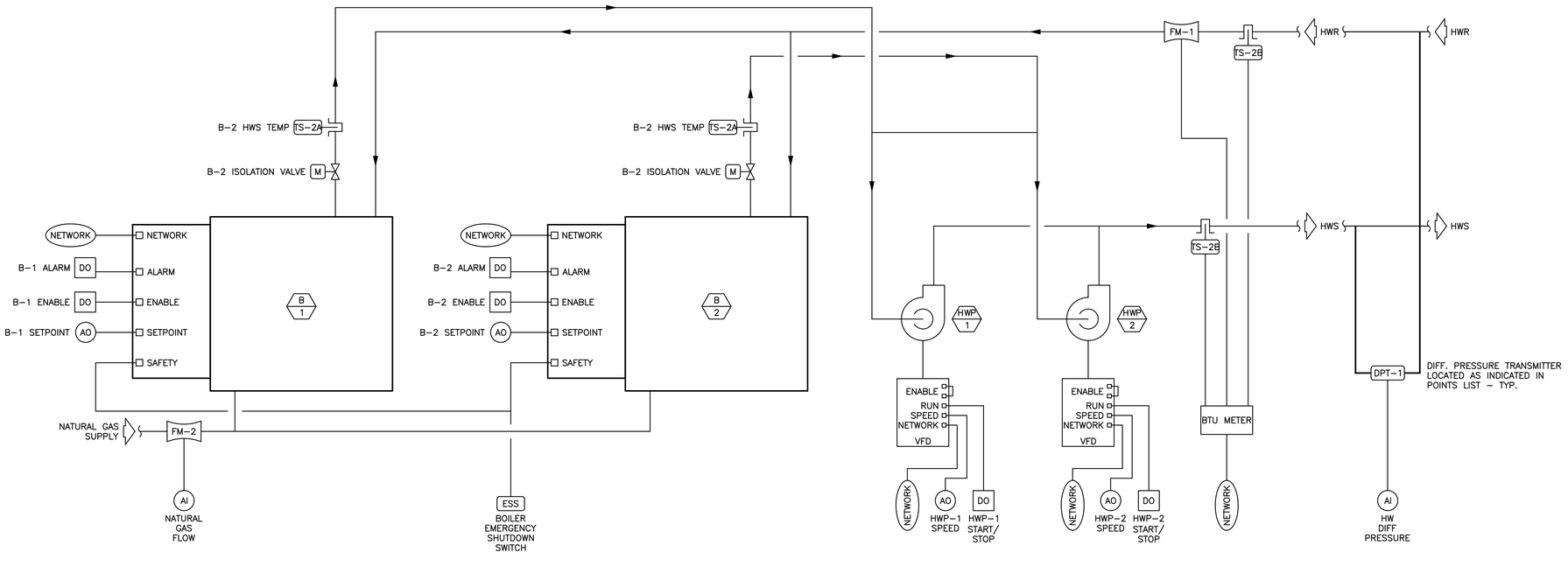
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08-31-2015		DD Check Set
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ERG# 15-28.2



1 M7.5 HW SYSTEM CONTROL SCHEMATIC
NO SCALE

POINTS MAPPED FROM BTU METER BACNET CARD

Description	Type	Device	Trend Logging: Comm-issioning	Trend Logging: Contin-uous	Calibra-tion
Return temperature	AI	Through network	1 min	15 min	–
Supply temperature	AI	Through network	1 min	15 min	–
Flow	AI	Through network	1 min	15 min	–
Btu/h	AI	Through network	1 min	15 min	–

HW SYSTEM HARDWIRED POINTS LIST

Description	Type	Device	Trend Logging: Comm-issioning	Trend Logging: Contin-uous	Calibra-tion
Boiler B-1 enable	DO	Connect to boiler enable contact	COV	COV	–
Boiler B-2 enable	DO	Connect to boiler enable contact	COV	COV	–
HWP-1 start/stop	DO	Connect to VFD Run	COV	COV	–
HWP-2 start/stop	DO	Connect to VFD Run	COV	COV	–
B-1 isolation valve	DO	Two position valve, line size	COV	COV	–
B-2 isolation valve	DO	Two position valve, line size	COV	COV	–
HWP-1 speed	AO	Connect to VFD Speed	1 min	15 min	–
HWP-2 speed	AO	Connect to VFD Speed	1 min	15 min	–
B-1 setpoint	AO	Connect to boiler setpoint input	1 min	15 min	–
B-2 setpoint	AO	Connect to boiler setpoint input	1 min	15 min	–
Boiler B-1 Alarm	DI	Connect to boiler alarm contact	COV	COV	–
Boiler B-2 Alarm	DI	Connect to boiler alarm contact	COV	COV	–
B-1 HWS temperature	AI	TS-2A	1 min	±2°F	–
B-2 HWS temperature	AI	TS-2A	1 min	±2°F	–
HW differential pressure	AI	DPT-1, 0 to 20 psi	1 min	15 min	–
Natural gas flow	AI	FM-2	1 min	15 min	–

POINTS MAPPED FROM BOILER BACNET CARD

Description	Type	Device	Trend Logging: Comm-issioning	Trend Logging: Contin-uous	Calibra-tion
Status/fault code 1-47	AI	Through network	±1	±1	–
Unit Status code 0-5	AI	Through network	±1	±1	–
HWS temperature	AI	Through network	1 min	1 min	–
HWR temperature	AI	Through network	15 min	15 min	–
Exhaust temperture	AI	Through network	15 min	15 min	–
FFWD temperature	AI	Through network	15 min	15 min	–
Firing rate %	AI	Through network	1 min	15 min	–
O2 level	AI	Through network	15 min	15 min	–
CO level	AI	Through network	15 min	15 min	–
Flame strength %	AI	Through network	15 min	15 min	–
Active HWST setpoint	AI	Through network	1 min	15 min	–
HWST Setpoint command	AO	Through network	±1°F	±1°F	–

POINTS MAPPED FROM VFD BACNET CARD

Description	Type	Device	Trend Logging: Comm-issioning	Trend Logging: Contin-uous	Calibra-tion
Fault reset	DO	Through network	COV	COV	–
On/off status	DI	Through network	COV	COV	–
Fault (Critical Alarm)	DI	Through network	COV	COV	–
Minor Alarm	DI	Through network	COV	COV	–
Fault Text	DI	Through network (convert code to plain English text)	COV	COV	–
Alarm Text	DI	Through network (convert code to plain English text)	COV	COV	–
Keypad in hand/auto	DI	Through network	COV	COV	–
Minimum frequency setpoint	AO	Through network	±5%	±5%	–
Maximum frequency setpoint	AO	Through network	±5%	±5%	–
Acceleration rate	AO	Through network	±5%	±5%	–
Deceleration rate	AO	Through network	±5%	±5%	–
Actual frequency	AI	Through network	1 min	15 min	–
AC output voltage	AI	Through network	±10%	±10%	–
Current	AI	Through network	15 min	60 min	–
VFD temperature	AI	Through network	60 min	60 min	–
Power, kW	AI	Through network	1 min	15 min	–
Energy, MWh	AI	Through network	15 min	60 min	–
DC Bus Voltage	AI	Through network	±10%	±10%	–

HW SYSTEM SEQUENCE OF OPERATION

General: HW system with condensing boilers and variable speed pumps.

1. For boilers, convert firing rate (valve position or other indicator per mfr's recommendations) from boiler controller to % load. Display % load on boiler graphic as well as valve position (or other % load indicator used).
2. Boilers and hot water pumps shall be lead/lag alternated as described in Sequence of Operations – General.
3. Lead boiler and pump.
   - 3.1. The lead system shall be enabled if there are more than 3 (adjustable) Boiler Plant Requests from zones or air handlers for more than 10 minutes (adjustable).
   - 3.2. The lead system shall be disabled if it has run at least 10 minutes and there are no Boiler Plant Requests from zones or air handlers for more than 10 minutes (adjustable).
4. Lag boiler and pump.
   - 4.1. The lag system shall be enabled if:
     - 4.1.1. The lead boiler is enabled and its firing rate exceeds [2 * boiler minimum firing rate + 20%] for 10 minutes. Boiler firing rate shall be passed though network. Minimum firing rate shall be per manufacturer's submittal.
   - 4.2. The lag system shall be disabled if:
     - 4.2.1. The lead system is disabled or,
     - 4.2.2. The lag system has run at least 10 minutes and the average boiler firing rate is less than minimum.
5. When the lead system is enabled, first start the lead pump and simultaneously open the boiler isolation valve, then after 30 seconds, enable the boiler. When the lead system is disabled, first disable the boiler, then after 3 minutes turn off the lead pump and simultaneously close the boiler isolation valve. Use similar logic for the lag system.
6. Pumps speed shall be controlled by a PID loop maintaining the differential pressure signal at a setpoint determined in conjunction with Work performed under Section 230593 Testing, Adjusting, and Balancing. All active pumps receive the same speed signal.
7. Hot Water Supply Temperature Reset:
   - 7.1. Hot water supply temperature setpoint shall be reset using Trim & Respond logic (see Sequence of Operation – General) based on hot water pump status with the following parameters:

Variable	Value
Device	HWS temperature
SP0	SPmax
SPmin	90°F
SPmax	140°F
Td	10 minutes
T	5 minutes
I	2
R	Heating HWST Reset Requests
SPtrim	-2°F
SPres	+3°F
SPres-max	+7°F

8. Boiler efficiency shall be calculated for each boiler from the following:
   - 8.1. Convert measured gas usage to Btu/h by a user adjustable conversion factor (default value = 1000 Btu/h per cubic feet of gas; acutal value set by user from utility bill).
   - 8.2. Calculate load from flow and temperature difference (HWS temperature minus HWR temperature).

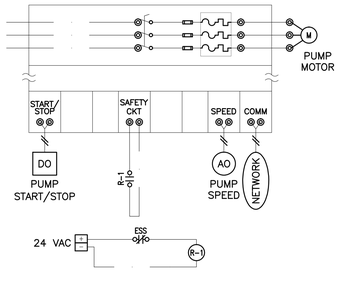
     QE = 490*GPMs*(HWS temp – HWR temp)

   - 8.3. Thermal efficiency is equal to measured load divided by measured gas consumption.
   - 8.4. Calculate predicted thermal efficiency.

     Qpart-load = GD (0.0634 + 0.7856*PLR + 0.1534*PLR^2)

     - 8.4.1. Where GD is the design gas flow rate and PLR is the measured load divided by the design load. See schedules for design load and gas rate.
   - 8.5. Summary Data. For each boiler, statistics shall be calculated and displayed on associated graphic for runtime, peak load, energy use, average actual efficiency, average predicted efficiency, and average load (flow rate, MBH, etc.), all summarized on an instantaneous (displaying real-time data), year-to-date, and last year basis.
9. Emergency Shutdown.
   - 9.1. Boilers shall be hardwire interlocked with the Boiler Emergency Shutdown Switch. Upon activation of the Boiler Emergency Shutdown Switch, the boilers shall be disabled and an alarm generated, Level 1.
10. Alarms.
    - 10.1. Maintenance interval alarm when pump has operated for more than 1500 hours: Level 5. Reset interval counter when alarm is acknowledged.
    - 10.2. Maintenance interval alarm when boiler has operated for more than 2000 hours: Level 5. Reset interval counter when alarm is acknowledged.
    - 10.3. Boiler alarm: Level 2.
    - 10.4. Low boiler leaving hot water temperature (more than 15F below setpoint) for more than 15 minutes when boiler has been enabled for longer than 15 minutes: Level 3.
    - 10.5. Pump alarm is indicated by the status input being different from the output command after a period of 15 seconds after a change in output status.
      - 10.5.1. Commanded on, status off: Level 2.
      - 10.5.2. Commanded off, status on: Level 4.
    - 10.6. HW System low differential pressure: Level 2 alarm if HW system differential pressure falls below 0.75 times the differential pressure setpoint for more than 15 minutes.

PUMP LADDER DIAGRAMS



HW PUMP VFD

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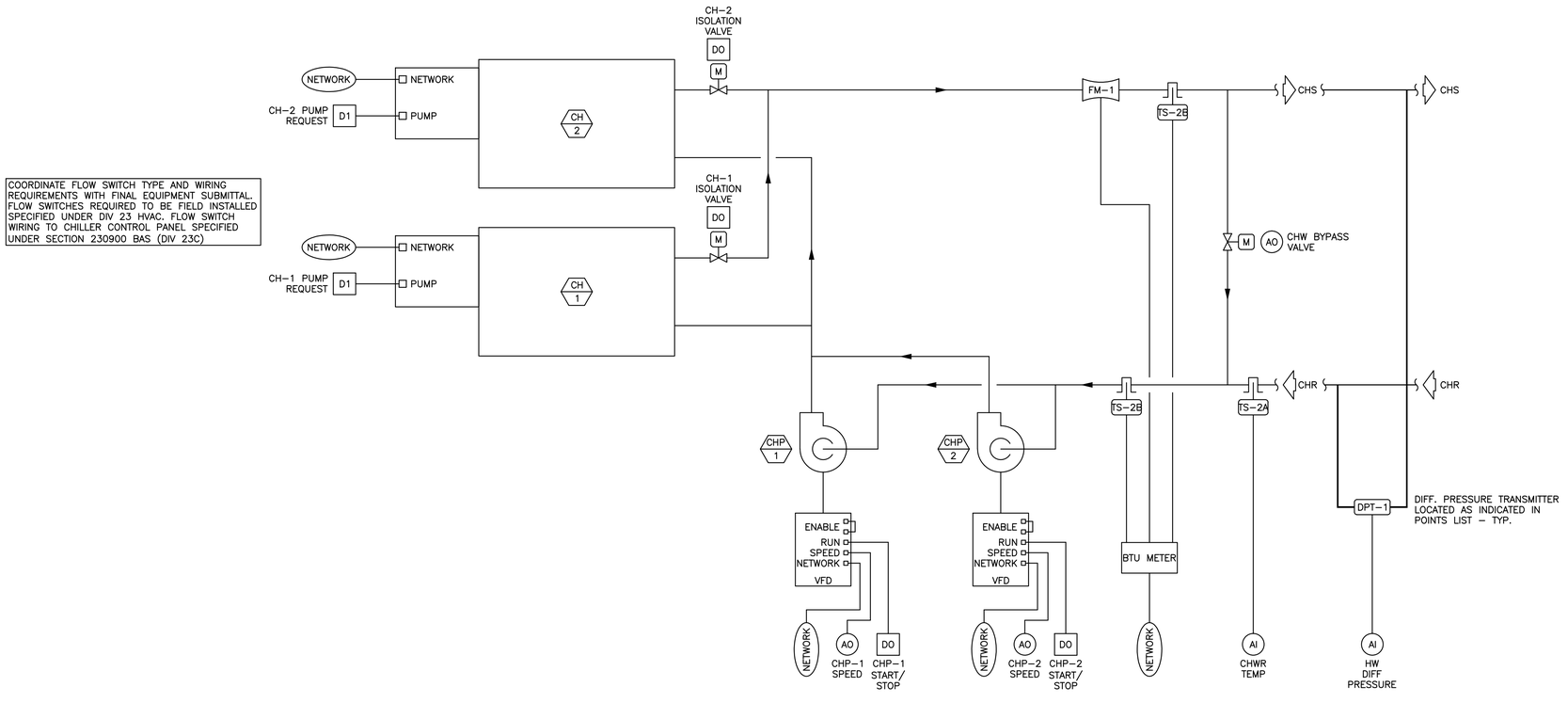
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Checked By: CM,TP
Client No: ------
Albert & Associates: 12575

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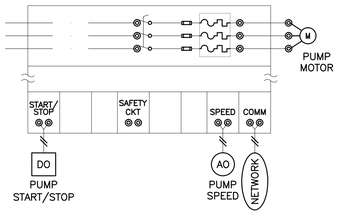
1 / M7.6 CHW SYSTEM CONTROL SCHEMATIC
NO SCALE

CHW SYSTEM SEQUENCE OF OPERATION

General: CHW system with air-cooled chillers and variable speed pumps.

1. Chillers and chilled water pumps shall be lead/lag alternated as described in Sequence of Operations – General.
2. Lead chiller and pump.
   - 2.1. The lead chilled water system shall be enabled if there are more than 2 (adjustable) Chiller Plant Requests from zones or air handlers for more than 10 minutes (adjustable).
   - 2.2. The lead chilled water system shall be disabled if it has run at least 10 minutes and there are no Chiller Plant Requests from zones or air handlers for more than 10 minutes (adjustable).
3. Lag chiller and pump.
   - 3.1. The lag chilled water system shall be enabled if:
     - 3.1.1. The lead chiller is enabled and the Chilled Water Supply Temperature (CHWST) is greater than 3°F above setpoint for 10 minutes.
   - 3.2. The lag chilled water system shall be disabled if:
     - 3.2.1. The lead chilled water system is disabled or,
     - 3.2.2. The lag chilled water system has run at least 10 minutes and the calculated Chiller Plant load is < 40% of total plant capacity for 15 minutes.
4. When a chilled water system is enabled via the chiller BACnet interface, the BAS shall perform the following:
   - 4.1. Command open the chiller isolation valve. After 30 seconds, enable the chiller.
   - 4.2. Upon receiving pump request from chiller control panel, the lead chilled water pump shall be started.
   - 4.3. Once the chiller has proven flow through the evaporator, the chiller shall begin its startup sequence and operate subject to its own internal controls and safeties.
5. When a chilled water system is disabled, first disable the chiller, then after 3 minutes turn off the lead pump and simultaneously close the chiller isolation valve.
6. Pumps speed shall be controlled by a reverse acting PID loop maintaining the differential pressure signal at the setpoint. Differential pressure setpoint shall be determined within the range of 1 psi to DP–MAX by a slow direct–acting control loop whose control point is the position of the most open valve and whose setpoint is 90% open. In other words, the DP setpoint is reset to maintain the valve requiring the most differential pressure at 90% open. DP–MAX is the design DP setpoint determined in conjunction with Work performed under Section 230593 Testing, Adjusting, and Balancing. All active pumps receive the same speed signal.
7. Chilled Water Supply Temperature Control:
   - 7.1. CHWST shall be controlled to its setpoint (ajustable from BACnet interface and locally at chiller control panel). CHWST initial setpoint shall be 42°F (ajustable).
   - 7.2. Calculate load from flow and temperature difference (CHWS temperature minus CHWR temperature).
8. Alarms.
   - 8.1. Maintenance interval alarm when pump has operated for more than 1500 hours: Level 5. Reset interval counter when alarm is acknowledged.
   - 8.2. Maintenance interval alarm when chiller has operated for more than 2000 hours: Level 5. Reset interval counter when alarm is acknowledged.
   - 8.3. Chiller alarm: Level 2.
   - 8.4. High chiller leaving chilled water temperature (more than 5°F above setpoint) for more than 10 minutes when chiller has been enabled for longer than 15 minutes: Level 3.
   - 8.5. Pump alarm is indicated by the status input being different from the output command after a period of 15 seconds after a change in output status.
     - 8.5.1. Commanded on, status off: Level 2.
     - 8.5.2. Commanded off, status on: Level 4.
   - 8.6. CHW System low differential pressure: Level 2 alarm if CHW system differential pressure falls below 0.75 times the differential pressure setpoint for more than 15 minutes.

PUMP LADDER DIAGRAMS



CHW PUMP VFD

POINTS MAPPED FROM BTU METER BACNET CARD

Description	Type	Device	Trend Logging: Comm–issioning	Trend Logging: Contin–uous	Calibra–tion
Return temperature	AI	Through network	1 min	15 min	–
Supply temperature	AI	Through network	1 min	15 min	–
Flow	AI	Through network	1 min	15 min	–
Btu/h	AI	Through network	1 min	15 min	–

CHW SYSTEM HARDWIRED POINTS LIST

Description	Type	Device	Trend Logging: Comm–issioning	Trend Logging: Contin–uous	Calibra–tion
Chiller CH–1 pump request	DI	Connect to chiller pump contact	COV	COV	–
Chiller CH–2 pump request	DI	Connect to chiller pump contact	COV	COV	–
CHP–1 start/stop	DO	Connect to VFD Run	COV	COV	–
CHP–2 start/stop	DO	Connect to VFD Run	COV	COV	–
CH–1 isolation valve	DO	Two position valve, line size	COV	COV	–
CH–2 isolation valve	DO	Two position valve, line size	COV	COV	–
CHP–1 speed	AO	Connect to VFD Speed	1 min	15 min	–
CHP–2 speed	AO	Connect to VFD Speed	1 min	15 min	–
CHW bypass valve	AO	Modulating 2–way valve	1 min	15 min	–
CHWR temperature	AI	TS–2A	1 min	±2°F	–
CHW differential pressure	AI	DPT–1, 0 to 20 psi	1 min	15 min	–

POINTS MAPPED FROM CHILLER BACNET CARD

Description	Type	Device	Trend Logging: Comm–issioning	Trend Logging: Contin–uous	Calibra–tion
Enable	DO	Through network	COV	COV	–
Alarm Present	DI	Through network	COV	–	–
Chiller Running State	DI	Through network	COV	–	–
Compressor Running	DI	Through network	COV	–	–
Local Setpoint Control	DI	Through network	COV	–	–
Evaporator Flow	DI	Through network	COV	–	–
Current Limit Setpoint	AO	Through network	COV	COV	–
Chilled Water Setpoint	AO	Through network	COV	COV	–
Evaporator EWT	AI	Through network	1 min	60 min	–
Evaporator LWT	AI	Through network	1 min	60 min	–
Active Running Capacity	AI	Through network	1 min	60 min	–
Running Amps	AI	Through network	1 min	60 min	–
Power, kW	AI	Through network	1 min	60 min	–

POINTS MAPPED FROM VFD BACNET CARD

Description	Type	Device	Trend Logging: Comm–issioning	Trend Logging: Contin–uous	Calibra–tion
Fault reset	DO	Through network	COV	COV	–
On/off status	DI	Through network	COV	COV	–
Fault (Critical Alarm)	DI	Through network	COV	COV	–
Minor Alarm	DI	Through network	COV	COV	–
Fault Text	DI	Through network (convert code to plain English text)	COV	COV	–
Alarm Text	DI	Through network (convert code to plain English text)	COV	COV	–
Keypad in hand/auto	DI	Through network	COV	COV	–
Minimum frequency setpoint	AO	Through network	±5%	±5%	–
Maximum frequency setpoint	AO	Through network	±5%	±5%	–
Acceleration rate	AO	Through network	±5%	±5%	–
Deceleration rate	AO	Through network	±5%	±5%	–
Actual frequency	AI	Through network	1 min	15 min	–
AC output voltage	AI	Through network	±10%	±10%	–
Current	AI	Through network	15 min	60 min	–
VFD temperature	AI	Through network	60 min	60 min	–
Power, kW	AI	Through network	1 min	15 min	–
Energy, MWh	AI	Through network	15 min	60 min	–
DC Bus Voltage	AI	Through network	±10%	±10%	–

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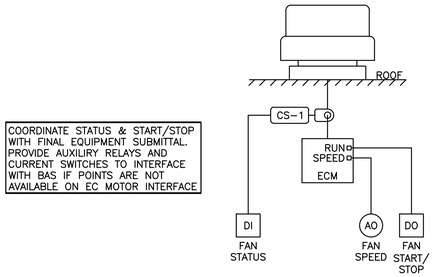
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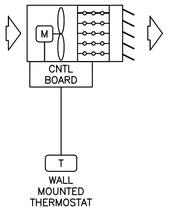
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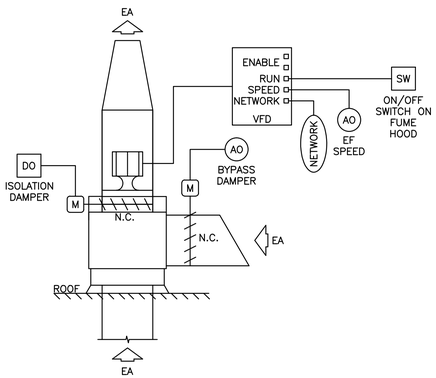
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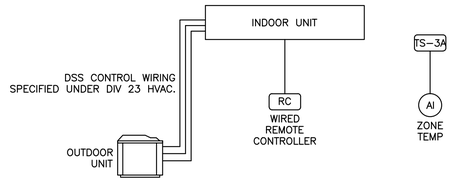
1 M7.7 EXHAUST FAN CONTROL SCHEMATIC
NO SCALE



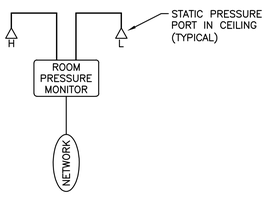
2 M7.7 ELECTRIC UNIT HEATER CONTROL SCHEMATIC
NO SCALE



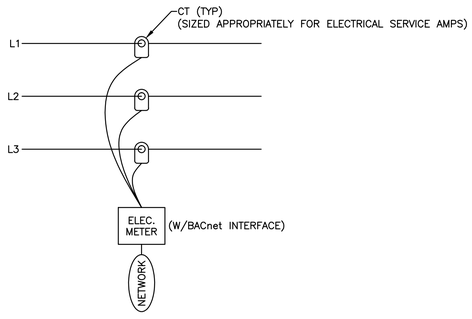
3 M7.7 LABORATORY EXHAUST FAN CONTROL SCHEMATIC
NO SCALE



4 M7.7 DUCTLESS SPLIT SYSTEM CONTROL SCHEMATIC
NO SCALE



5 M7.7 ROOM PRESSURE MONITOR
NO SCALE



6 M7.7 BUILDING ELECTRIC METER CONTROL SCHEMATIC
NO SCALE

POINTS MAPPED FROM ROOM PRESSURE MONITOR

Description	Type	Device	Trend Logging: Comm-issioning	Trend Logging: Contin-uous	Calibra-tion
Alarm Present	DI	Through Network	COV	COV	–
Device Status	DI	Through Network	COV	COV	–
Primary Pressure	AI	Through Network	15 min	60 min	–
Secondary Pressure	AI	Through Network	15 min	60 min	–
Room Differential Pressure	AI	Through Network	15 min	60 min	–

ELECTRIC UNIT HEATER SEQUENCE OF OPERATION

General: Electric unit heater controlled by wall mounted thermostat.

1. Unit heater shall be enabled when space temperature fall below the space temperature setpoint. It shall be disabled otherwise.
2. Fan shall run when unit heater is enabled.
3. Electric heat shall stage on and off to maintain the space heating setpoint temperature.

DUCTLESS SPLIT-SYSTEM POINTS LIST

Description	Type	Device	Trend Logging: Comm-issioning	Trend Logging: Contin-uous	Calibra-tion
Ductless Split-System Zone Temperature	AI	TS-3A	1 min	15 min	–

DUCTLESS SPLIT-SYSTEM SEQUENCE OF OPERATION

General: Ductless split-system controlled by wall mounted thermostat.

1. Unit operation shall be fully controlled by the wall mounted thermostat.
2. DSS controls including indoor to outdoor control wiring and thermostat wiring is specified under Division 23 HVAC.
3. BAS shall monitor the room temperature via a wall mounted temperature sensor (TS-3A).

POINTS MAPPED FROM ELEC. METER BACNET CARD

Description	Type	Device	Trend Logging: Comm-issioning	Trend Logging: Contin-uous	Calibra-bration
Real power (kW)	AI	Through network	15 min	60 min	–
Reactive power (kVAR)	AI	Through network	15 min	60 min	–
Apparent power (kVA)	AI	Through network	15 min	60 min	–
Power Factor, 3-phase average and per phase	AI	Through network	15 min	60 min	–
Demand, real (kW)	AI	Through network	15 min	60 min	–
Demand reactive (kVAR)	AI	Through network	15 min	60 min	–
Demand apparent (kVA)	AI	Through network	15 min	60 min	–
Peak demand, real (kW)	AI	Through network	15 min	60 min	–
Peak demand, reactive (kVAR)	AI	Through network	15 min	60 min	–
Peak demand, apparent (kVA)	AI	Through network	15 min	60 min	–
Current, 3-phase average and per phase	AI	Through network	15 min	60 min	–
Voltage, 3-phase average and per phase	AI	Through network	15 min	60 min	–
Frequency	AI	Through network	15 min	60 min	–
Accumulated energy, real (kWh)	AI	Through network	15 min	60 min	–
Accumulated energy reactive (kVARh)	AI	Through network	15 min	60 min	–
Accumulated energy apparent (kVAh)	AI	Through network	15 min	60 min	–
Demand interval configuration	AI	Through network	15 min	60 min	–
Alarm	AI	Through network	15 min	60 min	–

EXHAUST FAN POINTS LIST

Description	Type	Device	Trend Logging: Comm-issioning	Trend Logging: Contin-uous	Calibra-tion
Fan Status	DI	CS-1	COV	COV	–
Fan Start/Stop	DO	Dry Contact to 120V starter control circuit (coordinate with final equipment submittal)	COV	COV	–

EXHAUST FAN SEQUENCE OF OPERATION

General: Constant volume exhaust fan(s).

1. See Sequence of Operation – General for setpoints, loops, control modes, alarms, etc.
2. Exhaust fans shall operate when any of the associated system supply fans are proven on and associated Zone Group is in the occupied mode.
3. Alarms:
   - 3.1. Generate a Level 5 maintenance alarm when fan has operated for more than 3000 hours. Reset interval counter when alarm is acknowledged.
   - 3.2. Fan alarm is indicated by the status input being different from the output command after a period of 15 seconds after a change in output status.
     - 3.2.1. Commanded on, status off: Level 2.
     - 3.2.2. Commanded off, status on: Level 4.

LABORATORY EXHAUST FAN POINTS LIST

Description	Type	Device	Trend Logging: Comm-issioning	Trend Logging: Contin-uous	Calibra-tion
Isolation Damper	DO	Two position actuator	COV	COV	–
Fan Start/Stop	DO	Connect to VFD "Run"	COV	COV	–
Relief Fan Speed	AO	Connect to VFD "Speed"	1 min	60 min	–
Bypass Damper	AO	Modulating actuator	1 min	60 min	–
Duct Static Pressure	AI	DPT-2A, 0 to 4 inches	1 min	60 min	–

POINTS MAPPED FROM VFD BACNET CARD

Description	Type	Device	Trend Logging: Comm-issioning	Trend Logging: Contin-uous	Calibra-tion
Fault reset	DO	Through network	COV	COV	–
On/off status	DI	Through network	COV	COV	–
Fault (Critical Alarm)	DI	Through network	COV	COV	–
Minor Alarm	DI	Through network	COV	COV	–
Fault Text	DI	Through network (convert code to plain English text)	COV	COV	–
Alarm Text	DI	Through network (convert code to plain English text)	COV	COV	–
Keypad in hand/auto	DI	Through network	COV	COV	–
Minimum frequency setpoint	AO	Through network	±5%	±5%	–
Maximum frequency setpoint	AO	Through network	±5%	±5%	–
Acceleration rate	AO	Through network	±5%	±5%	–
Deceleration rate	AO	Through network	±5%	±5%	–
Actual frequency	AI	Through network	1 min	15 min	–
AC output voltage	AI	Through network	±10%	±10%	–
Current	AI	Through network	15 min	60 min	–
VFD temperature	AI	Through network	60 min	60 min	–
Power, kW	AI	Through network	1 min	15 min	–
Energy, MWh	AI	Through network	15 min	60 min	–
DC Bus Voltage	AI	Through network	±10%	±10%	–

LAB EXHAUST FAN SEQUENCE OF OPERATION

General: Constant volume laboratory exhaust fan fully controlled by the BAS.

1. See Sequence of Operation – General for setpoints, loops, control modes, alarms, etc.
2. Start/Stop: BAS open the fan isolation damper and after 30 seconds shall enable the exhaust fan. The fan remain enabled 24/7 (adjustable).
3. Proof: BAS shall prove fan operation and use the status indication to accumulate runtime.
4. VFD Control: Fan speed shall be set to the speed corresponding to the fan's design exhaust air flow rate. This fan speed shall be determined in conjunction with Work performed under 230593 Testing, Adjusting, and Balancing.
5. Bypass Damper Control: The fan bypass damper shall be controlled by a PID loop maintaining the exhaust duct differential pressure signal at a setpoint determined in conjunction with Work performed under 230593 Testing, Adjusting, and Balancing.
6. Alarms:
   - 6.1. Generate a Level 5 maintenance alarm when fan has operated for more than 3000 hours. Reset interval counter when alarm is acknowledged.
   - 6.2. BAS shall monitor VFD alarms through the VFD BACnet interface. Generate a Level 2 alarm when active.
   - 6.3. Fan alarm is indicated by the status input being different from the output command after a period of 15 seconds after a change in output status.
     - 6.3.1. Commanded on, status off: Level 2.
     - 6.3.2. Commanded off, status on: Level 4.

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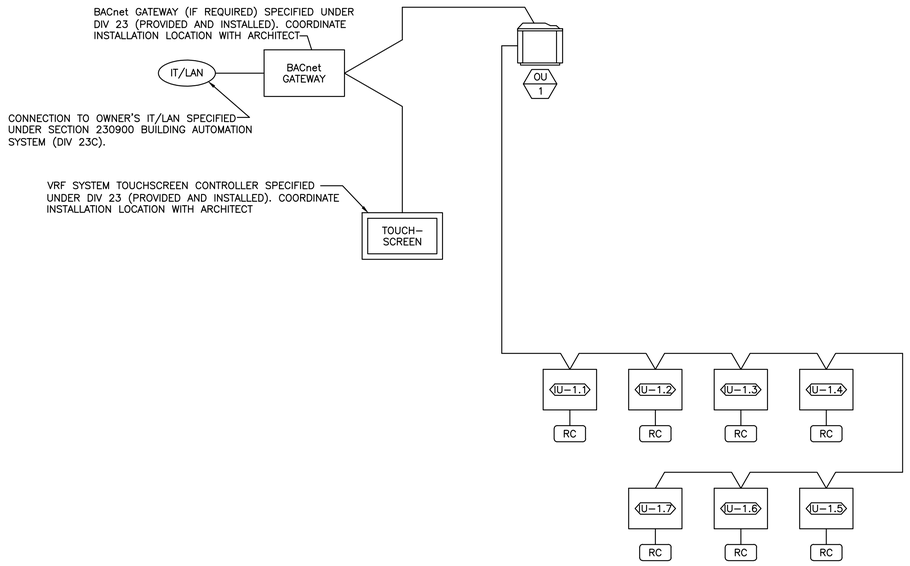
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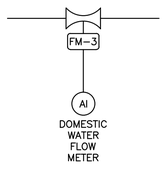
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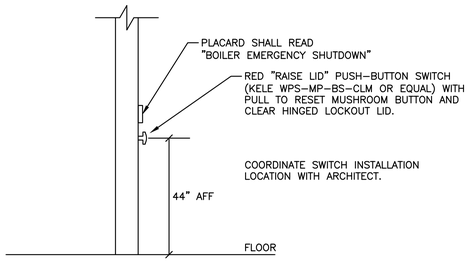
1 M7.8 VARIABLE REFRIGERANT FLOW (VRF) SYSTEM CONTROL SCHEMATIC
NO SCALE

VARIABLE REFRIGERANT FLOW (VRF) SYSTEM NOTES

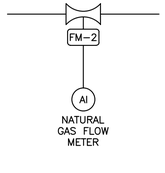
1. VRF CONTROL SYSTEM WIRING SPECIFIED UNDER DIVISION 23 HVAC. VRF CONTROL SYSTEM WIRING INCLUDES BUT IS NOT LIMITED TO COMMUNICATION WIRING. REMOTE CONTROLLER (RC) WIRING, SYSTEM CONTROLLER, BACNET GATEWAY, ETC.



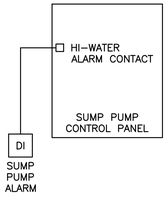
2 M7.8 DOMESTIC WATER FLOW METER
NO SCALE



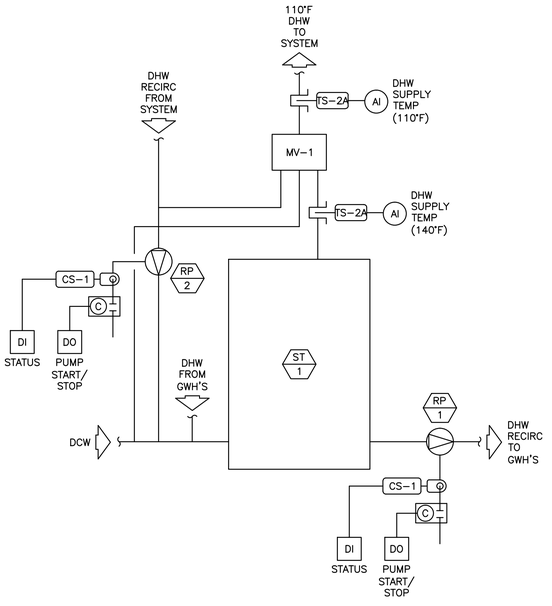
3 M7.8 BOILER EMERGENCY SHUTDOWN SWITCH
NO SCALE



4 M7.8 NATURAL GAS FLOW METER
NO SCALE



5 M7.8 SUMP HI-LEVEL ALARM
NO SCALE



6 M7.8 DOMESTIC HOT WATER CONTROL SCHEMATIC
NO SCALE

POINT MAPPED FROM VRF SYSTEM

Description	Type	Device	Trend Logging		Calibration
			Commissioning	Continuous	
Outdoor Unit Status	DI	Through network	COV	COV	–
Branch Controller Status	DI	Through network	COV	COV	–
Indoor Unit Mode	DI	Through network	COV	COV	–
Alarms	DI	Through network	COV	COV	–
Indoor Unit Enable	DO	Through network	COV	COV	–
Zone Temperature	AI	Through network	15 min	60 min	–
Zone Temperature Setpoint Adjustment	AO	Through network	COV	COV	–
Zone Temperature Limits	AO	Through network	–	–	–
Time-of-Day Scheduling	AO	Through network	–	–	–
Fan Speed Setting	AO	Through network	COV	–	–
Air Flow Direction	AO	Through network	–	–	–
Permit/Prohibit Function	AO	Through network	COV	–	–

VRF SYSTEM SEQUENCE OF OPERATION

General: Once enabled via the Building Automation System (BAS), the Variable Refrigerant Flow (VRF) system shall operate subject to its own internal controls and safeties.

1. See Sequence of Operation – General for setpoints, loops, control modes, alarms, etc.
2. BAS shall enable/disable, schedule system modes, monitor system parameters, and change setpoints for the VRF system via the BACnet gateway.
3. Division 23 HVAC Contractor shall be responsible for initial VRF system setup, programming, point naming, schedules, setpoints, etc (system configuration). Division 23 HVAC Contractor and VRF system vendor shall provide technical support to the Section 230900 BAS (Division 23C) Contractor in mapping across BAS points.
4. Zone Temperature Control: Zone temperature shall be controlled via each indoor unit's remote controller within the temperature limits specified.
5. BAS Alarms:
   5.1. Maintenance interval alarm when unit has operated for more than 1500 hours: Level 5. Reset interval counter when alarm is acknowledged.

MISCELLANEOUS POINTS LIST

Description	Type	Device	Trend Logging		Calibration
			Commissioning	Continuous	
Sump Pump Alarm	DI	Connect to Sump Pump Control Panel Alarm Contact	COV	COV	–
RP-1 Status	DI	CS-1	COV	COV	–
RP-2 Status	DI	CS-1	COV	COV	–
RP-1 Start/Stop	DO	Dry contact to 120V or 24V control circuit	COV	COV	–
RP-2 Start/Stop	DO	Dry contact to 120V or 24V control circuit	COV	COV	–
Natural Gas Flow Meter	AI	FM-2	1 min	15 min	–
Domestic Water Flow Meter	AI	FM-3	1 min	15 min	–
DHW Supply Temperature (110°F)	AI	TS-2A	1 min	15 min	–
DHW Supply Temperature (140°F)	AI	TS-2A	1 min	15 min	–

DOM. HOT WATER SYSTEM SEQUENCE OF OPERATION

General: Domestic hot water circulation pumps shall be fully controlled (start/stop) by the BAS.

1. Domestic hot water pumps shall be enabled based on the facility's normal occupancy schedule and shall be adjustable via the OWS and CSS.
2. BAS Alarms:
   2.1. Maintenance interval alarm when pump has operated for more than 1500 hours: Level 5. Reset interval counter when alarm is acknowledged.
   2.2. Hot water supply temperature less than 110°F when RP-1 is proven on for 10 minutes: Level 2.
   2.3. Pump alarm is indicated by the status input being different from the output command after a period of 15 seconds after a change in output status.
      2.3.1. Commanded on, status off: Level 2.
      2.3.2. Commanded off, status on: Level 4.

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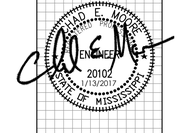
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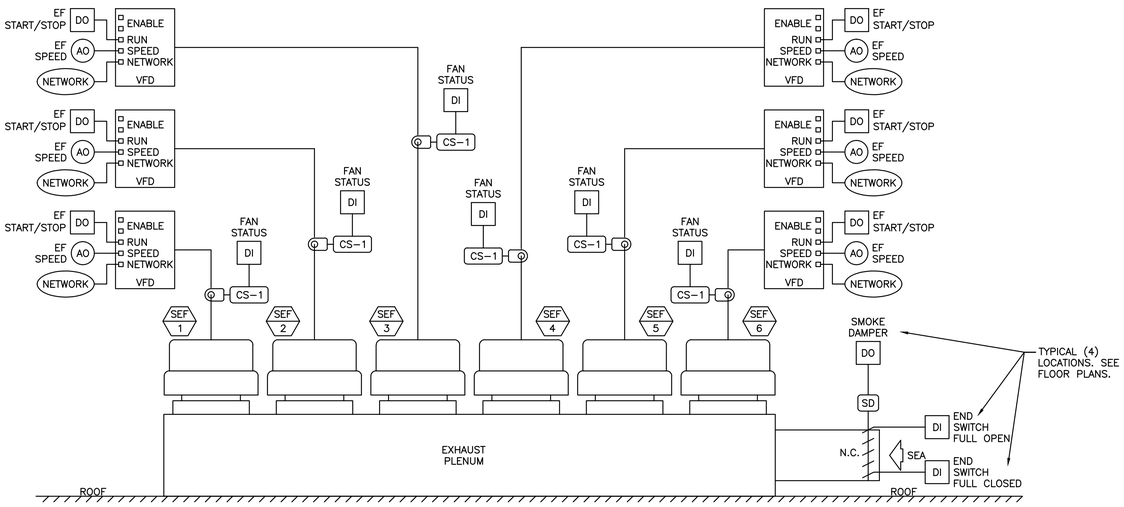
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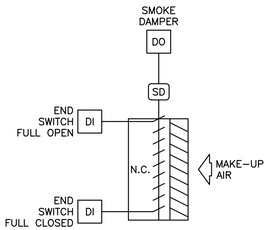
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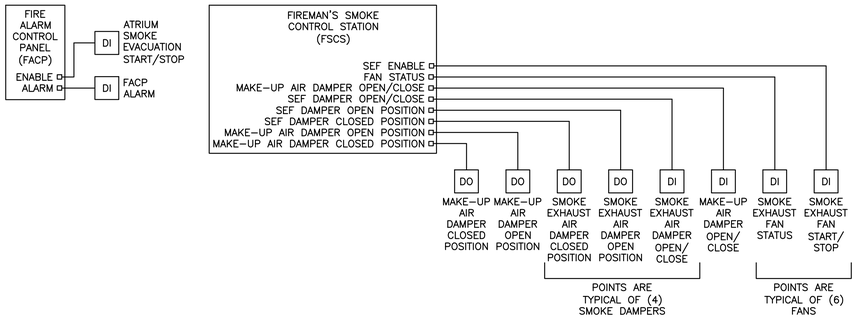


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1 / M7.9 ATRIUM SMOKE EVACUATION CONTROL SCHEMATIC
NO SCALE

EXHAUST FAN POINTS LIST

Description	Type	Device	Trend Logging: Commissioning	Trend Logging: Continuous	Calibration
Fan Start/Stop	DO	Connect to VFD "Run"	–	–	–
Smoke Damper	DO	Two-position actuator	–	–	–
Make-up Air Damper Open Position	DO	FSCS	–	–	–
Make-up Air Damper Closed Position	DO	FSCS	–	–	–
Smoke Exhaust Air Damper Open Position	DO	FSCS	–	–	–
Smoke Exhaust Air Damper Closed Position	DO	FSCS	–	–	–
Fan Status	DI	CS-1	–	–	–
Damper End-Switch Open position	DI	Damper end switch		–	–
Damper End-Switch Closed position	DI	Damper end switch	–	–	–
Smoke Exhaust Fan Start/Stop	DI	FSCS	–	–	–
Make-Up Air Damper Open/Close	DI	FSCS	–	–	–
Smoke Exhaust Air Damper Open/Close	DI	FSCS	–	–	–
Atrium Smoke Evacuation Start/Stop	DI	FACP	–	–	–
FACP Alarm	DI	FACP	–	–	–

POINTS MAPPED FROM VFD BACNET CARD

Description	Type	Device	Trend Logging: Commissioning	Trend Logging: Continuous	Calibration
Fault reset	DO	Through network	COV	COV	–
On/off status	DI	Through network	COV	COV	–
Fault (Critical Alarm)	DI	Through network	COV	COV	–
Minor Alarm	DI	Through network	COV	COV	–
Fault Text	DI	Through network (convert code to plain English text)	COV	COV	–
Alarm Text	DI	Through network (convert code to plain English text)	COV	COV	–
Keypad in hand/auto	DI	Through network	COV	COV	–
Minimum frequency setpoint	AO	Through network	±5%	±5%	–
Maximum frequency setpoint	AO	Through network	±5%	±5%	–
Acceleration rate	AO	Through network	±5%	±5%	–
Deceleration rate	AO	Through network	±5%	±5%	–
Actual frequency	AI	Through network	1 min	15 min	–
AC output voltage	AI	Through network	±10%	±10%	–
Current	AI	Through network	15 min	60 min	–
VFD temperature	AI	Through network	60 min	60 min	–
Power, kW	AI	Through network	1 min	15 min	–
Energy, MWh	AI	Through network	15 min	60 min	–
DC Bus Voltage	AI	Through network	±10%	±10%	–

ATRIUM SMOKE EVACUATION SEQUENCE OF OPERATION

General: Sequence describes the Atrium smoke evacuation system control. Smoke evacuation system shall be fully controlled by a UL 864 compliant Building Automation System (BAS). The smoke evacuation BAS system components shall be dedicated to the smoke evacuation only per UL 864. Smoke evacuation BAS shall be integrated into the overall BAS.

1. Smoke Evacuation Initiated by Fire Alarm Control Panel (FACP).
   - 1.1. Upon detection of smoke by the Atrium smoke detectors, the FACP shall enable the smoke evacuation system.
   - 1.2. Upon receiving an enable signal from the FACP the smoke evacuation BAS shall open the smoke dampers (both make-up air and exhaust air smoke dampers).
   - 1.3. After 30 seconds (adjustable) the smoke evacuation fans shall be enabled.
   - 1.4. Smoke evacuation system shall run until either disabled by the FACP or overrided by the Fireman's Smoke Control Station (FSCS).
2. Smoke Evacuation System Control by Fireman's Smoke Control Station (FSCS).
   - 2.1. FSCS shall fully comply with UL 864.
   - 2.2. The smoke evacuation system (all components; fans and smoke dampers) shall be fully controllable via the FSCS.
   - 2.3. Each fan and smoke damper shall be controllable by a On-Auto-Off switch installed in the FSCS.
   - 2.4. FSCS shall have a Fireman's key switch (Panel Enable Switch) to limit access to the operation of system.
   - 2.5. Exhaust fans shall be manually controllable (start/stop) from FSCS.
   - 2.6. Smoke dampers shall be manually controllable (open/close) from FSCS.
   - 2.7. BAS shall provide feedback of all points listed to FSCS.
3. Alarms:
   - 3.1. Generate a Level 1 alarm when fan is enabled for any source (FACP or FSCS).
   - 3.2. Fan alarm is indicated by the status input being different from the output command after a period of 15 seconds after a change in output status.
     - 3.2.1. Commanded on, status off: Level 1.
     - 3.2.2. Commanded off, status on: Level 1.

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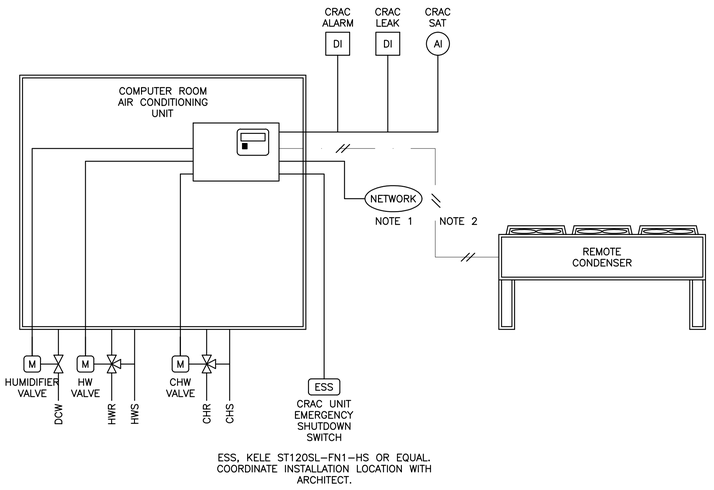
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1 / M710 COMPUTER ROOM AIR CONDITIONING (CRAC) UNIT CONTROL SCHEMATIC

NO SCALE

EXHAUST FAN POINTS LIST

Description	Type	Device	Trend Logging		Calibration
			Commissioning	Continuous	
CRAC Leak	DI	Connect to CRAC leak detection contact	COV	COV	–
CRAC Alarm	DI	Connect to CRAC Alarm contact	COV	COV	–
CRAC Supply Air Temp	AI	Connect to CRAC SAT contact	COV	COV	–

POINTS MAPPED FROM CRAC UNIT BACNET CARD

Description	Type	Device	Trend Logging		Calibration
			Commissioning	Continuous	
Unit Enable	DO	Through network	COV	COV	–
Local Alarm Present	DI	Through network	COV	COV	–
Dehumidification	DI	Through network	COV	COV	–
Humidification	DI	Through network	COV	COV	–
Reheat	DI	Through network (convert code to plain English text)	COV	COV	–
Unit Status	DI	Through network (convert code to plain English text)	COV	COV	–
Water Detection	DI	Through network	COV	COV	–
Dirty Filter	DI	Through network	COV	COV	–
Cooling Stages On	AO	Through network	COV	COV	–
Heating Stages On	AO	Through network	COV	COV	–
CHW Valve Position	AO	Through network	1 min	60 min	–
HW Valve Posiiton	AO	Through network	1 min	60 min	–
CHW Runtime	A1	Through network	1 min	60 min	–
HW Runtime	AI	Through network	1 min	60 min	–
Temperature Setpoint	AO	Through network	COV	COV	–
Humidity Setpoint	AO	Through network	COV	COV	–
Discharge Air Temperature	AI	Through network	1 min	60 min	–
Return Air Temperture	AI	Through network	1 min	60 min	–
Relative Humidty	AI	Through network	1 min	60 min	

CRAC UNIT SEQUENCE OF OPERATION

General: Computer Room Air Conditioning (CRAC) Unit. EMCS shall monitor CRAC unit's hardwired and network points for diagnostic purposes. All alarms shall be displayed at the OWS.

1. CRAC unit shall be controlled by it's internal controller and shall run subject to it's own internal safeties.
2. Alarms:
   - 2.1. Generate a Level 5 maintenance alarm when unit has operated for more than 5000 hours. Reset interval counter when alarm is acknowledged.

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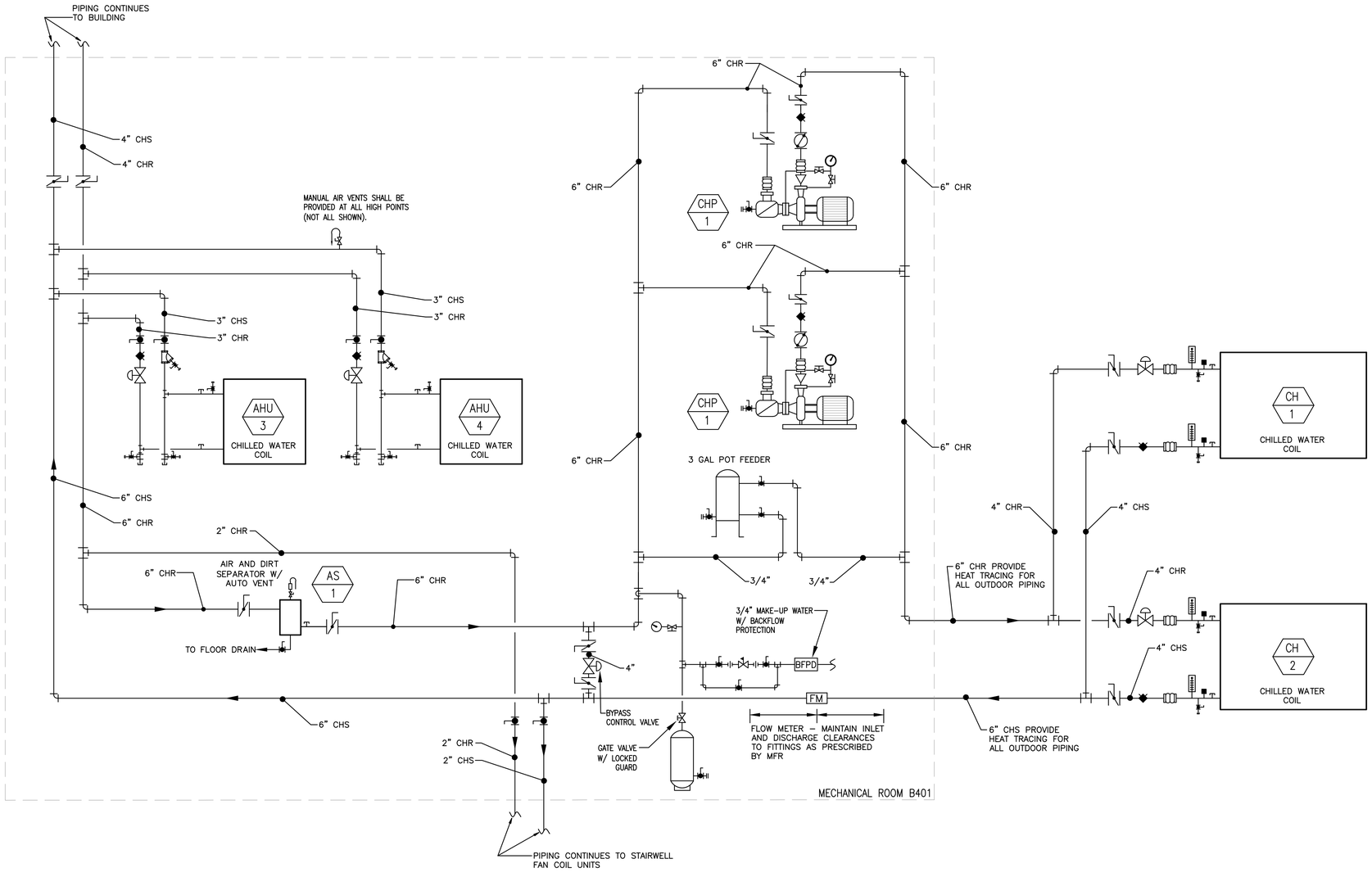
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Albert & Associates:	12575

DAVID E. MCCLESKEY REGISTERED ENGINEER 20102 1/13/2017 STATE OF MISSISSIPPI

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ERG# 15-28.2



1 / M8.1 CHILLED WATER PIPING SCHEMATIC (MECHANICAL ROOM B401)

NO SCALE

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

Drawing Issued:

Date	Rev.	Description
08-31-2015		DD Check Set
10-20-2015		75% Progress Set
11-02-2015		90% Pricing Set
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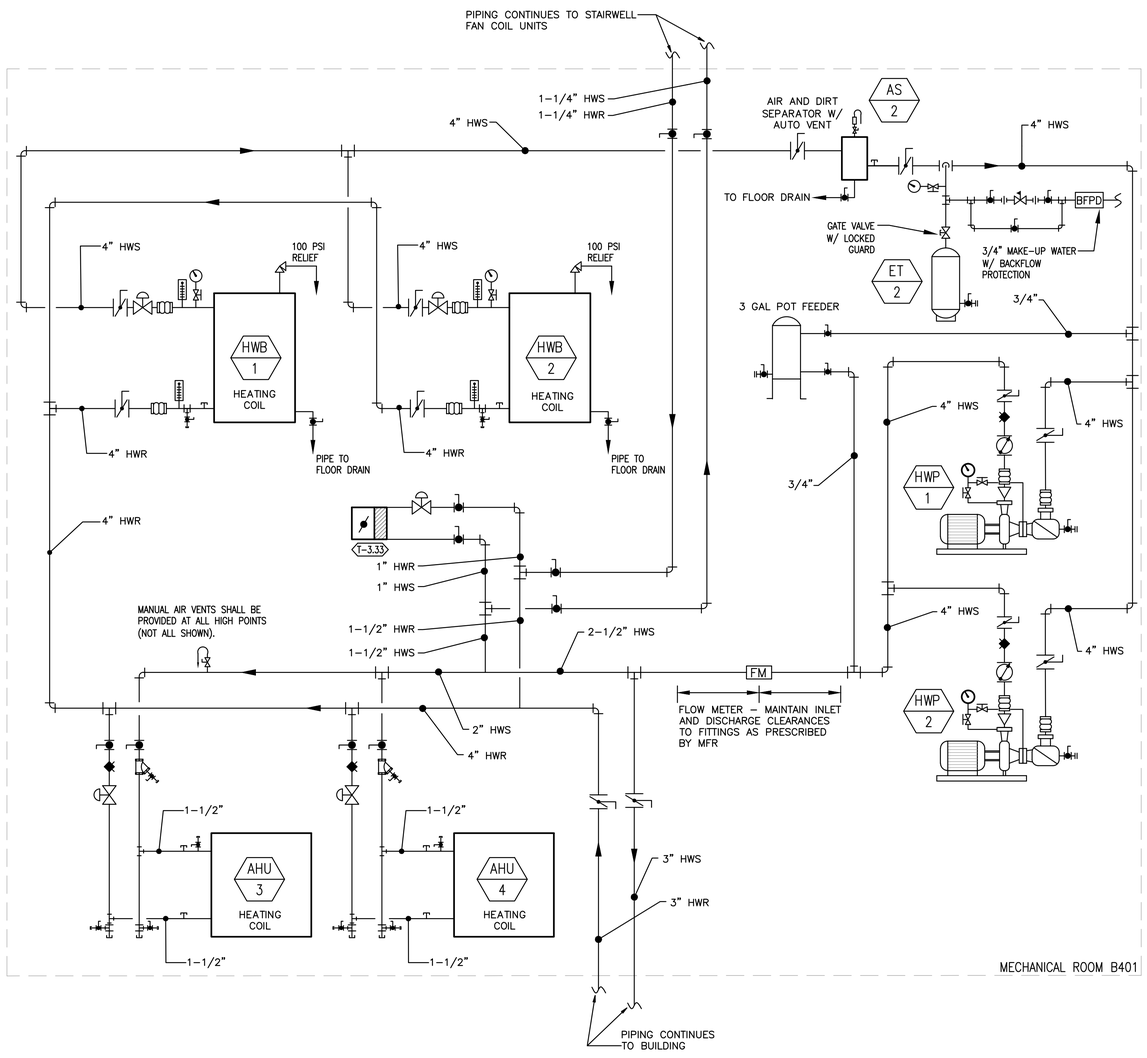
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DAVID E. MOORE, REGISTERED PROFESSIONAL ENGINEER, 20102, 1/13/2017, STATE OF MISSISSIPPI

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1 M8.2 HEATING WATER PIPING SCHEMATIC (MECHANICAL ROOM B401)

NO SCALE

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

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ELECTRICAL LEGEND

GENERAL NOTES

1. ALL EQUIPMENT AND DEVICES ARE TO BE FLUSH MOUNTED UNLESS OTHERWISE NOTED.
2. DEVICES NOTED AS "GFI" SHALL BE GROUND FAULT CIRCUIT INTERRUPTING DEVICES.
3. DEVICES NOTED AS "WP" SHALL BE WEATHERPROOF WHILE-IN-USE.
4. DEVICES NOTED AS "DL" SHALL BE RATED FOR DAMP LOCATION.
5. DEVICES NOTED AS "NL" SHALL BE NIGHT LIGHTS. PROVIDE UNSWITCHED POWER TO FIXTURE.
6. DEVICES NOTED AS "WG" SHALL BE PROVIDED AND INSTALLED WITH A WIRE GUARD.
7. DEVICES NOTED AS "TR" SHALL BE TAMPER RESISTANT.
8. PROVIDE UNSWITCHED POWER TO EMERGENCY BATTERY PACKS.

LUMINAIRES (See Light Fixture Schedule)

NOTE: THE NUMBER INSIDE THE CIRCLE IS THE CIRCUIT NUMBER. THE LETTER BESIDE THE SYMBOL IS THE FIXTURE TYPE DESCRIBED IN THE LIGHT FIXTURE SCHEDULE.

- 2'X2' RECESSED FIXTURE.
- 2'X4' RECESSED FIXTURE.
- 1'X4' RECESSED FIXTURE.
- 2'X2' RECESSED EMERGENCY FIXTURE.
- 2'X4' RECESSED EMERGENCY FIXTURE.
- 1'X4' RECESSED EMERGENCY FIXTURE.
- LINEAR RECESSED FIXTURE.
- LINEAR RECESSED EMERGENCY FIXTURE.
- SURFACE MOUNTED OR SUSPENDED FIXTURE.
- SURFACE MOUNTED OR SUSPENDED EMERGENCY FIXTURE.
- RECESSED CEILING FIXTURE.
- RECESSED EMERGENCY CEILING FIXTURE.
- PENDANT MOUNT FIXTURE.
- CEILING MOUNTED EXIT SIGN. PROVIDE CHEVRONS AS INDICATED BY ARROWS.
- EXIT SIGN WITH EMERGENCY LIGHTING.
- WALL MOUNTED EXIT SIGN. PROVIDE CHEVRONS AS INDICATED BY ARROWS.
- WALL MOUNTED FIXTURE.
- WALL MOUNTED LINEAR FIXTURE.
- WALL MOUNTED EMERGENCY LINEAR FIXTURE.
- SITE ARM MOUNT POLE LIGHT FIXTURE.
- SITE POLE TOP LIGHT FIXTURE.
- SURFACE MOUNTED TRACK AND TRACK LIGHTING FIXTURE.
- WALLWASH OR SPOT LIGHT FIXTURE.
- IN-GRADE MOUNTED FIXTURE.

MISCELLANEOUS

- C — CONTACTOR.
- PE — PHOTOCELL.
- CEILING MOUNTED JUNCTION BOX.
- WALL MOUNTED JUNCTION BOX.
- FLEXIBLE CONNECTION TO EQUIPMENT.
- PROVISIONS FOR CABLE TELEVISION OUTLET. MOUNT ABOVE CEILING UNLESS NOTED OTHERWISE. PROVIDE AN OUTLET BOX AND A 3/4" CONDUIT TO ACCESSIBLE LOCATION (IF REQUIRED.)

GEAR

- ???/F-? — FUSED DISCONNECT SWITCH. TEXT INDICATES AMPACITY/NUMBER OF POLES/ENCLOSURE TYPE; F=(RATING OF FUSES).
- ???/? — NON-FUSED DISCONNECT SWITCH. TEXT INDICATES AMPACITY/NUMBER OF POLES/ENCLOSURE TYPE.
- MAGNETIC MOTOR STARTER.
- ???/F-?/NEMA SIZE ? — COMBINATION FUSED DISCONNECT AND MAGNETIC MOTOR STARTER.
- COMBINATION CIRCUIT BREAKER AND MAGNETIC MOTOR STARTER.
- PANELBOARD.
- COMBINATION CIRCUIT BREAKER AND MAGNETIC MOTOR STARTER.
- FLUSH MOUNTED CIRCUIT BREAKER STYLE SWITCH IN A NEMA 3R ENCLOSURE. SWITCH SHALL BE RATED 60A, 2-POLE MINIMUM.

SWITCHES

- $ — SINGLE-POLE, SINGLE-THROW SWITCH. MOUNT CENTERLINE OF BOX AT 45"A.F.F. UNLESS NOTED OTHERWISE.
- 2P $ — DOUBLE-POLE, SINGLE-THROW, 30 AMP SWITCH. MOUNT CENTERLINE OF BOX AT 45"A.F.F. UNLESS NOTED OTHERWISE.
- 3 $ — THREE-WAY SWITCH. MOUNT CENTERLINE OF BOX AT 45"A.F.F. UNLESS NOTED OTHERWISE.
- 4 $ — FOUR-WAY SWITCH. MOUNT CENTERLINE OF BOX AT 45"A.F.F. UNLESS NOTED OTHERWISE.
- LV — LOW VOLTAGE DIMMER. MOUNT CENTERLINE OF BOX AT 45"A.F.F. UNLESS NOTED OTHERWISE. SELECT PROPER DIMMER FOR TRANSFORMER TYPE.
- LED DIMMER SWITCH. MOUNT CENTERLINE OF BOX AT 45"A.F.F. UNLESS NOTED OTHERWISE.
- C — LINE VOLTAGE COMPANION DIMMER SWITCH. LUTORN #MSC-AD-277-WH OR APPROVED EQUAL. MOUNT CENTERLINE OF BOX AT 45"A.F.F. UNLESS NOTED OTHERWISE.
- M $ — AUTOMATIC WALL SWITCH. LUTRON #MS-A102-WH OR APPROVED EQUAL. MOUNT CENTERLINE OF BOX AT 45" A.F.F. UNLESS NOTED OTHERWISE.
- MS $ — MANUAL MOMENTARY WALL SWITCH. LUTRON #MS-A102-WH OR APPROVED EQUAL. MOUNT CENTERLINE OF BOX AT 45" A.F.F. UNLESS NOTED OTHERWISE.
- M2 $ — DUAL TECHNOLOGY, DUAL RELAY WALL SWITCH. SENSORSWITCH #WSD-PDT-2P OR APPROVED EQUAL. MOUNT CENTERLINE OF BOX AT 45" A.F.F. UNLESS NOTED OTHERWISE.
- M — AUTOMATIC WALL SWITCH WITH INTEGRAL 0-10V DIMMER. LUTRON #MS-Z101 OR APPROVED EQUAL. MOUNT CENTERLINE OF BOX AT 45"A.F.F. UNLESS NOTED OTHERWISE.
- TS $ — DIGITAL TIME SWITCH WITH ADJUSTABLE RANGE FROM 5 MINUTES TO 12 HOURS. FURNISH WITH AUDIBLE WARNING. SENSORSWITCH #PTS-60 OR APPROVED EQUAL. MOUNT CENTERLINE OF BOX AT 45" A.F.F. UNLESS NOTED OTHERWISE.
- T $ — HORSEPOWER RATED SWITCH WITH THERMAL OVERLOADS (MANUAL MOTOR STARTER).
- 3RL $ — WIRELESS THREE BUTTON WITH DIMMING WALL SWITCH. LUTRON #PJ2-3BRL-GWH-L01
- MD1 — PASSIVE INFRARED AND ULTRASONIC DUAL TECHNOLOGY OCCUPANCY SENSOR WITH A 12' RADIAL COVERAGE. CEILING MOUNTED. SENSORSWITCH #CM-PDT-9 OR APPROVED EQUAL.
- MD2 — PASSIVE INFRARED AND ULTRASONIC DUAL TECHNOLOGY OCCUPANCY SENSOR WITH 2000 SQFT COVERAGE. CEILING MOUNTED. LUTRON #LOS-CDT-2000-WH OR APPROVED EQUAL.
- MDW — WIRELESS PASSIVE INFRARED OCCUPANCY SENSOR. CEILING MOUNTED. LUTRON #LRF2-OCR2B-P-WH OR APPROVED EQUAL.
- MDH — PASSIVE INFRARED OCCUPANCY SENSOR WITH A 130 LINEAR FT. COVERAGE. WALL MOUNTED AT 7' ABOVE FINISH FLOOR. SENSORSWITCH #HW13 OR APPROVED EQUAL.
- HMD — PASSIVE INFRARED OCCUPANCY SENSOR. HIGH CEILING MOUNT. SENSORSWITCH #CMR-6 OR APPROVED EQUAL.
- MDC — PASSIVE INFRARED AND ULTRASONIC DUAL TECHNOLOGY OCCUPANCY SENSOR WITH A 2000 SQ. FT. COVERAGE. MOUNT IMMEDIATELY BELOW CEILING. SENSORSWITCH #WV-PDT-16 OR APPROVED EQUAL.
- PP — POWER PACK MOUNTED ABOVE CEILING. LUTRON #PP-DV OR APPROVED EQUAL.
- PP — POWER PACK WITH WIRELESS AND DIMMING MODULE WITH 0-10V CONTROL MOUNTED ABOVE CEILING. LUTRON #RMJ-5T-DV-B OR APPROVED EQUAL.
- PW — POWER PACK WITH WIRELESS MOUNTED ABOVE CEILING. LUTRON #RMJ-16R-DV-B OR APPROVED EQUAL.
- PP2 — DUAL RELAY PACK MOUNTED ABOVE CEILING. SENSORSWITCH #PP20-2P OR APPROVED EQUAL.
- ELCU — EMERGENCY LIGHTING CONTROL UNIT. EQUAL TO WATTSTOPPER #ELCU-100 OR APPROVED EQUAL.
- EPD — EMERGENCY LIGHTING CONTROL UNIT WITH DIMMING BYPASS. EQUAL TO LVS CONTROLS #EPC-1-D OR APPROVED EQUAL.
- EPR — EMERGENCY LIGHTING BYPASS SHUNT RELAY. SENSORSWITCH #PP16-SHUNT OR APPROVED EQUAL.
- DS — WIRELESS DAYLIGHT SENSOR.
- MDO — PASSIVE INFRARED AND DUEL TECHNOLOGY LOW TEMPERATURE / HIGH HUMIDITY OCCUPANCY SENSOR.

ACCESS CONTROL

- CR — CARD READER.
- PB — PUSH TO EXIT BUTTON.
- BR — BIOMETRIC READER.
- MD — MOTION DETECTOR TO RELEASE MAGNETIC LOCK.
- ML — MAGNETIC LOCK.
- EL — ELECTRIC LATCH.
- ES — ELECTRIC DOOR STRIKE.
- D — DURESS BUTTON CONNECTED TO IDS.
- ACP — ACCESS CONTROL PANEL.
- CONNECTION TO MAGNETIC LOCK RELEASE SWITCH IN PANIC HARDWARE.
- HC — HANDICAP PUSHPAD FURNISHED WITH AUTOMATIC DOOR OPERATOR, INSTALLED BY ELECTRICAL CONTRACTOR.
- DHO — DOOR HOLD OPEN.
- CR — VEHICLE PEDESTAL CONTAINING CARD READER FOR ENTRANCE GATE TO PARKING LOT.
- BCR — VEHICLE BARCODE READER.

CONDUIT AND WIRING

- CONDUCTORS IN CONDUIT CONCEALED WITHIN WALL OR CEILING. TIC MARKS INDICATE NUMBER OF CONDUCTORS. THE EQUIPMENT GROUNDING CONDUCTOR IS NOT SHOWN, BUT SHALL BE PROVIDED. SIZE THE EQUIPMENT GROUNDING CONDUCTOR AND THE CONDUIT PER THE NEC. THE ABSENCE OF TIC MARKS SIGNIFIES THAT TWO CONDUCTORS PLUS AN EQUIPMENT GROUNDING CONDUCTOR SHOULD BE PROVIDED. FOR EXAMPLE, THE MARKINGS TO THE LEFT SIGNIFY THAT THREE CONDUCTORS PLUS AN EQUIPMENT GROUNDING CONDUCTOR SHOULD BE PROVIDED.
- 10 — THE TEXT INSIDE THE ARC INDICATES THE AWG SIZE OF THE CONDUCTORS THAT SHALL BE RUN IN THE CONDUIT. THE ABSENCE OF TEXT SIGNIFIES THAT THE CONDUCTORS SHOULD BE #12 AWG.
- CIRCUITRY RUN IN STRAIGHT LINE SEGMENTS SIGNIFIES EXPOSED SURFACE-MOUNTED RACEWAY (SEE SPECIFICATIONS).
- CONDUCTORS IN CONDUIT CONCEALED BELOW GRADE OR FLOOR. TIC MARKS INDICATE NUMBER OF CONDUCTORS. THE EQUIPMENT GROUNDING CONDUCTOR IS NOT SHOWN, BUT SHALL BE PROVIDED. SIZE THE EQUIPMENT GROUNDING CONDUCTOR AND THE CONDUIT PER THE NEC. THE ABSENCE OF TIC MARKS SIGNIFIES THAT TWO CONDUCTORS PLUS AN EQUIPMENT GROUNDING CONDUCTOR SHOULD BE PROVIDED. THE MARKINGS TO THE LEFT SIGNIFY THAT THREE CONDUCTORS PLUS AN EQUIPMENT GROUNDING CONDUCTOR SHOULD BE PROVIDED.
- LA-1 — HOMERUN TO PANELBOARD. ARC DENOTES CONCEALED CIRCUITRY. TEXT DENOTES PANELBOARD NAME WITH CIRCUIT NUMBER. DEVICES HAVING CIRCUIT NUMBERS LOCATED BESIDE THEM MAY NOT SHOW THE CIRCUIT NUMBERS AT THE HOMERUN ARROWS.
- LA-1 — PARTIAL HOMERUN TO PANELBOARD. COMBINE ALL PARTIAL HOMERUNS THAT ARE ON THE SAME CIRCUIT IN A JUNCTION BOX PRIOR TO ENTERING THE PANELBOARD.
- LOW VOLTAGE CONDUCTORS USED FOR MOTION DETECTOR CIRCUITRY. SEE MANUFACTURER'S RECOMMENDATIONS FOR CONDUCTOR REQUIREMENTS.
- CABLE TRAY. SEE A/V DRAWINGS FOR CABLE TRAY SPECIFICATIONS.
- LIFE SAFETY CONDUCTORS IN CONDUIT CONCEALED WITHIN WALL OR CEILING. TIC MARKS INDICATE NUMBER OF CONDUCTORS. THE EQUIPMENT GROUNDING CONDUCTOR IS NOT SHOWN, BUT SHALL BE PROVIDED. SIZE THE EQUIPMENT GROUNDING CONDUCTOR AND THE CONDUIT PER THE NEC. THE ABSENCE OF TIC MARKS SIGNIFIES THAT TWO CONDUCTORS PLUS AN EQUIPMENT GROUNDING CONDUCTOR SHOULD BE PROVIDED. FOR EXAMPLE, THE MARKINGS TO THE LEFT SIGNIFY THAT TWO #12 AWG CONDUCTORS PLUS AN EQUIPMENT GROUNDING CONDUCTOR SHOULD BE PROVIDED.

VOLTAGE DROP CHART FOR 20A, 1Ø CIRCUITS

Voltage	Circuit Length	Conductor Size (AWG)
120	< 90'	#12
120	> 90'	#10
120	> 145'	#8
120	> 230'	#6
277	< 200'	#12
277	> 200'	#10
277	> 325'	#8
277	> 525'	#6

VOLTAGE DROP CHART NOTES:
1) CIRCUIT SIZES INDICATED ON THE DRAWINGS ARE MINIMUM REQUIREMENTS. REFER TO THIS CHART FOR UPSIZING CONDUCTORS AS NEEDED.

2) DO NOT CONNECT CONDUCTORS LARGER THAN #10 DIRECTLY TO A RECEPTACLE OR A SWITCH. PROVIDE A JUNCTION BOX TO DOWNSIZE THE CONDUCTOR TO #12 AT THE DEVICE.

3) FOR CIRCUITS LONGER THAN THOSE LISTED ABOVE, CONSULT WITH THE ENGINEER FOR CONDUCTOR SIZES.

INTERCOM SYSTEM

- CEILING SPEAKER.
- CS — CALL-IN SWITCH.
- MS — INTERCOM MASTER STATION WITH DOOR RELEASE. DESKTOP MOUNT.
- VANDAL & WEATHER RESISTANT INTERCOM SUB STATION.
- CALL BUTTON.

CCTV SYSTEM

NOTE: SEE SPECIFICATION 28-23-23 FOR CAMERA TYPES

- CEILING MOUNTED CAMERA.
- WALL MOUNTED CAMERA.
- INSIDE CORNER MOUNTED CAMERA.
- OUTSIDE CORNER MOUNTED CAMERA.
- WM — WALL MOUNTED MONITOR.
- DM — DESK MOUNTED MONITOR.

RECEPTACLES

- ? — DUPLEX RECEPTACLE, NEMA 5-20R, MOUNTED 18" A.F.F. TO CENTERLINE OF BOX UNLESS NOTED OTHERWISE.
- ? — SWITCHED DUPLEX RECEPTACLE, NEMA 5-20R, MOUNTED 18" A.F.F. TO CENTERLINE OF BOX UNLESS NOTED OTHERWISE. CONTROLLED RECEPTACLES SHALL BE MARKED IN ACCORDANCE WITH NEC 406.3 (E).
- ? — DOUBLE DUPLEX RECEPTACLE, NEMA 5-20R, ONE COVER PLATE, MOUNTED 18" A.F.F. TO CENTERLINE OF BOX UNLESS NOTED OTHERWISE.
- ? — DOUBLE DUPLEX RECEPTACLE, NEMA 5-20R, ONE COVER PLATE, MOUNTED WITH BOTTOM OF BOX 2" ABOVE COUNTER WITH BACKSPLASH, AND 6" ABOVE COUNTER WITHOUT BACKSPLASH. WHERE RECEPTACLE IS SHOWN IN AN AREA WITH NO COUNTER, MOUNT 45"A.F.F. TO CENTERLINE OF BOX.
- ? — DOUBLE DUPLEX RECEPTACLE, NEMA 5-20R, ONE COVER PLATE, MOUNTED 18" A.F.F. TO CENTERLINE OF BOX UNLESS NOTED OTHERWISE. ONE DUPLEX RECEPTACLE WILL BE SWITCH AND ONE DUPLEX RECEPTACLE WILL BE UNSWITCHED. CONTROLLED RECEPTACLES SHALL BE MARKED IN ACCORDANCE WITH NEC 406.3 (E).
- ? — DUPLEX RECEPTACLE, NEMA 5-20R, MOUNTED WITH BOTTOM OF BOX 2" ABOVE COUNTER WITH BACKSPLASH AND 6" ABOVE COUNTER WITHOUT BACKSPLASH. WHERE RECEPTACLE IS SHOWN IN AN AREA WITH NO COUNTER, MOUNT 45"A.F.F. TO CENTERLINE OF BOX.
- ? — DUPLEX RECEPTACLE, NEMA CONFIGURATION AS NOTED ON FLOORPLANS. PROVIDE 6' CORD AND MATCHING PLUG WHERE REQUIRED. MOUNTING DETERMINED BY NEC FOR TYPE OF EQUIPMENT BEING CONNECTED.
- ?/DF — DUPLEX RECEPTACLE, NEMA 5-20R, FOR DRINKING FOUNTAIN FED FROM GFCI BREAKER. MOUNTED IN ACCORDANCE WITH MANUFACTURER'S ROUGH-IN REQUIREMENTS. VERIFY CONNECTION TYPE PRIOR TO BID. PROVIDE PROPER EQUIPMENT FOR CONNECTION TYPE REQUIRED.
- ? — DUPLEX RECEPTACLE, NEMA 5-20R, MOUNTED IN A FLOOR BOX.
- ? — DOUBLE DUPLEX RECEPTACLE, NEMA 5-20R, MOUNTED IN A FLOOR BOX.
- ? — SINGLE RECEPTACLE, NEMA 14-50R. PROVIDE 6' CORD AND MATCHING PLUG WHERE REQUIRED. MOUNTING DETERMINED BY NEC FOR TYPE OF EQUIPMENT BEING CONNECTED.
- ? — SINGLE RECEPTACLE, NEMA 5-10R, MOUNTED 18" A.F.F. TO CENTERLINE OF BOX UNLESS NOTED OTHERWISE.
- ? — SINGLE RECEPTACLE, NEMA 6-30R, MOUNTED 18" A.F.F. TO CENTERLINE OF BOX UNLESS NOTED OTHERWISE.
- ? — SINGLE RECEPTACLE, NEMA 14-30R, MOUNTED 36" A.F.F. TO CENTERLINE OF BOX UNLESS NOTED OTHERWISE. PROVIDE 6' CORD AND MATCHING PLUG WHERE REQUIRED.
- ? — DUPLEX RECEPTACLE, NEMA 5-20R, MOUNTED ABOVE THE CEILING UNLESS NOTED OTHERWISE.
- 20A RELAY MOUNTED ABOVE CEILING. SEE DETAIL 3/E0.6 FOR BASIC WIRING DETAIL.

FIRE ALARM SYSTEM

- F — MANUAL PULL STATION. MOUNT 48"A.F.F. TO CENTERLINE OF BOX.
- STROBE. MOUNT 80"A.F.F. TO BOTTOM OF BOX.
- F — COMBINATION HORN AND STROBE. MOUNT 80"A.F.F. TO BOTTOM OF BOX.
- SMOKE DETECTOR.
- T — THERMAL DETECTOR.
- DR — DUCT SMOKE DETECTOR IN RETURN DUCT.
- DS — DUCT SMOKE DETECTOR IN SUPPLY DUCT.
- E — ELEVATOR RECALL SMOKE DETECTOR.
- SES — SMOKE DETECTOR CONNECTED TO THE SMOKE EVACUATION SYSTEM.
- FACP — FIRE ALARM CONTROL PANEL.
- FAAN — FIRE ALARM ANNUNCIATOR PANEL.
- FATC — FIRE ALARM TERMINAL CABINET/BOOSTER PANEL.
- FASD — FIRE ALARM CONNECTION TO SHUTTER DOOR. DOOR SHALL ROLL DOWN UPON AN ALARM CONDITION.
- SEP — SMOKE EVACUATION ACTIVATION PANEL.
- FS — FLOW SWITCH.
- TS — TAMPER SWITCH.
- DHO — DOOR HOLD OPEN MAGNET TO RELEASE UPON ALARM CONDITION OF THE FIRE ALARM CONTROL PANEL.
- FAHS — FIRE ALARM HORN AND STROBE MOUNTED ON THE CEILING TO A FLUSH MOUNTED BOX.
- FIRE ALARM STROBE MOUNTED ON THE CEILING TO A FLUSH MOUNTED BOX.
- S — SMOKE DAMPER.

INTRUSION DETECTION SYSTEM

- KP — KEYPAD.
- MD — MOTION DETECTOR.
- GB — GLASS BREAK DETECTOR.
- DC — DOOR CONTACT.
- HORN.
- IDCP — INTRUSION DETECTION CONTROL PANEL.
- D — DURESS PUSH BUTTON.

COMMUNICATIONS

- E — TELEPHONE CONNECTION FOR ELEVATOR CONTROLLER. INCLUDE ALL CABLING AND ACTIVATION OF TELEPHONE SERVICE. ROUTE CABLE INTO THE ELEVATOR CONTROLLER.
- COMBINATION TELEPHONE/DATA OUTLET MOUNTED 18" A.F.F. TO CENTERLINE OF BOX UNLESS NOTED OTHERWISE.
- COMBINATION TELEPHONE/DATA OUTLET MOUNTED WITH BOTTOM OF BOX 2" ABOVE COUNTER WITH BACKSPLASH, AND 6" ABOVE COUNTER WITHOUT BACKSPLASH.
- TELEPHONE OUTLET MOUNTED 18" A.F.F. TO CENTERLINE OF BOX UNLESS NOTED OTHERWISE.
- TELEPHONE OUTLET MOUNTED WITH BOTTOM OF BOX 2" ABOVE COUNTER WITH BACKSPLASH, AND 6" ABOVE COUNTER WITHOUT BACKSPLASH.
- DATA OUTLET MOUNTED 18" A.F.F. TO CENTERLINE OF BOX UNLESS NOTED OTHERWISE.
- DATA OUTLET MOUNTED WITH BOTTOM OF BOX 2" ABOVE COUNTER WITH BACKSPLASH, AND 6" ABOVE COUNTER WITHOUT BACKSPLASH.
- COMBINATION TELEPHONE/DATA OUTLET MOUNTED IN A FLOOR BOX.
- 2 MVE F2 ? — DUPLEX RECEPTACLE, NEMA 5-20R, DATA OUTLETS, AND A/V OUTLETS MOUNTED IN A FLOOR BOX. DATA OUTLET SHALL HAVE TWO JACKS UNLESS NOTED OTHERWISE WITH NUMBER BESIDE SYMBOL. COORDINATE ALL FLOOR BOX DETAILS WITH EAV DRAWINGS.
- 2 MVE — DOUBLE DUPLEX RECEPTACLE, NEMA 5-20R, DATA OUTLETS, AND A/V OUTLETS MOUNTED IN A FLOOR BOX. DATA OUTLET SHALL HAVE TWO JACKS UNLESS NOTED OTHERWISE WITH NUMBER BESIDE SYMBOL. COORDINATE ALL FLOOR BOX DETAILS WITH EAV DRAWINGS.
- 4 MVE FBT ? — DOUBLE DUPLEX RECEPTACLE, NEMA 5-20R, DATA OUTLETS, AND A/V OUTLETS MOUNTED IN A FLOOR BOX. DATA OUTLET SHALL HAVE FOUR JACKS UNLESS NOTED OTHERWISE WITH NUMBER BESIDE SYMBOL. COORDINATE ALL FLOOR BOX DETAILS WITH EAV DRAWINGS.
- MVE — DOUBLE DUPLEX RECEPTACLE, NEMA 5-20R AND A COMBINATION TELEPHONE/DATA OUTLET MOUNTED IN A FLOOR BOX.
- TELEVISION CABLE OUTLET MOUNTED 18" A.F.F. TO CENTERLINE OF BOX UNLESS NOTED OTHERWISE.

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TPS PROJ. # 15079

CITY OF HATTIESBURG MISSISSIPPI 1884

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

Drawing Issued:

Date	Rev.	Description
08-31-2015		DD Check Set
10-20-2015		75% Progress Set
11-02-2015		90% Pricing Set
11-19-2018		100% Bid Docs

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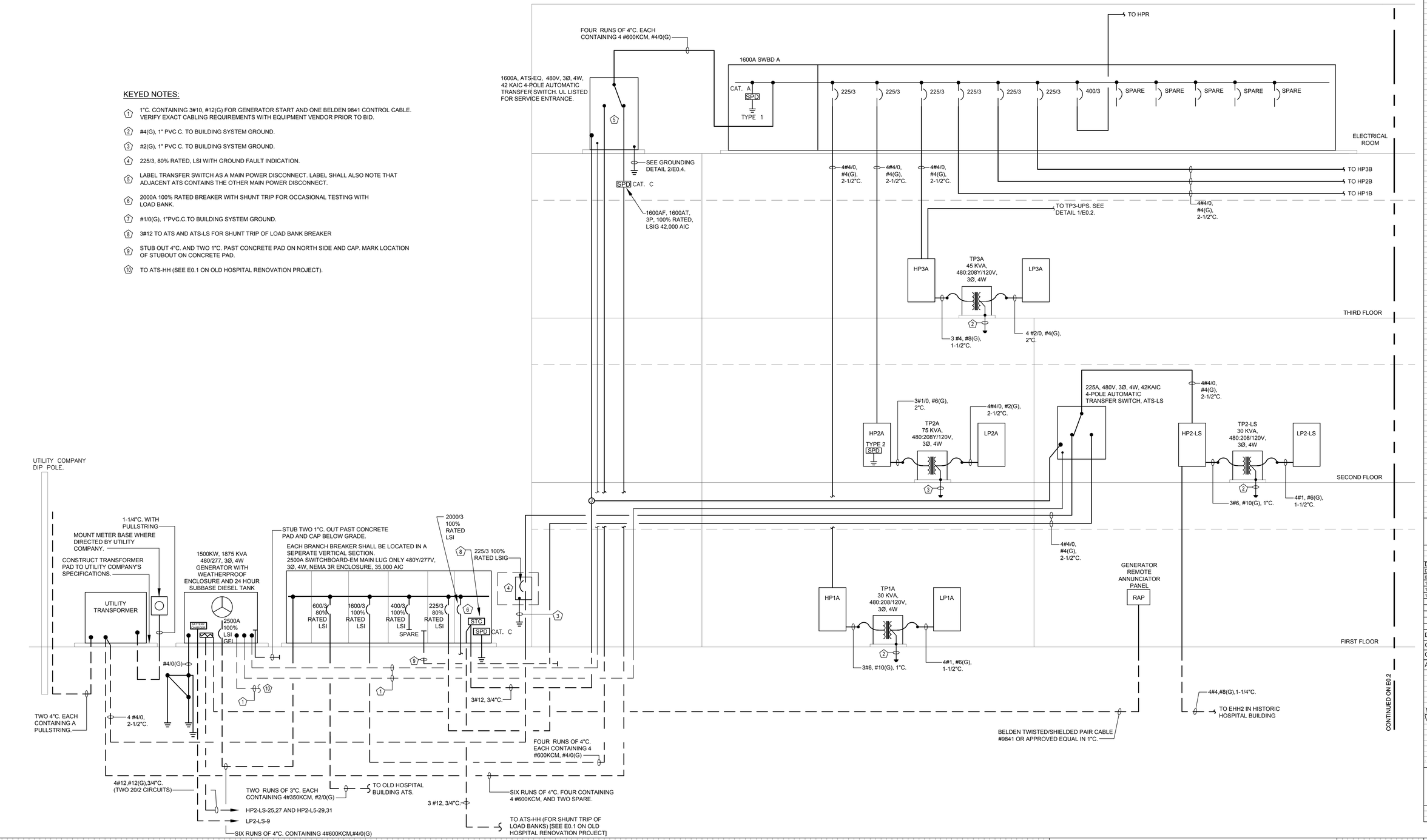
STATE OF MISSISSIPPI — 11853 — REGISTERED ENGINEER — 12/20/2016

E0.0

The POWER SOURCE PLLC
945 Madison Ave.
Madison, MS 39110
Voice (601) 605-4820
Fax (601) 605-4875
TPS Proj. # 15079

KEYED NOTES:

1. 1"C. CONTAINING 3#10, #12(G) FOR GENERATOR START AND ONE BELDEN 9841 CONTROL CABLE. VERIFY EXACT CABLING REQUIREMENTS WITH EQUIPMENT VENDOR PRIOR TO BID.
2. #4(G), 1" PVC C. TO BUILDING SYSTEM GROUND.
3. #2(G), 1" PVC C. TO BUILDING SYSTEM GROUND.
4. 225/3, 80% RATED, LSI WITH GROUND FAULT INDICATION.
5. LABEL TRANSFER SWITCH AS A MAIN POWER DISCONNECT. LABEL SHALL ALSO NOTE THAT ADJACENT ATS CONTAINS THE OTHER MAIN POWER DISCONNECT.
6. 2000A 100% RATED BREAKER WITH SHUNT TRIP FOR OCCASIONAL TESTING WITH LOAD BANK.
7. #1/0(G), 1"PVC.C.TO BUILDING SYSTEM GROUND.
8. 3#12 TO ATS AND ATS-LS FOR SHUNT TRIP OF LOAD BANK BREAKER
9. STUB OUT 4"C. AND TWO 1"C. PAST CONCRETE PAD ON NORTH SIDE AND CAP. MARK LOCATION OF STUBOUT ON CONCRETE PAD.
10. TO ATS-HH (SEE E0.1 ON OLD HOSPITAL RENOVATION PROJECT).



HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

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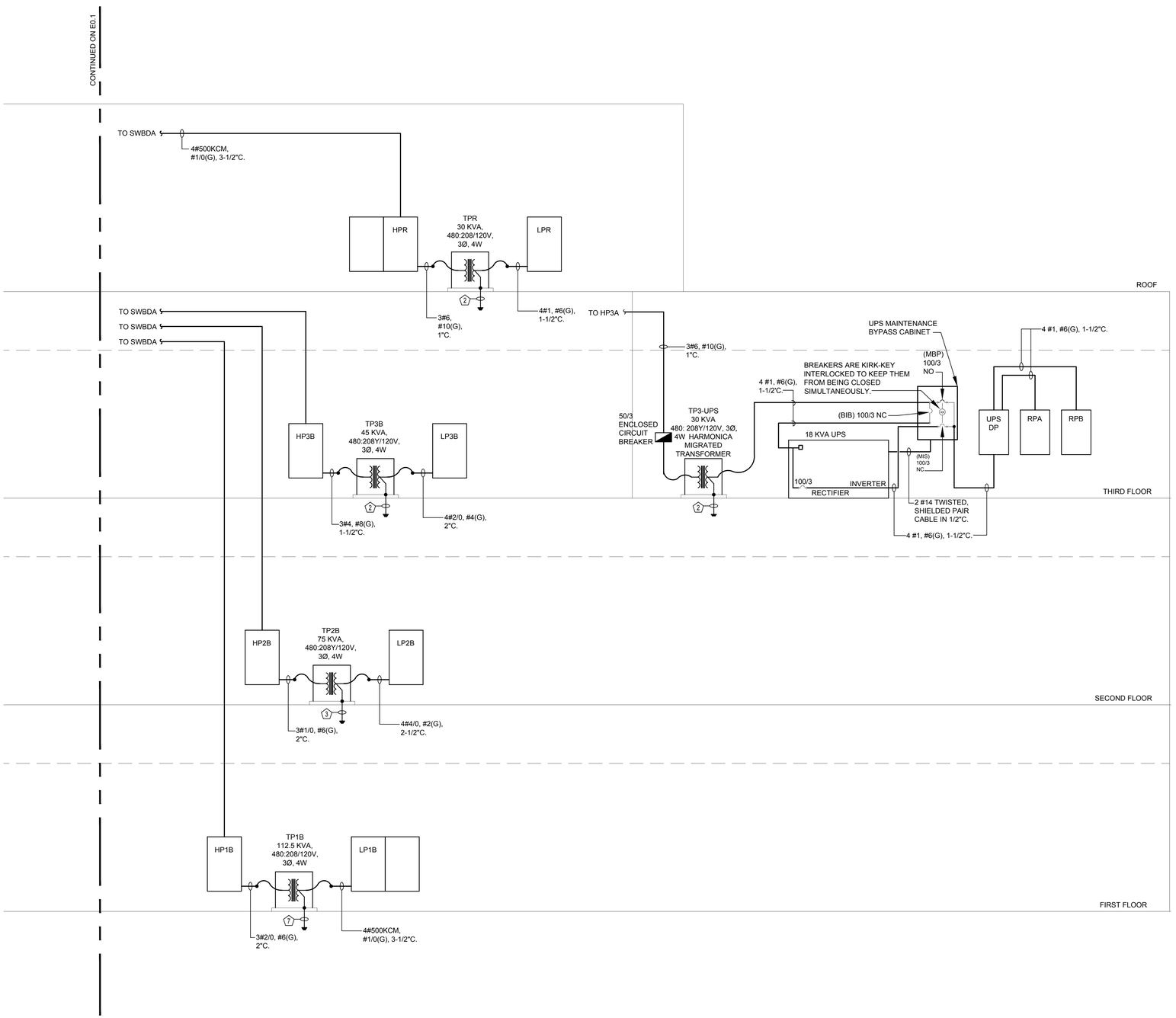
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12/5/2016

E0.1



KEYED NOTES:

1. 1"C. CONTAINING 3#10, #12(G) FOR GENERATOR START AND ONE BELDEN 9841 CONTROL CABLE. VERIFY EXACT CABLING REQUIREMENTS WITH EQUIPMENT VENDOR PRIOR TO BID.
2. #4(G), 1" PVC C. TO BUILDING SYSTEM GROUND.
3. #2(G), 1" PVC C. TO BUILDING SYSTEM GROUND.
4. 225/3, 100% RATED, LSI WITH GROUND FAULT INDICATION.
5. LABEL TRANSFER SWITCH AS A MAIN POWER DISCONNECT. LABEL SHALL ALSO NOTE THAT ADJACENT ATS CONTAINS THE OTHER MAIN POWER DISCONNECT.
6. 200A 100% RATED BREAKER WITH SHUNT TRIP FOR OCCASIONAL TESTING WITH DOCKING STATION.
7. #1/0(G), 1"PVC.C.TO BUILDING SYSTEM GROUND.

1 / E0.2 SINGLE LINE DIAGRAM (CONT)
Scale: NONE

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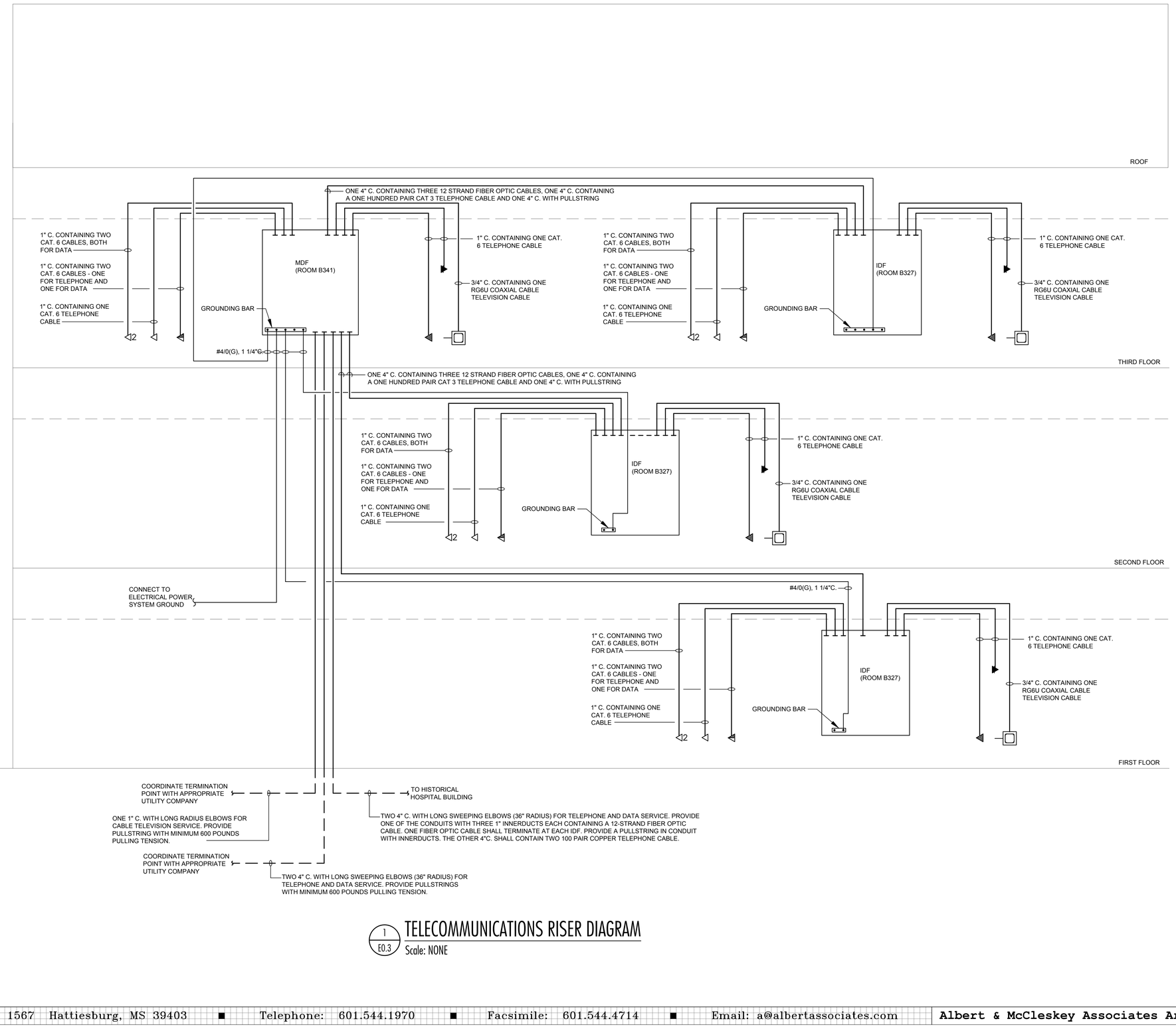
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E0.2



1 / E0.3 TELECOMMUNICATIONS RISER DIAGRAM

Scale: NONE

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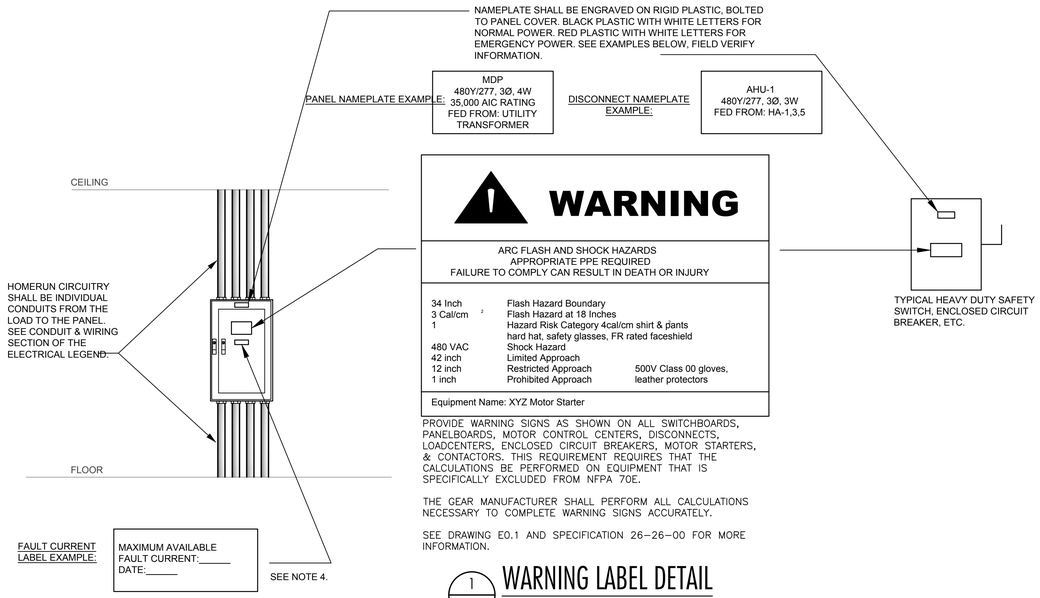
Albert & Associates: 12575

STATE OF MISSISSIPPI ... REGISTERED ENGINEER ... 11853 ... 12/20/2016

E0.3

LIGHTING FIXTURE SCHEDULE

TYPE	MANUFACTURER	PART NUMBER	LAMPS	MOUNTING	REMARKS
A	LITHONIA	16C-700-40K-SYM-MVOLT-PE-DDBXD	LED	BOLLARD	
B1	LITHONIA	ZL2N-L48-2000LM-MDD-MVOLT-35K-80CRI-WH	LED 2000 LUMENS	SUSPENDED	
B2	LITHONIA	ZL2N-L48-3000LM-MDD-MVOLT-35K-80CRI-WH	LED 3000 LUMENS	SUSPENDED	
B3	LITHONIA	ZLN2-L48-5000LM-MDD-MVOLT-35K-80CRI-WH	LED 5000 LUMENS	SUSPENDED	
C1	GOTHAM	EVO-35/10-6AR-LS-MVOLT-EZB	LED 1000 LUMENS	RECESSED	
C2	GOTHAM	EVO-35/15-6AR-LS-MVOLT-EZB	LED 1500 LUMENS	RECESSED	
D	GOTHAM	EVO-35/14-6-DFR-MVOLT-EZB	LED 1400 LUMENS	RECESSED	
F	WAC LIGHTING	WHK-1035N-835-WT	LED, 35W 2773 LUMENS	TRACK**	** - WHT-4-RT-WT(RECESSED TRACK)
G	PRESCOLITE	MC10LED-P-12L-35K-8-FL35-30-WH	LED, 132W 12000 LUMENS	PENDANT	MOUNT FIXTURE LEVEL WITH THE BOTTOM OF THE FLOATING PANELS.
H	LITHONIA	WST LED-P1-40K-VW-MVOLT-PE-DDBXD	LED,12W 1660 LUMENS	WALL MOUNTED	
J	NITE-GLOW	FX-525-WW	LED, 2.8W 7 LUMENS	STEP LIGHT	
K4ID	FINELITE	HP-4-ID-XX-SO-SO-3500K-TG-277-FA-SC	LED	SUSPENDED	XX-PROVIDE FIXTURE IN LENGTHS AS SHOWN. PROVIDE FACTORY AIRCRAFT CABLE IN LENGTH REQUIRED.
K4RG	FINELITE	HP4 RG-XX-H-8-35-277-SC	LED	RECESSED	4" APERTURE RECESSED, HIGH OUTPUT XX-PROVIDE FIXTURE IN LENGTHS AS SHOWN.
K4WW	FINELITE	HP4 WW-R-K-4'-S-840-277V-C3F-SC	LED	RECESSED	
KP4	FINELITE	HP-4-ID-XX-SO-SO-3500K-TG-277-FA-SC-C4	LED	PENDANT	XX-PROVIDE FIXTURE IN LENGTHS AS SHOWN. PROVIDE FACTORY AIRCRAFT CABLE IN LENGTH REQUIRED.
KR2L	FINELITE	HP-2-R-XX-SO-3500K-277-SC	LED	RECESSED	2" APERTURE RECESSED, LOW OUTPUT XX-PROVIDE FIXTURE IN LENGTHS AS SHOWN.
KR2H	FINELITE	HP-2-R-XX-HO-3500K-277-SC	LED	RECESSED	2" APERTURE RECESSED, HIGH OUTPUT XX-PROVIDE FIXTURE IN LENGTHS AS SHOWN.
KR4L	FINELITE	HP-4-R-XX-SO-3500K-277-SC	LED	RECESSED	4" APERTURE RECESSED, LOW OUTPUT XX-PROVIDE FIXTURE IN LENGTHS AS SHOWN.
KR4H	FINELITE	HP-4-R-XX-HO-3500K-277-SC	LED	RECESSED	4" APERTURE RECESSED, HIGH OUTPUT XX-PROVIDE FIXTURE IN LENGTHS AS SHOWN.
KR4W	FINELITE	HP-4 WW-R-XX-H-3500K-277-SC	LED	RECESSED	4" APERTURE RECESSED, HIGH OUTPUT XX-PROVIDE FIXTURE IN LENGTHS AS SHOWN.
L	STERNBERG	A850SRLED-5P4ARC45T5-MDL03	LED	POLE TOP	POLE: 52-12-TS-FCC-XX XX: VERIFY FINISH WITH ARCHITECT
M	LITHONIA	DMW-2-32-120-GEB10PS-EL14DW	(2) 32W T8	WALL MOUNTED	
N	LITHONIA	WST LED-P2-40K-VW-MVOLT-DDBXD	LED, 25W 3000 LUMEN	WALL MOUNTED	
P	LITHONIA	ZL2N-L24-2000LM-MDD-MVOLT-35K-80CRI-WH	LED, 22W 2000 LUMENS	SUSPENDED	
Q3	FINELITE	S11-LED-3-SO-3500-SC-96W-277	LED	COVE	3' COVE FIXTURE
Q4	FINELITE	S11-LED-4-SO-3500-SC-96W-277	LED	COVE	4' COVE FIXTURE
Q8	FINELITE	S11-LED-8-SO-3500-SC-96W-277	LED	COVE	8' COVE FIXTURE
R	OCL	CQ1-P1EC-38-MW-BAL-1LD109/35K-277-DMO	LED, 109W	PENDANT	
S	CREE	ZR24-40LHE-35K-10V	LED, 44W 4000 LUMENS	RECESSED	
S2	CREE	ZR22-32L-35K-10V	LED, 35W 3200 LUMENS	RECESSED	
T	HYDREL	M9710-B-22LED-WHT53K-MVOLT-SP-FLC10-34S-LDIM-BZ	LED	IN-GRADE	FLAG POLE LIGHT
W	RAB LIGHTING	HBLED-26-B	LED, 26W 2263 LUMENS	SURFACE	SELECT MOUNTING TYPE/OPTION.
X1	LITHONIA	EDG-1-G-EL	LED	UNIVERSAL	
X2	LITHONIA	EDG-2-G-EL	LED	UNIVERSAL	
XR1	LITHONIA	EDGR-1-G-EL	LED	UNIVERSAL	
XR2	LITHONIA	EDGR-2-G-EL	LED	UNIVERSAL	
Z	CREE	PKG-304-5M-DM-06-E-UL-BK-700-40K	LED, 135W 11,625 LUMENS	SURFACE	



PROVIDE WARNING SIGNS AS SHOWN ON ALL SWITCHBOARDS, PANELBOARDS, MOTOR CONTROL CENTERS, DISCONNECTS, LOADCENTERS, ENCLOSED CIRCUIT BREAKERS, MOTOR STARTERS, & CONTACTORS. THIS REQUIREMENT REQUIRES THAT THE CALCULATIONS BE PERFORMED ON EQUIPMENT THAT IS SPECIFICALLY EXCLUDED FROM NFPA 70E.

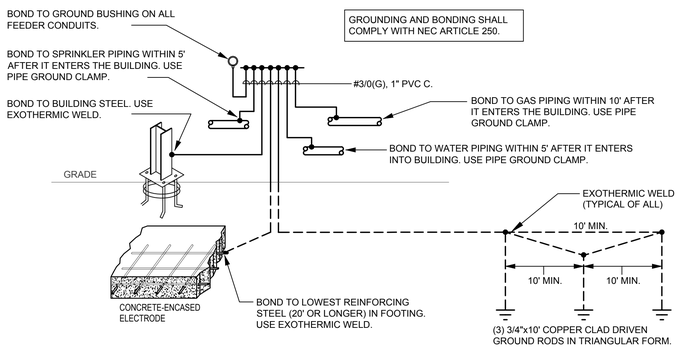
THE GEAR MANUFACTURER SHALL PERFORM ALL CALCULATIONS NECESSARY TO COMPLETE WARNING SIGNS ACCURATELY.

SEE DRAWING E0.1 AND SPECIFICATION 26-26-00 FOR MORE INFORMATION.

1 / E0.4 WARNING LABEL DETAIL
Scale: NONE

NOTES:

1. HOMERUN CONDUITS SHALL BE SIZE 3/4" OR LARGER.
2. CONDUITS SHALL BE LIMITED TO THREE CURRENT CARRYING CONDUCTORS.
3. PROVIDE TYPEWRITTEN CIRCUIT DIRECTORIES INSIDE DOOR OF EACH PANELBOARD. EACH CIRCUIT SHALL BE DISTINGUISHED FROM ALL OTHERS.
4. PROVIDE A LABEL FOR ALL SWITCHGEAR, SWITCHBOARDS, MOTOR CONTROL CENTERS, PANELBOARDS, AND OTHER SERVICE EQUIPMENT THAT LEGIBLY DISPLAYS THE MAXIMUM AVAILABLE FAULT CURRENT. THE MAXIMUM FAULT CURRENT INFORMATION SHALL BE TAKEN FROM THE ARC FLASH/PROTECTIVE DEVICE COORDINATION STUDY PERFORMED BY THE GEAR MANUFACTURER. THE LABEL SHALL INCLUDE THE DATE THAT THE FAULT CURRENT CALCULATION WAS PERFORMED AND BE OF SUFFICIENT DURABILITY TO WITHSTAND THE ENVIRONMENT OF THE EQUIPMENT.



2 / E0.4 GROUNDING DETAIL
Scale: NONE

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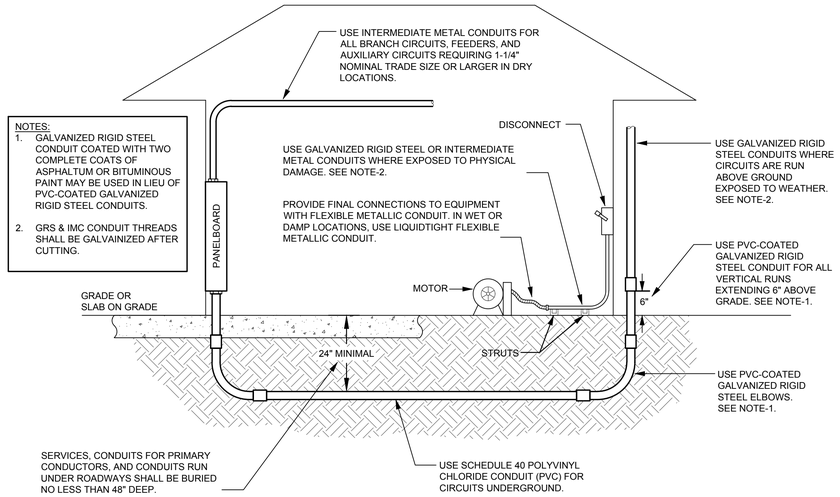
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E0.4



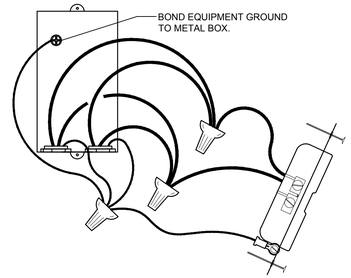
1 E0.5 **CONDUIT DETAIL**
Scale: NONE

RECEPTACLE DETAIL NOTES:

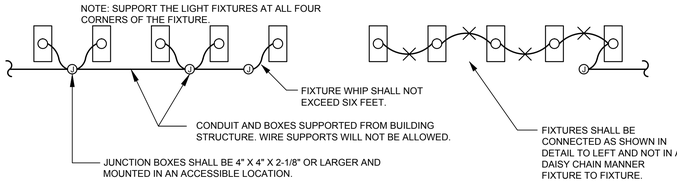
A. THESE DRAWINGS ARE BASED ON THE BEST INFORMATION AVAILABLE AT THE TIME OF DESIGN. COORDINATE WITH THE MILLWORK CONTRACTOR TO DETERMINE THE EXACT LOCATION OF OUTLETS BEING PLACED IN AND AROUND MILLWORK.

B. RECEPTACLES SHOWN AS GFI MAY BE NON GFI TYPE RECEPTACLES IF FED FROM A 20/1 GFI BREAKER OR THE LOAD SIDE OF A GFI RECEPTACLE IN THE SAME ROOM, ON THE SAME CIRCUIT AND RATED 20 AMP FEED-THRU CAPACITY. COVER PLATES SHALL BE CLEARLY MARKED GFI.

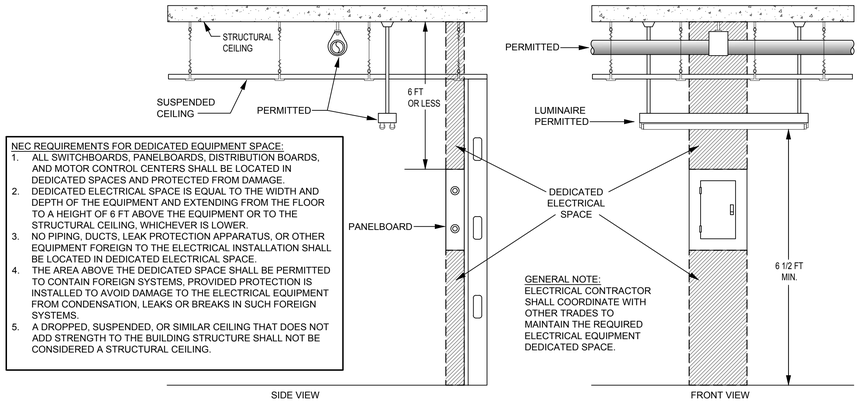
C. NON GFI RECEPTACLES SHALL NOT BE CONNECTED IN A FEED-THRU MANNER. WIRE CONNECTIONS IN RECEPTACLE BOXES SHALL BE MADE IN A PIGTAIL MANNER AS SHOWN IN RECEPTACLE DETAIL.



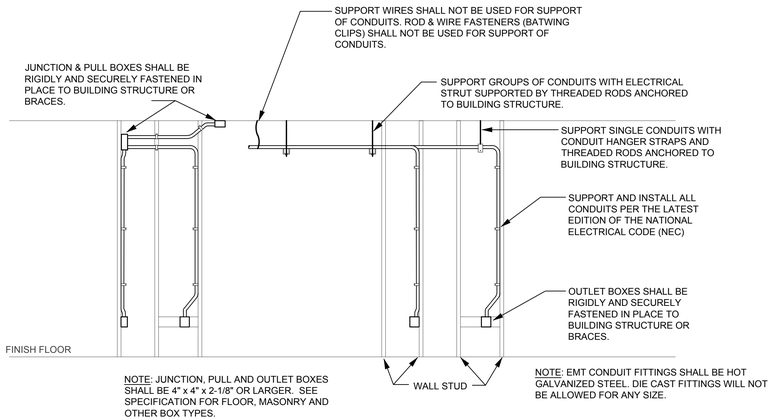
2 E0.5 **RECEPTACLE DETAIL**
Scale: NONE



4 E0.4 **FIXTURE CONNECTION DETAIL**
Scale: NONE



3 E0.5 **DEDICATED SPACE DETAIL**
Scale: NONE



5 E0.5 **JUNCTION & OUTLET BOX DETAIL**
Scale: NONE

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HPSC Police and Court Building

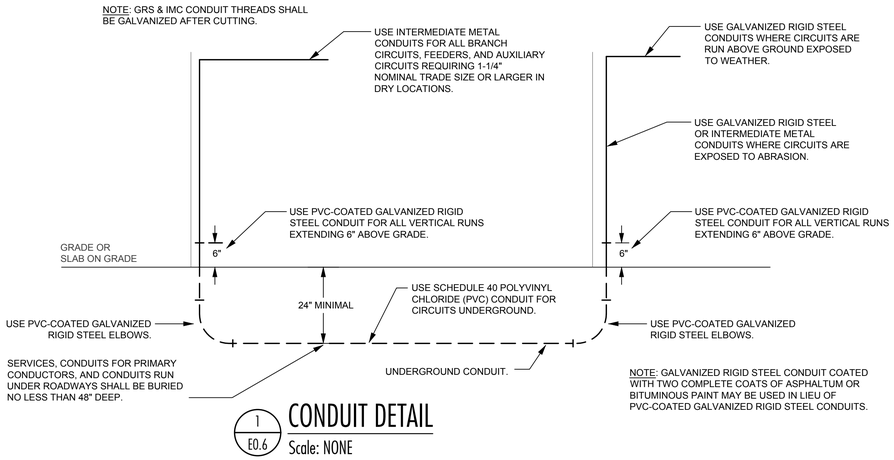
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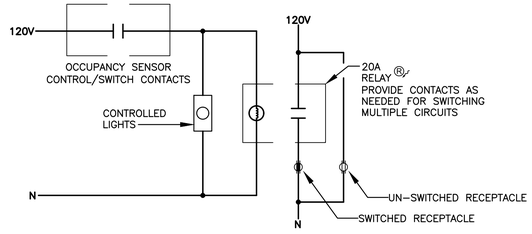
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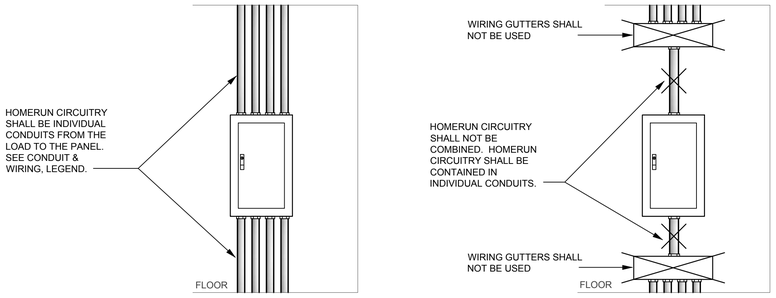
E0.5



1 / E0.6 CONDUIT DETAIL
Scale: NONE



2 / E0.6 RECEPTACLE SWITCHING DETAIL
Scale: NONE



NOTES:

1. HOMERUN CONDUITS SHALL BE SIZE 3/4" OR LARGER.
2. CONDUITS SHALL BE LIMITED TO THREE CURRENT CARRYING CONDUCTORS

2 / E0.6 HOMERUN DETAIL
Scale: NONE

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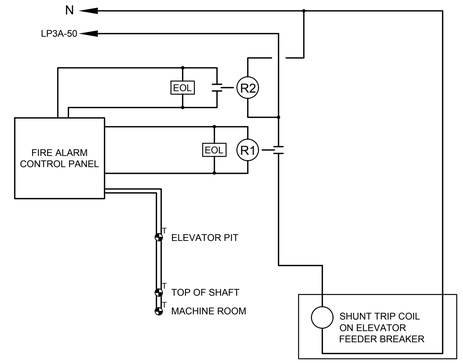
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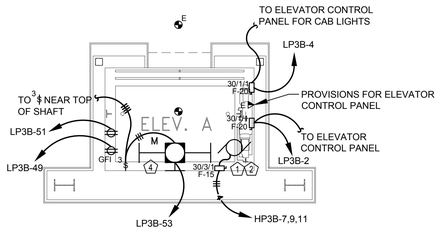
DETAIL NOTES:

A. R1 IS A FIRE ALARM SYSTEM RELAY. THE COIL VOLTAGE IS BASED ON THE OUTPUT OF THE FIRE ALARM CONTROL PANEL. IT SHALL HAVE NORMALLY OPEN CONTACTS THAT ARE CLOSED BY THE FACP AFTER AN ALARM SIGNAL FROM ONE OF THE THERMAL DETECTORS HAS BEEN RECIEVED AND THE TIME DELAY REQUIRED BY NFPA 72, PARAGRAPH 21.4.3 HAS EXPIRED.

B. R2 SHALL HAVE A 120V COIL. IT SHALL HAVE NORMALLY-CLOSED CONTACTS. THE CONTACTS ARE SHOWN IN THE SCHEMATIC IN THEIR NORMAL OPERATING STATE OF HELD-OPEN WHEN CONTROL VOLTAGE IS PRESENT.

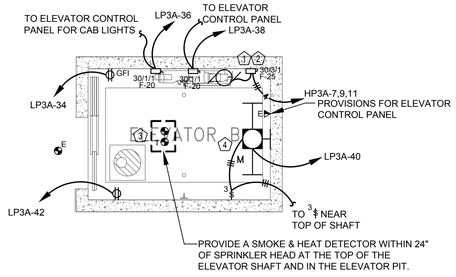
1 / E0.7 ELEVATOR/FIRE ALARM DETAIL TYPICAL (ELEVATOR B)

Scale: NONE



2 / E0.7 ELEVATOR A DETAIL

Scale: NONE



3 / E0.7 ELEVATOR B DETAIL

Scale: NONE

ELEVATOR "A" NOTES:

A. ELEVATOR "A" IS AN OCCUPANT ELEVATOR AND SHALL COMPLY WITH REQUIREMENTS OF IBC 2012 SECTION 3008/

B. ALL ELECTRICAL RELATED POWER, CONTROL SIGNAL, COMMUNICATION, LIGHTING, HEATING, AIR CONDITIONING, VENTILATION, AND AUXILIARY SYSTEM WIRES AND CABLES THAT ARE LOCATED OUTSIDE OF THE ELEVATOR HOISTWAY SHALL HAVE A UL LISTED FIRE-RESISTANCE RATING OF NOT LESS THAN TWO HOURS AND TO BE INSTALLED IN ACCORDANCE WITH ITS UL LISTING.

C. ELEVATOR "A" SHALL NOT HAVE SMOKE/THERMAL DETECTORS INSTALLED IN THE HOISTWAY AND SHALL NOT BE SHUNT TRIPPED.

GENERAL ELEVATOR DETAIL NOTES:

A. THE MAINTENANCE RECEPTACLE SHALL BE ON A DEDICATED CIRCUIT.

B. THE LIGHTS LOCATED IN THE ELEVATOR SHAFT MUST BE ON A DEDICATED CIRCUIT.

C. MOUNT LIGHT SWITCHES IN ELEVATOR SHAFT NEAR LADDER.

D. ALL EQUIPMENT, RECEPTACLES, LIGHTING, ETC. SHALL BE INSTALLED IN ACCORDANCE WITH THE ELEVATOR MANUFACTURER'S INSTALLATION REQUIREMENTS.

E. PROVIDE A NORMALLY OPEN, DRY CONTACT SIGNAL FROM EACH EQUIPMENT AUTOMATIC TRANSFER SWITCH TO EACH ELEVATOR CONTROL PANEL TO SIGNAL WHEN ON EMERGENCY POWER AND TO PROVIDE A 30 SECOND PRE-SIGNAL TO TRANSFER SWITCH CHANGE.

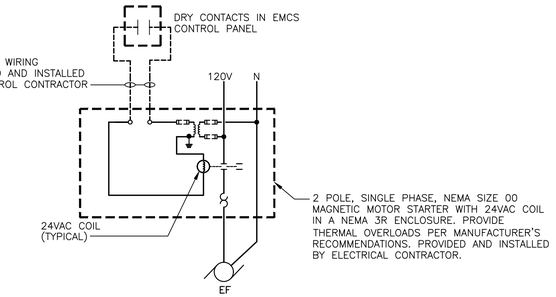
KEYED ELEVATOR DETAIL NOTES:

1. PROVIDE DISCONNECT SWITCH FOR ELEVATOR WITH A SET OF AUXILIARY CONTACTS FOR THE ELEVATOR VENDOR'S USE. CONSULT ELEVATOR VENDOR FOR EXACT FUSE SIZE AND ALL ELEVATOR ELECTRICAL REQUIREMENTS.

2. ELEVATOR FEEDER AND EQUIPMENT SIZES ARE BASED ON BEST INFORMATION AVAILABLE AT THE TIME OF DESIGN. VERIFY ALL ELECTRICAL REQUIREMENTS WITH ELEVATOR VENDOR PRIOR TO SUBMITTING BROCHURES AND/OR INSTALLING ELECTRICAL GEAR.

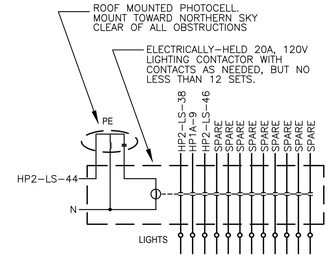
3. SEE DETAIL 1/E0.7 FOR FIRE ALARM AND SHUNT TRIP OPERATION.

4. PROVIDE AND INSTALL A FIXTURE AND THREE-WAY SWITCH NEAR THE TOP AND BOTTOM OF THE ELEVATOR SHAFT.



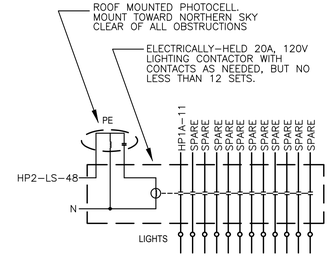
4 / E0.7 EXHAUST FAN MAGNETIC MOTOR STARTER DETAIL (TYPICAL)

Scale: NONE



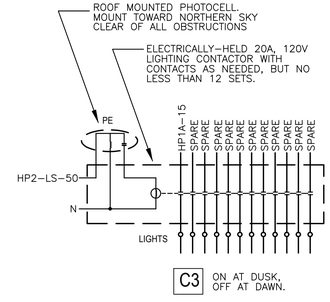
5 / E0.7 CONTACTOR "C1" DETAIL

Scale: NONE



6 / E0.7 CONTACTOR "C2" DETAIL

Scale: NONE



7 / E0.7 CONTACTOR "C2" DETAIL

Scale: NONE

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HATTIESBURG PUBLIC SAFETY COMPLEX

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Drawing Issued:

Date	Rev.	Description
08-31-2015		DD Check Set
10-20-2015		75% Progress Set
11-02-2015		90% Pricing Set
11-19-2018		100% Bid Docs

Drawn By: TJ,ST,FB

Checked By: AC,CG

Client No: --------

Albert & Associates: 12575



E0.7

PANEL SWBDA

LOCATION: **ELECTRICAL ROOM** | LUG LOCATION: **TOP FEED** | **SEE GENERAL NOTE A.**
VOLT: **480Y/277V, 3Ø, 4W** | MAIN BUS: **MAIN LUGS ONLY**
BUS: **1600A** | MOUNTING: **SURFACE** | SWITCHBOARD AIC RATING (A): **42,000**

CIRCUIT NO.	BREAKER AMPS	BREAKER POLES	DESCRIPTION	PHASE LOAD (KVA) A	A	B	B	C	C	DESCRIPTION	BREAKER AMPS	BREAKER POLES	CIRCUIT NO.
1	225	3	HP1A	12.1	31.8					HP1B	225	3	2
3	-	-	-			11.8	39.3			-	-	-	4
5	-	-	-					9.8	34.0	-	-	-	6
7	225	3	HP2A	14.6	13.2					HP2B	225	3	8
9	-	-	-			17.4	13.7			-	-	-	10
11	-	-	-					16.7	15.7	-	-	-	12
13	225	3	HP3A	30.9	15.9					HP3B	225	3	14
15	-	-	-			30.4	16.2			-	-	-	16
17	-	-	-					29.1	13.6	-	-	-	18
19	400	3	HPR	67.2	76.4					CH-2 (ROOF)	400	3	20
21	-	-	-			66.3	76.4			-	-	-	22
23	-	-	-					64.4	76.4	-	-	-	24
25	400	3	CH-1 (ROOF)	76.4	0.0					SPARE	225	3	26
27	-	-	-			76.4	0.0			-	-	-	28
29	-	-	-					76.4	0.0	-	-	-	30
31	400	3	SPARE	0.0	0.0					SPARE	400	3	32
33	-	-	-			0.0	0.0			-	-	-	34
35	-	-	-					0.0	0.0	-	-	-	36
37	225	3	SPACE	0.0	0.0					SPACE	225	3	38
39	-	-	-			0.0	0.0			-	-	-	40
41	-	-	-					0.0	0.0	-	-	-	42
TOTAL				338.5		347.8		336.0					

PANEL HP1A

LOCATION: **ELECTRICAL ROOM** | LUG LOCATION: **TOP FEED**
VOLT: **480Y/277V, 3Ø, 4W** | MAIN BUS: **MAIN LUGS ONLY**
BUS: **225A** | MOUNTING: **SURFACE** | PANELBOARD AIC RATING (A): **42000 (SERIES RATED)**

CIRCUIT NO.	BREAKER AMPS	BREAKER POLES	DESCRIPTION	PHASE LOAD (KVA) A	A	B	B	C	C	DESCRIPTION	BREAKER AMPS	BREAKER POLES	CIRCUIT NO.
1	50	3	XFMR TP1A (PNL LP1A)	4.4	2.8					SECURITY GATE	20	3	2
3	-	-	-			5.1	2.8			-	-	-	4
5	-	-	-					4.5	2.8	-	-	-	6
7	20	1	PARKING GARAGE	3.8	0.0					SPARE	60	3	8
9	20	1	EXTERIOR LIGHTS			1.5	0.0			-	-	-	10
11	20	1	SITE LIGHTS					2.5	0.0	-	-	-	12
13	20	1	LIGHTS - CORR. (B101), LOADING DOCK	1.2	0.0					SPARE	45	3	14
15	20	1	FLAG POLE LIGHITNG			2.5	0.0			-	-	-	16
17	20	1	SPARE					0.0	0.0	-	-	-	18
19	20	1	SPARE	0.0	0.0					SPARE	60	3	20
21	20	1	SPARE			0.0	0.0			-	-	-	22
23	20	1	SPARE					0.0	0.0	-	-	-	24
25	20	1	SPARE	0.0	0.0					SPARE	20	3	26
27	20	1	SPARE			0.0	0.0			-	-	-	28
29	20	1	SPARE					0.0	0.0	-	-	-	30
TOTAL				12.1		11.8		9.8					

PANEL LP1A

LOCATION: **ELECTRICAL ROOM** | LUG LOCATION: **TOP FEED**
VOLT: **208Y/120V, 3Ø, 4W** | MAIN BUS: **100A MAIN BREAKER W/FEED THRU LUGS**
BUS: **100A** | MOUNTING: **SURFACE** | PANELBOARD AIC RATING (A): **22,000**

CIRCUIT NO.	BREAKER AMPS	BREAKER POLES	DESCRIPTION	PHASE LOAD (KVA) A	A	B	B	C	C	DESCRIPTION	BREAKER AMPS	BREAKER POLES	CIRCUIT NO.
1	20	1	REC. - B104, B105, PARKING GARAGE	0.9	0.0					SPARE	15	2	2
3	20	1	REC. - PARKING GARAGE, B101			0.5	0.0			-	-	-	4
5	20	1	REC. - B102					0.4	0.0	SPARE	15	2	6
7	15	3	EUH-1 - ELEC	1.3	0.0					-	-	-	8
9	-	-	-			1.3	1.4			DSS-1 INDOOR AND OUTDOOR	20	2	10
11	-	-	-					1.3	1.4	-	-	-	12
13	20	3	SPARE	0.0	1.4					DSS-2 INDOOR AND OUTDOOR	20	2	14
15	-	-	-			0.0	1.4			-	-	-	16
17	-	-	-					0.0	1.4	DSS-3 INDOOR AND OUTDOOR	20	2	18
19	20	3	SPARE	0.0	0.0					-	-	-	20
21	-	-	-			0.0	0.0			SPARE	15	2	22
23	-	-	-					0.0	0.0	-	-	-	24
25	20	1	SPARE	0.0	0.0					SPARE	20	3	26
27	20	1	SPARE			0.0	0.0			-	-	-	28
29	20	1	SPARE					0.0	0.0	-	-	-	30
31	20	1	SPARE	0.0	0.7					REC - COURTYARD	20	1	32
33	20	1	SPARE			0.0	0.4			REC - SALLY PORT	20	1	34
35	20	1	SPARE					0.0	0.0	SPARE	20	1	36
37	20	1	SPARE	0.0	0.0					SPARE	20	1	38
39	20	1	SPARE			0.0	0.0			SPARE	20	1	40
41	20	1	SPARE					0.0	0.0	SPARE	20	1	42
TOTAL				4.4		5.1		4.5					

PANEL HP1B

LOCATION: **ELECTRICAL ROOM** | LUG LOCATION: **TOP FEED**
VOLT: **480Y/277V, 3Ø, 4W** | MAIN BUS: **MAIN LUGS ONLY**
BUS: **225A** | MOUNTING: **SURFACE** | PANELBOARD AIC RATING (A): **42000 (SERIES RATED)**

CIRCUIT NO.	BREAKER AMPS	BREAKER POLES	DESCRIPTION	PHASE LOAD (KVA) A	A	B	B	C	C	DESCRIPTION	BREAKER AMPS	BREAKER POLES	CIRCUIT NO.
1	175	3	XFMR TP1B (PNL LP1B)	21.3	1.4					HIGH SPEED DOOR	20	3	2
3	-	-	-			28.5	1.4			-	-	-	4
5	-	-	-					25.2	1.4	-	-	-	6
7	60	3	SPARE	0.0	1.4					HIGH SPEED DOOR	20	3	8
9	-	-	-			0.0	1.4			-	-	-	10
11	-	-	-					0.0	1.4	-	-	-	12
13	20	1	FIRST FLOOR LIGHTING	3.5	2.8					SECURITY GATE	20	3	14
15	20	1	FIRST FLOOR LIGHTING			2.7	2.8			-	-	-	16
17	20	1	FIRST FLOOR LIGHTING					1.8	2.8		-	-	18
19	20	1	FIRST FLOOR LIGHTING	1.1	0.0					SPARE	20	1	20
21	20	1	FIRST FLOOR LIGHTING			2.6	0.0			SPARE	20	1	22
23	20	1	FIRST FLOOR LIGHTING					1.5	0.0	SPARE	20	1	24
25	20	1	TRACK LIGHTING - A126	0.3	0.0					SPARE	20	1	26
27	20	1	SPARE			0.0	0.0			SPARE	20	1	28
29	20	1	SPARE					0.0	0.0	SPARE	20	1	30
31	20	1	SPARE	0.0	0.0					SPARE	20	1	32
33	20	1	SPARE			0.0	0.0			SPARE	20	1	34
35	20	1	SPARE					0.0	0.0	SPARE	20	1	36
TOTAL				31.8		39.3		34.0					

PANEL LP1B

LOCATION: **ELECTRICAL ROOM** | LUG LOCATION: **TOP FEED**
VOLT: **208Y/120V, 3Ø, 4W** | MAIN BUS: **400A MAIN BREAKER W/FEED THRU LUGS**
BUS: **400A** | MOUNTING: **SURFACE** | PANELBOARD AIC RATING (A): **22,000**

CIRCUIT NO.	BREAKER AMPS	BREAKER POLES	DESCRIPTION	PHASE LOAD (KVA) A	A	B	B	C	C	DESCRIPTION	BREAKER AMPS	BREAKER POLES	CIRCUIT NO.
1	20	1	REC. - A168, A147	0.7	2.0					REC, - A157, A159	20	1	2
3	20	1	REC. - A163, A165			2.2	1.8			REC, - A155, A152	20	1	4
5	20	1	REC. - A166, A167					2.2	2.2	REC. - A153, A154	20	1	6
7	20	1	REC. - REFRIGERATOR A164	0.8	0.2					REC. - A158	20	1	8
9	20	1	REC. - VENDING MACHINE A164			1.4	1.4			REC. - A137, A147, A148, A162, A161, A160	20	1	10
11	20	1	REC. - VENDING MACHINE A164					1.4	0.9	REC, - A156, A105	20	1	12
13	20	1	REC. - A164	0.4	1.1					REC. - A149, 150	20	1	14
15	20	1	REC. - A164			0.4	1.1			REC, - A151	20	1	16
17	20	1	REC. - A146, A147					2.2	1.0	REC. - COPIER A151	20	1	18
19	20	1	REC. - A145, A144	2.2	1.1					REC. - A149	20	1	20
21	20	1	REC. - A139			1.8	1.1			REC. - A149	20	1	22
23	20	1	REC. - A131, A130					2.2	1.1	REC. - A149	20	1	24
25	20	1	REC. - A129, A128	2.2	0.5					REC. - A149	20	1	26
27	20	1	REC. - A122			1.8	0.7			REC. - A138	20	1	28
29	20	1	REC. - REFRIGERATOR A119					0.8	0.7	REC. - A138	20	1	30
31	20	1	REC. - A119	0.4	0.9					REC. - A126	20	1	32
33	20	1	REC. - VENDING MACHINE A119			1.4	1.1			REC. - A126	20	1	34
35	20	1	REC. - VENDING MACHINE A119					1.4	1.1	REC. - A126, A124	20	1	36
37	20	1	REC. - A119	0.4	1.3					REC. - A142	20	1	38
39	20	1	REC. - A117			1.1	1.3			REC. - EXTERIOR, A120, A121, A127, A132, A136	20	1	40
41	20	1	REC. - A117					1.1	0.0	SPARE	20	1	42
43	20	1	REC. - A117	1.1	0.0					SPARE	20	1	44
45	20	1	REC. - A117			1.1	1.6			REC. - A118	20	1	46
47	20	1	REC. - A117					0.5	1.3	REC. - EXTERIOR, A104	20	1	48
49	20	1	REC. - A117	0.7	0.5					REC. - METAL DETECTOR	20	1	50
51	20	1	REC. - A117			0.7	1.3			REC. - A103	20	1	52
53	20	1	REC. - A117					0.5	0.9	REC. - A106, A116	20	1	54
TOTAL				16.2		23.2		21.4					

PANEL LP1B - SEC. 2

LOCATION: **ELECTRICAL ROOM** | LUG LOCATION: **BOTTOM FEED**
VOLT: **208Y/120V, 3Ø, 4W** | MAIN: **MAIN LUGS ONLY**
BUS: **400A** | MOUNTING: **SURFACE** | PANELBOARD AIC RATING (A): **22,000**

CIRCUIT NO.	BREAKER AMPS	BREAKER POLES	DESCRIPTION	PHASE LOAD (KVA) A	A	B	B	C	C	DESCRIPTION	BREAKER AMPS	BREAKER POLES	CIRCUIT NO.
55*	20	1	REC. - DRINKING FOUNTAIN A107	0.5	1.3					REC - A126	20	1	56
57	20	1	REC. - A109, A108			0.7	1.2			REC - A119 (VENDING)	20	1	58
59	20	1	REC. - A112					0.4	1.2	REC - A119 (VENDING)	20	1	60
61	20	1	REC. - A112	0.4	1.2					REC - A119 REFRIGERATOR	20	1	62
63	20	1	REC. - A111			1.3	0.4			REC - A119	20	1	64
65	20	1	REC. - REFRIDGERATOR A113					0.8	1.2	POWER DOOR A101	20	1	66
67	20	1	REC. - A113	0.4	1.2					POWER DOOR A101	20	1	68
69	20	1	REC. - A115			0.4	1.2			POWER DOOR A101	20	1	70
71	15	1	T2.01 - T2.10					0.2	0.0	SPARE	20	1	72
73	15	1	T5.06 - T5.15	0.2	0.0					SPARE	20	1	74
75	15	1	T5.01 - T5.05, T6.01-T6.03			0.2	0.0			SPARE	20	1	76
77	20	1	SPARE					0.0	0.0	SPARE	20	1	78
79	20	1	SPARE	0.0	0.0					SPARE	20	1	80
81	20	1	SPARE			0.0	0.0			SPARE	20	1	82
83	20	1	SPARE					0.0	0.0	SPARE	20	1	84
85	20	1	SPARE	0.0	0.0					SPARE	20	1	86
87	20	1	SPARE			0.0	0.0			SPARE	20	1	88
89	20	1	SPARE					0.0	0.0	SPARE	20	1	90
91	20	1	SPARE	0.0	0.0					SPARE	20	1	92
93	20	1	SPARE			0.0	0.0			SPARE	20	1	94
95	20	1	SPARE					0.0	0.0	SPARE	20	1	96
97	20	1	SPARE	0.0	0.0					SPARE	20	1	98
99	20	1	SPARE			0.0	0.0			SPARE	20	1	100
101	20	1	SPARE					0.0	0.0	SPARE	20	1	102
103	20	1	SPARE	0.0	0.0					SPARE	20	1	104
105	20	1	SPARE			0.0	0.0			SPARE	20	1	106
107	20	1	SPARE					0.0	0.0	SPARE	20	1	108
TOTAL				5.1		5.3		3.8		* = GFCI CIRCUIT BREAKER			

PANEL HP2A

LOCATION: **ELECTRICAL ROOM** | LUG LOCATION: **TOP FEED**
VOLT: **480Y/277V, 3Ø, 4W** | MAIN BUS: **MAIN LUGS ONLY**
BUS: **225A** | MOUNTING: **SURFACE** | PANELBOARD AIC RATING (A): **42000 (SERIES RATED)**

CIRCUIT NO.	BREAKER AMPS	BREAKER POLES	DESCRIPTION	PHASE LOAD (KVA) A	A	B	B	C	C	DESCRIPTION	BREAKER AMPS	BREAKER POLES	CIRCUIT NO.
1	125	3	XFMR TP2A (PNL LP2A)	12.8	0.0					SPARE	60	3	2
3	-	-	-			14.6	0.0			-	-	-	4
5	-	-	-					16.7	0.0	-	-	-	6
7	20	1	LIGHTING SECOND FLOOR	1.8	0.0					SPARE	40	3	8
9	20	1	LIGHTING SECOND FLOOR			2.8	0.0			-	-	-	10
11	20	1	SPARE					0.0	0.0	-	-	-	12
13	20	1	SPARE	0.0	0.0					SPARE	20	1	14
15	20	1	SPARE			0.0	0.0			SPARE	20	1	16
17	20	1	SPARE					0.0	0.0	SPARE	20	1	18
19	20	1	SPARE	0.0	0.0					SPARE	20	1	20
21	20	1	SPARE			0.0	0.0			SPARE	20	1	22
23	20	1	SPARE					0.0	0.0	SPARE	20	1	24
25	20	1	SPARE	0.0	0.0					SPARE	20	1	26
27	20	1	SPARE			0.0	0.0			SPARE	20	1	28
29	20	1	SPARE					0.0	0.0	SPARE	20	1	30
31	20	1	SPARE	0.0	0.0					SPARE	20	1	32
33	20	1	SPARE			0.0	0.0			SPARE	20	1	34
35	20	1	SPARE					0.0	0.0	SPARE	20	1	36
TOTAL				14.6		17.4		16.7					

GENERAL NOTES:

A. ALL BREAKERS IN SWBD SHALL BE 80% RATED WITH GROUND FAULT PROTECTION.

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HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

Drawing Issued:

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10-20-2015		75% Progress Set
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11-19-2018		100% Bid Docs

Drawn By: TJ,ST,FB
Checked By: AC,CG
Client No: -------
Albert & Associates: 12575

12/20/2016

E0.8

PANEL	LOCATION:	ELECTRICAL ROOM	LUG LOCATION:	TOP FEED
LP2A	VOLT:	208Y/120V, 3Ø, 4W	MAIN BUS:	225A MAIN BREAKER W/FEED THRU LUGS
	BUS:	225A	MOUNTING:	SURFACE

PANELBOARD AIC RATING (A): **22,000**

CIRCUIT NO.	BREAKER AMPS	BREAKER POLES	DESCRIPTION	PHASE LOAD (KVA) A	A	B	B	C	C	DESCRIPTION	BREAKER AMPS	BREAKER POLES	CIRCUIT NO.
1	20	1	REC. - B244 - REFRIGERATOR	0.8	0.9					REC. - B238	20	1	2
3	20	1	REC. - B244 - REFRIGERATOR			0.8	1.1			REC. - B239	20	1	4
5	20	1	REC. - B244 - REFRIGERATOR					0.8	1.1	REC. - B239	20	1	6
7	20	1	REC. - B244 - REFRIGERATOR	0.8	1.1					REC. - B239	20	1	8
9	20	1	REC. - B244 - REFRIGERATOR			0.8	1.1			REC. - B230	20	1	10
11	20	1	REC. - B244 - REFRIGERATOR					0.8	1.1	REC. - B230	20	1	12
13	20	1	REC. - B242	1.3	1.1					REC. - B230	20	1	14
15	20	1	REC. - B242			0.4	1.1			REC. - B230	20	1	16
17	20	1	REC. - B241					1.8	1.1	REC. - B230	20	1	18
19	20	1	REC. - B240	0.4	1.1					REC. - B230	20	1	20
21	20	1	REC. - B248			0.4	1.1			REC. - B230	20	1	22
23	20	1	REC. - B226, B227, B228					1.1	1.1	REC. - B230	20	1	24
25	20	1	REC. - B249	0.4	1.1					REC. - B230	20	1	26
27	20	1	REC. - B249			0.4	1.1			REC - B238	20	1	28
29	20	1	REC. - B236, B235, B237					0.5	1.2	EVIDENCE HOLDING	20	1	30
31	20	1	REC. - B234	0.4	1.2					EVIDENCE HOLDING	20	1	32
33	20	1	REC. - B234 - VENDING MACHINE			1.4	1.0			FCU-1,2,3 - STAIR B	15	2	34
35	20	1	REC. - B234 - VENDING MACHINE					1.4	1.0	-	-	-	36
37	20	1	REC. - B234	0.4	0.5					IU-1.4, IU1.5, IU1.6	20	2	38
39	20	1	REC. - B234 - REFRIGERATOR			0.8	0.5			-	-	-	40
41	20	1	REC. - B232					1.4	0.3	T3.15 - T3.25	50	1	42
43	20	1	REC. - B233	0.9	0.0					SPARE	20	1	44
45	20	1	REC. - B231, B229			1.8	0.0			SPARE	20	1	46
47	20	1	REC. - B230					1.1	0.0	SPARE	20	1	48
49	20	1	REC. - B238	0.7	0.0					SPARE	20	1	50
51	20	1	REC. - B238			0.9	0.0			SPARE	20	1	52
53	20	1	REC. - B238					0.9	0.0	SPARE	20	1	54
TOTAL				12.8		14.6		16.7					

PANEL	LOCATION:	ELECTRICAL ROOM	LUG LOCATION:	TOP FEED
HP2B	VOLT:	480Y/277V, 3Ø, 4W	MAIN BUS:	MAIN LUGS ONLY
	BUS:	225A	MOUNTING:	SURFACE

PANELBOARD AIC RATING (A): **42000 (SERIES RATED)**

CIRCUIT NO.	BREAKER AMPS	BREAKER POLES	DESCRIPTION	PHASE LOAD (KVA) A	A	B	B	C	C	DESCRIPTION	BREAKER AMPS	BREAKER POLES	CIRCUIT NO.
1	125	3	XFMR TP2B (PNL LP2B)	11.0	0.0					SPARE	60	3	2
3	-	-	-			11.8	0.0			-	-	-	4
5	-	-	-					14.0	0.0	-	-	-	6
7	20	3	SPARE	0.0	0.0					SPARE	40	3	8
9	-	-	-			0.0	0.0			-	-	-	10
11	-	-	-					0.0	0.0	-	-	-	12
13	15	3	SPARE	0.0	0.0					SPARE	20	3	14
15	-	-	-			0.0	0.0			-	-	-	16
17	-	-	-					0.0	0.0	-	-	-	18
19	20	1	LIGHTING SECOND FLOOR	2.2	0.0					SPARE	20	3	20
21	20	1	LIGHTING SECOND FLOOR			1.9	0.0			-	-	-	22
23	20	1	LIGHTING SECOND FLOOR					1.6	0.0	-	-	-	24
25	20	1	SPARE	0.0	0.0					SPARE	20	3	26
27	20	1	SPARE			0.0	0.0			-	-	-	28
29	20	1	SPARE					0.0	0.0	-	-	-	30
31	20	1	SPARE	0.0	0.0					SPARE	20	1	32
33	20	1	SPARE			0.0	0.0			SPARE	20	1	34
35	20	1	SPARE					0.0	0.0	SPARE	20	1	36
TOTAL				13.2		13.7		15.7					

PANEL	LOCATION:	ELECTRICAL ROOM	LUG LOCATION:	TOP FEED
LP2B	VOLT:	208Y/120V, 3Ø, 4W	MAIN BUS:	225A MAIN BREAKER W/FEED THRU LUGS
	BUS:	225A	MOUNTING:	SURFACE

PANELBOARD AIC RATING (A): **22,000**

CIRCUIT NO.	BREAKER AMPS	BREAKER POLES	DESCRIPTION	PHASE LOAD (KVA) A	A	B	B	C	C	DESCRIPTION	BREAKER AMPS	BREAKER POLES	CIRCUIT NO.
1	20	1	REC. - B225	1.1	0.2					REC. - B253	20	1	2
3	20	1	REC. - B225			1.1	0.4			REC. - B253	20	1	4
5	20	1	REC. - B225					1.1	1.8	REC. - B251	20	1	6
7	20	1	REC. - B224	0.4	1.3					REC. - B255, B256, B257	20	1	8
9	20	1	REC. - B224			0.4	1.1			REC. - A202	20	1	10
11	20	1	REC. - B224					0.7	0.7	REC. - A202	20	1	12
13	20	1	REC. - A216, A217	2.2	0.4					REC. - A202	20	1	14
15	20	1	REC. - B218, B225, B223			0.9	0.2			REC. - B258	20	1	16
17	20	1	REC. - B215, B213, B214, B204, B201					1.3	0.7	REC. - B258	20	1	18
19	20	1	REC. - B215 - DRINKING FOUNAIN	0.5	0.3					T3.01 - T3.13, T3.28, T3.29 , T6.04 - T6.06	15	1	20
21	20	1	REC. - B220, B221			2.2	0.3			MOTORIZED LOUVER B258	15	1	22
23	20	1	REC. - B222					1.1	0.9	REC - ROOF	20	1	24
25	20	1	REC. - A201	0.9	0.0					SPARE	20	1	26
27	20	1	REC. - B211			0.9	0.0			SPARE	20	1	28
29	20	1	REC. - B212 - VENDING MACHINE					1.4	0.0	SPARE	20	1	30
31	20	1	REC. - B212	0.4	0.0					SPARE	20	1	32
33	20	1	REC. - B212			0.4	0.0			SPARE	20	1	34
35	20	1	REC. - B212 - REFRIGERATOR					0.8	0.0	SPARE	20	1	36
37	20	1	REC. - B203, B202	2.2	0.0					SPARE	20	1	38
39	20	1	REC. - B210, B209			2.2	0.0			SPARE	20	1	40
41	20	1	REC. - B208, B207					2.2	0.0	SPARE	20	1	42
43	20	1	REC. - B206	1.1	0.0					SPARE	20	1	44
45	20	1	REC. - B205			1.3	0.0			SPARE	20	1	46
47	20	1	REC. - B205					0.5	0.0	SPARE	20	1	48
49	20	1	REC. - B205	0.4	0.0					SPARE	20	1	50
51	20	1	REC. - B253, B252			0.7	0.0			SPARE	20	1	52
53	20	1	REC. - B253 - REFRIGERATOR					0.8	0.0	SPARE	20	1	54
TOTAL				11.0		11.8		14.0					

PANEL	LOCATION:	ELECTRICAL ROOM	LUG LOCATION:	TOP FEED
HP3A	VOLT:	480Y/277V, 3Ø, 4W	MAIN BUS:	MAIN LUGS ONLY
	BUS:	225A	MOUNTING:	SURFACE

PANELBOARD AIC RATING (A): **42000 (SERIES RATED)**

CIRCUIT NO.	BREAKER AMPS	BREAKER POLES	DESCRIPTION	PHASE LOAD (KVA) A	A	B	B	C	C	DESCRIPTION	BREAKER AMPS	BREAKER POLES	CIRCUIT NO.
1	70	3	XFMR TP3A (PNL LP3A)	14.7	3.1					CRC-1 - B333	15	3	2
3	-	-	-			13.8	3.1			-	-	-	4
5	-	-	-					12.9	3.1	-	-	-	6
7	60	3	ELEVATOR B	5.0	3.1					CRC-2 - B327	15	3	8
9	-	-	-			5.0	3.1			-	-	-	10
11	-	-	-					5.0	3.1	-	-	-	12
13	-	-	SHUNT TRIP COIL	0.0	2.8					UPS ISOLATION TRANSFORMER	50	3	14
15	20	1	LIGHTING THIRD FLOOR			2.6	2.8			-	-	-	16
17	20	1	LIGHTING THIRD FLOOR					2.3	2.8	-	-	-	18
19	20	1	LIGHTING THIRD FLOOR	2.1	0.0					SPARE	20	1	20
21	20	1	SPARE			0.0	0.0			SPARE	15	3	22
23	20	1	SPARE					0.0	0.0	-	-	-	24
25	20	1	SPARE	0.0	0.0					-	-	-	26
27	20	1	SPARE			0.0	0.0			SPARE	20	3	28
29	20	1	SPARE					0.0	0.0	-	-	-	30
31	20	1	SPARE	0.0	0.0					-	-	-	32
33	20	1	SPARE			0.0	0.0			SPARE	20	1	34
35	20	1	SPARE					0.0	0.0	SPARE	20	1	36
TOTAL				30.9		30.4		29.1					

PANEL	LOCATION:	ELECTRICAL ROOM	LUG LOCATION:	TOP FEED
LP3A - SEC. 1	VOLT:	208Y/120V, 3Ø, 4W	MAIN BUS:	175A MAIN BREAKER W/FEED THRU LUGS
	BUS:	225A	MOUNTING:	SURFACE

PANELBOARD AIC RATING (A): **22,000**

CIRCUIT NO.	BREAKER AMPS	BREAKER POLES	DESCRIPTION	PHASE LOAD (KVA) A	A	B	B	C	C	DESCRIPTION	BREAKER AMPS	BREAKER POLES	CIRCUIT NO.
1	20	1	REC. - B334	0.7	0.5					REC. - B331, B332	20	1	2
3*	20	1	REC. - B334			0.5	1.4			REC. - B331 - VENDING MACHINE	20	1	4
5	20	1	REC. - B334, B332					0.7	1.4	REC. - B331 - VENDING MACHINE	20	1	6
7	20	1	REC. - B334	0.4	1.3					REC. - B330	20	1	8
9	20	1	REC. - B334			0.4	0.9			REC. - B328	20	1	10
11*	20	1	REC. - B334 - TREADMILL					1.0	0.7	REC. - B328	20	1	12
13*	20	1	REC. - B334 - TREADMILL	1.0	1.1					REC. - B328	20	1	14
15*	20	1	REC. - B334 - TREADMILL			1.0	1.1			REC. - B328	20	1	16
17*	20	1	REC. - B334 - TREADMILL					1.0	1.1	REC. - B328	20	1	18
19*	20	1	REC. - B334 - TREADMILL	1.0	1.1					REC. - B328	20	1	20
21*	20	1	REC. - B334 - TREADMILL			1.0	1.1			REC. - B328	20	1	22
23*	20	1	REC. - B334 - TREADMILL					1.0	0.7	REC. - B333	20	1	24
25*	20	1	REC. - B334 - TREADMILL	1.0	0.7					REC. - B333	20	1	26
27	20	1	REC. - B338 - VENDING MACHINE			1.4	0.7			REC. - B333	20	1	28
29	20	1	REC. - B338 - VENDING MACHINE					1.4	0.4	REC. - B327	20	1	30
31	20	1	REC. - B336 - VENDING MACHINE	1.4	0.7					REC. - B327	20	1	32
33	20	1	REC. - B336 - VENDING MACHINE			1.4	0.2			ELEVATOR REC	20	1	34
35	20	1	REC. - B336					0.9	0.5	ELEVATOR CONTROL PANEL	20	1	36
37	20	1	REC. - B335, B338	1.4	0.5					ELEVATOR CAB LIGHTS	20	1	38
39	20	1	REC. - B342			0.4	0.5			ELVATOR PIT LIGHTS	20	1	40
41	20	1	REC. - B343					0.4	0.5	ELVATOR PIT SUMP PUMP	20	1	42
43	20	1	REC. - B341	0.4	0.5					IU-1.1, IU.1.2, IU-.3	20	2	44
45	30	1	RP-1			0.5	0.5			-	-	-	46
47	25	1	RP-2					0.5	0.3	T3.30 - T3.32, T4.11, T4.15 - T4.20	15	1	48
49	20	1	GWH-1	0.5	0.5					ELEVATOR MONITOR	20	1	50
51	20	1	REC. - B331 - REFRIGERATOR			0.8	0.0			SPARE	15	1	52
53	20	1	REC. - B331					0.4	0.0	SPARE	15	1	54
TOTAL				14.7		13.8		12.9		*INDICATES GFI BREAKER IN PANEL			

PANEL	LOCATION:	ELECTRICAL ROOM	LUG LOCATION:	BOTTOM FEED
LP3A - SEC. 2	VOLT:	208Y/120V, 3Ø, 4W	MAIN:	MAIN LUGS ONLY
	BUS:	225A	MOUNTING:	SURFACE

PANELBOARD AIC RATING (A): **22,000**

CIRCUIT NO.	BREAKER AMPS	BREAKER POLES	DESCRIPTION	PHASE LOAD (KVA) A	A	B	B	C	C	DESCRIPTION	BREAKER AMPS	BREAKER POLES	CIRCUIT NO.
55	20	1	SPARE	0.0	0.0					SPARE	20	1	56
57	20	1	SPARE			0.0	0.0			SPARE	20	1	58
59	20	1	SPARE					0.0	0.0	SPARE	20	1	60
61	20	1	SPARE	0.0	0.0					SPARE	20	1	62
63	20	1	SPARE			0.0	0.0			SPARE	20	1	64
65	20	1	SPARE					0.0	0.0	SPARE	20	1	66
67	20	1	SPARE	0.0	0.0					SPARE	20	1	68
69	20	1	SPARE			0.0	0.0			SPARE	20	1	70
71	20	1	SPARE					0.0	0.0	SPARE	20	1	72
73	20	1	SPARE	0.0	0.0					SPARE	20	1	74
75	20	1	SPARE			0.0	0.0			SPARE	20	1	76
77	20	1	SPARE					0.0	0.0	SPARE	20	1	78
79	20	1	SPARE	0.0	0.0					SPARE	20	1	80
81	20	1	SPARE			0.0	0.0			SPARE	20	1	82
83	20	1	SPARE					0.0	0.0	SPARE	20	1	84
85	20	1	SPARE	0.0	0.0					SPARE	20	1	86
87	20	1	SPARE			0.0	0.0			SPARE	20	1	88
89	20	1	SPARE					0.0	0.0	SPARE	20	1	90
91	20	1	SPARE	0.0	0.0					SPARE	20	1	92
93	20	1	SPARE			0.0	0.0			SPARE	20	1	94
95	20	1	SPARE					0.0	0.0	SPARE	20	1	96
97	20	1	SPARE	0.0	0.0					SPARE	20	1	98
99	20	1	SPARE			0.0	0.0			SPARE	20	1	100
101	20	1	SPARE					0.0	0.0	SPARE	20	1	102
103	20	1	SPARE	0.0	0.0					SPARE	20	1	104
105	20	1	SPARE			0.0	0.0			SPARE	20	1	106
107	20	1	SPARE					0.0	0.0	SPARE	20	1	108
TOTAL				0.0		0.0		0.0					

PANEL	LOCATION:	ELECTRICAL ROOM	LUG LOCATION:	TOP FEED
HP3B	VOLT:	480Y/277V, 3Ø, 4W	MAIN BUS:	MAIN LUGS ONLY
	BUS:	225A	MOUNTING:	SURFACE

PANELBOARD AIC RATING (A): **42000 (SERIES RATED)**

CIRCUIT NO.	BREAKER AMPS	BREAKER POLES	DESCRIPTION	PHASE LOAD (KVA) A	A	B	B	C	C	DESCRIPTION	BREAKER AMPS	BREAKER POLES	CIRCUIT NO.
1	70	3	XFMR TP3B (PNL LP3B)	10.7	0.0					SPARE	60	3	2
3	-	-	-			11.2	0.0			-	-	-	4
5	-	-	-					8.1	0.0	-	-	-	6
7	60	3	ELEVATOR A (LOBBY)	2.8	0.0					SPARE	40	3	8
9	-	-	-			2.8	0.0			-	-	-	10
11	-	-	-					2.8	0.0	-	-	-	12
13	20	0	SPARE	0.0	0.0					SPARE	40	3	14
15	20	1	LIGHTING THIRD FLOOR			2.3	0.0			-	-	-	16
17	20	1	LIGHTING THIRD FLOOR					2.7	0.0	-	-	-	18
19	20	1	LIGHTING - OPEN LOBBY AREA	2.5	0.0					SPARE	20	3	20
21	20	1	SPARE			0.0	0.0			-	-	-	22
23	20	1	SPARE					0.0	0.0	-	-	-	24
25	20	1	SPARE	0.0	0.0					SPARE	20	3	26
27	20	1	SPARE			0.0	0.0			-	-	-	28
29	20	1	SPARE					0.0	0.0	-	-	-	30
31	20	1	SPARE	0.0	0.0					SPARE	20	1	32
33	20	1	SPARE			0.0	0.0			SPARE	20	1	34
35	20	1	SPARE					0.0	0.0	SPARE	20	1	36
TOTAL				15.9		16.2		13.6					

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HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT

HPSC Police and Court Building

Drawing Issued:

Date	Rev.	Description
08-31-2015		DD Check Set
10-20-2015		75% Progress Set
11-02-2015		90% Pricing Set
11-19-2018		100% Bid Docs

Drawn By: TJ,ST,FB
Checked By: AC,CG
Client No: -------
Albert & Associates: 12575



E0.9

PANEL LP3B

LOCATION: **ELECTRICAL ROOM** | LUG LOCATION: **TOP FEED**
VOLT: **208Y/120V, 3Ø, 4W** | MAIN BUS: **175A MAIN BREAKER W/FEED THRU LUGS**
BUS: **225A** | MOUNTING: **SURFACE** | PANELBOARD AIC RATING (A): **22,000**

CIRCUIT NO.	BREAKER AMPS	BREAKER POLES	DESCRIPTION	PHASE LOAD (KVA) A	A	B	B	C	C	DESCRIPTION	BREAKER AMPS	BREAKER POLES	CIRCUIT NO.
1	20	1	REC. - B345, B344, B314, B313, B312, B302	1.4	0.5					ELEVATOR CONTROL PANEL3	20	1	2
3	20	1	REC. - B316			1.4	0.5			ELEVATOR CAB LIGHTS	20	1	4
5	20	1	REC. - B315					1.6	0.0	SPARE	20	1	6
7	20	1	REC. - 310	1.8	0.0					SPARE	15	1	8
9	20	1	REC. - B320			1.1	0.3			T4.01 - T4.19, T6.07, T6.08	15	1	10
11	20	1	REC. - 318					1.4	0.0	0	20	1	12
13	20	1	REC. - B317	1.4	0.0					SPARE	20	1	14
15	20	1	REC. - B324			2.2	0.0			SPARE	20	1	16
17	20	1	REC. - B325, B319					2.3	0.0	SPARE	20	1	18
19	20	1	REC. - B305, B307, B306, B309, B305, B308	1.4	0.0					SPARE	20	1	20
21	20	1	REC. - B322			0.4	0.0			SPARE	20	1	22
23	20	1	REC. - B309, B323, B321					1.3	0.0	SPARE	20	1	24
25	20	1	REC. - B305 - REFRIGERATOR	0.8	0.0					SPARE	20	1	26
27	20	1	REC. - B305			0.4	0.0			SPARE	20	1	28
29	20	1	REC. - B305					0.2	0.0	SPARE	20	1	30
31	20	1	REC. - B305 - VENDING MACHINE	1.4	0.0					SPARE	20	1	32
33	20	1	REC. - B305 - VENDING MACHINE			1.4	0.0			SPARE	20	1	34
35	20	1	SPARE					0.0	0.0	SPARE	20	1	36
37	20	1	REC. - B304	0.4	0.0					SPARE	20	1	38
39	20	1	REC. - B304			1.4	0.0			SPARE	20	1	40
41	20	1	SPARE					0.0	0.0	SPARE	20	1	42
43	20	1	REC. - B303	1.3	0.0					SPARE	20	1	44
45	20	1	REC. - B301			1.6	0.0			SPARE	20	1	46
47	20	1	REC. - A301					0.7	0.0	SPARE	20	1	48
49	20	1	REC - ELEVATOR	0.2	0.0					SPARE	20	1	50
51	20	1	ELEVATOR SUMP PUMP			0.5	0.0			SPARE	20	1	52
53	20	1	ELEVATOR LIGHTS					0.5	0.0	SPARE	20	1	54
TOTAL				10.7		11.2		8.1					

PANEL HPR

LOCATION: **ELECTRICAL ROOM** | LUG LOCATION: **TOP FEED**
VOLT: **480Y/277V, 3Ø, 4W** | MAIN BUS: **MAIN LUGS ONLY W/FEED THRU LUGS**
BUS: **400A** | MOUNTING: **SURFACE** | PANELBOARD AIC RATING (A): **42000 (SERIES RATED)**

CIRCUIT NO.	BREAKER AMPS	BREAKER POLES	DESCRIPTION	PHASE LOAD (KVA) A	A	B	B	C	C	DESCRIPTION	BREAKER AMPS	BREAKER POLES	CIRCUIT NO.
1	50	3	XFMR TPR (PNL LPR)	5.0	7.8					AHU-3 - ROOF	45	3	2
3	-	-	-			4.8	7.8			-	-	-	4
5	-	-	-					2.9	7.8	-	-	-	6
7	15	3	EF-8 - ROOF	0.9	5.5					AHU-4 - ROOF	35	3	8
9	-	-	-			0.9	5.5			-	-	-	10
11	-	-	-					0.9	5.5	-	-	-	12
13	20	3	RF-1 - ROOF	3.0	1.4					HWB-1 - ROOF	15	3	14
15	-	-	-			3.0	1.4			-	-	-	16
17	-	-	-					3.0	1.4	-	-	-	18
19	20	3	RF-2 - ROOF	3.0	1.4					HWB-2 - ROOF	15	3	20
21	-	-	-			3.0	1.4			-	-	-	22
23	-	-	-					3.0	1.4	-	-	-	24
25	15	3	AHU-1 (SUPPLY) - ROOF	1.7	1.7					AHU-1 (RELIEF) - ROOF	15	3	26
27	-	-	-			1.7	1.7			-	-	-	28
29	-	-	-					1.7	1.7	-	-	-	30
31	20	3	AHU-2 (SUPPLY) - ROOF	2.4	1.7					AHU-2 (RELIEF) - ROOF	15	3	32
33	-	-	-			2.4	1.7			-	-	-	34
35	-	-	-					2.4	1.7	-	-	-	36
37	25	3	AHU-5 (SUPPLY) - ROOF	3.2	2.4					AHU-5 (RELIEF) - ROOF	20	3	38
39	-	-	-			3.2	2.4			-	-	-	40
41	-	-	-					3.2	2.4	-	-	-	42
43	25	3	AHU-6 (SUPPLY) - ROOF	3.8	3.3					AHU-6 (RELIEF) - ROOF	20	3	44
45	-	-	-			3.8	3.3			-	-	-	46
47	-	-	-					3.8	3.3	-	-	-	48
49	40	3	CHP-1	5.8	5.8					CHP-2	40	3	50
51	-	-	-			5.8	5.8			-	-	-	52
53	-	-	-					5.8	5.8	-	-	-	54
TOTAL				59.8		59.6		57.7					

PANEL HPR - SEC. 2

LOCATION: **ELECTRICAL ROOM** | LUG LOCATION: **BOTTOM FEED**
VOLT: **480Y/277V, 3Ø, 4W** | MAIN: **MAIN LUGS ONLY**
BUS: **400A** | MOUNTING: **SURFACE** | PANELBOARD AIC RATING (A): **42000 (SERIES RATED)**

CIRCUIT NO.	BREAKER AMPS	BREAKER POLES	DESCRIPTION	PHASE LOAD (KVA) A	A	B	B	C	C	DESCRIPTION	BREAKER AMPS	BREAKER POLES	CIRCUIT NO.
55	20	3	HWP-1	3.0	3.0					HWP-2	20	3	56
57	-	-	-			3.0	3.0			-	-	-	58
59	-	-	-					3.0	3.0	-	-	-	60
61	15	3	CU-1	0.3	0.3					CU-2	15	3	62
63	-	-	-			0.3	0.3			-	-	-	64
65	-	-	-					0.3	0.3	-	-	-	66
67	40	3	SPARE	0.0	0.0					SPARE	60	3	68
69	-	-	-			0.0	0.0			-	-	-	70
71	-	-	-					0.0	0.0	-	-	-	72
73	20	3	SPARE	0.0	0.0					SPARE	40	3	74
75	-	-	-			0.0	0.0			-	-	-	76
77	-	-	-					0.0	0.0	-	-	-	78
79	20	3	SPARE	0.0	0.0					SPARE	20	3	80
81	-	-	-			0.0	0.0			-	-	-	82
83	-	-	-					0.0	0.0	-	-	-	84
85	20	1	LIGHTING - B401	0.7	0.0					SPARE	15	3	86
87	20	1	SPARE			0.0	0.0			-	-	-	88
89	20	1	SPARE					0.0	0.0	-	-	-	90
91	20	3	SPARE	0.0	0.0					SPARE	25	3	92
93	-	-	-			0.0	0.0			-	-	-	94
95	-	-	-					0.0	0.0	-	-	-	96
97	20	3	SPARE	0.0	0.0					SPARE	60	3	98
99	-	-	-			0.0	0.0			-	-	-	100
101	-	-	-					0.0	0.0	-	-	-	102
103	15	3	SPARE	0.0	0.0					SPARE	30	3	104
105	-	-	-			0.0	0.0			-	-	-	106
107	-	-	-					0.0	0.0	-	-	-	108
TOTAL				7.4		6.7		6.7					

PANEL LPR

LOCATION: **ELECTRICAL ROOM** | LUG LOCATION: **TOP FEED**
VOLT: **208Y/120V, 3Ø, 4W** | MAIN BUS: **100A MAIN BREAKER**
BUS: **100A** | MOUNTING: **SURFACE** | PANELBOARD AIC RATING (A): **22,000**

CIRCUIT NO.	BREAKER AMPS	BREAKER POLES	DESCRIPTION	PHASE LOAD (KVA) A	A	B	B	C	C	DESCRIPTION	BREAKER AMPS	BREAKER POLES	CIRCUIT NO.
1	20	1	REC. - ROOF EXTERIOR, B401, B402	1.1	2.2					OU-1 - ROOF	40	2	2
3	20	1	REC. - B403			0.4	2.2			-	-	-	4
5	20	1	EF-5 - ROOF					1.2	0.7	EF-6 - ROOF	15	1	6
7	15	1	EF-7 - ROOF	0.5	0.0					T3.33	15	1	8
9	15	1	EF-1 - ROOF			0.5	0.7			REC - ROOF B401	20	1	10
11	15	1	EF-2 - ROOF					0.5	0.0	SPARE	20	1	12
13	15	1	EF-3 - ROOF	0.5	0.0					SPARE	20	1	14
15	15	1	EF-4 - ROOF			0.5	0.0			SPARE	20	1	16
17	20	1	-					0.0	0.0	SPARE	20	1	18
19	20	1	HWB-1	0.5	0.0					SPARE	20	1	20
21	20	1	HWB-2			0.5	0.0			SPARE	20	1	22
23	20	1	TP-2					0.5	0.0	SPARE	20	1	24
25	20	1	MECH REC B401	0.2	0.0					SPARE	20	1	26
27	20	1	SPARE			0.0	0.0			SPARE	20	1	28
29	20	1	SPARE					0.0	0.0	SPARE	20	1	30
31	20	1	SPARE	0.0	0.0					SPARE	20	1	32
33	20	1	SPARE			0.0	0.0			SPARE	20	1	34
35	20	1	SPARE					0.0	0.0	SPARE	20	1	36
TOTAL				5.0		4.8		2.9					

PANEL HP2-LS

LOCATION: **ELECTRICAL ROOM** | LUG LOCATION: **TOP FEED**
VOLT: **480Y/277V, 3Ø, 4W** | MAIN BUS: **MAIN LUGS ONLY**
BUS: **225A** | MOUNTING: **SURFACE** | PANELBOARD AIC RATING (A): **42000 (SERIES RATED)**

CIRCUIT NO.	BREAKER AMPS	BREAKER POLES	DESCRIPTION	PHASE LOAD (KVA) A	A	B	B	C	C	DESCRIPTION	BREAKER AMPS	BREAKER POLES	CIRCUIT NO.
1	50	3	XFMR TP2-LS (PNL LP2-LS)	1.5	3.0					SEF-1 - ROOF	20	3	2
3	-	-	-			1.0	3.0			-	-	-	4
5	-	-	-					2.0	3.0	-	-	-	6
7	20	3	SEF-2 - ROOF	3.0	3.0					SEF-3 - ROOF	20	3	8
9	-	-	-			3.0	3.0			-	-	-	10
11	-	-	-					3.0	3.0	-	-	-	12
13	20	3	SEF-4 - ROOF	3.0	3.0					SEF-5 - ROOF	20	3	14
15	-	-	-			3.0	3.0			-	-	-	16
17	-	-	-					3.0	3.0	-	-	-	18
19	20	3	SEF-6 - ROOF	3.0	0.0					SPARE	20	1	20
21	-	-	-			3.0	0.0			SPARE	20	1	22
23	-	-	-					3.0	0.0	SPARE	20	1	24
25	20	2	GEN BLOCK HTR #1	0.0	3.0					EMERGENCY LIGHTING - 3RD FLOOR	20	1	26
27	-	-	-			0.0	0.8			EMERGENCY LIGHTING - 3RD FLOOR LOBBY	20	1	28
29	20	2	GEN BLOCK HTR #2					0.0	2.1	EMERGENCY LIGHTING PARKING GARAGE / COR	20	1	30
31	-	-	-	0.0	3.0					EMERGENCY LIGHTING - 2ND FLOOR AND ROOF	20	1	32
33	-	-	SPACE			0.0	2.8			EMERGENCY LIGHTING - 2ND FLOOR	20	1	34
35	-	-	SPACE					0.0	2.8	EMERGENCY LIGHTING - FIRST FLOOR	20	1	36
37	20	3	SPARE	0.0	2.8					EXTERIOR EMERGENCY LIGHTING - FIRST FLOOI	20	1	38
39	-	-	-			0.0	2.0			EMERGENCY LIGHTING - STAIR 'B'	20	1	40
41	-	-	-					0.0	0.5	EMERGENCY LIGHTING - OPEN LOBBY AREA	20	1	42
43	20	1	SPARE	0.0	0.5					CONTACTOR "C1"	20	1	44
45	20	1	SPARE			0.0	0.5			EXTERIOR LIGHTS	20	1	46
47	20	1	SPARE					0.0	0.5	CONTACTOR "C2"	20	1	48
49	60	3	PANEL EHH2	1.6	0.5					CONTACTOR "C3"	20	1	50
51	-	-	-			0.8	0.0			SPARE	20	1	52
53	-	-	-					0.9	0.0	SPARE	20	1	54
TOTAL				31.2		26.2		27.1					

PANEL LP2-LS

LOCATION: **ELECTRICAL ROOM** | LUG LOCATION: **TOP FEED**
VOLT: **208Y/120V, 3Ø, 4W** | MAIN BUS: **100A MAIN BREAKER**
BUS: **100A** | MOUNTING: **SURFACE** | PANELBOARD AIC RATING (A): **22,000**

CIRCUIT NO.	BREAKER AMPS	BREAKER POLES	DESCRIPTION	PHASE LOAD (KVA) A	A	B	B	C	C	DESCRIPTION	BREAKER AMPS	BREAKER POLES	CIRCUIT NO.
1	20	1	FACP	0.5	0.0					COMM. A133 QUAD	20	1	2
3	20	1	TDBB-B341			0.0	0.0			COMM. A133 QUAD	20	1	4
5	20	1	TDBB-B341					0.0	0.0	COMM. B249 QUAD	20	1	6
7	20	1	QUAD REC-B341	0.0	0.0					COMM. B249 QUAD	20	1	8
9	20	1	GEN BATTERY CHARGER			0.5	0.5			BELL RISER ROOM	20	1	10
11	20	1	LVR-3					0.0	2.0	DRY PIPE COMPRESSOR - B102	30	1	12
13	20	1	SMOKE DAMPERS	1.0	0.0					SPARE	20	1	14
15	20	1	SPARE			0.0	0.0			SPARE	20	1	16
17	20	1	SPARE					0.0	0.0	SPARE	20	1	18
19	20	1	SPARE	0.0	0.0					SPARE	20	1	20
21	20	1	SPARE			0.0	0.0			SPARE	20	1	22
23	20	1	SPARE					0.0	0.0	SPARE	20	1	24
25	20	1	SPARE	0.0	0.0					SPARE	20	1	26
27	20	1	SPARE			0.0	0.0			SPARE	20	1	28
29	20	1	SPARE					0.0	0.0	SPARE	20	1	30
31	20	1	SPARE	0.0	0.0					SPARE	20	1	32
33	20	1	SPARE			0.0	0.0			SPARE	20	1	34
35	20	1	SPARE					0.0	0.0	SPARE	20	1	36
37	20	1	SPARE	0.0	0.0					SPARE	20	1	38
39	20	1	SPARE			0.0	0.0			SPARE	20	1	40
41	20	1	SPARE					0.0	0.0	SPARE	20	1	42
TOTAL				1.5		1.0		2.0					

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CITY OF HATTIESBURG MISSISSIPPI

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Checked By: AC,CG
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Albert & Associates: 12575

GREGORY A. MCCLESKEY REGISTERED PROFESSIONAL ENGINEER 11853 STATE OF MISSISSIPPI
12/30/2016

E0.10

PANEL	LOCATION:	DISPATCH NETWORK ROOM	LUG LOCATION:	BOTTOM FEED								
UPSDP	VOLT:	208Y/120V, 3Ø, 4W	MAIN BUS:	100A MAIN BREAKER								
	BUS:	100A	MOUNTING:	SURFACE					PANELBOARD AIC RATING (A):		10,000	

CIRCUIT	BREAKER		DESCRIPTION	PHASE LOAD (KVA)						DESCRIPTION	BREAKER		CIRCUIT
NO.	AMPS	POLES		A		B		C			AMPS	POLES	NO.
1	100	3	RPA	1.9	0.0					RPB	100	3	2
3	-	-	-			1.5	0.0			-	-	-	4
5	-	-	-					1.5	0.0	-	-	-	6
7	100	3	SPACE	0.0	0.0					SPACE	100	3	8
9	-	-	-			0.0	0.0			-	-	-	10
11	-	-	-					0.0	0.0	-	-	-	12
TOTAL				1.9		1.5		1.5					

PANEL	LOCATION:	ELECTRICAL ROOM	LUG LOCATION:	TOP FEED								
RPA	VOLT:	208Y/120V, 3Ø, 4W	MAIN BUS:	MAIN LUGS ONLY								
	BUS:	100A	MOUNTING:	SURFACE					PANELBOARD AIC RATING (A):		10,000	

CIRCUIT	BREAKER		DESCRIPTION	PHASE LOAD (KVA)						DESCRIPTION	BREAKER		CIRCUIT
NO.	AMPS	POLES		A		B		C			AMPS	POLES	NO.
1	20	1	REC - DISPATCH	1.5	0.0					SPARE	20	1	2
3	20	1	REC - DISPATCH			1.5	0.0			SPARE	20	1	4
5	20	1	REC - DISPATCH					1.5	0.0	SPARE	20	1	6
7	20	1	REC - DISPATCH NETWORK EQUIPMENT	0.4	0.0					SPARE	20	1	8
9	20	1	SPARE			0.0	0.0			SPARE	20	1	10
11	20	1	SPARE					0.0	0.0	SPARE	20	1	12
13	20	1	SPARE	0.0	0.0					SPARE	20	1	14
15	20	1	SPARE			0.0	0.0			SPARE	20	1	16
17	20	1	SPARE					0.0	0.0	SPARE	20	1	18
19	20	1	SPARE	0.0	0.0					SPARE	20	1	20
21	20	1	SPARE			0.0	0.0			SPARE	20	1	22
TOTAL				1.9		1.5		1.5					

PANEL	LOCATION:	ELECTRICAL ROOM	LUG LOCATION:	TOP FEED								
RPB	VOLT:	208Y/120V, 3Ø, 4W	MAIN BUS:	MAIN LUGS ONLY								
	BUS:	100A	MOUNTING:	SURFACE					PANELBOARD AIC RATING (A):		65,000	

CIRCUIT	BREAKER		DESCRIPTION	PHASE LOAD (KVA)						DESCRIPTION	BREAKER		CIRCUIT
NO.	AMPS	POLES		A		B		C			AMPS	POLES	NO.
1	20	1	REC - DISPATCH	0.4	0.0					SPARE	20	1	2
3	20	1	REC - DISPATCH			0.4	0.0			SPARE	20	1	4
5	20	1	REC - DISPATCH					0.4	0.0	SPARE	20	1	6
7	20	1	REC - DISPATCH NETWORK EQUIPMENT	0.5	0.0					SPARE	20	1	8
9	20	1	SPARE			0.0	0.0			SPARE	20	1	10
11	20	1	SPARE					0.0	0.0	SPARE	20	1	12
13	20	1	SPARE	0.0	0.0					SPARE	20	1	14
15	20	1	SPARE			0.0	0.0			SPARE	20	1	16
17	20	1	SPARE					0.0	0.0	SPARE	20	1	18
19	20	1	SPARE	0.0	0.0					SPARE	20	1	20
21	20	1	SPARE			0.0	0.0			SPARE	20	1	22
23	20	1	SPARE					0.0	0.0	SPARE	20	1	24
TOTAL				0.9		0.4		0.4					

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E0.11

GENERAL NOTE:

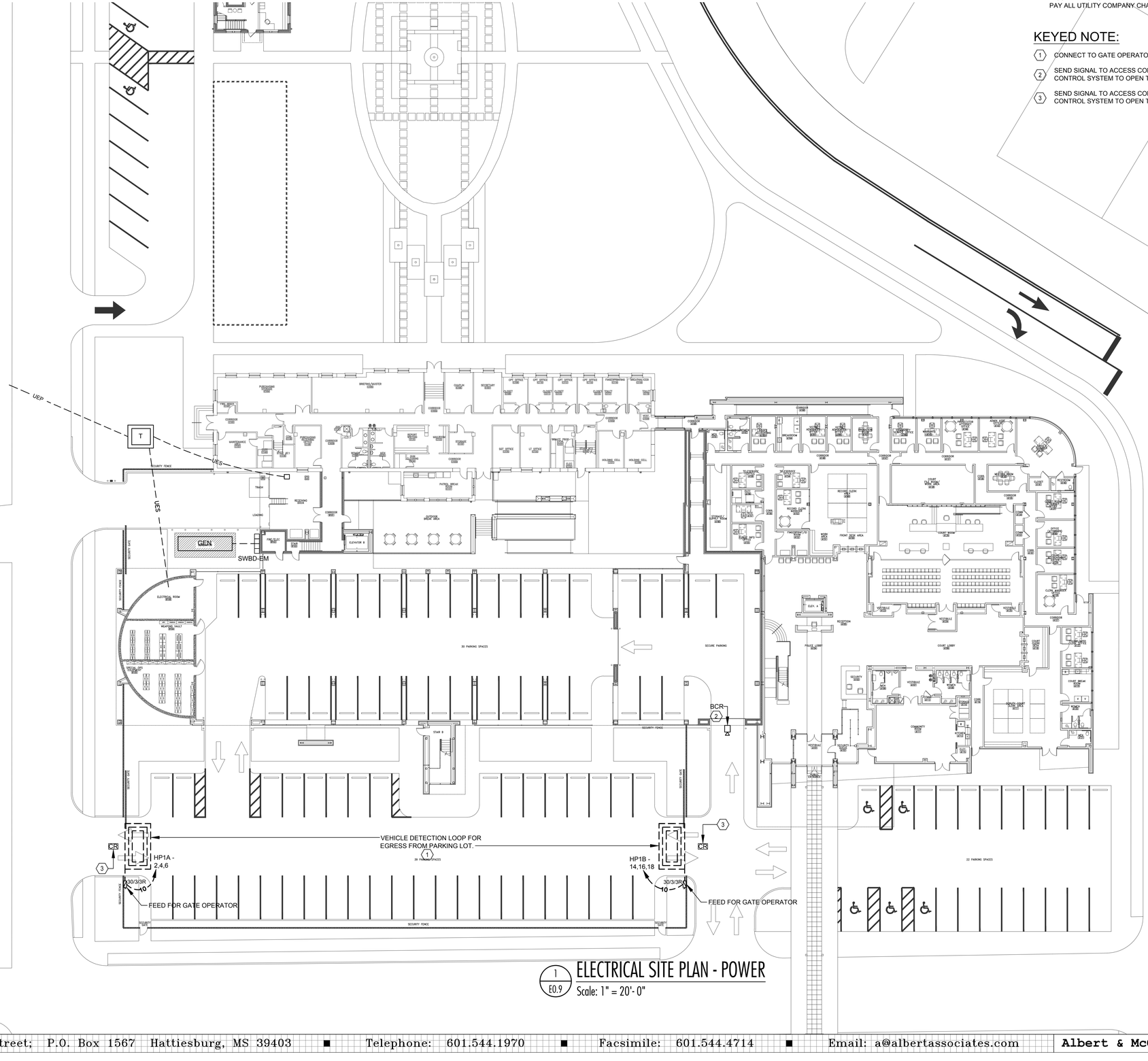
A. COMPLY COMPLETELY WITH ALL UTILITY COMPANY REQUIREMENTS EVEN IF DIFFERENT FROM THE INFORMATION SHOWN. NOTIFY THE ENGINEER AT LEAST TEN DAYS PRIOR TO BID OF ANY DISCREPANCIES BETWEEN THE UTILITY COMPANY REQUIREMENTS AND THE INFORMATION SHOWN. PAY ALL UTILITY COMPANY CHARGES.

KEYED NOTE:

1. CONNECT TO GATE OPERATOR PER VENDORS RECOMMENDATIONS.
2. SEND SIGNAL TO ACCESS CONTROL SYSTEM AND PROVIDE SIGNAL FROM ACCESS CONTROL SYSTEM TO OPEN THE GATE ON VALID BARCODE RECOGNITION.
3. SEND SIGNAL TO ACCESS CONTROL SYSTEM AND PROVIDE SIGNAL FROM ACCESS CONTROL SYSTEM TO OPEN THE GATE.

SITE PLAN LEGEND:

- P — EXISTING OVERHEAD PRIMARY
- P — EXISTING UNDERGROUND PRIMARY
- UEP — NEW UNDERGROUND PRIMARY
- UES — NEW UNDERGROUND SECONDARY
- T — NEW PAD-MOUNTED TRANSFORMER
- PP — EXISTING POWER POLE
- EC — NEW ELBOW CABINET



1 / E0.9 ELECTRICAL SITE PLAN - POWER
Scale: 1" = 20'- 0"

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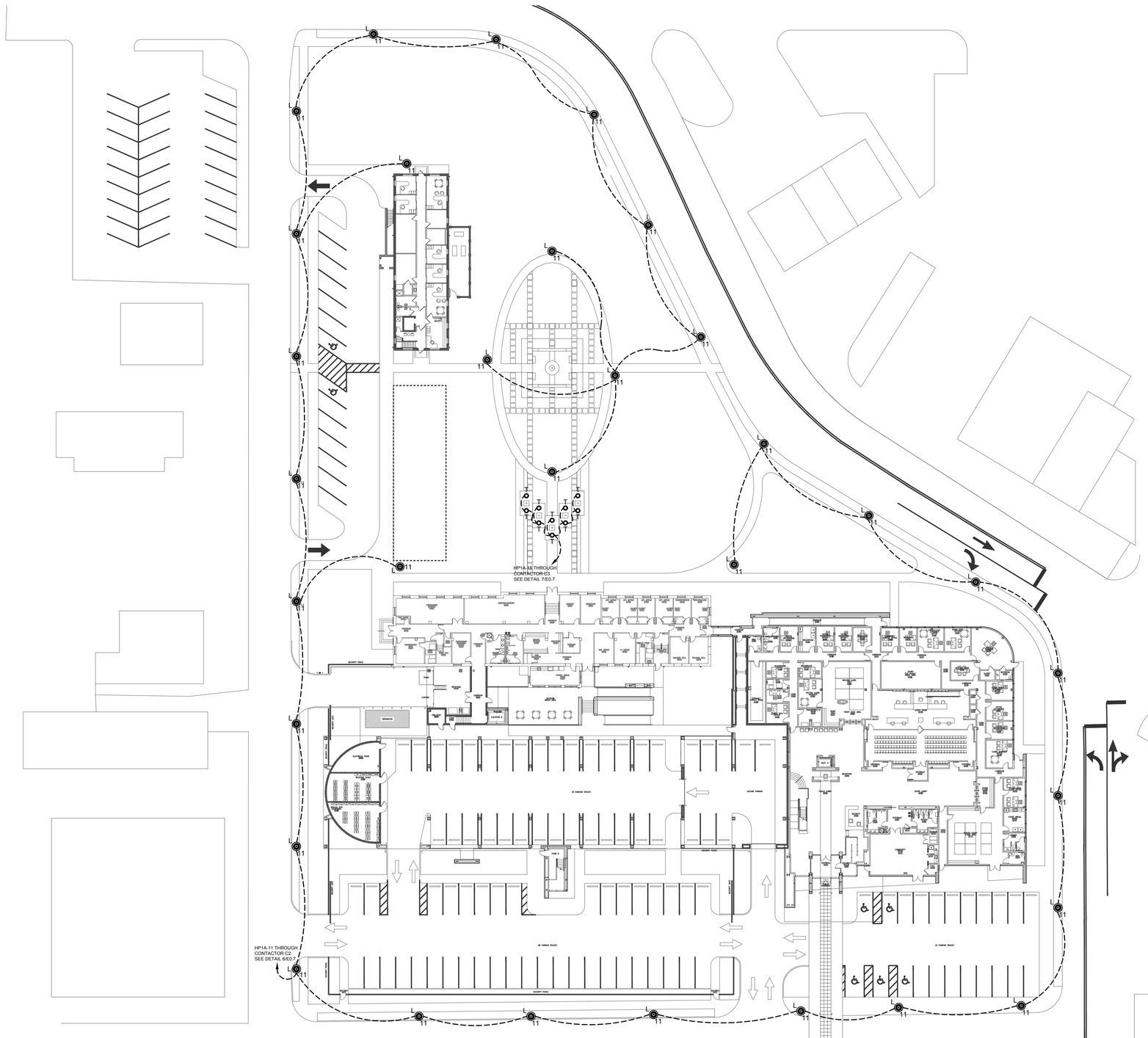
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REGISTERED PROFESSIONAL ENGINEER 11553 STATE OF MISSISSIPPI 12/30/2016

E0.12



1 E0.9 ELECTRICAL SITE PLAN - LIGHTING

Scale: 1" = 20'- 0"

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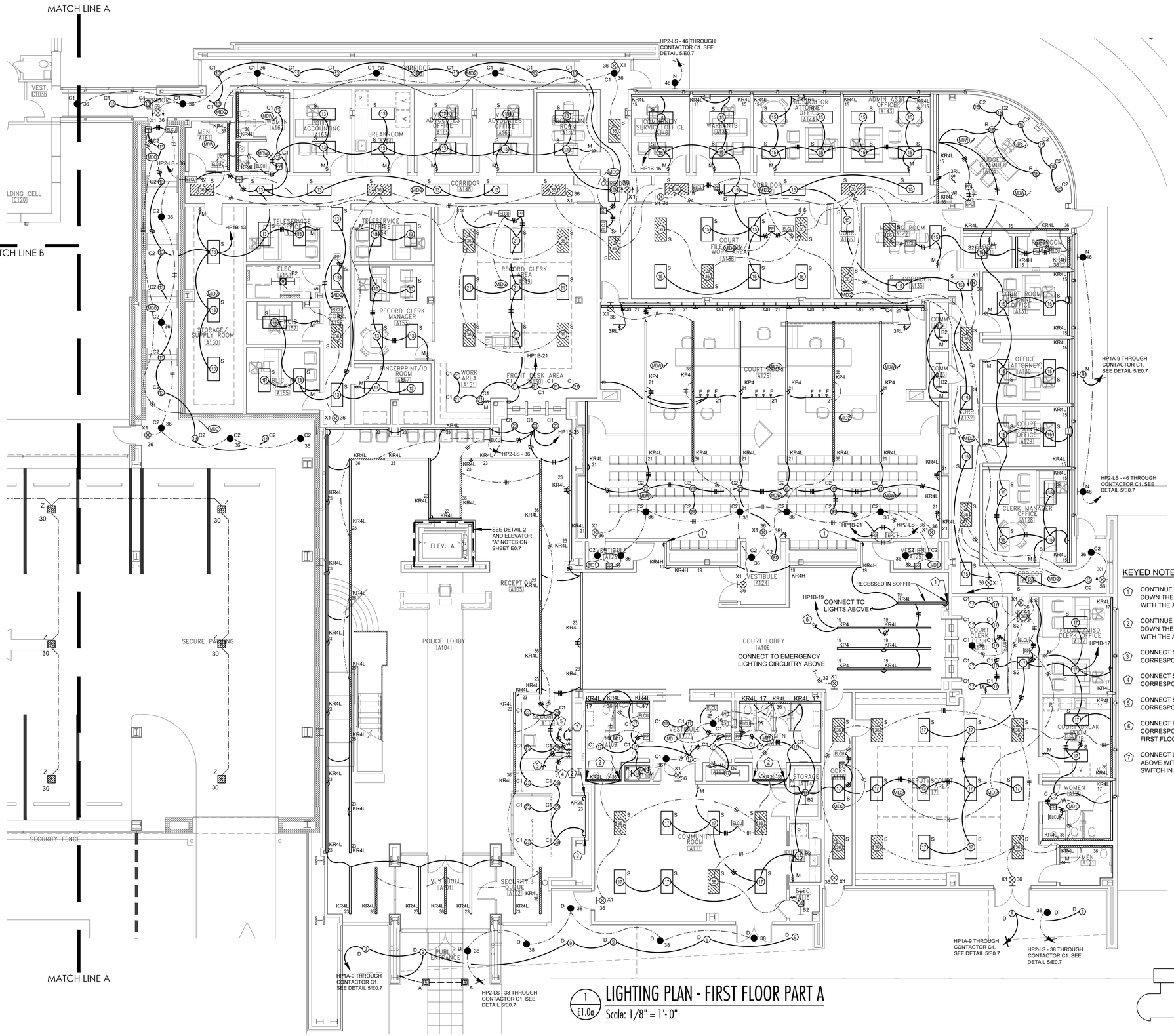
Drawing Issued:

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11-19-2018		100% Bid Docs

Drawn By: TJ,ST,FB
Checked By: AC,CG
Client No: --------
Albert & Associates: 12575

GREGORY A. CLEVELAND 11853 REGISTERED ENGINEER STATE OF MISSISSIPPI
12/20/2016

E0.13



1 / E1.0a — LIGHTING PLAN - FIRST FLOOR PART A

Scale: 1/8" = 1'- 0"

KEYED NOTES:

1. CONTINUE RECESSED LINEAR "KR4L" FIXTURE DOWN THE WALL. COORDINATE THE EXACT HEIGHT WITH THE ARCHITECTURAL PLANS.
2. CONTINUE RECESSED LINEAR "KR2L" FIXTURE DOWN THE WALL. COORDINATE THE EXACT HEIGHT WITH THE ARCHITECTURAL PLANS.
3. CONNECT SWITCH TO LIGHTING CIRCUIT WITH THE CORRESPONDING LETTER ON SECOND FLOOR.
4. CONNECT SWITCH TO LIGHTING CIRCUIT WITH THE CORRESPONDING LETTER ON THIRD FLOOR.
5. CONNECT SWITCH TO LIGHTING CIRCUIT WITH THE CORRESPONDING LETTER IN COURTROOM LOBBY.
6. CONNECT LIGHTING CIRCUIT TO SWITCH WITH THE CORRESPONDING LETTER IN SECURITY ON THE FIRST FLOOR.
7. CONNECT LIGHTS IN THE POLICE LOBBY AREA ABOVE WITH THE CORRESPONDING LETTER OF THE SWITCH IN THE SECURITY OFFICE A103.

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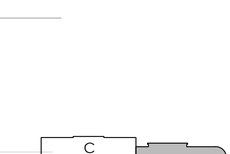
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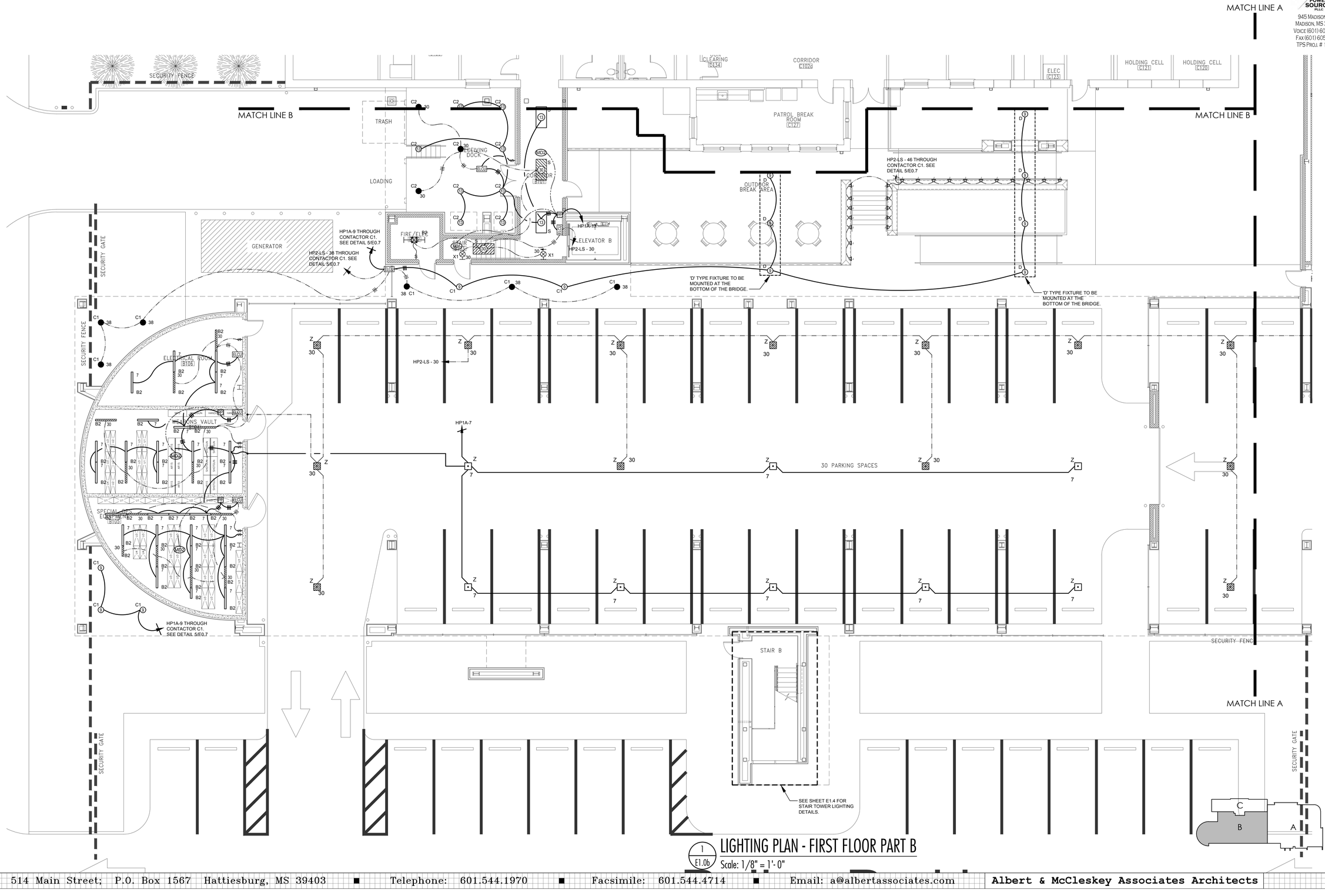
Drawing Issued:

Date	Rev.	Description
08-31-2015		DD Check Set
10-20-2015		75% Progress Set
11-02-2015		90% Pricing Set
11-19-2018		100% Bid Docs

Drawn By: TJ,ST,FB
Checked By: AC,CG
Client No: -------
Albert & Associates: 12575



E1.0a



LIGHTING PLAN - FIRST FLOOR PART B

1 / E1.0b

Scale: 1/8" = 1'-0"

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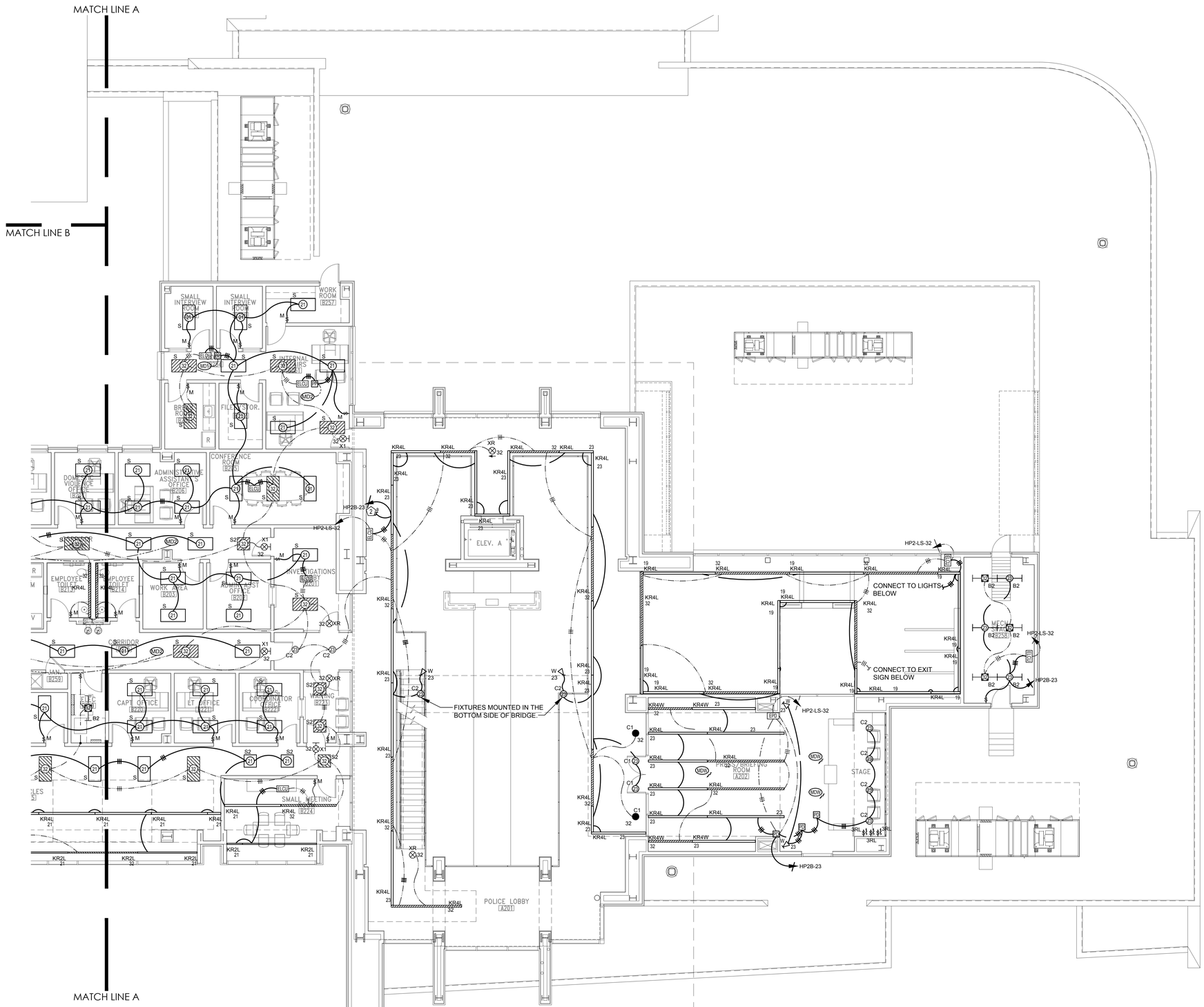
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11-02-2015	90% Pricing Set
11-19-2018	100% Bid Docs

Drawn By:	TJ,ST,FB
Checked By:	AC,CG
Client No:	-------
Albert & Associates:	12575

E1.0b



KEYED NOTES:

1. CONTINUE RECESSED LINEAR "KR4L" FIXTURE DOWN THE WALL. COORDINATE THE EXACT HEIGHT WITH THE ARCHITECTURAL PLANS.
2. CONNECT LIGHTING CIRCUIT TO SWITCH WITH THE CORRESPONDING LETTER IN SECURITY ON THE FIRST FLOOR.

1 E1.1a — LIGHTING PLAN - SECOND FLOOR PART A

Scale: 1/8" = 1'-0"

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TPS Proj. # 15079

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

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08-31-2015		DD Check Set
10-20-2015		75% Progress Set
11-02-2015		90% Pricing Set
11-19-2018		100% Bid Docs

Drawn By: TJ,ST,FB

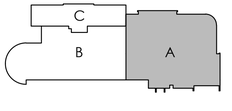
Checked By: AC,CG

Client No: ---

Albert & Associates: 12575

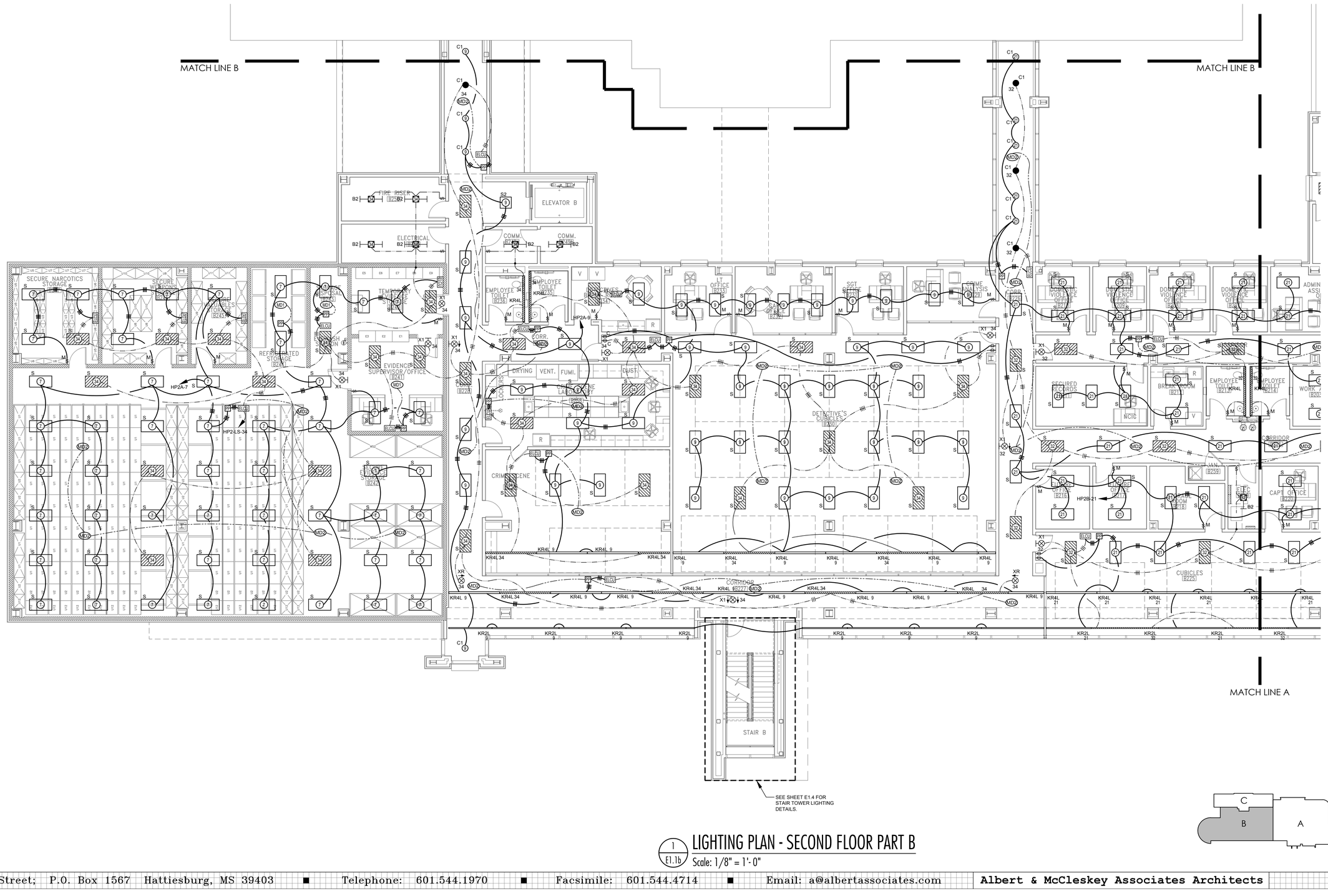


E1.1a



KEYED NOTES:

1. CONTINUE RECESSED LINEAR "KR4L" FIXTURE DOWN THE WALL. COORDINATE THE EXACT HEIGHT WITH THE ARCHITECTURAL PLANS.
2. PROVIDE LOW VOLTAGE DIMMING CIRCUITRY TO ALL FIXTURES IN THIS ROOM. NOT ALL LOW VOLTAGE WIRING IS SHOWN IN AN EFFORT TO INCREASE CLARITY.



1 E1.1b LIGHTING PLAN - SECOND FLOOR PART B

Scale: 1/8" = 1'-0"

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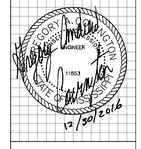
Date	Rev.	Description
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11-02-2015		90% Pricing Set
11-19-2018		100% Bid Docs

Drawn By: TJ,ST,FB

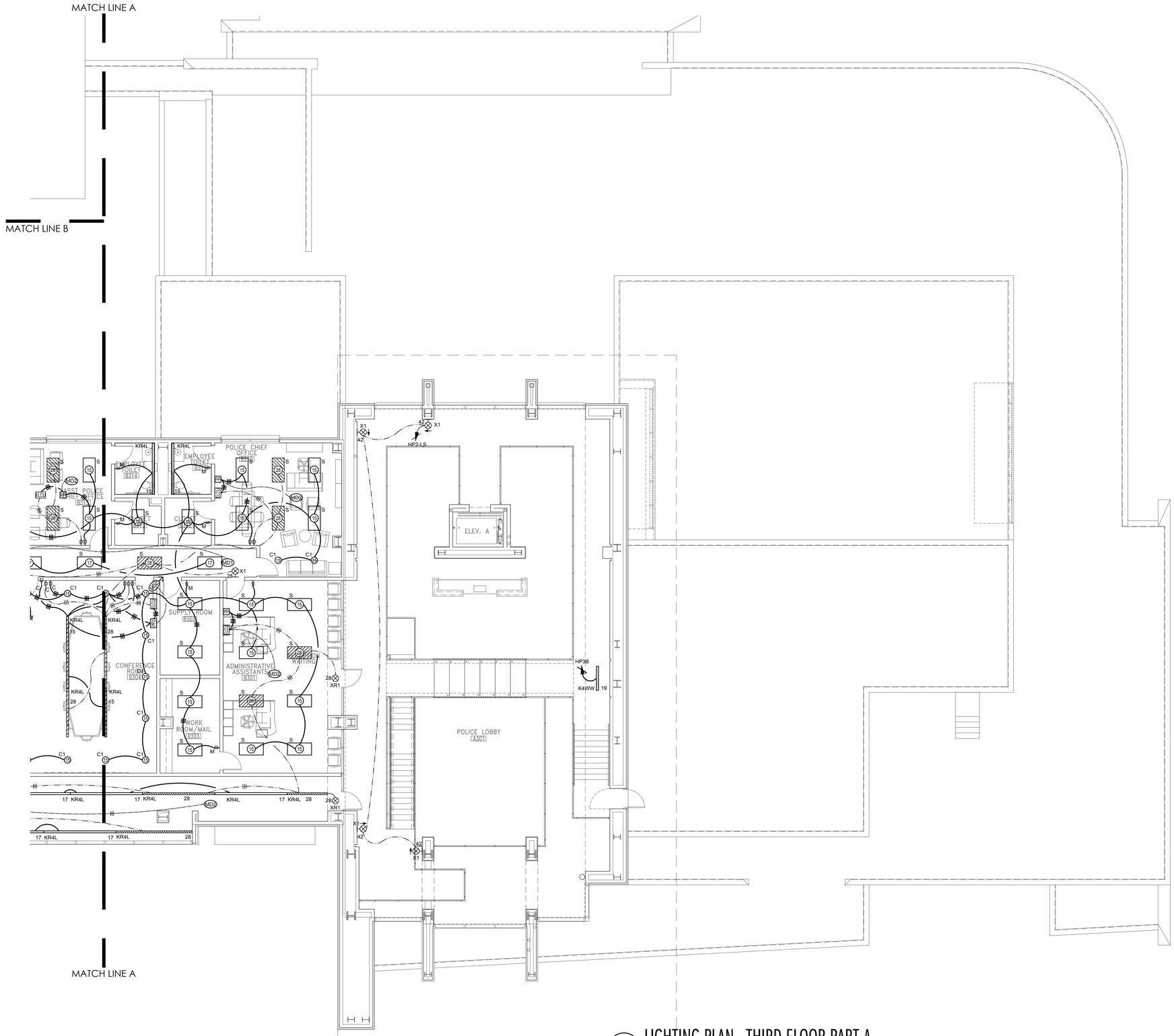
Checked By: AC,CG

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Albert & Associates: 12575



E1.1b

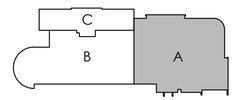


KEYED NOTES:

1. CONNECT LIGHTING CIRCUIT TO SWITCH WITH THE CORRESPONDING LETTER IN SECURITY ON THE FIRST FLOOR.

1 / E1.2a LIGHTING PLAN - THIRD FLOOR PART A

Scale: 1/8" = 1'-0"



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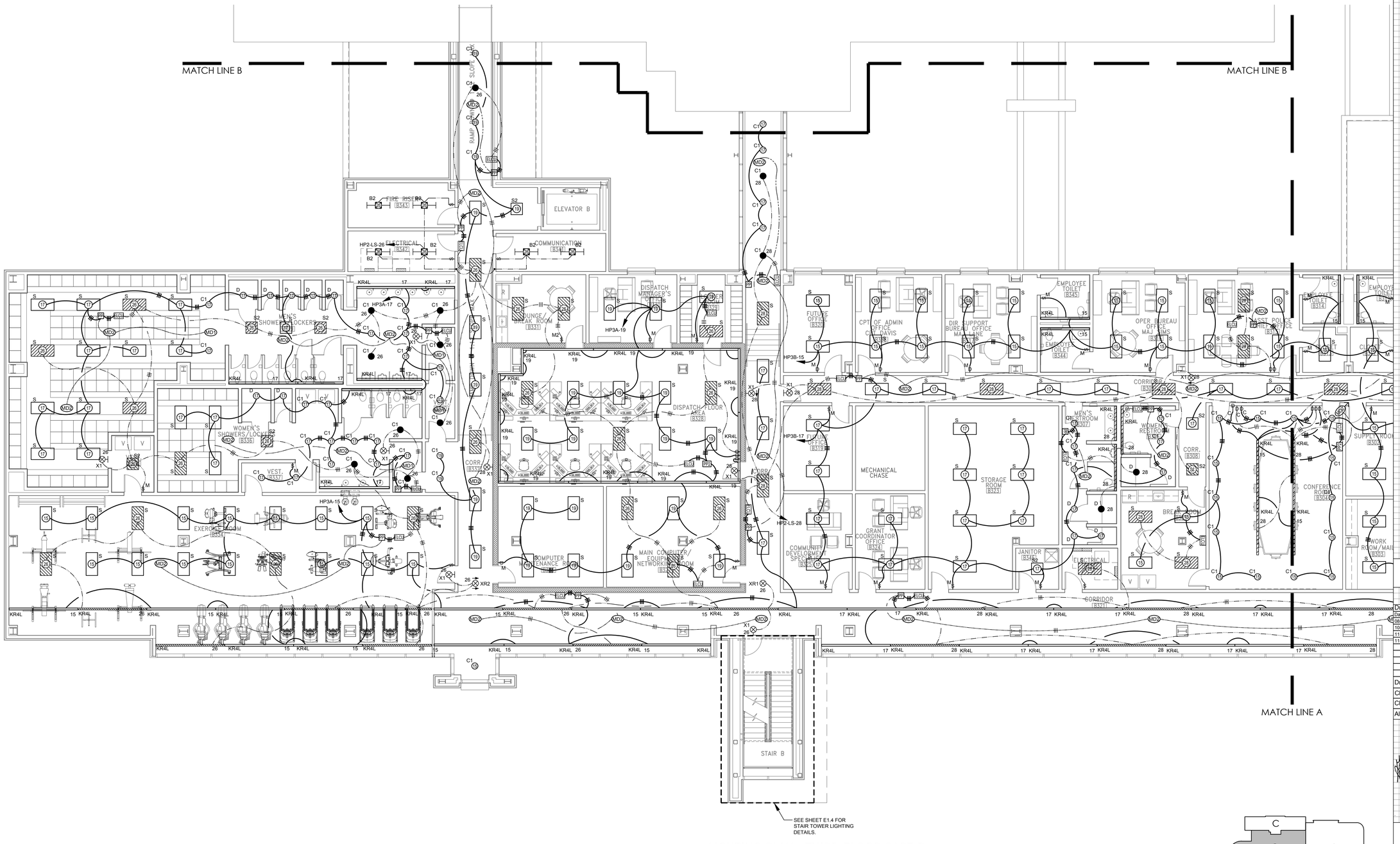
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Checked By:	AC,CG
Client No:	--------
Albert & Associates:	12575

GREGORY CARLTON MARTIN 11853 REGISTERED PROFESSIONAL ENGINEER STATE OF MISSISSIPPI 12/30/2016

E1.2a

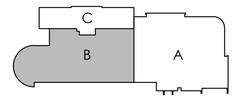
KEYED NOTES:

1. PROVIDE LOW VOLTAGE DIMMING CIRCUITRY TO ALL FIXTURES IN THIS ROOM. NOT ALL LOW VOLTAGE WIRING IS SHOWN IN AN EFFORT TO INCREASE CLARITY.



1 / E1.2b LIGHTING PLAN - THIRD FLOOR PART B

Scale: 1/8" = 1'-0"



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Checked By:	AC,CG
Client No:	-------
Albert & Associates:	12575

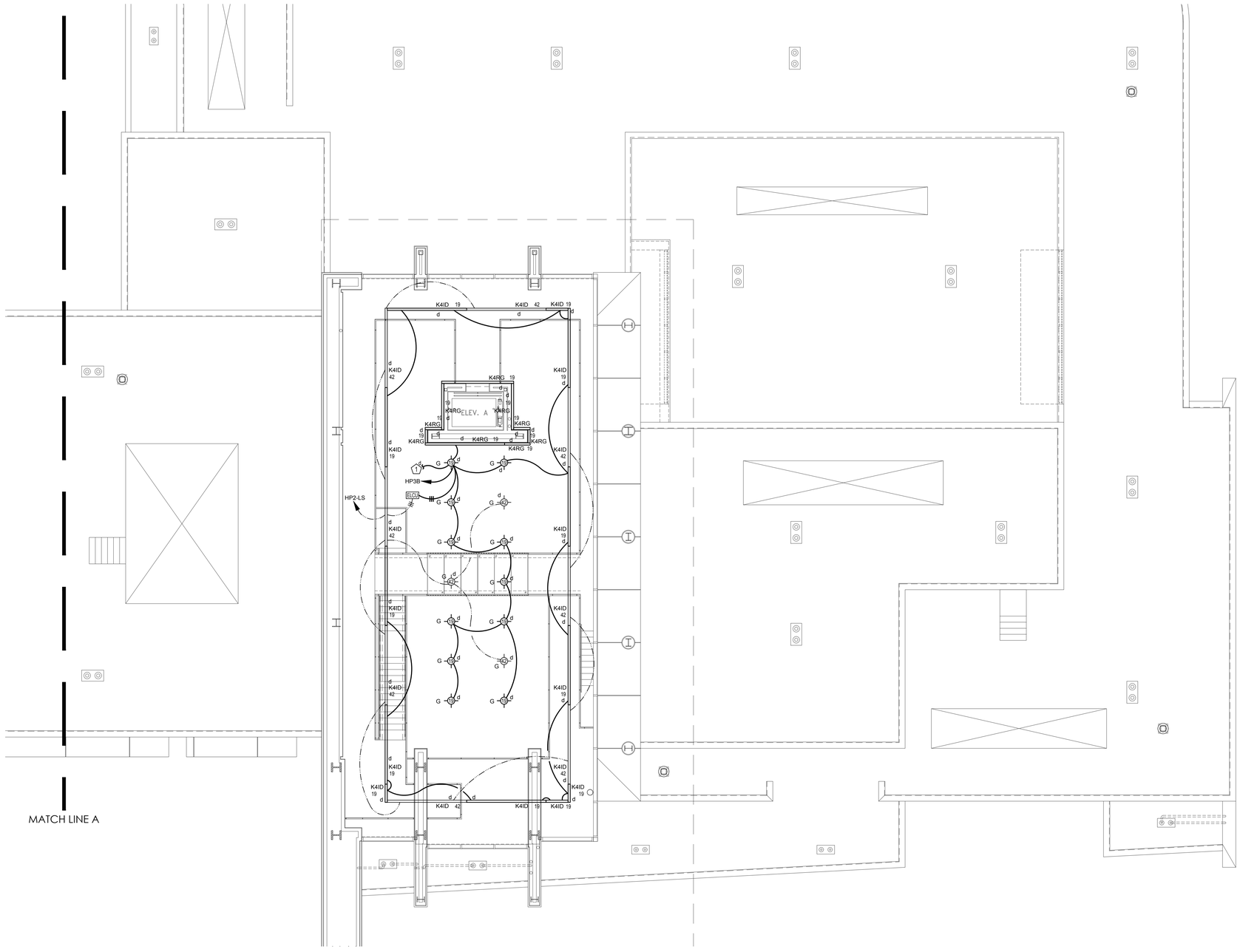
GREGORY A. McCLESKEY 11853 REGISTERED ARCHITECT STATE OF MISSISSIPPI
12/30/2016

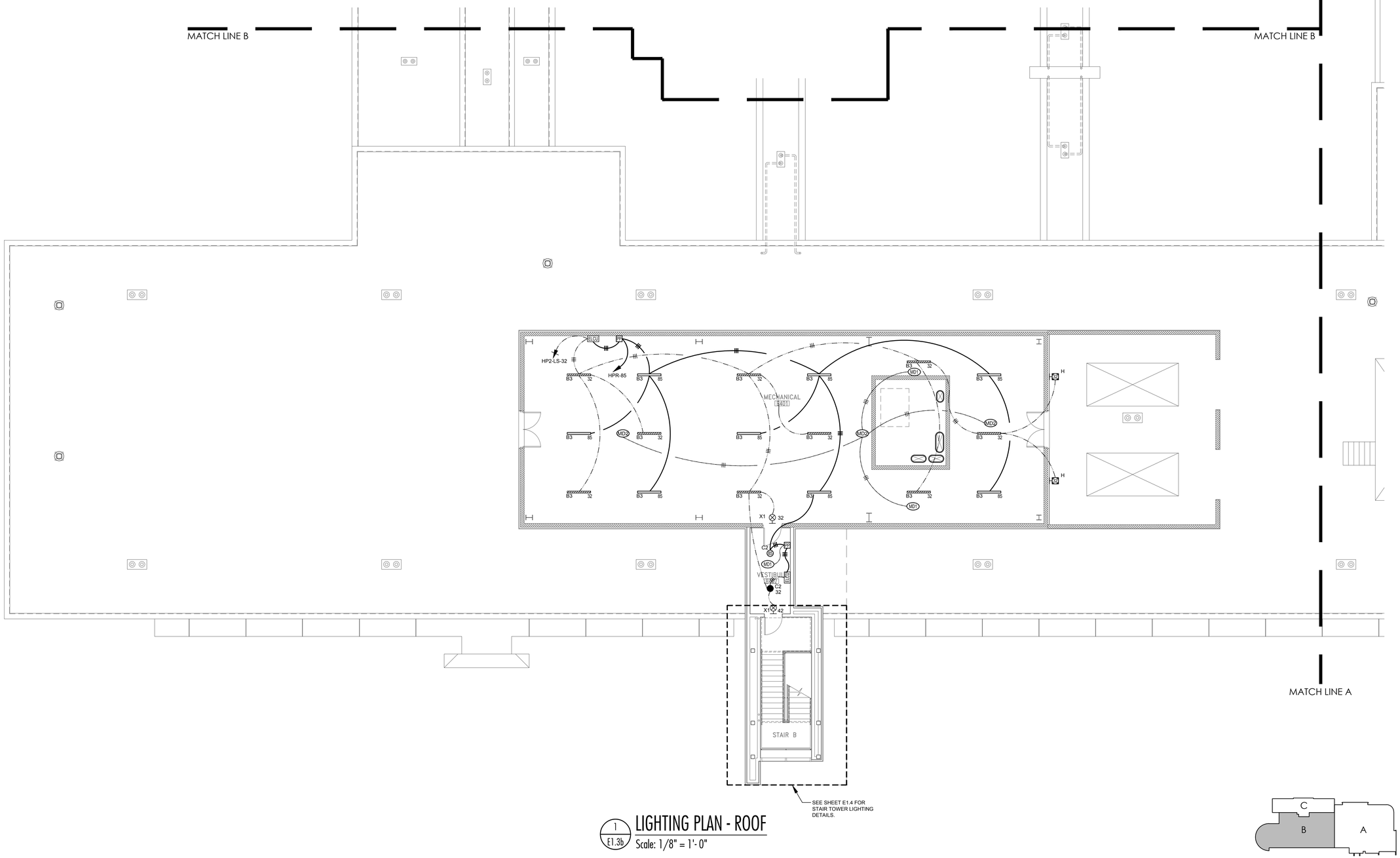
E1.2b

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com **Albert & McCleskey Associates Architects**

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MATCH LINE A


K4ID 19
K4ID 42
K4ID 19
K4RG 19
K4RG ELEV. A
K4RG
K4RG
K4RG
K4RG
K4RG 19
K4ID 42
K4ID 19
K4ID 42
HP3B
HP2-LS
ELDU
K4ID 19
K4ID 42
K4ID 19
K4ID 42
K4ID 19
K4ID 42
K4ID 19
K4ID 19
K4ID 42
K4ID 19
K4ID 19
K4ID 19
K4ID 42
K4ID 19
K4ID 19
K4ID 19
K4ID 42
K4ID 19



1 / E1.3b **LIGHTING PLAN - ROOF**
Scale: 1/8" = 1'-0"

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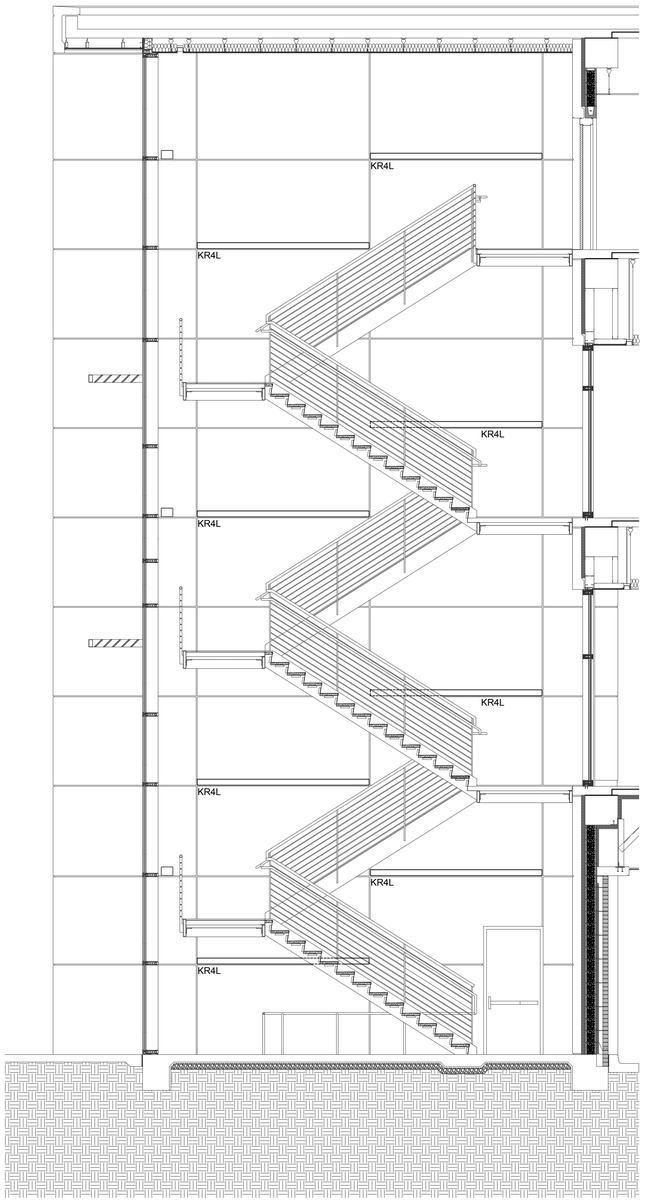
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Drawing Issued:

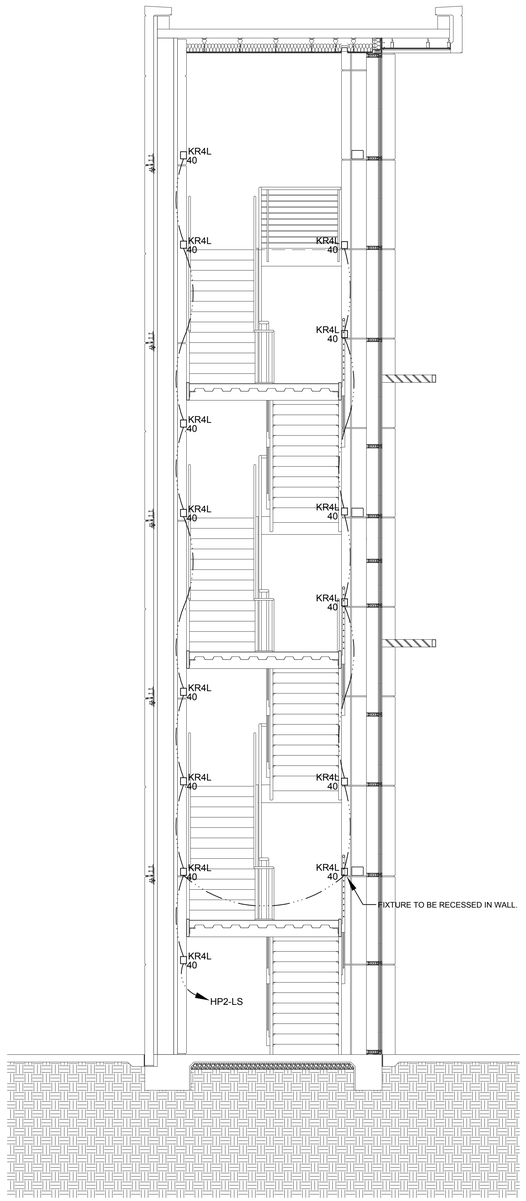
Date	Rev.	Description
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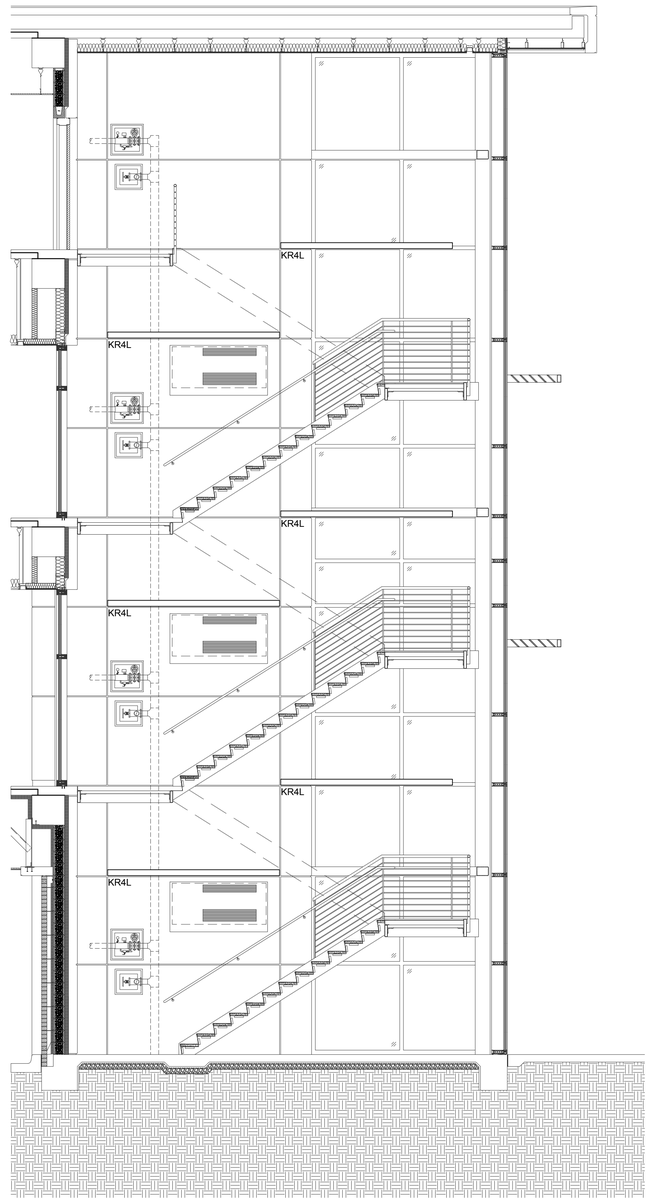
E1.3b



1 E1.4 STAIR 'B' - LIGHTING DETAIL - WEST
Scale: 1/4" = 1'- 0"



2 E1.4 STAIR 'B' - LIGHTING DETAIL - FRONT
Scale: 1/4" = 1'- 0"



3 E1.4 STAIR 'B' - LIGHTING DETAIL - EAST
Scale: 1/4" = 1'- 0"

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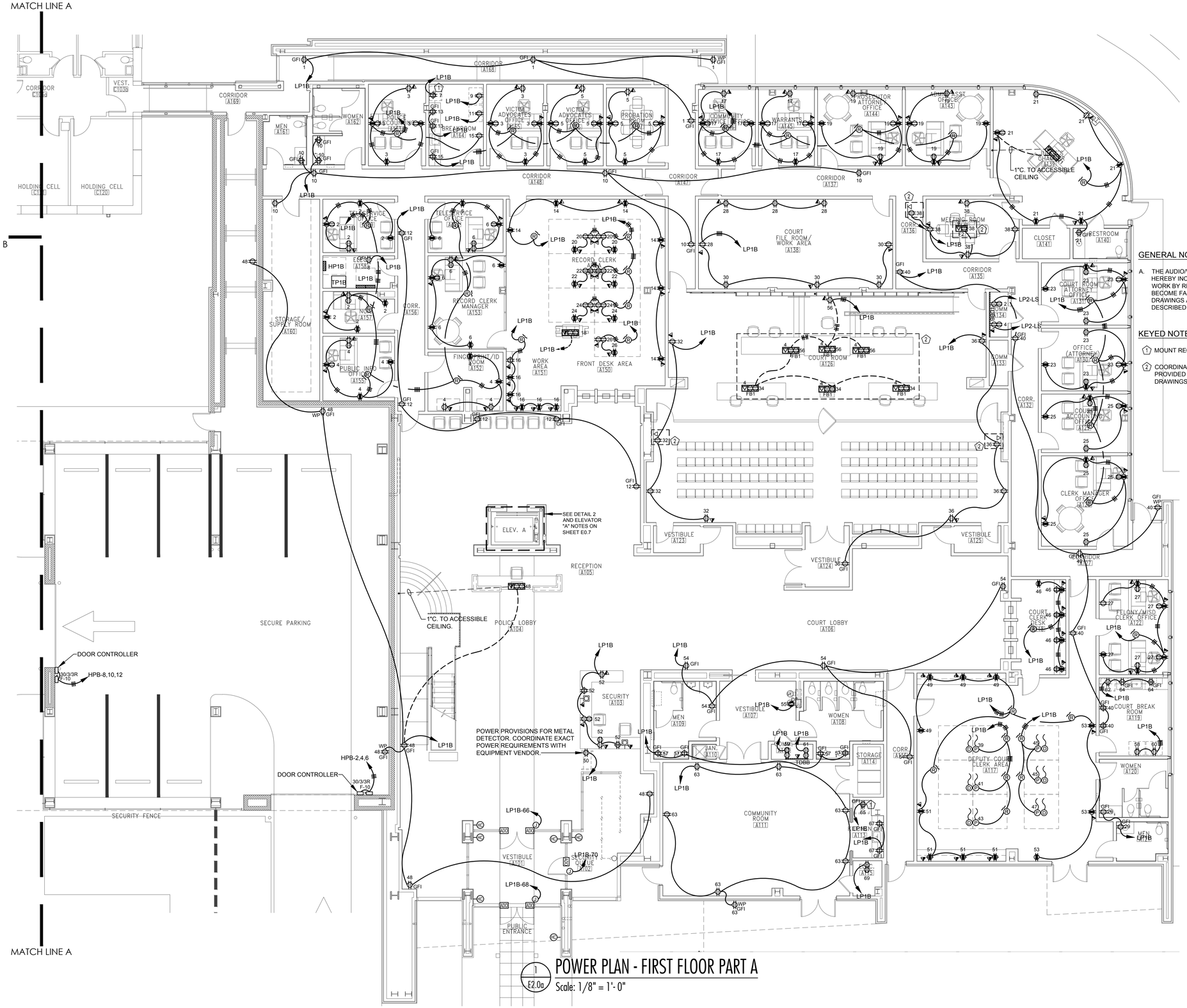
Drawing Issued:

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Checked By: AC,CG
Client No: -------
Albert & Associates: 12575

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E1.4



GENERAL NOTES:

A. THE AUDIO/VIDEO DRAWINGS INCLUDED IN THIS PROJECT ARE HEREBY INCORPORATED INTO THE ELECTRICAL SECTION OF THE WORK BY REFERENCE. THE ELECTRICAL CONTRACTOR SHALL BECOME FAMILIAR WITH THE REQUIREMENTS OF THE AUDIO/VIDEO DRAWINGS AND INCLUDE ALL COSTS ASSOCIATED WITH THE WORK DESCRIBED THEREIN IN HIS BID.

KEYED NOTES:

1. MOUNT RECEPTACLE FOR REFRIGERATOR AT 60" A.F.F.
2. COORDINATE EXACT DEVICE LOCATIONS AND EQUIPMENT TO BE PROVIDED AND INSTALLED IN THIS LOCATION WITH THE EAV DRAWINGS.

POWER PLAN - FIRST FLOOR PART A

1 / E2.0a

Scale: 1/8" = 1'- 0"

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CITY OF HATTIESBURG MISSISSIPPI

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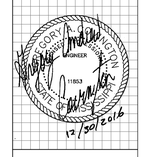
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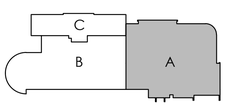
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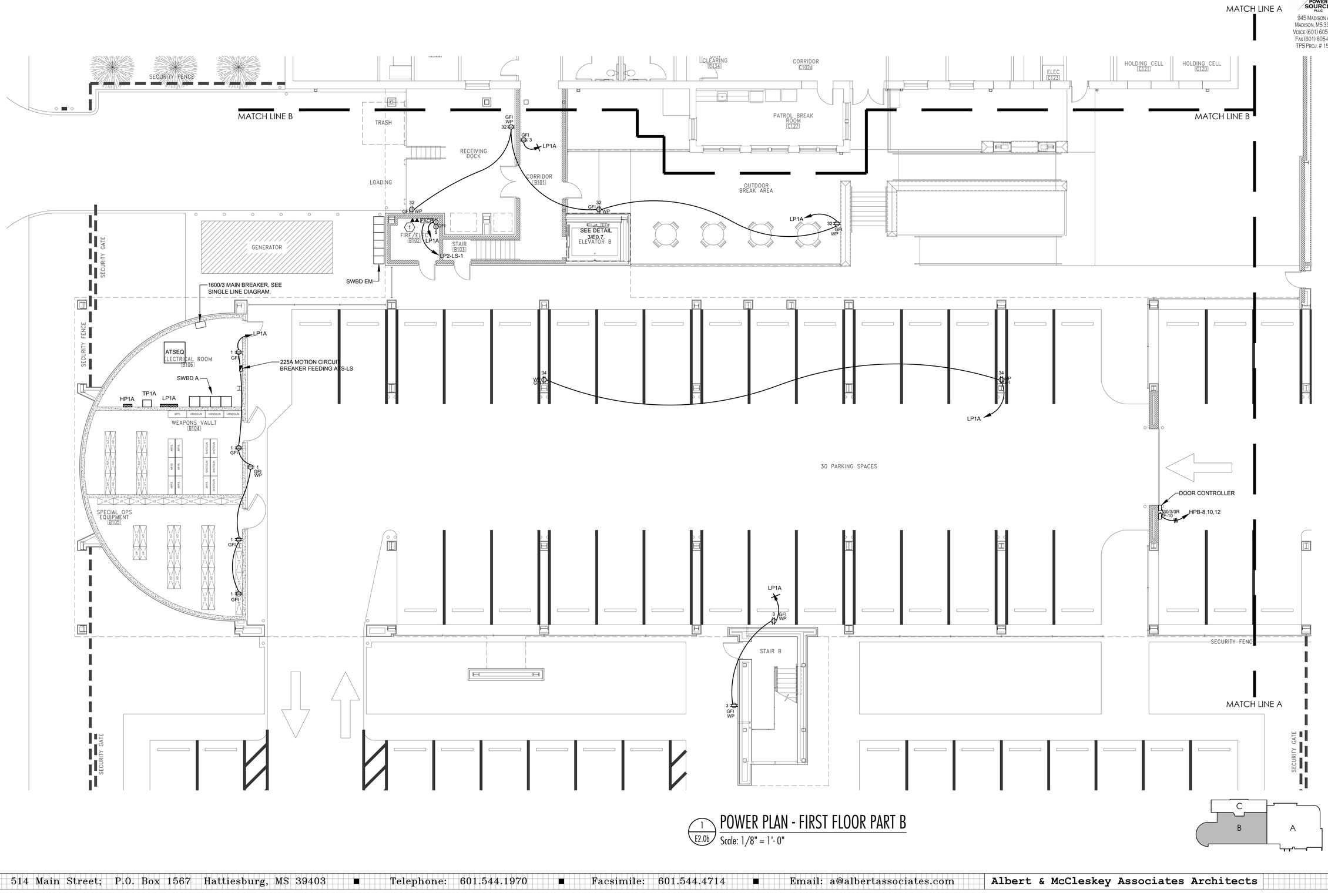


E2.0a



KEYED NOTES:

1. PROVIDE TWO DEDICATED POTS LINES FOR MONITORING OF FIRE ALARM SYSTEM.



POWER PLAN - FIRST FLOOR PART B

Scale: 1/8" = 1'-0"

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Drawn By:	TJ,ST,FB
Checked By:	AC,CG
Client No:	-------
Albert & Associates:	12575

GREGORY CARLTON WASHINGTON 11853 LICENSED PROFESSIONAL ENGINEER STATE OF MISSISSIPPI 12/30/2016

E2.0b

MATCH LINE A

MATCH LINE B

MATCH LINE A

GENERAL NOTES:

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KEYED NOTES:

1. MOUNT RECEPTACLE FOR REFRIGERATOR AT 60" A.F.F.
2. POWER PROVIDED FOR MECHANICAL CONTROLS. COORDINATE EXACT CONNECTION TYPE AND LOCATION WIT MECHANICAL CONTROLS CONTRACTOR.
3. 1"C. TO ABOVE ACCESSIBLE CEILING
4. COORDINATE EXACT DEVICE LOCATIONS AND EQUIPMENT TO BE PROVIDED AND INSTALLED IN THIS LOCATION WITH THE EAV DRAWINGS.

SEE DETAIL 2 AND ELEVATOR "A" NOTES ON SHEET E0.7

DATA CONNECTION FOR MECHANICAL CONTROLS

1 E2.1a POWER PLAN - SECOND FLOOR PART A

Scale: 1/8" = 1'-0"

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Drawn By: TJ,ST,FB

Checked By: AC,CG

Client No: --------

Albert & Associates: 12575

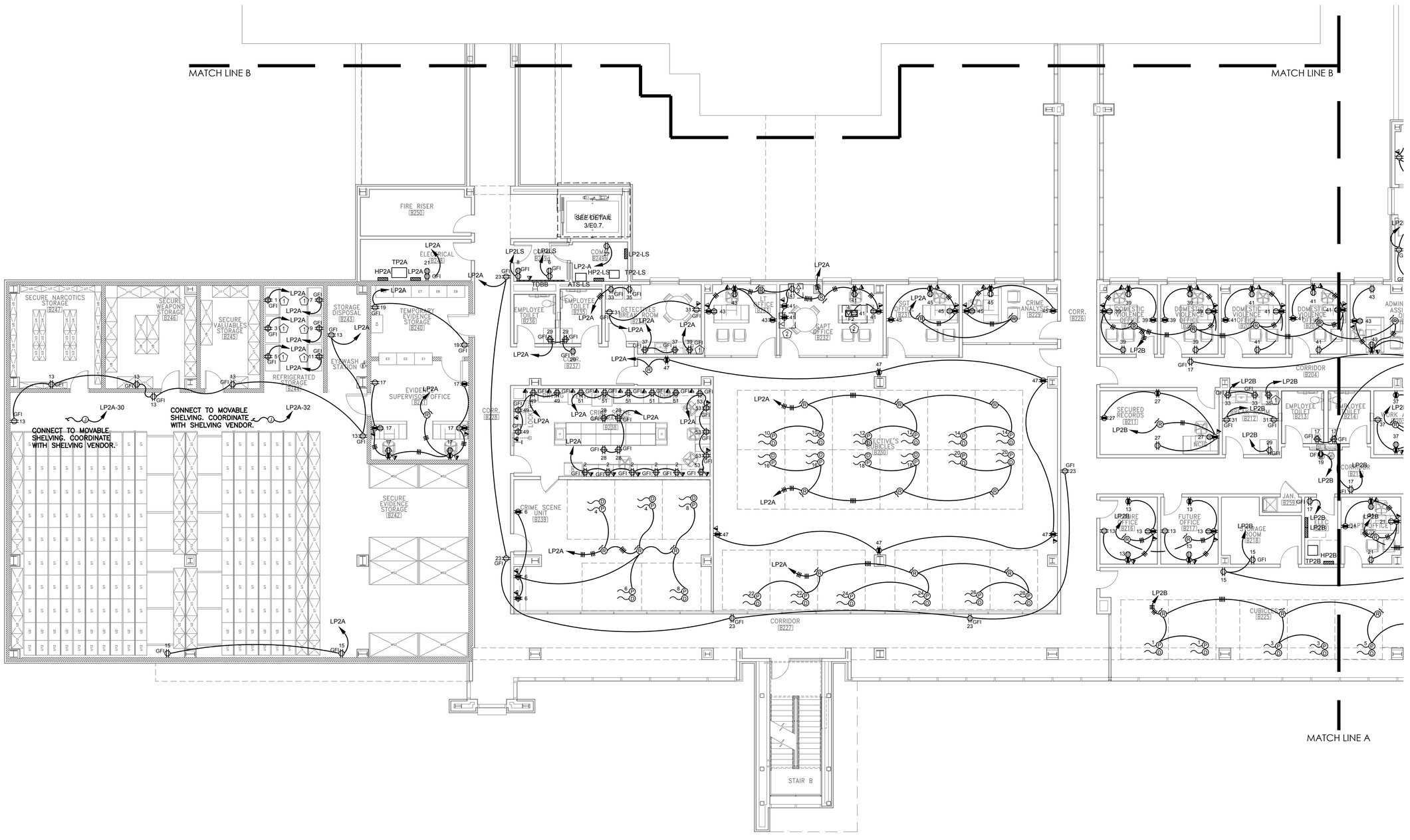
E2.1a

GENERAL NOTES:

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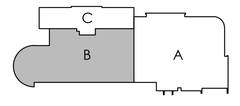
KEYED NOTES:

1. MOUNT RECEPTACLE FOR REFRIGERATOR AT 60" A.F.F.
2. COORDINATE EXACT DEVICE LOCATIONS AND EQUIPMENT TO BE PROVIDED AND INSTALLED IN THIS LOCATION WITH THE EAV DRAWINGS.



1 / E2.1b — POWER PLAN - SECOND FLOOR PART B

Scale: 1/8" = 1'- 0"



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Checked By: AC,CG

Client No: -------

Albert & Associates: 12575

GARY C. MCGEE 11853 REGISTERED ENGINEER STATE OF MISSISSIPPI 12/30/2016

E2.1b

MATCH LINE A

MATCH LINE B

GENERAL NOTES:

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KEYED NOTES:

1. MOUNT RECEPTACLE FOR REFRIGERATOR AT 60" A.F.F.
2. 1"C. TO ABOVE ACCESSIBLE CEILING.
3. COORDINATE EXACT DEVICE LOCATIONS AND EQUIPMENT TO BE PROVIDED AND INSTALLED IN THIS LOCATION WITH THE EAV DRAWINGS.

EMPLOYEE TOILET [B311]
EMPLOYEE TOILET [B311]
POLICE CHIEF OFFICE [B310]
ASST POLICE CHIEF OFFICE [B315]
CLOSET [B313]
CLOSET [B312]
SUPPLY ROOM [B302]
CONFERENCE ROOM [B304]
ADMINISTRATIVE ASSISTANTS [B301]
RECEPTION WAITING
WORK ROOM/MAIL [B303]
ELEV. A
SEE DETAIL 2 AND ELEVATOR "A" NOTES ON SHEET E0.7
POLICE LOBBY [A301]
LP3B
(2)1"C
72" A.F.F.
GFI
WP GFI

MATCH LINE A

1 E2.2a POWER PLAN - THIRD FLOOR PART A
Scale: 1/8" = 1'-0"

C
B
A

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Drawn By: TJ,ST,FB
Checked By: AC,CG
Client No: ---------
Albert & Associates: 12575

STATE OF MISSISSIPPI REGISTERED ENGINEER 11553 12/5/2016

E2.2a

GENERAL NOTES:

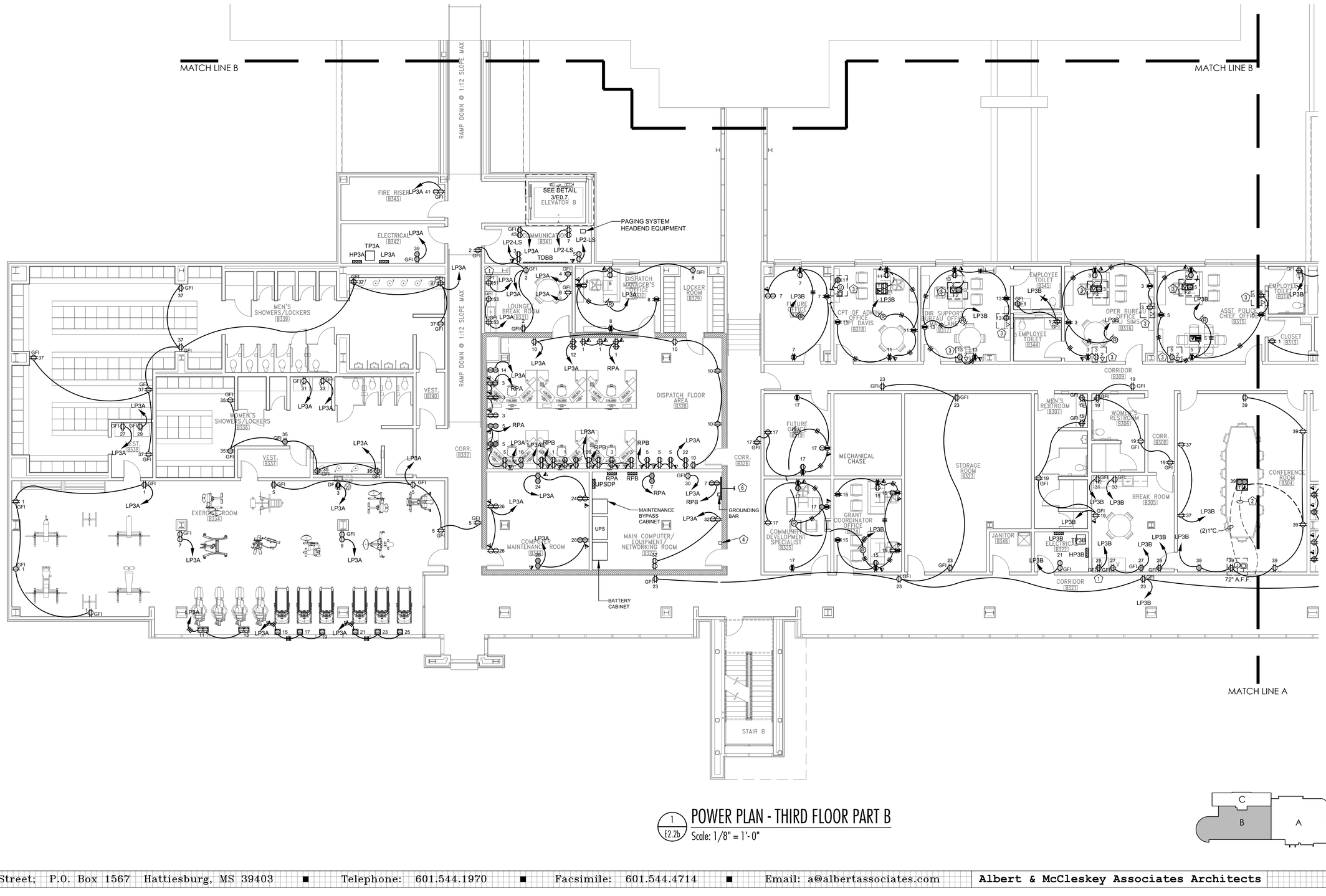
A. ON SERVER/UPS ROOM PERIMETER, CONDUCTORS INSIDE CONDUITS SHALL BE SEALED AIR-TIGHT.

B. THE AUDIO/VIDEO DRAWINGS INCLUDED IN THIS PROJECT ARE HEREBY INCORPORATED INTO THE ELECTRICAL SECTION OF THE WORK BY REFERENCE. THE ELECTRICAL CONTRACTOR SHALL BECOME FAMILIAR WITH THE REQUIREMENTS OF THE AUDIO/VIDEO DRAWINGS AND INCLUDE ALL COSTS ASSOCIATED WITH THE WORK DESCRIBED THEREIN IN HIS BID.

C. ALL RECEPTACLES FED FROM THE UPS SHALL BE ORANGE IN COLOR.

KEYED NOTES:

1. MOUNT RECEPTACLE FOR REFRIGERATOR AT 60" A.F.F.
2. 1"C. TO ABOVE ACCESSIBLE CEILING.
3. COORDINATE EXACT DEVICE LOCATIONS AND EQUIPMENT TO BE PROVIDED AND INSTALLED IN THIS LOCATION WITH THE EAV DRAWINGS.
4. MOUNT UPS REMOTE POWER OFF BUTTON IN GLASS BREAK STATION.
5. PROVIDE A #6(G) TO THE ACCESS FLOORING METAL SUPPORTS. GROUND IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.
6. ROUTE 4" C. WITH PULLSTRING UP THROUGH ROOF FOR INSTALLATION OF RADIO EQUIPMENT CIRCUITRY. COORDINATE EXACT TERMINATION POINT WITH OWNER.



POWER PLAN - THIRD FLOOR PART B

1 / E2.2b

Scale: 1/8" = 1'- 0"

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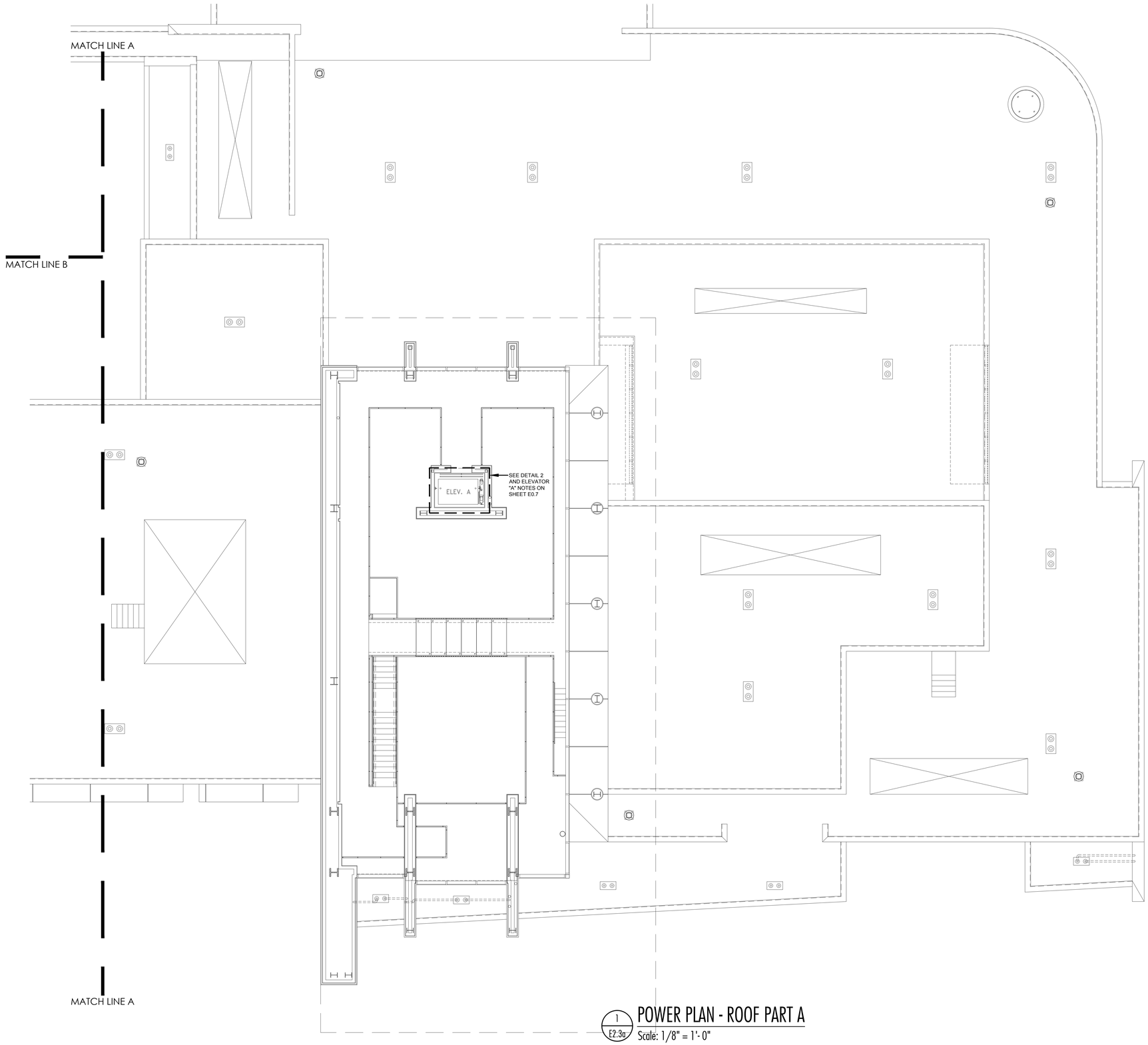
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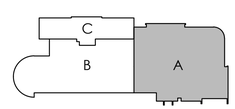
GARY A. McCLESKEY REGISTERED ENGINEER 11853 STATE OF MISSISSIPPI 12/30/2016

E2.2b



1 E2.3a POWER PLAN - ROOF PART A

Scale: 1/8" = 1'-0"



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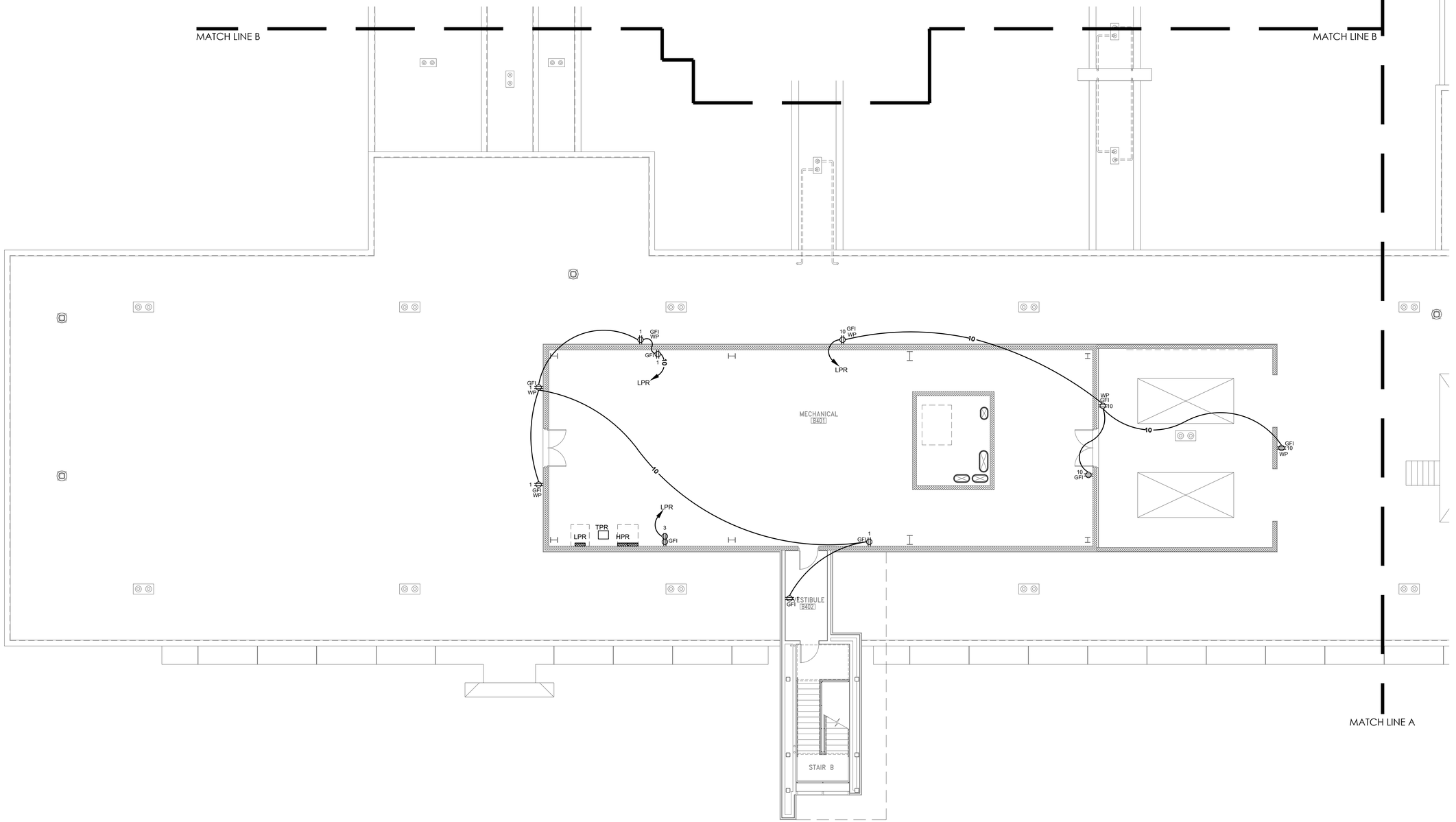
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Client No:	--------
Albert & Associates:	12575

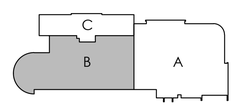
GREGORY A. CARLSON 11853 REGISTERED PROFESSIONAL ENGINEER STATE OF MISSISSIPPI 12/30/2016

E2.3a



1 / E2.3b POWER PLAN - ROOF PART B

Scale: 1/8" = 1'- 0"



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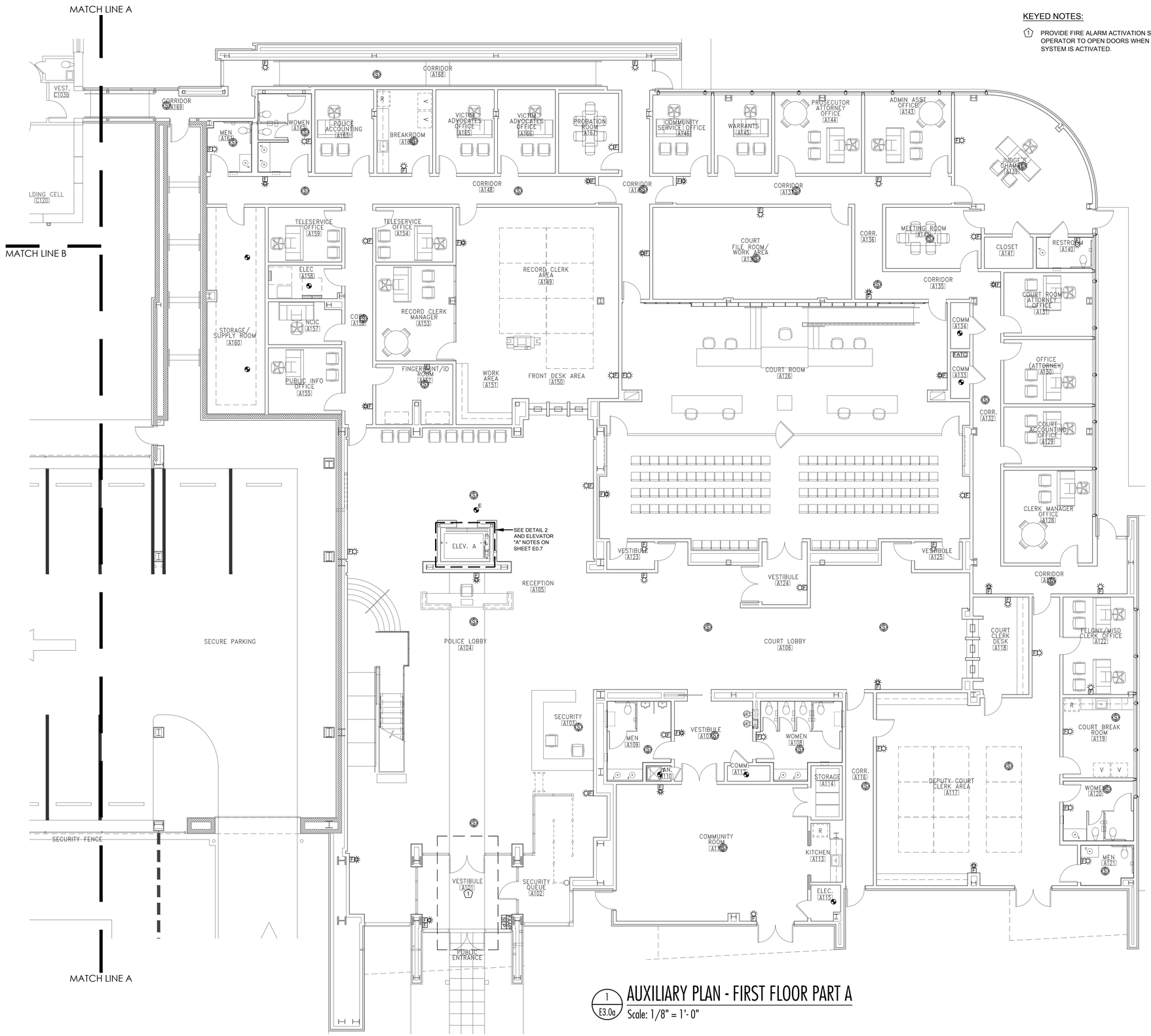
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12/20/2016

E2.3b

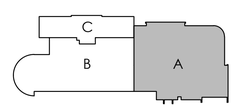


KEYED NOTES:

1. PROVIDE FIRE ALARM ACTIVATION SIGNAL TO DOOR MOTOR OPERATOR TO OPEN DOORS WHEN SMOKE EVACUATION SYSTEM IS ACTIVATED.

1 / E3.0a — AUXILIARY PLAN - FIRST FLOOR PART A

Scale: 1/8" = 1'-0"



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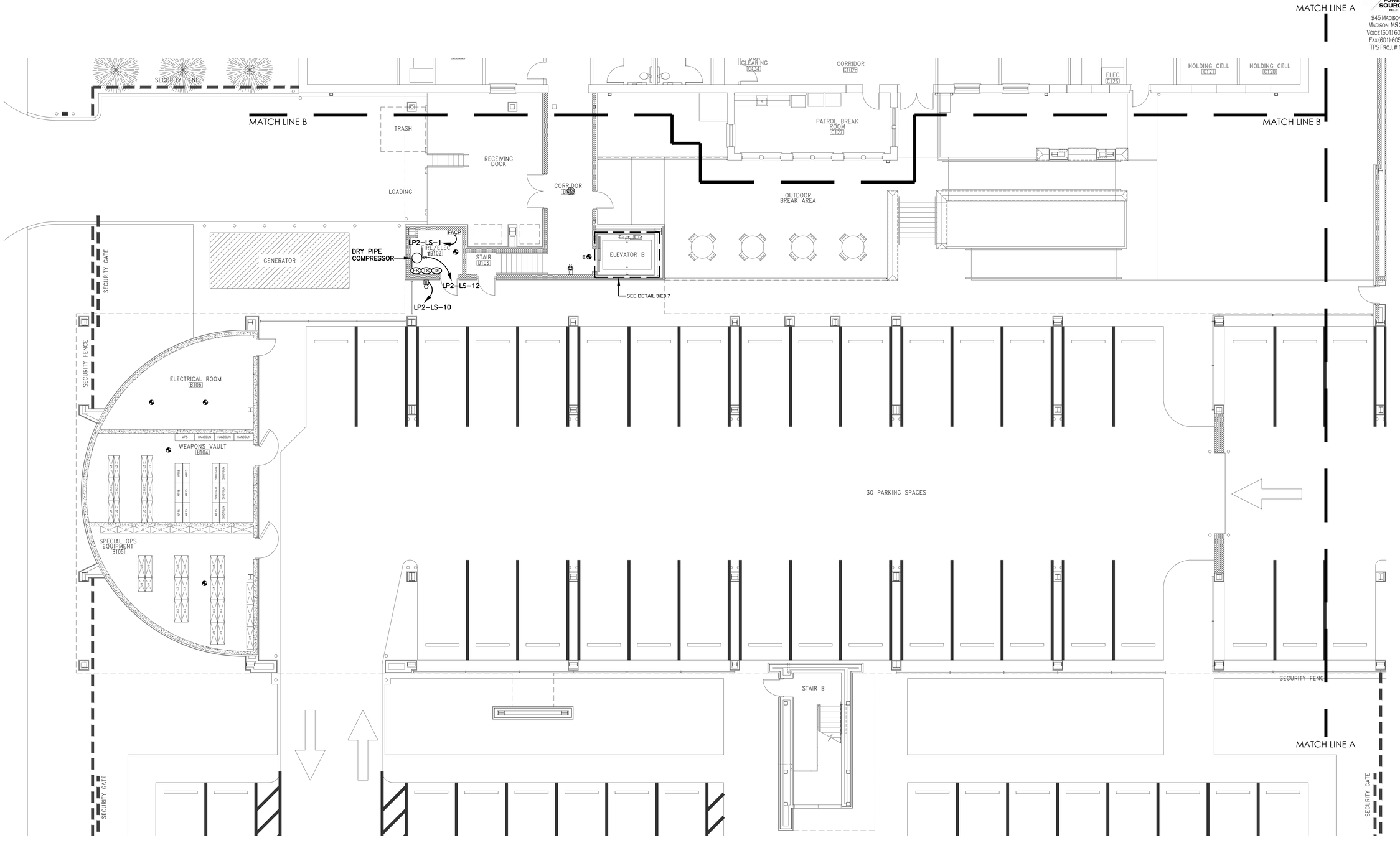
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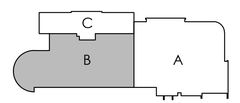


E3.0a



1 E3.0b **AUXILIARY PLAN - FIRST FLOOR PART B**

Scale: 1/8" = 1'- 0"



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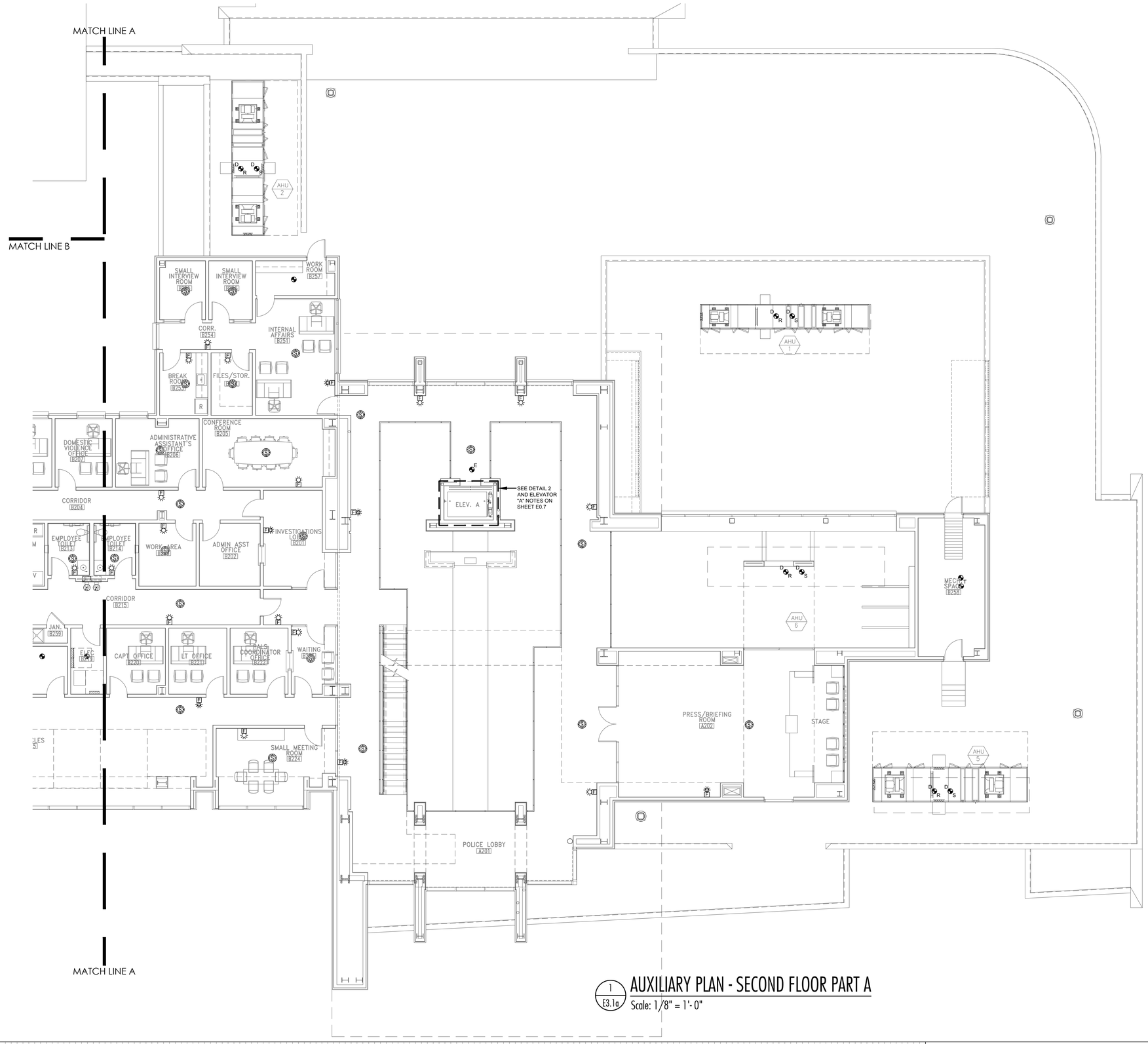
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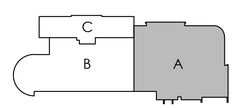
GREGORY MARTIN WASHINGTON 11853 LICENSED PROFESSIONAL ENGINEER STATE OF MISSISSIPPI 12/30/2016

E3.0b



1 E3.1a AUXILIARY PLAN - SECOND FLOOR PART A

Scale: 1/8" = 1'- 0"



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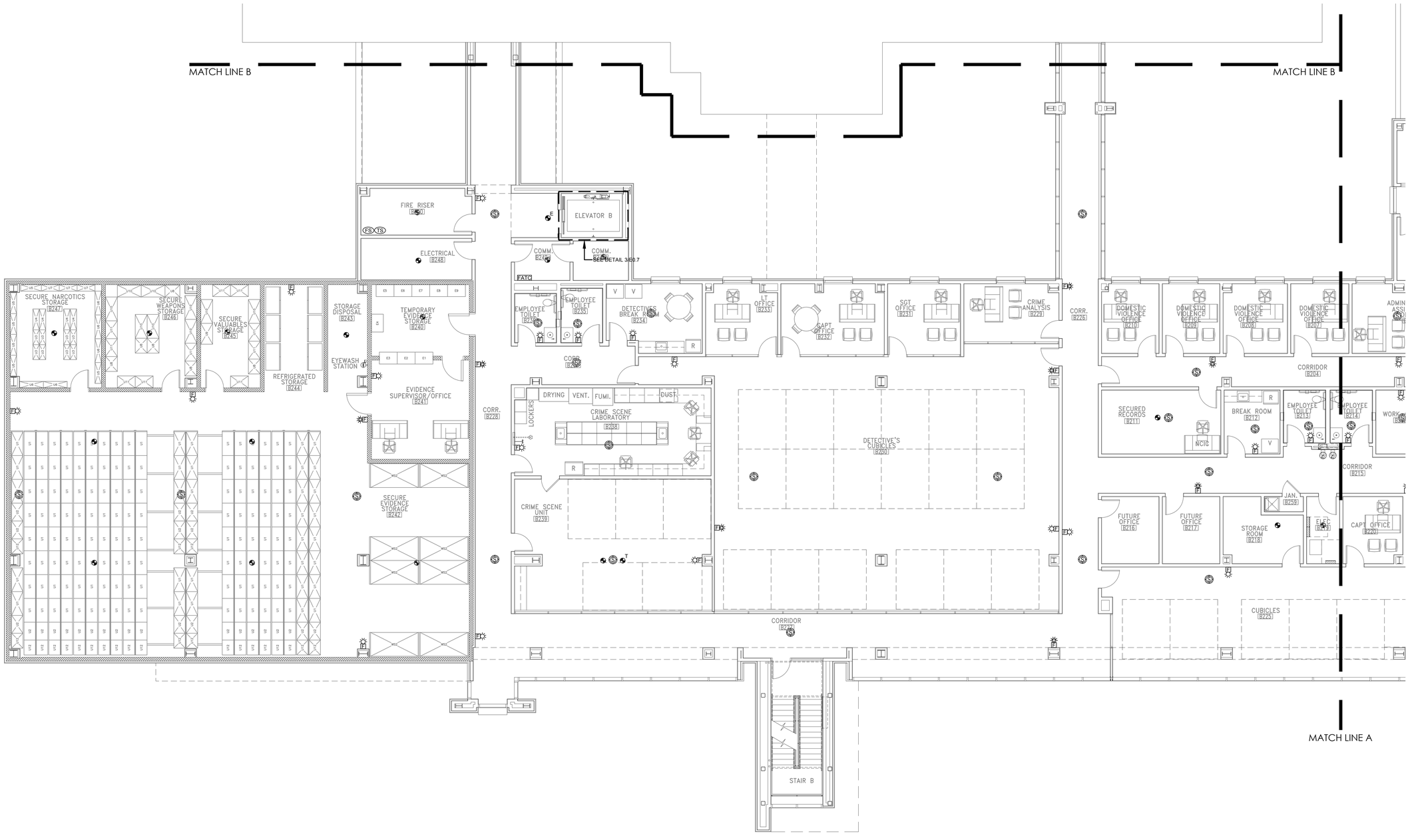
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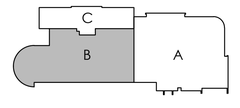


E3.1a



1 / E3.1b AUXILIARY PLAN - SECOND FLOOR PART B

Scale: 1/8" = 1'- 0"



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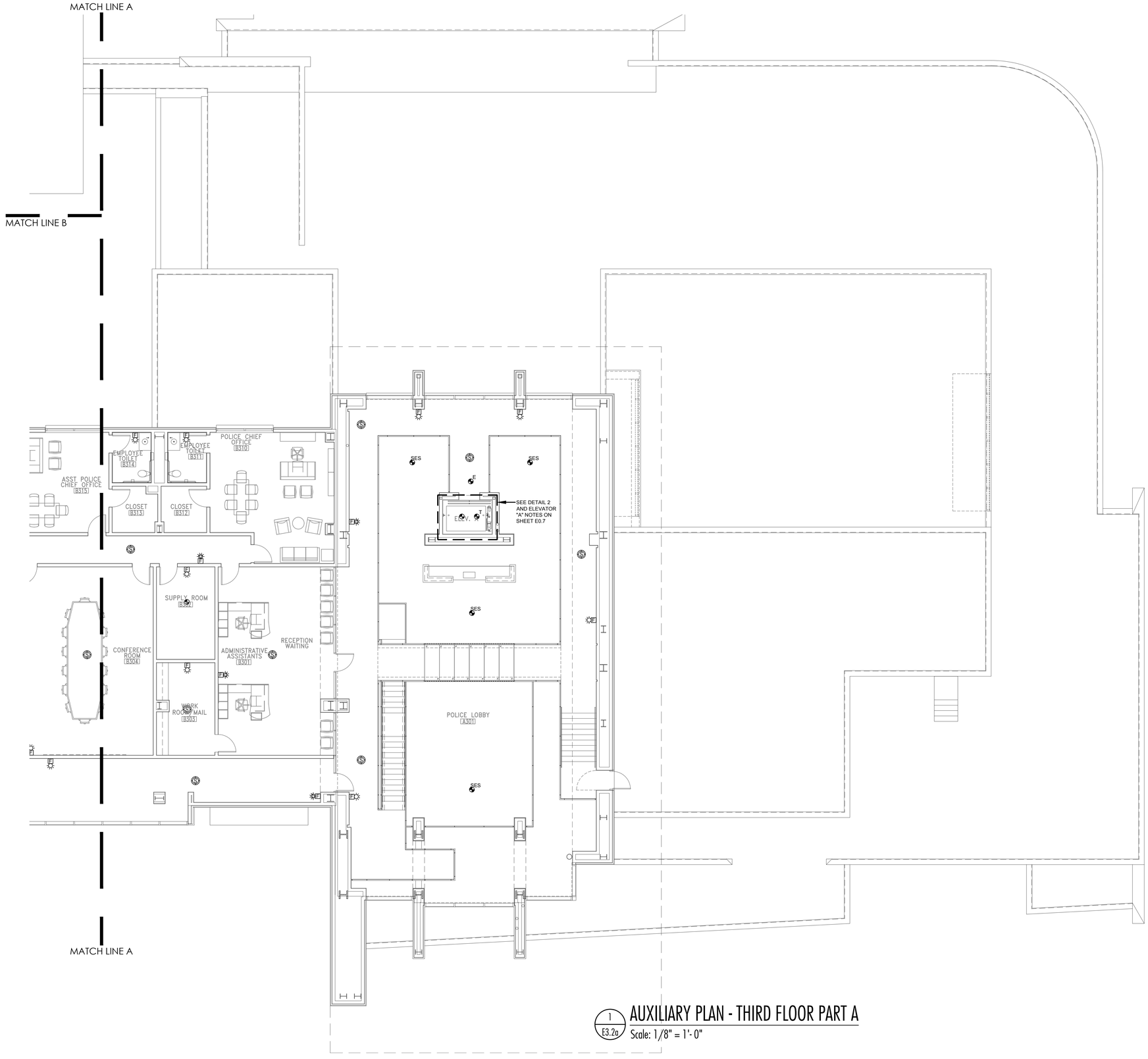
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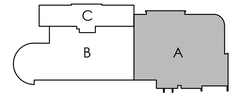
GREGORY A. CRAWFORD 11853 REGISTERED ENGINEER STATE OF MISSISSIPPI 12/30/2016

E3.1b



1 E3.2a AUXILIARY PLAN - THIRD FLOOR PART A

Scale: 1/8" = 1'- 0"



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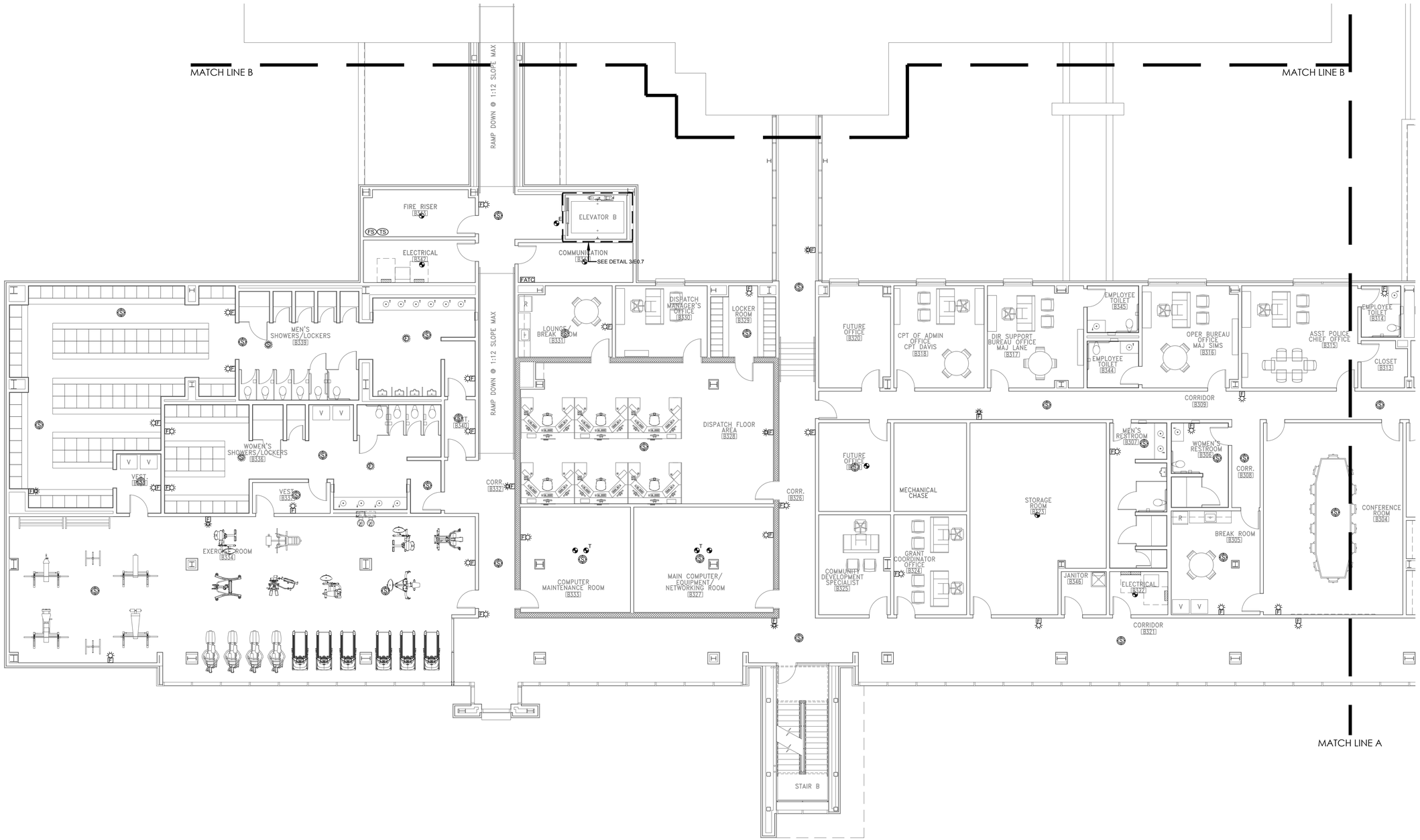


E3.2a

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MATCH LINE A

MATCH LINE B



MATCH LINE A

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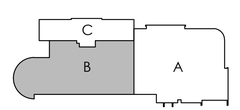
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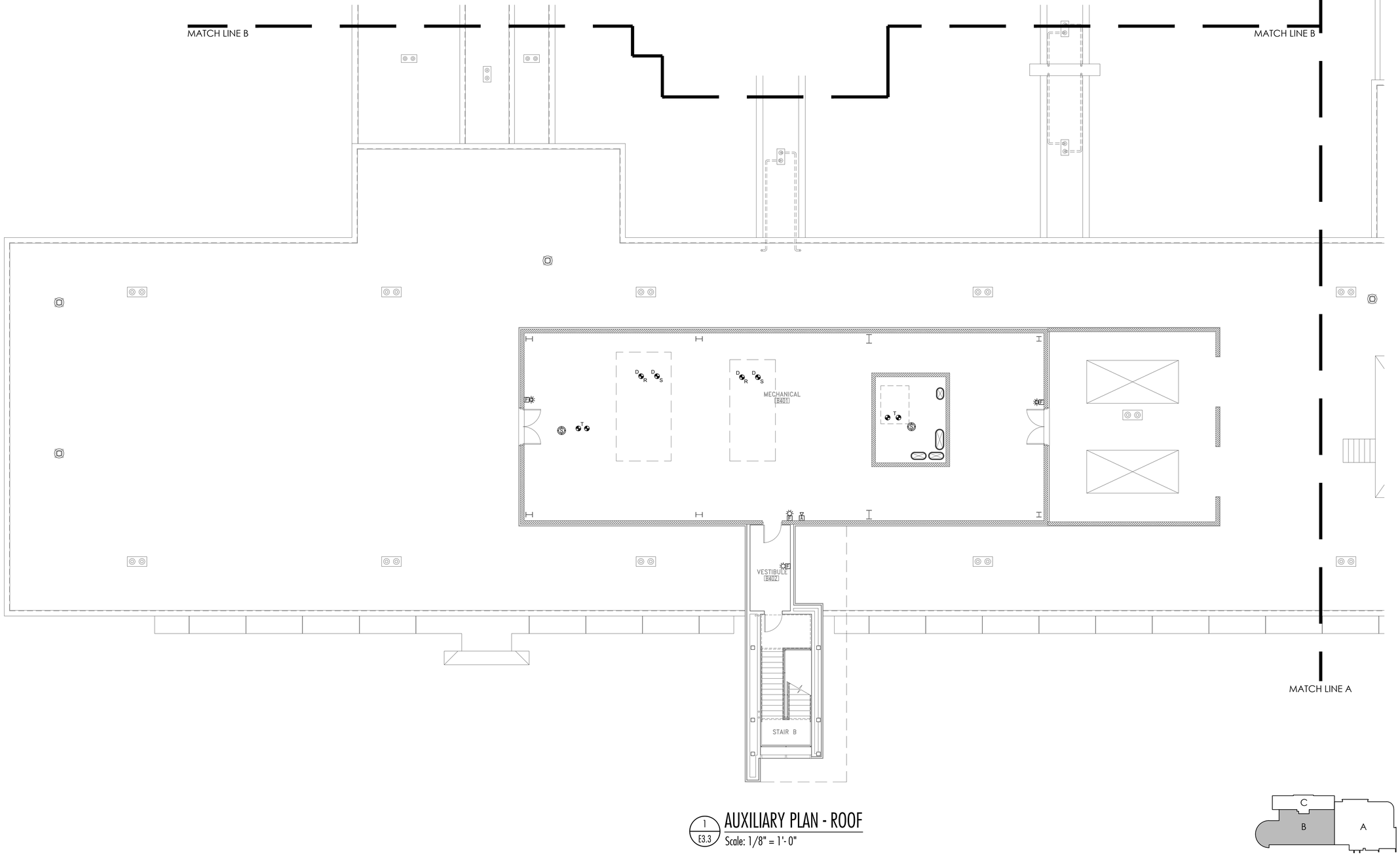
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GLORY A. MCCLESKEY — 11853 — REGISTERED ARCHITECT — STATE OF MISSISSIPPI
12/20/2016

E3.2b

1 / E3.2b AUXILIARY PLAN - THIRD FLOOR PART B
Scale: 1/8" = 1'- 0"





1 / E3.3 AUXILIARY PLAN - ROOF
Scale: 1/8" = 1'-0"

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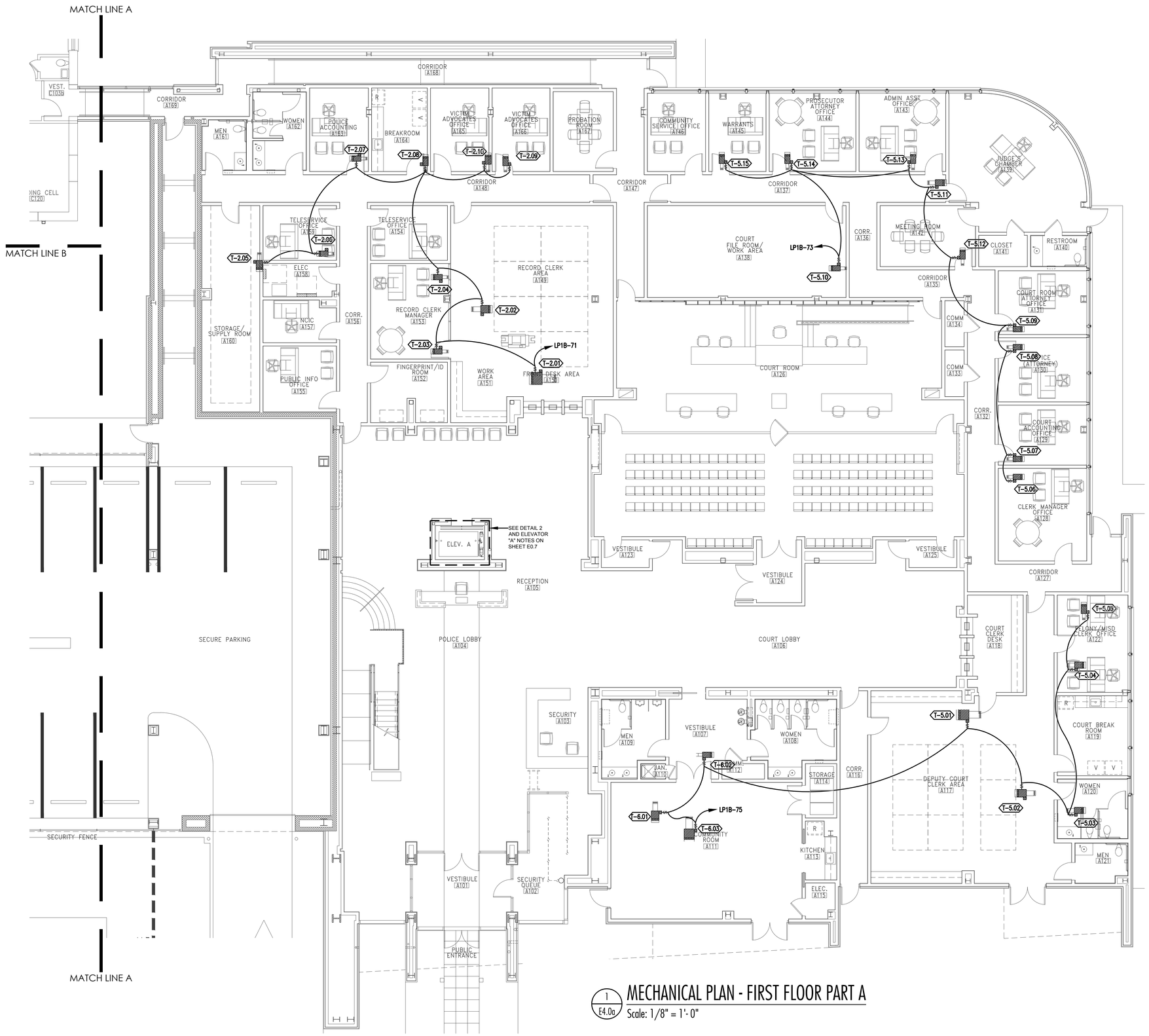
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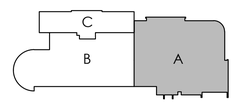
Registered Professional Engineer — 11853 — State of Mississippi — 12/20/2016

E3.3



1 E4.0a MECHANICAL PLAN - FIRST FLOOR PART A

Scale: 1/8" = 1'-0"



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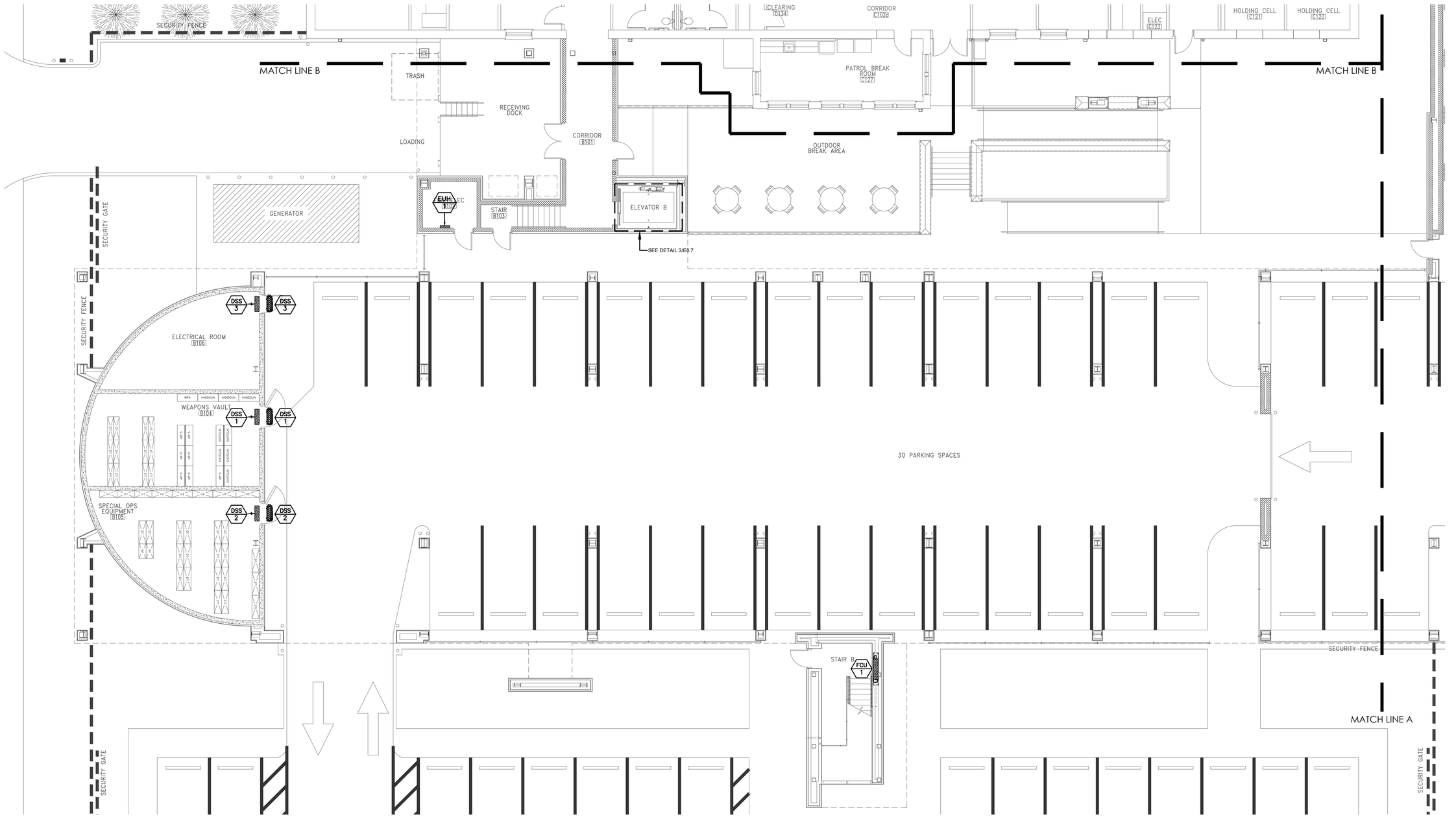
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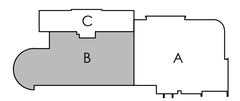
E4.0a



1 E4.0b

MECHANICAL PLAN - FIRST FLOOR PART B

Scale: 1/8" = 1'- 0"



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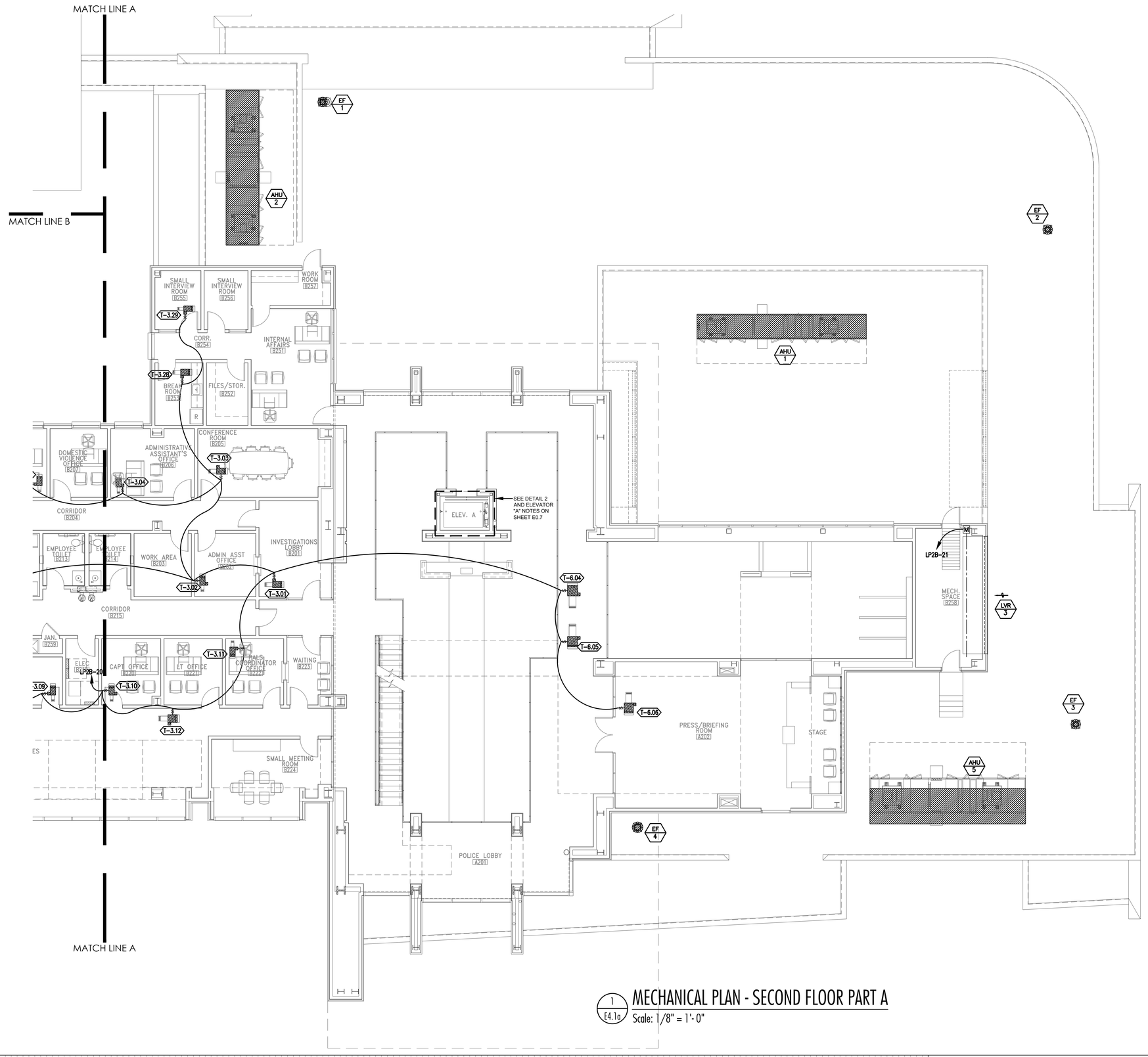
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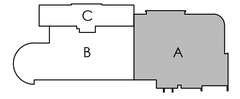


E4.0b



1 E4.1a MECHANICAL PLAN - SECOND FLOOR PART A

Scale: 1/8" = 1'-0"



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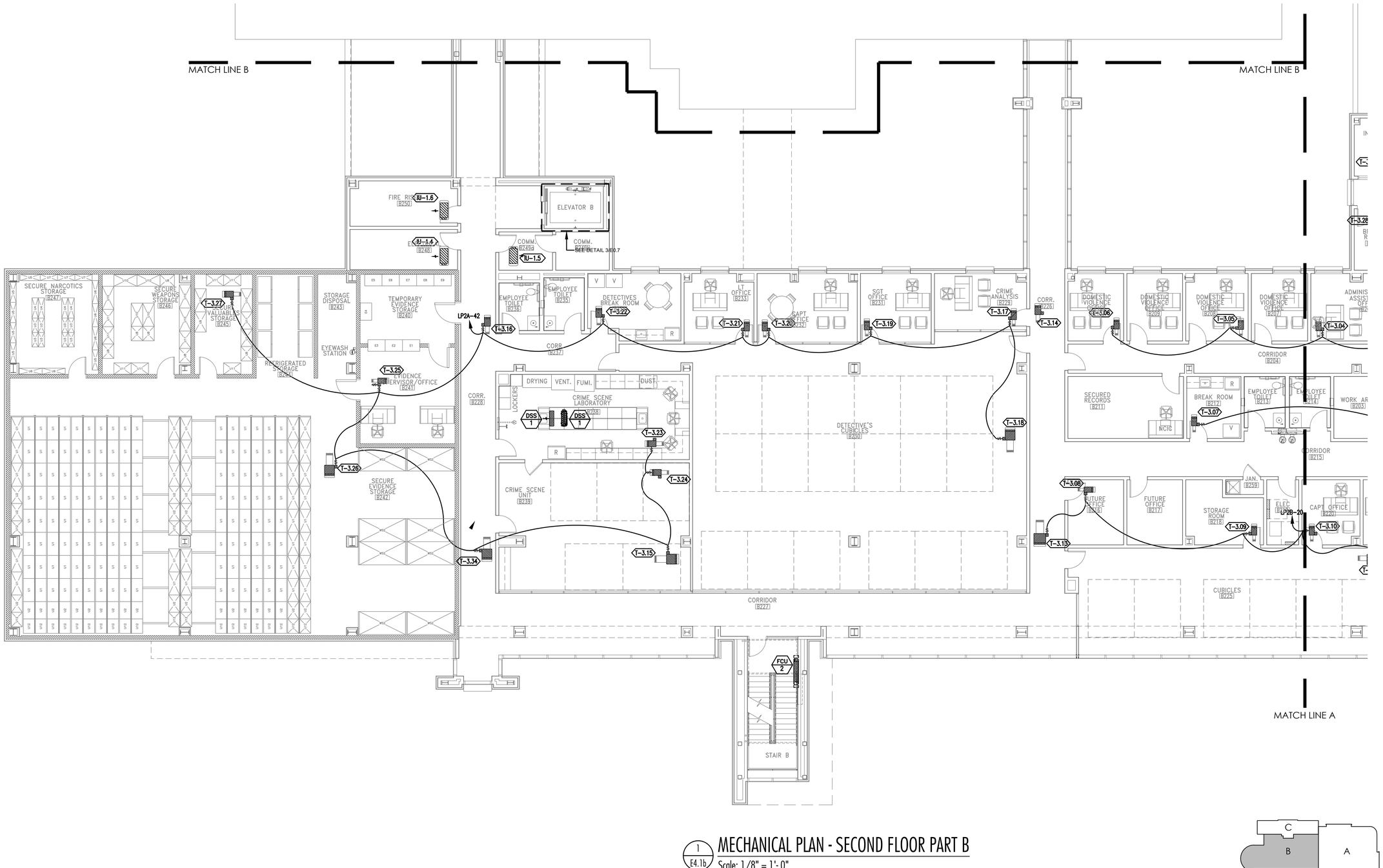
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Kelly Marie McCleskey 11853 Engineer State of Mississippi 12/20/2018

E4.1a



1 / E4.1b MECHANICAL PLAN - SECOND FLOOR PART B

Scale: 1/8" = 1'-0"

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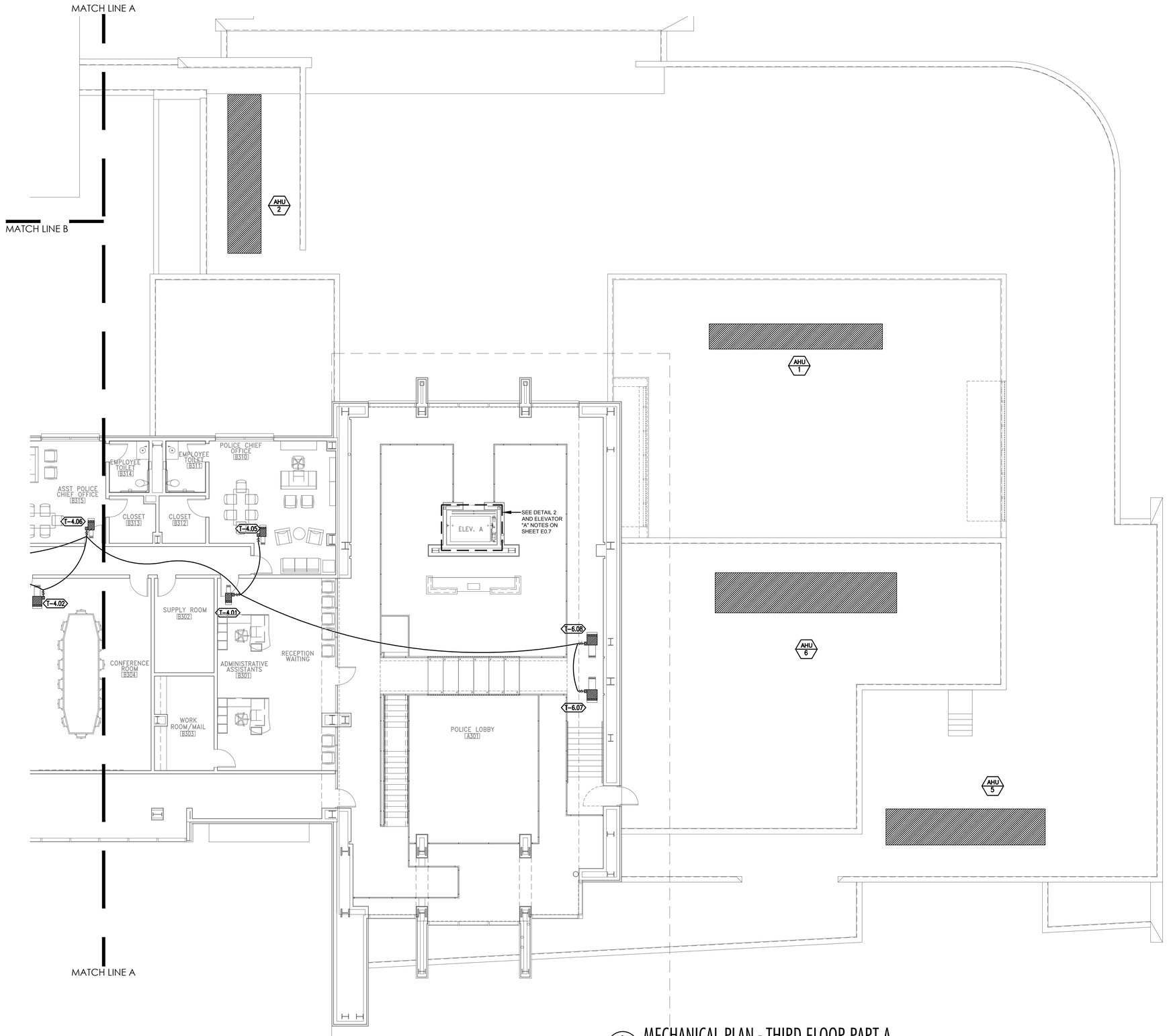
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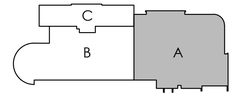
GARY C. McCLESKEY REGISTERED ARCHITECT No. 11853 STATE OF MISSISSIPPI
12/30/2016

E4.1b



1 / E4.2a MECHANICAL PLAN - THIRD FLOOR PART A

Scale: 1/8" = 1'-0"



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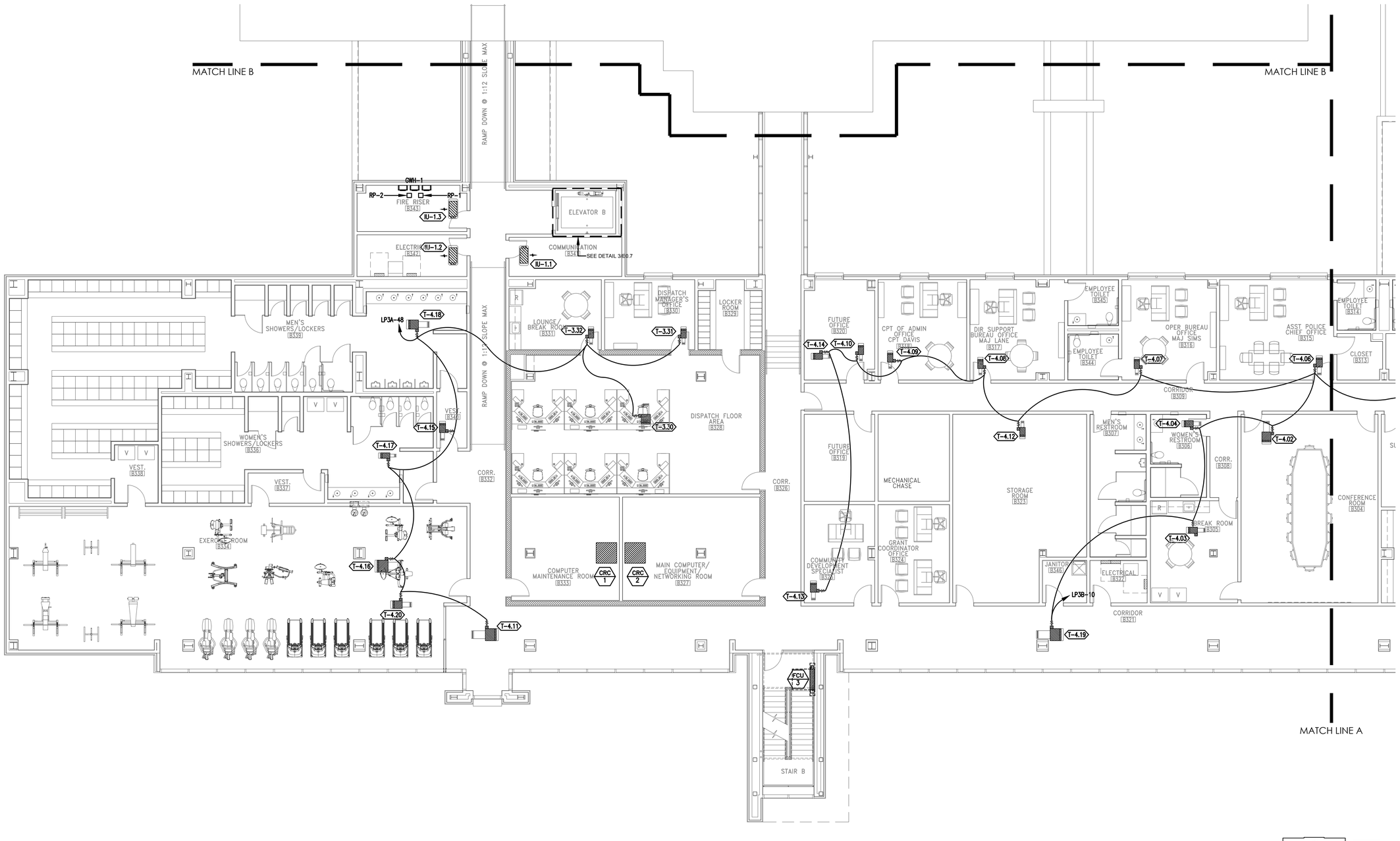
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E4.2a

514 Main Street; P.O. Box 1567 Hattiesburg, MS 39403 ■ Telephone: 601.544.1970 ■ Facsimile: 601.544.4714 ■ Email: a@albertassociates.com
Albert & McCleskey Associates Architects



1 / E4.2b MECHANICAL PLAN - THIRD FLOOR PART B

Scale: 1/8" = 1'- 0"

C B A

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TPS Proj. # 15079

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

HPSC Police and Court Building

Drawing Issued:

Date	Rev.	Description
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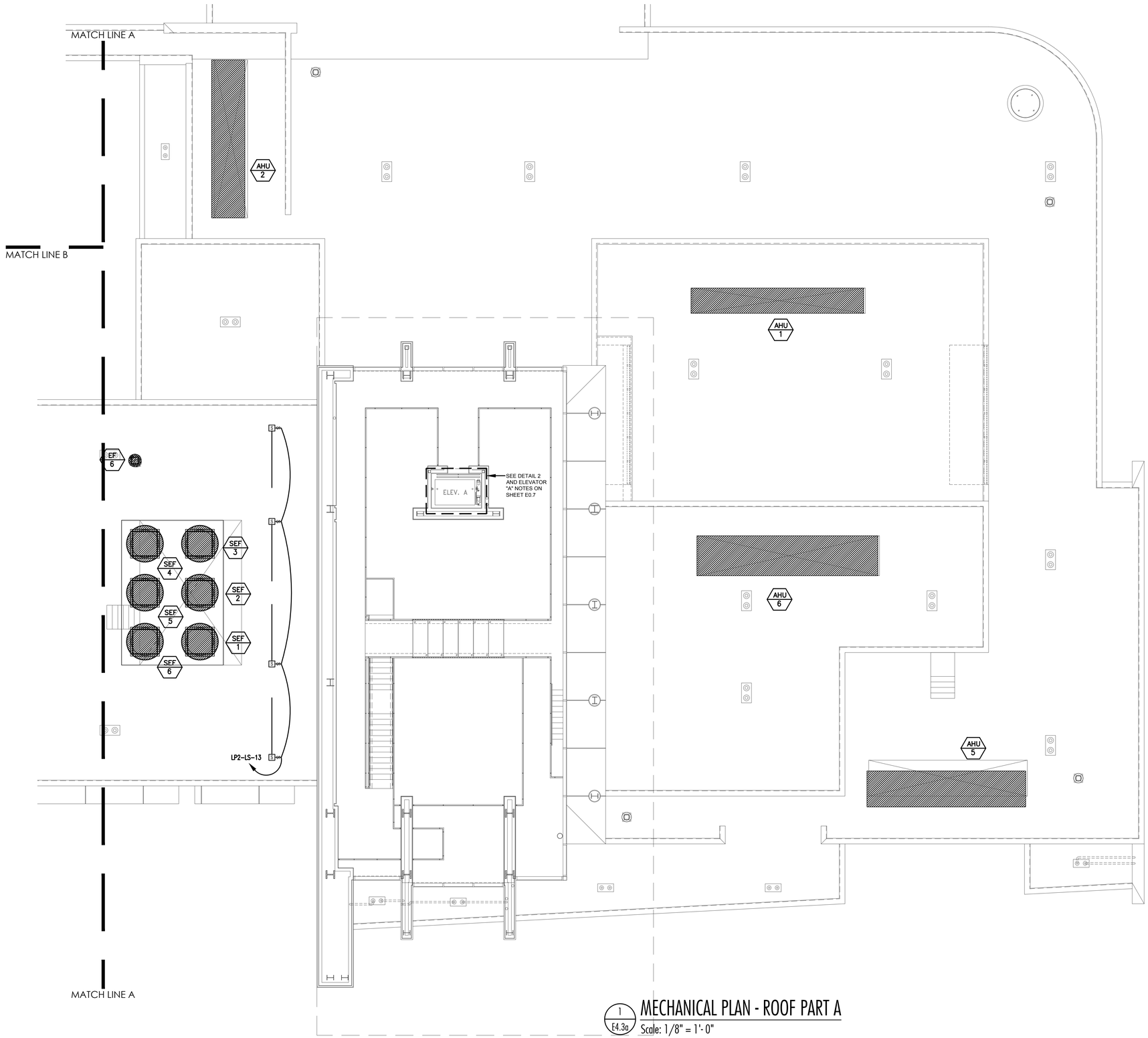
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Client No: --------

Albert & Associates: 12575

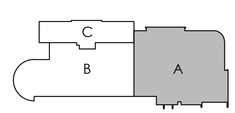


E4.2b



1 E4.3a MECHANICAL PLAN - ROOF PART A

Scale: 1/8" = 1'-0"



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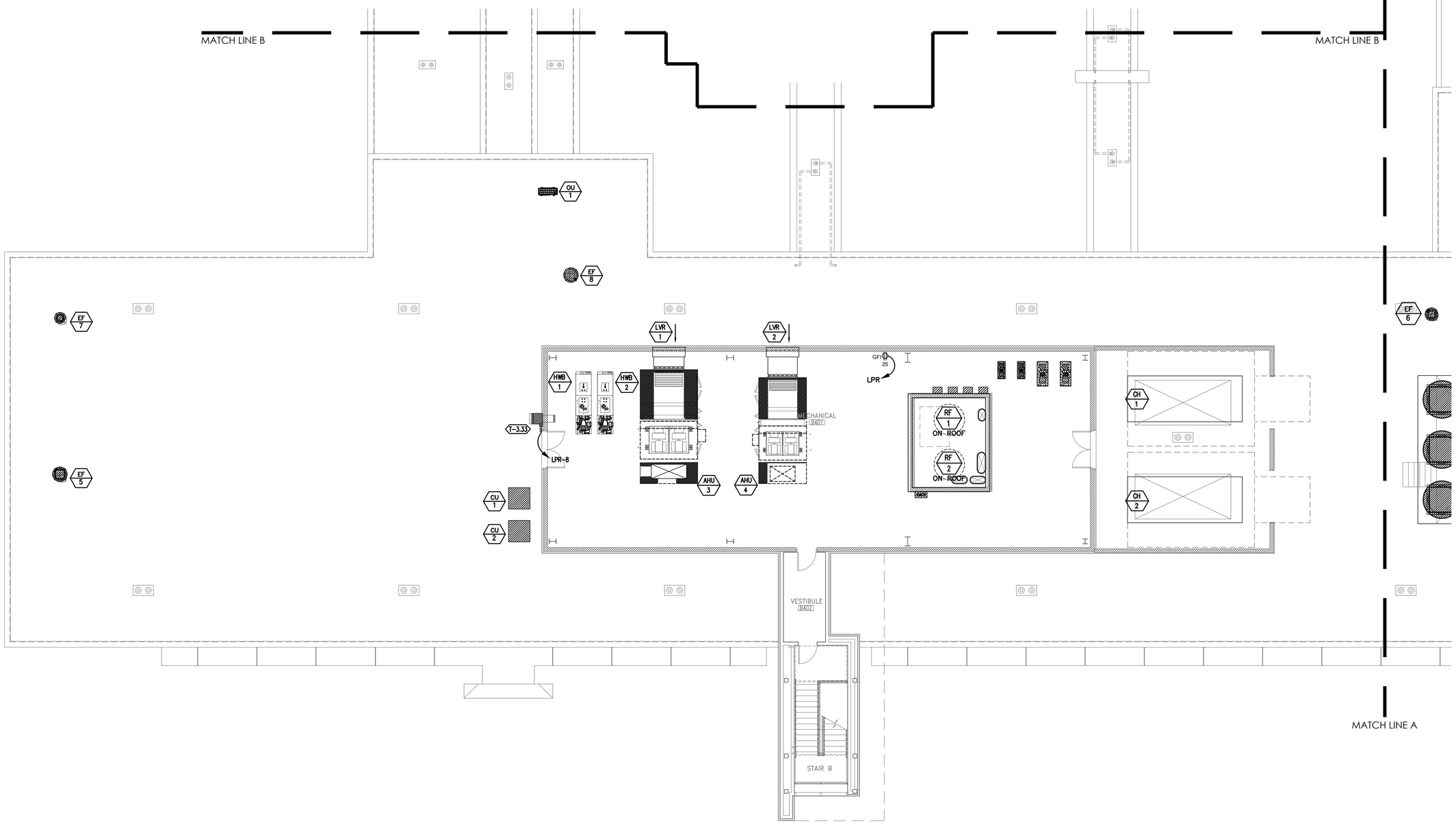
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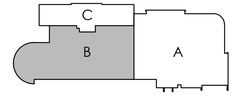
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Checked By:	AC,CG
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Albert & Associates:	12575



E4.3a



1 E4.3b MECHANICAL PLAN - ROOF PART B
Scale: 1/8" = 1'- 0"



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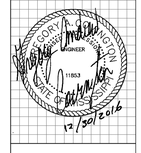
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E4.3b

MECHANICAL EQUIPMENT CONNECTIONS SCHEDULE

MARK	VOLTAGE	PANEL	CIRCUITRY	LOCAL DISCONNECT	REMARKS
MODULAR AIR HANDLING UNIT					
AHU-1 (SUPPLY)	480V, 3Ø	HPR-25,27,29	3#10, #10(G), 3/4"C.	30/3/3R	SEE NOTE A BELOW. SEE NOTE B BELOW.
AHU-1 (RELIEF)	480V, 3Ø	HPR-26,28,30	3#10, #10(G), 3/4"C.	30/3/3R	
AHU-2 (SUPPLY)	480V, 3Ø	HPR-31,33,35	3#10, #10(G), 3/4"C.	30/3/3R	
AHU-2 (RELIEF)	480V, 3Ø	HPR-32,34,36	3#10, #10(G), 3/4"C.	30/3/3R	
AHU-3	480V, 3Ø	HPR-2,4,6	3#6, #10(G), 1"C.	60/3/1	
AHU-4	480V, 3Ø	HPR-8,10,12	3#8, #10(G), 3/4"C.	60/3/1	
AHU-5 (SUPPLY)	480V, 3Ø	HPR-37,39,41	3#8, #10(G), 3/4"C.	30/3/3R	
AHU-5 (RELIEF)	480V, 3Ø	HPR-38,40,42	3#8, #10(G), 3/4"C.	30/3/3R	
AHU-6 (SUPPLY)	480V, 3Ø	HPR-43,45,47	3#8, #10(G), 3/4"C.	30/3/3R	
AHU-6 (RELIEF)	480V, 3Ø	HPR-44,46,48	3#8, #10(G), 3/4"C.	30/3/3R	
AIR COOLED CHILLER					
CH-1	480V, 3Ø	SWBD A	3#400KCM, #3(G), 3"C.	400/3/3R	
CH-2	480V, 3Ø	SWBD A	3#400KCM, #3(G), 3"C.	400/3/3R	
HYDRONIC PUMPS					
CHP-1	480V, 3Ø	HPR-49,51,53	3#8, #10(G), 3/4"C.	60/3/1	
CHP-2	480V, 3Ø	HPR-50,52,54	3#8, #10(G), 3/4"C.	60/3/1	
HWP-1	480V, 3Ø	HPR-55,57,59	3#12, #12(G), 1/2"C.	30/3/1	
HWP-2	480V, 3Ø	HPR-56,58,60	3#12, #12(G), 1/2"C.	30/3/1	
FAN COIL UNITS					
FCU-1	208V, 1Ø	LP2A-34,36	2#12, #12(G), 3/4"C.	2-POLE SWITCH	
FCU-2	208V, 1Ø	LP2A-34,36	2#12, #12(G), 3/4"C.	2-POLE SWITCH	
FCU-3	208V, 1Ø	LP2A-34,36	2#12, #12(G), 3/4"C.	2-POLE SWITCH	
ELECTRIC UNIT HEATER					
EUH-1	208V, 3Ø	LP1A-7,9,11	2#12, #12(G), 3/4"C.	WITH EQUIPMENT	
CONDENSING GAS FIRED HEATER BOILER					
HWB-1	120V, 1Ø	LPR-19	2#12, #12(G), 3/4"C.	30/1/1	
HWB-2	120V, 1Ø	LPR-21	2#12, #12(G), 3/4"C.	30/1/1	
POWER VENTILATOR SCHEDULE					
EF-1	120V, 1Ø	LPR-9	2#8, #10(G), 1"C.	WITH EQUIPMENT	PROVIDE MAGNETIC MOTOR STARTER. SEE DETAIL 4/E0.7
EF-2	120V, 1Ø	LPR-11	2#6, #10(G), 3/4"C.	WITH EQUIPMENT	PROVIDE MAGNETIC MOTOR STARTER. SEE DETAIL 4/E0.8
EF-3	120V, 1Ø	LPR-13	2#6, #10(G), 3/4"C.	WITH EQUIPMENT	PROVIDE MAGNETIC MOTOR STARTER. SEE DETAIL 4/E0.9
EF-4	120V, 1Ø	LPR-15	2#8, #10(G), 1"C.	WITH EQUIPMENT	PROVIDE MAGNETIC MOTOR STARTER. SEE DETAIL 4/E0.10
EF-5	120V, 1Ø	LPR-5	2#12, #12(G), 3/4"C.	WITH EQUIPMENT	PROVIDE MAGNETIC MOTOR STARTER. SEE DETAIL 4/E0.11
EF-6	120V, 1Ø	LPR-6	2#12, #12(G), 3/4"C.	WITH EQUIPMENT	PROVIDE MAGNETIC MOTOR STARTER. SEE DETAIL 4/E0.12
EF-7	120V, 1Ø	LPR-7	2#12, #12(G), 3/4"C.	WITH EQUIPMENT	PROVIDE MAGNETIC MOTOR STARTER. SEE DETAIL 4/E0.13
EF-8	480V, 3Ø	HPR-7,9,11	3#12, #12(G), 1/2"C.	WITH EQUIPMENT	PROVIDE AND INSTALL MAGNETIC MOTOR STARTER
RF-1	480V, 3Ø	HPR-13,15,17	3#12, #12(G), 1/2"C.	WITH EQUIPMENT	SEE NOTE A BELOW. SEE NOTE B BELOW.
RF-2	480V, 3Ø	HPR-19,21,23	3#12, #12(G), 1/2"C.	WITH EQUIPMENT	SEE NOTE A BELOW. SEE NOTE B BELOW.
SEF-1	480V, 3Ø	HP2-LS-2,4,6	3#12, #12(G), 1/2"C.	WITH EQUIPMENT	SEE NOTE A BELOW. SEE NOTE B BELOW.
SEF-2	480V, 3Ø	HP2-LS-7,9,11	3#12, #12(G), 1/2"C.	WITH EQUIPMENT	SEE NOTE A BELOW. SEE NOTE B BELOW.
SEF-3	480V, 3Ø	HP2-LS-8,10,12	3#12, #12(G), 1/2"C.	WITH EQUIPMENT	SEE NOTE A BELOW. SEE NOTE B BELOW.
SEF-4	480V, 3Ø	HP2-LS-13,15,17	3#12, #12(G), 1/2"C.	WITH EQUIPMENT	SEE NOTE A BELOW. SEE NOTE B BELOW.
SEF-5	480V, 3Ø	HP2-LS-14,16,18	3#12, #12(G), 1/2"C.	WITH EQUIPMENT	SEE NOTE A BELOW. SEE NOTE B BELOW.
SEF-6	480V, 3Ø	HP2-LS-19,21,23	3#12, #12(G), 1/2"C.	WITH EQUIPMENT	SEE NOTE A BELOW. SEE NOTE B BELOW.
SPLIT SYSTEM HEAT PUMP EQUIPMENT					
OU-1	208V, 1Ø	LPR-2,4	2#10, #10(G), 3/4"C.	60/2/3R	
IU-1.1	208V, 1Ø	LP3A-46,48	2#12, #12(G), 3/4"C.	2-POLE SWITCH	
IU-1.2	208V, 1Ø	LP3A-46,48	2#12, #12(G), 3/4"C.	2-POLE SWITCH	
IU-1.3	208V, 1Ø	LP3A-46,48	2#12, #12(G), 3/4"C.	2-POLE SWITCH	
IU-1.4	208V, 1Ø	LP2A-38,40	2#12, #12(G), 3/4"C.	2-POLE SWITCH	
IU-1.5	208V, 1Ø	LP2A-38,40	2#12, #12(G), 3/4"C.	2-POLE SWITCH	
IU-1.6	208V, 1Ø	LP2A-38,40	2#12, #12(G), 3/4"C.	2-POLE SWITCH	
DUCTLESS SPLIT SYSTEM					
DSS-1 (IN) B104	208V, 1Ø	LP1A-10,12	2#12, #12(G), 3/4"C.	2-POLE SWITCH	CONNECT TO DSS-1 (OUT)
DSS-1 (OUT) B104	208V, 1Ø	LP1A-10,12	2#12, #12(G), 3/4"C.	30 / 2 / 3R	
DSS-2 (IN) B105	208V, 1Ø	LP1A-14,16	2#12, #12(G), 3/4"C.	2-POLE SWITCH	CONNECT TO DSS-1 (OUT)
DSS-2 (OUT) B105	208V, 1Ø	LP1A-14,16	2#12, #12(G), 3/4"C.	30 / 2 / 3R	
DSS-3 (IN) BXXX	208V, 1Ø	LP1A-18,20	2#12, #12(G), 3/4"C.	2-POLE SWITCH	CONNECT TO DSS-1 (OUT)
DSS-3 (OUT) BXXX	208V, 1Ø	LP1A-18,20	2#12, #12(G), 3/4"C.	30 / 2 / 3R	
COMPUTER ROOM AIR-CONDITIONING UNIT SCHEDULE					
CRC-1	480V, 3Ø	HP3A-2,4,6	3#12, #12(G), 1/2"C.	WITH EQUIPMENT	
CRC-2	480V, 3Ø	HP3A-8,10,12	3#12, #12(G), 1/2"C.	WITH EQUIPMENT	
GAS WATER HEATER					
CRC-1	480V, 3Ø	HP3A-2,4,6	3#12, #12(G), 1/2"C.	WITH EQUIPMENT	
GAS WATER HEATER					
GWH-1	120V, 1Ø	LP3A-49	2#12, #12(G), 3/4"C.	$	
AIR-CONDITIONING UNIT					
CU-1	480V, 3Ø	HPR-61,63,65	3#12, #12(G), 1/2"C.	30/3/3R	
GWH-1	480V, 3Ø	HPR-62,64,66	3#12, #12(G), 1/2"C.	30/3/3R	
LOUVERS					
LVR-3	120V, 1Ø	LP2-LS-11	2#12, #12(G), 3/4"C.	$	SEE NOTE B BELOW
PUMPS					
RP-1	120V, 1Ø	LP3A-45	2#10, #10(G), 3/4"C.	$[7]	
RP-2	480V, 3Ø	LP3A-47	2#10, #10(G), 3/4"C.	$[7]	

General Note 1: Prior to submitting electrical equipment brochures, the Contractor shall verify actual equipment submittal data and adjust equipment services accordingly.

NOTE A: CONTROLLED BY FIELD MOUNTED VFD. PROVIDE AND INSTALL CONDUIT AND CONDUCTORS TO VFD. PROVIDE AND INSTALL VFD CABLING DOWNSTREAM OF VFD TO MOTOR.

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HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

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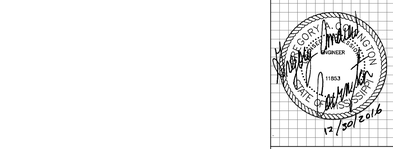
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E4.4

MATCH LINE A

MATCH LINE B

MATCH LINE A

KEYED NOTES:

1 DOOR SHALL ALARM IMMEDIATELY AND AUDIBLY IF OPENED.

VEST. C103S
LDING CELL C120
CORRIDOR A169
MEN A161
WOMEN A162
POLICE ACCOUNTING A163
BREAKROOM A164
VICTIM ADVOCATES OFFICE A165
VICTIM ADVOCATES OFFICE A166
PROBATION ROOM A167
CORRIDOR A168
COMMUNITY SERVICE OFFICE A146
WARRANTS A145
PROSECUTOR ATTORNEY OFFICE A144
ADMIN. ASST. OFFICE A143
JUDGE'S CHAMBER A139
CORRIDOR A146
CORRIDOR A137
CORRIDOR A135
CORR. A136
COURT FILE ROOM/ WORK AREA A138
MEETING ROOM A142
CLOSET A141
RESTROOM A140
COMM A134
COMM A133
CORR. A132
COURT ROOM ATTORNEY OFFICE A131
OFFICE (ATTORNEY) A130
COURT ACCOUNTING OFFICE A129
CLERK MANAGER OFFICE A128
CORRIDOR A127
COURT ROOM A126
TELESERVICE OFFICE A159
TELESERVICE OFFICE A154
ELEC A158
NCIC A157
CORR. A156
STORAGE/ SUPPLY ROOM A160
PUBLIC INFO OFFICE A155
RECORD CLERK MANAGER A153
RECORD CLERK AREA A149
FINGERPRINT/ID ROOM A152
WORK AREA A151
FRONT DESK A150
ELEV. A
RECEPTION A105
POLICE LOBBY A104
VESTIBULE A123
VESTIBULE A124
VESTIBULE A125
COURT LOBBY A106
COURT CLERK DESK A118
FELONY/MISD CLERK OFFICE A122
COURT BREAK ROOM A119
WOMEN A120
MEN A121
DEPUTY COURT CLERK AREA A117
CORR. A116
STORAGE A114
KITCHEN A113
ELEC. A115
COMMUNITY ROOM A111
SECURITY A103
MEN A109
VESTIBULE A107
WOMEN A108
JAN. A110
COMM. A112
VESTIBULE A101
SECURITY QUEUE A102
PUBLIC ENTRANCE
SECURE PARKING
VEHICLE PEDESTAL CARD READER FOR HIGH SPEED COIL DOOR SHOWN ON SEC-1.0b
SECURITY FENCE

TYPE A
TYPE B
TYPE D

1 SEC1.0a SECURITY PLAN - FIRST FLOOR PART A
Scale: 1/8" = 1'-0"

C
B
A

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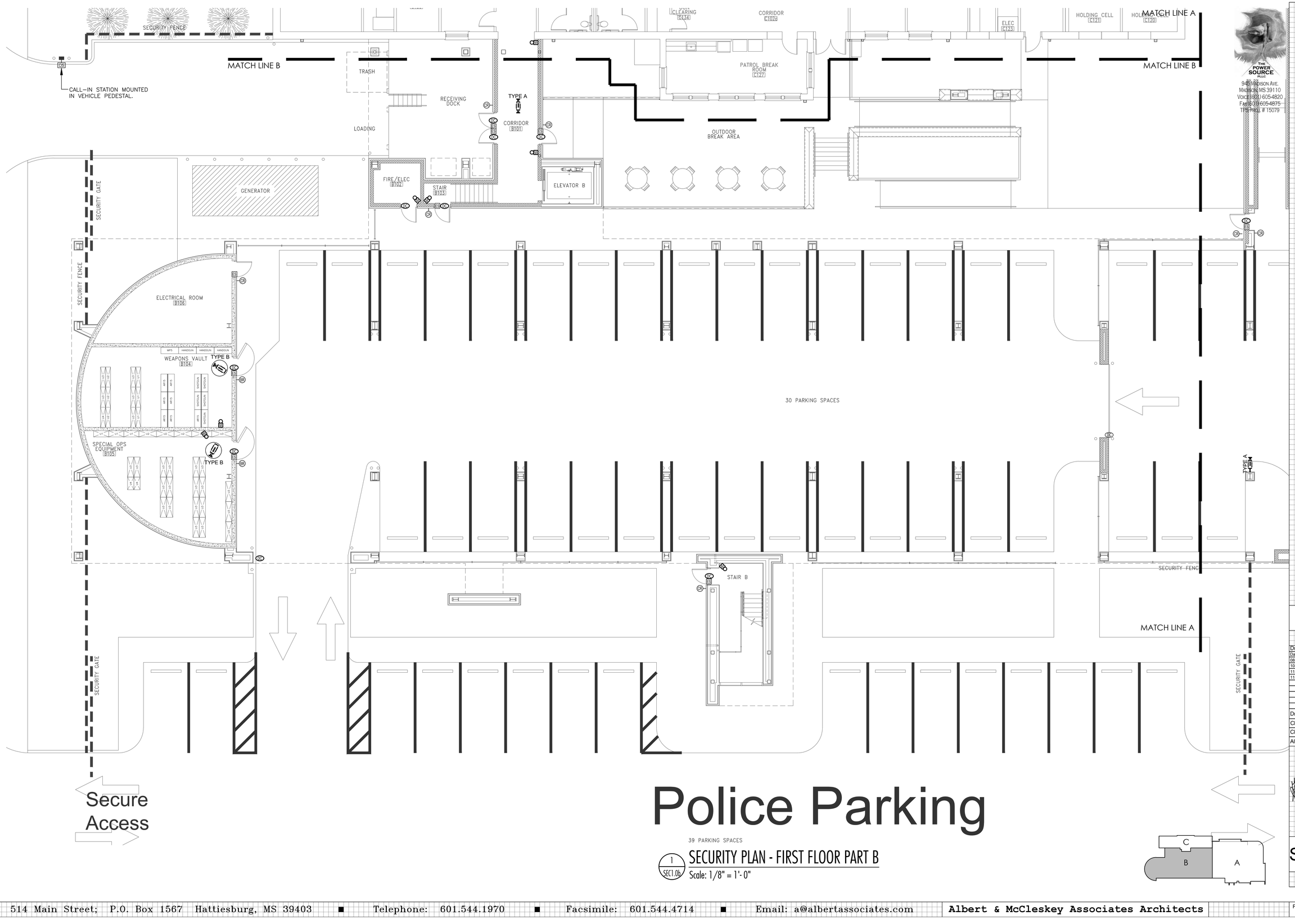
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SEC1.0a



Police Parking

39 PARKING SPACES

1 SEC1.0b — SECURITY PLAN - FIRST FLOOR PART B

Scale: 1/8" = 1'-0"

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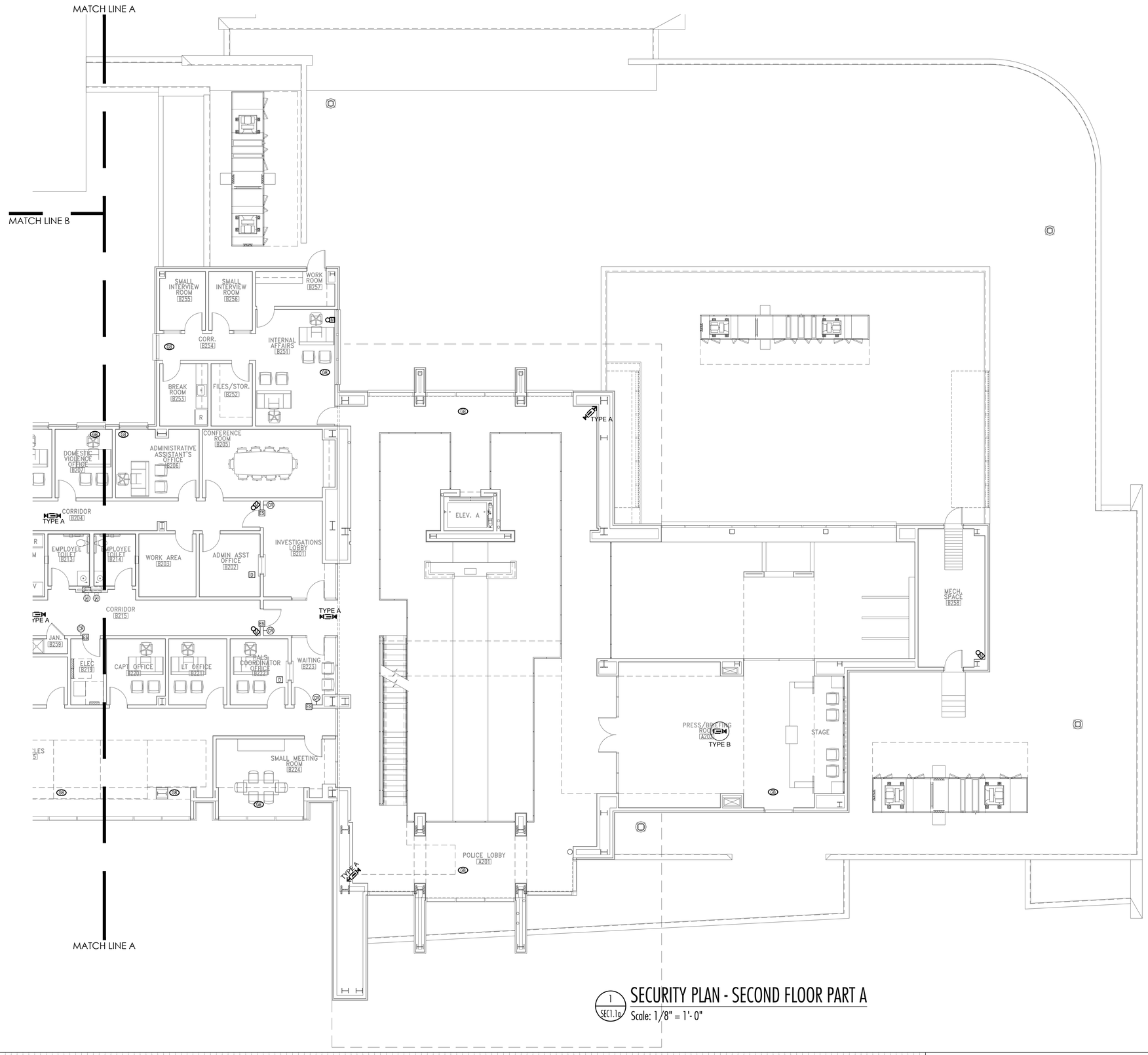
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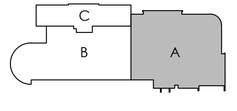
SEC1.0b

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1 SEC1.1a SECURITY PLAN - SECOND FLOOR PART A

Scale: 1/8" = 1'- 0"



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SEC1.1a

KEYED NOTES:

1. DOOR SHALL ALARM TO DISPATCH.

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MATCH LINE A

MATCH LINE B

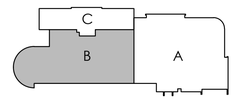
MATCH LINE B

MATCH LINE A

SECURE NARCOTICS STORAGE B247
SECURE WEAPONS STORAGE B246
SECURE VALUABLES STORAGE B245
REFRIGERATED STORAGE B244
STORAGE DISPOSAL B243
TEMPORARY EVIDENCE STORAGE B241
EVIDENCE SUPERVISOR'S OFFICE B240
SECURE EVIDENCE STORAGE B242
EYEWASH STATION
FIRE RISER B250
ELECTRICAL B246
ELEVATOR B
COMM. B249G
COMM. B249H
EMPLOYEE TOILET B236
EMPLOYEE TOILET B235
DETECTIVES BREAK ROOM B234
LT OFFICE B233
CAPT OFFICE B232
SGT OFFICE B231
CRIME ANALYSIS B229
CORR. B226
CORR. B237
CORR. B228
DRYING
VENT.
FUMI.
DUST
LOCKERS
CRIME SCENE LABORATORY B238
CRIME SCENE UNIT B239
DETECTIVE'S CUBICLES B230
CORRIDOR B227
STAIR B
DOMESTIC VIOLENCE OFFICE B210
DOMESTIC VIOLENCE OFFICE B209
DOMESTIC VIOLENCE OFFICE B208
DOMESTIC VIOLENCE OFFICE B207
ADMIN ASSI
CORRIDOR B204
SECURED RECORDS B211
NCIC
BREAK ROOM B212
EMPLOYEE TOILET B213
EMPLOYEE TOILET B214
WORK
CORRIDOR B215
JAN. B259
ELEC B219
CAPT OFFICE B220
FUTURE OFFICE B216
FUTURE OFFICE B217
STORAGE ROOM B218
CUBICLES B225

TYPE A
TYPE B
TYPE D

1 SEC1.1b SECURITY PLAN - SECOND FLOOR PART B
Scale: 1/8" = 1'-0"



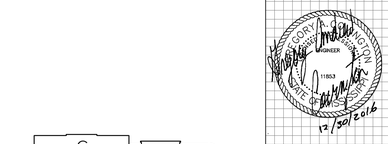
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HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT ■

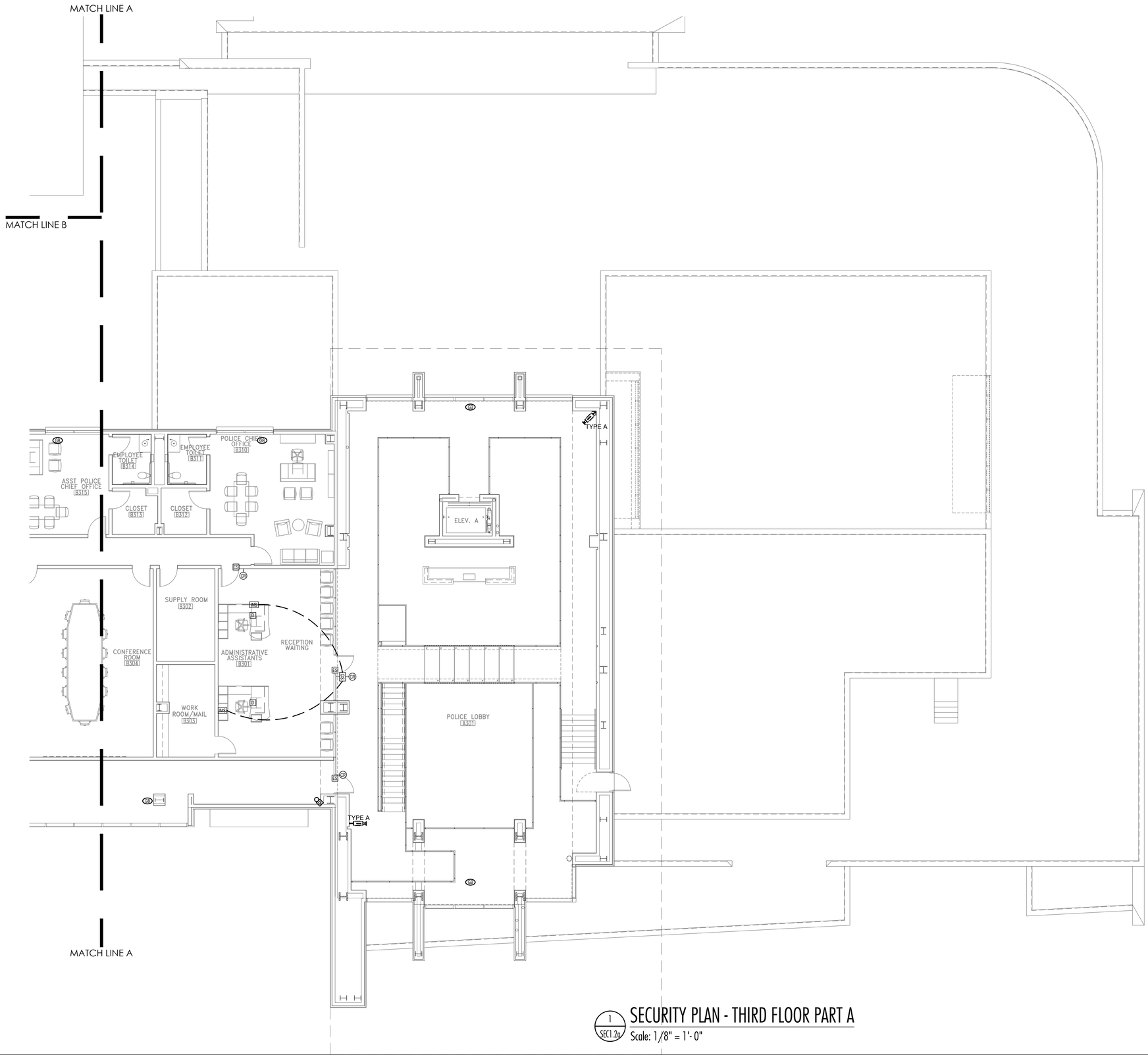
HPSC Police and Court Building

Drawing Issued:	
Date	Rev. Description
08-31-2015	DD Check Set
10-20-2015	75% Progress Set
11-02-2015	90% Pricing Set
11-19-2018	100% Bid Docs

Drawn By:	TJ,ST,FB
Checked By:	AC,CG
Client No:	-------
Albert & Associates:	12575

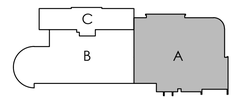


SEC1.1b



1 SEC1.2a SECURITY PLAN - THIRD FLOOR PART A

Scale: 1/8" = 1'-0"



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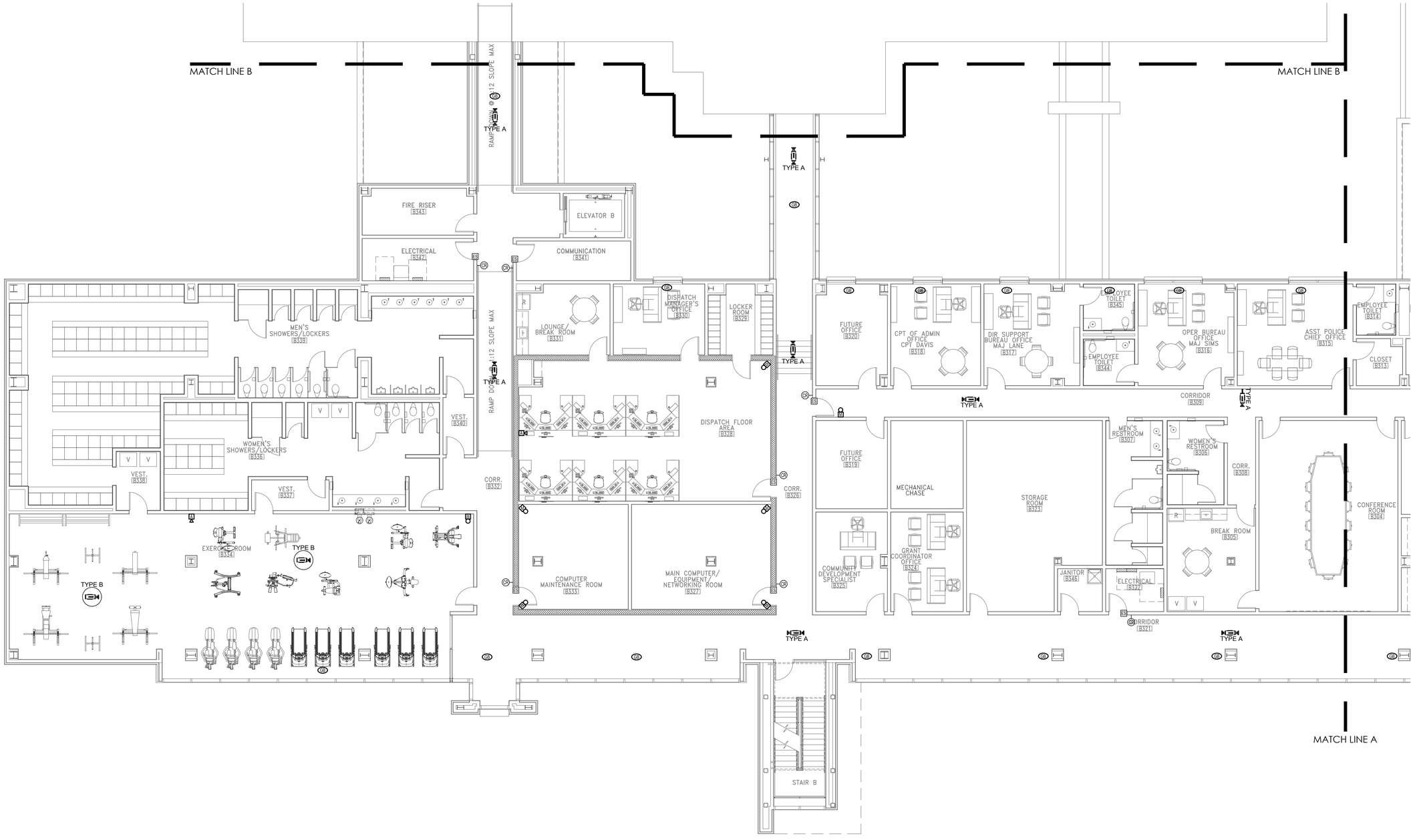
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HPSC Police and Court Building

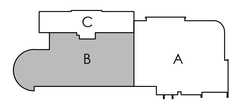
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11-19-2018		100% Bid Docs

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Checked By:	AC,CG
Client No:	-------
Albert & Associates:	12575

SEC1.2a



1 SEC1.2b **SECURITY PLAN - THIRD FLOOR PART B**
Scale: 1/8" = 1'-0"



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HATTIESBURG PUBLIC SAFETY COMPLEX

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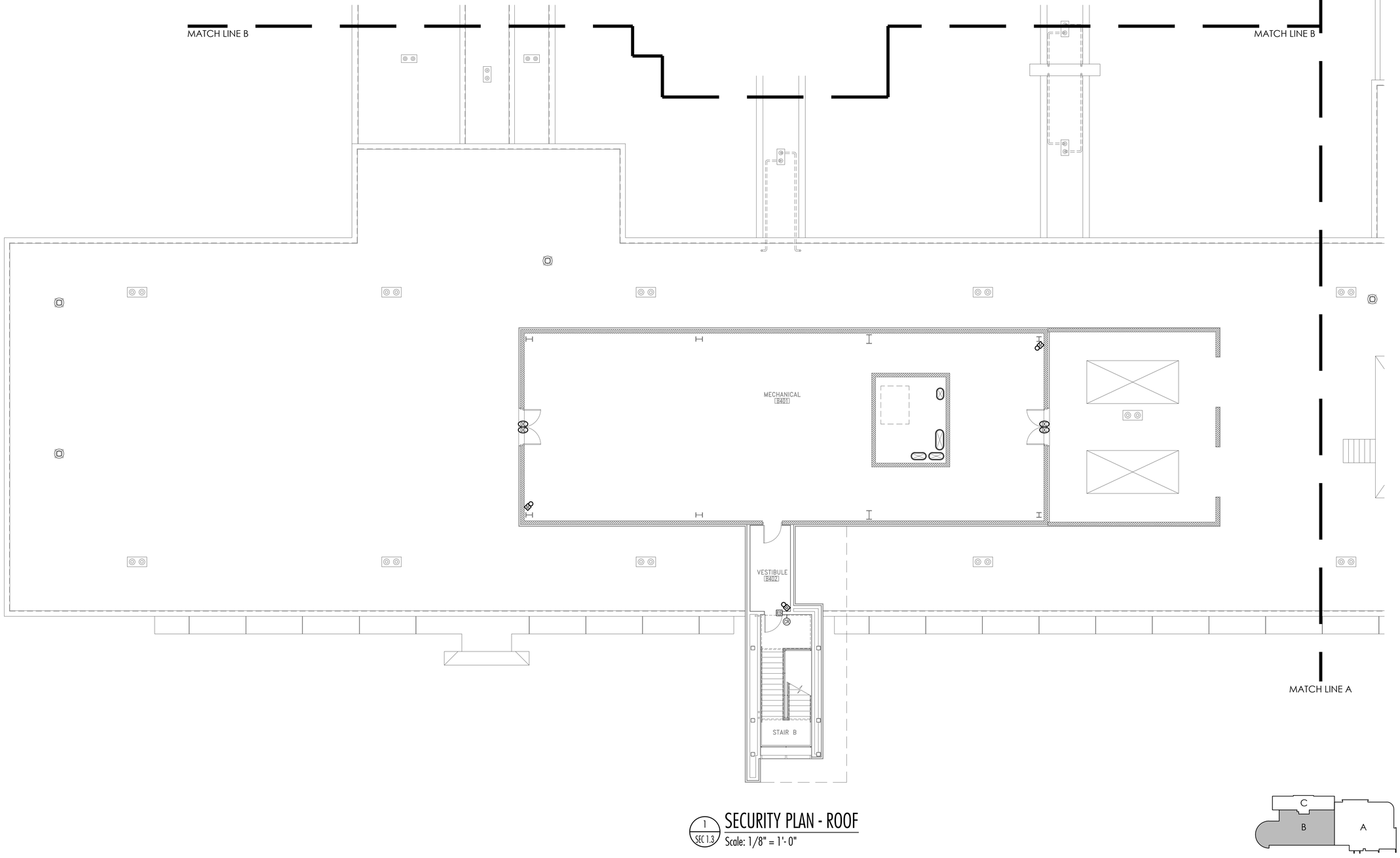
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11-19-2018		100% Bid Docs

Drawn By:	TJ,ST,FB
Checked By:	AC,CG
Client No:	-------
Albert & Associates:	12575

Gary A. McCleskey 11853 Registered Architect State of Mississippi 12/30/2016

SEC1.2b



1 / SEC 1.3 SECURITY PLAN - ROOF
Scale: 1/8" = 1'-0"

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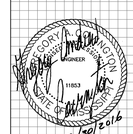
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SEC 1.3

SOUTH SITE BUILDINGS

CSI / MAINTENANCE

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG, MISSISSIPPI
CONSTRUCTION DOCUMENT SET
NOVEMBER 19, 2018



Albert & McCleskey Associates Architects

SOUTH SITE BUILDINGS A & B

BUILDING A: K-9, CSI VEHICLE BAY, AND MAINTENANCE SHOP

BUILDING B: FLEET & TRAFFIC MOTORCYCLE BAY

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG, MISSISSIPPI

CONSTRUCTION DOCUMENT SET

SEPTEMBER 2015

ARCHITECTURAL SYMBOLS

A — WINDOW TAG

xxx — DOOR TAG

ROOM NAME / 000 — ROOM NAME AND ROOM NUMBER

NOTATION LINES

FIRST FLOOR / 0'-0" F.F.E. — VERTICAL ELEVATION

X / Ax.x — BUILDING SECTION

X / Ax.x / ELEVATION — EXTERIOR ELEVATION

1 / A2.4 — AREA TO BE ENLARGED ON DRAWINGS

INDEX TO DRAWINGS:

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A3.2 BUILDING B: MEZZANINE FLOOR PLAN
A3.3 BUILDING B: ENLARGED FLOOR PLANS
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A8.1 BUILDING A SECTIONS/DETAILS
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E1.1 BUILDING B LIGHTING MEZZ.

E2.0 BUILDING B POWER PLAN
E2.1 BUILDING B POWER MEZZ.

E3.0 BUILDING B MECHANICAL / AUX PLAN
E3.1 BUILDING B MECHANICAL / AUX MEZZ.

E4.0 BUILDING B SECURITY PLAN
E4.1 BUILDING B SECURITY PLAN MEZZ.

GENERAL NOTES

GENERAL DEMOLITION NOTES

DO NOT SCALE DRAWINGS.

REFER TO ENTIRE CONSTRUCTION DOCUMENTS FOR ANY ADDITIONAL DEMOLITION NOTES.

THE GC SHALL BE RESPONSIBLE FOR ALL DEMOLITION DESCRIBED IN CONSTRUCTION DOCUMENTS.

THE GC SHALL FURNISH ALL LABOR, MATERIALS, EQUIPMENT, AND SERVICES REQUIRED FOR COMPLETE DEMOLITION, REMOVAL, AND RELATED WORK AS INDICATED.

THE GC SHALL REMOVE, REPAIR, CLEAN, AND STORE ANY REMOVED ITEMS SPECIFIED TO BE RE-USED.

GC SHALL VISIT SITE PRIOR TO START OF WORK TO DETERMINE EXTENT OF DEMOLITION. IF ANY DISCREPANCIES OR CONFLICTS, CONTACT ARCHITECT.

THE GC SHALL COORDINATE THE MOVEMENT OF CONSTRUCTION MATERIALS AND EQUIPMENT, TRASH REMOVAL, TEMPORARY ELECTRIC, AND REMOVAL OF BARRICADE WITH THE OWNER.

ALL MATERIALS AND EQUIPMENT SHALL BE REMOVED IN STRICT ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS.

GC SHALL SECURE, SUSPEND, AND/OR ANCHOR ANY EXISTING CONSTRUCTION AS REQUIRED TO OBTAIN A PROPER AND SAFE DEMOLITION WORK.

GC SHALL PROVIDE ALL NECESSARY TEMPORARY BARRICADES AND OTHER FORMS OF PROTECTION AS REQUIRED BY OWNER AND LOCAL GOVERNING AGENCIES TO PROTECT OWNER'S PERSONNEL FROM INJURY DUE TO CONSTRUCTION.

GENERAL SITE NOTES

GS01. ALL BIDDERS SHALL VISIT SITE TO EVALUATE ALL EXISTING CONDITIONS AFFECTING WORK PRIOR TO SUBMITTING BIDS. CONTRACTOR(S) SHALL NOTIFY ARCHITECT OF ANY CONDITIONS AND /OR DISCREPANCIES NOT ADDRESSED IN CONTRACT DOCUMENTS.

GS02. THE GENERAL CONTRACTOR SHALL PROTECT EXISTING PAVING, BUILDING, PROPERTY, & ADJACENT PROPERTIES. ANY & ALL DAMAGES BY CONSTRUCTION OPERATIONS, EMPLOYEES OF THE CONTRACTOR & ANY SUB CONTRACTORS SHALL BE CORRECTED AT THE EXPENSE OF GENERAL CONTRACTOR TO THE SATISFACTION OF THE OWNER.

GS03. THE OWNER RETAINS THE RIGHT TO SELECT AND RETAIN ANY ITEMS REMOVED FROM EXISTING SITE AND/OR BUILDING. THE GENERAL CONTRACTOR SHALL DISPOSE OF OTHER ITEMS REMOVED.

GS04. ANY QUANTITY ESTIMATES THAT MAY BE INCLUDED ON THE DOCUMENTS ARE ARE FOR DESIGN AND CLIENT REFERENCE ONLY. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO CALCULATE AND REALIZE THEIR OWN ESTIMATES AND QUANTITIES. THE ARCHITECT ASSUMES NO LIABILITY FOR OMISSIONS OR ERRORS FOR THESE ESTIMATES; AND NO COMPENSATION SHALL BE ALLOWED FOR CONTRACTOR MISINTERPRETATIONS.

GS05. QUANTITY ESTIMATES ON DRAWINGS ARE ONLY AN AID TO CLARIFICATION OF UNITS AND A CHECK FOR THE CONTRACTOR TO COMPARE WITH HIS OWN ESTIMATES. QUANTITY ESTIMATES HAVE BEEN MADE CAREFULLY; BUT THE ARCHITECT ASSUMES NO LIABILITY FOR OMISSIONS OR ERRORS. DIFFERENCES SHALL BE BROUGHT TO THE ATTENTION OF THE ARCHITECT. NO EXTRA COMPENSATION SHALL BE ALLOWED FOR ADDITIONAL QUANTITIES NECESSARY TO COMPLETE THE WORK.

GS06. THE DESIGN, ADEQUACY, AND SAFETY OF ERECTION, BRACING, SHORING, TEMPORARY SUPPORTS, ETC. IS THE SOLE RESPONSIBILITY OF THE CONTRACTOR.

GS07. MATERIAL, WORKMANSHIP, AND DESIGN SHALL CONFORM TO THE INTERNATIONAL BUILDING CODE, CURRENT EDITION.

GS08. PROVIDE BRICK EXPANSION JOINTS BEHIND EA. DOWNSPOUT AND/OR DIRECTED BY ARCHITECT ON JOB-SITE. (APPROX. 40'-0" O.C.).

GS09. THE CONTRACTOR SHALL COORDINATE THE ARCHITECTURAL, STRUCTURAL, MECHANICAL, ELECTRICAL, PLUMBING AND CIVIL CONTRACT DOCUMENTS. THE ARCHITECT OF RECORD SHALL BE NOTIFIED OF ANY DISCREPANCIES OR OMISSIONS.

SITE NOTES - GRADING AND DRAINAGE:

SG00. ALL ROUGH GRADING, FINISH GRADING, EXCAVATION & FILL WORK INDICATED IN CONTRACT DOCUMENTS & AS REQUIRED FOR CONSTRUCTION SHALL BE BY GENERAL CONTRACTOR.

SG01. THE GENERAL CONTRACTOR SHALL PROVIDE DRAINAGE OF SURFACE WATER AWAY FROM BUILDING ON ALL SIDES. 2% SLOPE MINIMUM.

SG02. FINISH GRADE SHALL BE 6" MINIMUM BELOW FINISH FLOOR ELEVATION AND SLOPE AWAY FROM BUILDING.

SG03. THE GENERAL CONTRACTOR IS TO PROVIDE AND PLACE TOPSOIL AND GRASSING (SEED) WHERE EARTH IS EXPOSED BY CONSTRUCTION OPERATIONS THAT IS NOT SCHEDULED TO RECEIVE CONCRETE OR ASPHALT PAVING.

SG04. THE CONTRACTOR WILL BE RESPONSIBLE FOR THE INSTALLATION AND MAINTENANCE OF ALL EROSION CONTROL MEASURES.

SG05. PROVIDE STABLE BASE AND/OR SUB GRADE. ANY SOFT OR YIELDING AREAS IN THE SHALL BE REMOVED AND BACKFILLED WITH FILL COMPACTED TO 95% OF STANDARD PROCTOR OR APPROVED MATERIAL.

SG06. ALL ROUGH GRADING, FINISH GRADING, EXCAVATION & FILL WORK INDICATED ON CONSTRUCTION DOCUMENTS & AS REQUIRED FOR CONSTRUCTION IS TO BE BY THE GENERAL CONTRACTOR.

SG07. EROSION CONTROL MEASURES SHALL BE TAKEN AS REQUIRED OR AS INDICATED ON AN EROSION CONTROL PLAN. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ASSESS SITE CONDITIONS AND POTENTIAL EROSION DISTURBANCES CAUSED BY CONSTRUCTION.

PARKING/PAVING NOTES

STRIPES FOR PARKING SHALL BE 4" WIDE (COLOR TO BE YELLOW TRAFFIC PAINT), STRIPES TO BE FAST DRYING TRAFFIC PAINT. MATERIALS USED AND APPLICATIONS ARE TO BE IN ACCORDANCE WITH M.S.H.D. STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION. ARROWS FOR DIRECTIONAL TRAFFIC AND HANDICAPPED SPACES SHALL ALSO BE PAINTED.

IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO PROVIDE A STABLE BASE AND/OR SUB GRADE FOR PAVING APPLICATION; UNSUITABLE MATERIAL ENCOUNTERED DURING PAVING PREPARATION SHALL BE REMOVED AND AREA BACK FILLED WITH ACCEPTABLE MATERIAL.

ALL ASPHALT AND CONCRETE PAVING AND RESURFACING SHALL BE IN ACCORDANCE WITH MS STATE HIGHWAY "STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION".

ACCESSIBLE (ADA) PARKING NOTES

HANDICAPPED PARKING AND ACCESS SHALL COMPLY WITH STATE LAW NUMBER 27-19-56 AND S.B.C. APPENDIX M; SIGN SHALL BE BLUE AND BEAR THE INTERNATIONAL ACCESSIBILITY IN WHITE. SIGN SHALL BE 12" X 18" AND MOUNTED ON PERMANENTLY ANCHORED POLES BETWEEN (54") AND (66") IN HEIGHT AND CENTERED AT EACH HANDICAPPED SPACE.

HANDICAP STALLS AND LOADING ZONES SHALL HAVE A MAXIMUM SLOPE OF 2%.

HANDICAP LOADING ZONES FOR CARS SHALL BE 5' WIDE MINIMUM.

HANDICAP LOADING ZONES FOR VANS SHALL BE 8' WIDE MINIMUM.

EACH HANDICAP STALL SHALL HAVE IDENTIFYING SIGN. SIGN SHALL BE 60 INCHES ABOVE GRADE TO BOTTOM OF SIGN.

EACH VAN HANDICAP STALL SHALL HAVE IDENTIFYING SIGN CONTAINING "VAN ACCESSIBLE". THE SIGN SHALL BE 60 INCHES ABOVE GRADE TO BOTTOM OF SIGN.

HANDICAP STALLS SHALL BE CLEARLY MARKED WITH PARKING EMBLEM (INTERNATIONAL SYMBOL OF ACCESSIBILITY)

HARDSCAPE NOTES

HS01. ALL HARDSCAPES INDICATED ARE BY GENERAL CONTRACTOR.

HS03. EXPANSION JOINTS ARE REQUIRED WHERE CONSTRUCTION ADJOINS NEW OR EXISTING SIDEWALKS, PAVEMENTS, BUILDINGS, AND / OR PARKING LOTS.

HS04. EXPANSION JOINTS SHALL BE FORMED OF PRE-FORMED JOINT FILLER CUT TO FULL CROSS-SECTION AND SHALL EXTEND THE WIDTH OF CONSTRUCTION

HS05. CONTROL JOINTS / SCORE PATTERNS SHALL BE PLACED AS INDICATED GRAPHICALLY. IF NO GRAPHIC IS INCLUDED, CONSULT ARCHITECT.

HS06. ALL CONCRETE SHALL BE 3000 PSI, UNLESS NOTED OTHERWISE.

HS11. SIDEWALK CROSS-SLOPES AND LANDINGS SHALL HAVE A MAXIMUM SLOPE OF 2%.

HS12. CONTINUOUS UNINTERRUPTED SIDEWALKS WITHOUT HANDRAILS SHALL NOT HAVE A SLOPE THAT EXCEEDS 5%.

HS13. SIDEWALKS SLEEVES SHALL BE PROVIDED AS INDICATED ON DRAWINGS AND/OR AT LONG SIDEWALK RUNS.

GENERAL NOTES

GN01. IT IS THE GENERAL CONTRACTOR'S RESPONSIBILITY TO DETERMINE THE FULL EXTENT OF THE RESPONSIBILITIES FOR EACH TRADE.

GN02. DRAWINGS INDICATE THE GENERAL SCOPE OF THE PROJECT IN TERMS OF ARCHITECTURAL DESIGN CONCEPT, I.E., THE DIMENSIONS OF THE BUILDING, THE MAJOR ARCHITECTURAL ELEMENTS, AND THE TYPE OF STRUCTURAL SYSTEM. THE DRAWINGS DO NOT NECESSARILY INDICATE OR DESCRIBE ALL WORK REQUIRED FOR FULL PERFORMANCE AND COMPLETION OF THE REQUIREMENTS OF THE CONTRACT. THE GENERAL CONTRACTOR / TRADE CONTRACTORS SHALL PERFORM SUCH SERVICES AND FURNISH ALL ITEMS REQUIRED FOR THE PROPER EXECUTION OF THE PROJECT.

GN03. THE CONTRACTOR SHALL VERIFY THE FLOOR AND ROOF MOUNTED MECHANICAL EQUIPMENT WEIGHTS, FLOOR AND/OR ROOF OPENING SIZES AND LOCATIONS WITH ARCHITECTURAL AND MECHANICAL DRAWINGS.

GN04. ALL MATERIALS STORED WITHIN THE BUILDING SHALL BE NEATLY STACKED AND SHALL NOT INTERFERE WITH OPERATION OF THE FACILITY OR NEARBY TENANTS. DO NOT STORE COMBUSTIBLE MATERIALS ON THE PREMISES FOR A PERIOD LONGER THAN NECESSARY FOR EXECUTION OF THE PROJECT.

GN05. THE CONTRACT DOCUMENTS SHALL NOT INCLUDE SHOP DRAWINGS, VENDOR DRAWINGS, OR ANY MATERIAL PREPARED AND SUBMITTED BY THE CONTRACTOR OR SUBCONTRACTOR.

GN06. NO PROVISION OF ANY REFERENCED STANDARD SPECIFICATION MANUAL OR CODE (WHETHER OR NOT SPECIFICALLY INCORPORATED BY REFERENCE IN THE CONTRACT DOCUMENTS) SHALL BE EFFECTIVE TO CHANGE THE DUTIES AND RESPONSIBILITIES OF OWNER, CONTRACTOR, ARCHITECT, OR SUPPLIER, OR ANY OF THEIR CONSULTANTS, AGENTS OR EMPLOYEES FROM THOSE SET FORTH IN THE CONTRACT DOCUMENTS, NOR SHALL IT BE EFFECTIVE TO ASSIGN TO THE ARCHITECT OF RECORD OR ANY OF THE ARCHITECT OF RECORD'S CONSULTANTS, AGENTS, OR EMPLOYEES ANY DUTY OR AUTHORITY TO SUPERVISE OR DIRECT THE FURNISHING OR PERFORMANCE OF THE WORK OR ANY DUTY OR AUTHORITY TO UNDERTAKE RESPONSIBILITIES CONTRARY TO THE PROVISIONS OF THE CONTRACT DOCUMENTS.

GN07. THE OWNER RETAINS THE RIGHT TO SELECT AND RETAIN ANY ITEMS REMOVED FROM EXISTING SITE AND/OR BUILDING. THE GENERAL CONTRACTOR SHALL DISPOSE OF OTHER ITEMS REMOVED.

GN08. THE GENERAL CONTRACTOR SHALL BE RESPONSIBLE FOR REMOVAL AND LEGALLY DISPOSAL OFF-SITE OF ALL DEBRIS RESULTING FROM THE DEMOLITION AND EXECUTION OF THE WORK.

GN09. THE CONTRACTOR SHALL, AT HIS OWN EXPENSE SHALL PERFORM ALL LAYOUT REQUIRED TO CONSTRUCT PROJECT, PROVIDE COMPETENT ENGINEERING SERVICES TO EXECUTE WORK IN ACCORDANCE WITH CONTRACT REQUIREMENTS, AND SHALL VERIFY FIGURES AS SHOWN ON SURVEY AND APPROACH DRAWINGS BEFORE UNDERTAKING ANY CONSTRUCTION WORK AND WILL BE RESPONSIBLE FOR FINISHED WORK.

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ CSI / MAINTENANCE ■ SOUTH SITE BUILDINGS ■

HPSC South Site Buildings: CSI / Maintenance

Drawing Issued:

Date	Rev.	Description
08-31-2015		DD Check Set
11-19-2018		100% Bid Docs

Drawn By: BHJ

Checked By:

Client No: -------

Architect No:

Donald O. McCleskey — 1995 — Hattiesburg, MS — Registered Architect — State of Mississippi

T1.1

GENERAL NOTES Continued from Sheet T1.1

CONSTRUCTION DOCUMENT NOTES

THE GENERAL CONTRACTOR SHALL VERIFY DIMENSIONS AND SITE CONDITIONS BEFORE INITIATING WORK ON THE PROJECT. THE ARCHITECT SHALL BE NOTIFIED OF ANY DISCREPANCY.

THE CONTRACTOR SHALL NOT SCALE DRAWINGS. IF DIMENSIONS ARE IN QUESTION, THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING CLARIFICATION FROM THE ARCHITECT BEFORE PROCEEDING.

ALL DIMENSIONS ARE NOMINAL UNLESS OTHERWISE NOTED. DO NOT SCALE DRAWINGS, CONTACT ARCHITECT FOR DISPUTED DIMENSIONS.

GENERAL CONTRACTOR AND EACH SUBCONTRACTOR SHALL BECOME FAMILIAR WITH THE PROJECT AND BRING ANY DISCREPANCIES BETWEEN DRAWINGS AND FIELD CONDITION TO THE IMMEDIATE ATTENTION OF THE ARCHITECT.

INFORMATION IN THE CONTRACT DOCUMENTS, IN SOME INSTANCES, ARE TAKEN FROM EXISTING DOCUMENTS AND ON-SITE OBSERVATION. THE GENERAL CONTRACTOR SHALL VERIFY CONDITIONS BEFORE STARTING WORK ON THE PROJECT. THE ARCHITECT SHALL BE NOTIFIED OF ANY DISCREPANCY.

THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING CLARIFICATION FROM THE ARCHITECT BEFORE PROCEEDING.

THE ERROR AND OMISSIONS DESIGN LIABILITY IS LIMITED TO THE COST OF CORRECTING THE DEFICIENCY.

ALL OR PART OF THESE DOCUMENTS WERE GENERATED BY ELECTRONIC MEANS. THE ARCHITECT IS RELYING ON THE ACCURACY OF THE SOFTWARE EMPLOYED. THE ARCHITECT'S LIABILITY IS THEREFORE LIMITED TO THE EXTENT CUSTOMARY IN THE INDUSTRY.

THE CONTRACTOR SHALL NOTIFY IN WRITING THE ARCHITECT OF RECORD OF CONDITIONS ENCOUNTERED IN THE FIELD CONTRADICTORY TO THOSE SHOWN ON THE CONTRACT DOCUMENTS.

CODE NOTES

CN01. MATERIAL, WORKMANSHIP, AND DESIGN SHALL CONFORM TO THE INTERNATIONAL BUILDING CODE, LATEST EDITION.

CN02. REFERENCE TO STANDARD SPECIFICATIONS OF ANY TECHNICAL SOCIETY, ORGANIZATION OR ASSOCIATION OR TO CODES OF LOCAL OR STATE AUTHORITIES, SHALL MEAN THE LATEST STANDARD, CODE, SPECIFICATION OR TENATIVE SPECIFICATION ADOPTED AND PUBLISHED AT THE DATE OF TAKING BIDS, UNLESS SPECIFICALLY STATED OTHERWISE.

CN03. ALL WORK IS TO BE DONE IN ACCORDANCE WITH ALL GOVERNING CODES AND REGULATING AGENCIES. THIS PROJECT IS DESIGNED AND DOCUMENTED PER THE ARCHITECT'S INTERPRETATION OF THE CODE REQUIREMENTS. VARIOUS GOVERNING AGENCIES SOMETIMES INTERPRET THE CODES, LAWS AND ORDINANCES DIFFERENTLY. THESE AGENCIES HAVE JURISDICTION TO REQUIRE CHANGES IN DESIGN AND CONSTRUCTION INCLUDING THOSE AGENCIES INVOLVED WITH THE "AMERICANS WITH DISABILITIES ACT"(ADA)

CN04. ALL WORK UNDER THIS CONTRACT SHALL COMPLY WITH THE PROVISIONS OF THE SPECIFICATIONS AND DRAWINGS AND SHALL SATISFY ALL APPLICABLE CODES, ORDINANCES, A.D.A., AND REGULATIONS OF ALL GOVERNING BODIES INVOLVED. ANY MODIFICATIONS TO THE CONTRACT WORK REQUIRED BY SUCH AUTHORITIES SHALL BE AT THE EXPENSE OF THE OWNER, SUBJECT TO THE RECEIPT OF AN AFFIDAVIT OR LETTER FROM THE GOVERNING BODY AND OWNER'S PRIOR APPROVAL OF ANY ADDITIONAL COST TO BE INCURRED. ALL PERMITS AND LICENSES NECESSARY FOR THE PROPER EXECUTION OF THE WORK SHALL BE SECURED AND PAID FOR BY THE CONTRACTOR INVOLVED. APPLICABLE CODES INCLUDE, BUT ARE NOT LIMITED TO THE FOLLOWING:

FIRE CODE
BUILDING CODE
PLUMBING CODE
MECHANICAL CODE
ELECTRICAL CODE

COPYRIGHT NOTES

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FLOOR PLAN NOTES

ALL PORCHES TO SLOPE AWAY FROM BUILDING

ALL EXTERIOR DOORS TO HAVE METAL THRESHOLDS

FLOOR DRAINS: TAPER FLOOR TO FLOOR DRAINS.

FIRE EXTINGUISHERS: PROVIDE AND INSTALL FIRE EXTINGUISHERS TO BE MOUNTED AS PER INSTRUCTIONS LOCAL FIRE OFFICIAL (SEE ALLOWANCE).

VERIFY RECESSED EQUIPMENT (FIRE EXTINGUISHER CABINETS, DRINK FOUNTAINS, REST ROOM ACCESSORIES, ETC.) TO ACCOMMODATE WALL CONSTRUCTION AND SPACE REQUIREMENTS.

FINISH NOTES

PAINTING: ALL SURFACES TO RECEIVE PAINT SHALL HAVE A PRIME SEALER COAT PLUS TWO (2) FINISH COATS. REPAIR/SEAL ALL SURFACES ON INTERIOR WHERE IMPERFECTIONS OCCUR BEFORE PAINTING. OWNER TO HAVE UNLIMITED CHOICE OF COLORS IN ALL AREAS REQUIRING PAINTING OR STAINING.

PAINT ALL EXPOSED STEEL, INCLUDING COLUMNS, RAILINGS, STRINGERS, AND RISER BACKS ON STAIRS.

ALL INTERIOR WALLS OF BUILDING TO RECEIVE PAINT EQUAL TO SHERWIN WILLIAMS "PRO-MAR 200", EGGSHELL FINISH, UNLESS NOTED DIFFERENTLY. APPLY PER MANUFACTURER'S RECOMMENDATIONS

FURRING: ALL FURRING NECESSARY TO COVER PIPES, DUCTS, COLUMNS, ETC. IN FINISHED AREAS SHALL BE FURNISHED AND INSTALLED BY GENERAL CONTRACTOR W/MATERIALS TO MATCH ADJACENT AREAS.

TERMITE TREATMENT: GENERAL CONTRACTOR SHALL BE RESPONSIBLE FOR TERMITE TREATMENT (SEE SPECIFICATIONS).

DOOR / WINDOW NOTES:

ALL VIEW PANELS TO HAVE 1/4" SAFETY GLASS (EXCEPT WHERE NOTED)

ALL SIDE LIGHTS TO HAVE 1/4" SAFETY GLASS (TEMPERED GLASS)

DOORS TO BE STAINED, FINISHED NATURAL OR PAINTED AS SELECTED BY OWNER

PROVIDE WEATHER STRIPPING & SWEEP STRIPS ON ALL EXTERIOR DOORS - SEE SPECS (WEATHER- STRIPPING TO BE IN HARDWARE ALLOWANCE)

ALL EXTERIOR DOORS TO HAVE METAL THRESHOLDS.

PANIC HARDWARE: CONTRACTOR IS TO PROVIDE AND INSTALL PANIC HARDWARE ON EXTERIOR EXIT DOORS. PANIC HARDWARE TO BE PROVIDED BY DOOR MANUFACTURER.

INSTALL DRIP CAP AT ALL DOORS DIRECTLY EXPOSED TO WEATHER

MASTIC AIR VAPOR BARRIER MEMBRANE AT WINDOWS SHALL BE "NERVASTRAL" 20 MIL.

LINTELS: PROVIDE AND INSTALL LINTELS AS REQUIRED AT ALL OPENINGS (WINDOWS, DOORS, ETC.), PAINT ALL EXPOSED LINTELS TO MATCH BRICK UNLESS NOTED DIFFERENTLY.

LINTEL SCHEDULE:

- ∠ 4" x 3 1/2" x 5/16" -------- (0-4' OPENINGS)
- ∠ 5" x 3 1/2" x 5/16" -------- (4'-6' OPENINGS)
- ∠ 6" x 3 1/2" x 5/16" -------- (6'-8' OPENINGS)

CMU WALL: EXPOSED CMU BLOCK WALL TO BE STACKED BOND.

PROVIDE TRUSS-TYPE MASONRY REINFORCING @ 16" O.C., TYPICAL ALL CMU WALLS.

RESTROOM NOTES:

MIRRORS ARE TO BE MOUNTED 36" HIGH FOR THE LENGTH OF THE VANITY, EXCEPT WHERE NOTED DIFFERENTLY. SEE ARCHITECTURAL PLANS FOR LENGTHS OF VANITY TOPS.

PROVIDE BLOCKING BEHIND ALL TOILET ACCESSORIES AND OTHER WALL MOUNTED ITEMS AS REQUIRED AND AS RECOMMENDED BY MANUFACTURER.

DOORS AND PARTITIONS: SOLID PLASTIC 1" PANEL (SOLID HDPE CONSTRUCTION), FLOOR MOUNTED, HEADRAIL BRACED (EXTRUDED ALUM.). 55" HEIGHT STANDARD CONTINUOUS PLASTIC BRACKETS & PLASTIC SHOES. PROVIDE COAT HOOK, LATCHES & PULLS. PROVIDE 8" ALUM. WRAP AROUND HINGES, ALUM. LATCH & ALUM. STRIKE.

BATHROOM ACCESSORIES NOTES:

CONTRACTOR IS TO PROVIDE AND INSTALL PAPER TOWEL DISPENSER EQUAL TO "BRADLEY" MODEL #250-15.

CONTRACTOR IS TO PROVIDE AND INSTALL TOILET TISSUE DISPENSER EQUAL TO "BRADLEY" MODEL #5402 AT WATER CLOSET (SURFACE MOUNTED DUAL ROLLS) AS PER ADA EQUIREMENTS.

CONTRACTOR IS TO PROVIDE AND INSTALL SOAP DISPENSER EQUAL TO "BRADLEY" MODEL #6562 AT LAVATORY PER ADA GUIDELINES.

CONTRACTOR IS TO PROVIDE AND INSTALL WASTE RECEPTACLE EQUAL TO "BRADLEY" MODEL #356.

ADA MIRROR SHALL BE TILTED FORWARD AT ADA ACCESSIBLE LAVATORY, EQUAL TO BRADLEY MODEL #740, STAINLESS STEEL CHANNEL FRAMED MIRRORS.

CONTRACTOR IS TO PROVIDE AND INSTALL MIRROR EQUAL TO BRADLEY MODEL #740, STAINLESS STEEL CHANNEL FRAMED MIRRORS.

ACCESSIBILITY (ADA) NOTES

TOILET AREA FOR HANDICAPPED: SPECIFIED WATER CLOSETS SHALL RECEIVE HANDRAILS AND SHALL MEET ADA STANDARDS.

TOILET GRAB BARS FOR HANDICAPPED: HORIZONTAL POSITION TO BE 33" - 36" ABOVE FINISH FLOOR TO THE TOP OF THE GRAB BAR(ADA 609.4). GRAB BARS SHALL BE ROUNDED AND FREE OF ABRASIVE ELEMENTS. GRAB BARS SHALL NOT ROTATE WITHIN THEIR FITTINGS.

TOILET PAPER DISPENSERS: DISPENSERS ARE TO BE MOUNTED 7" to 9" IN FRONT OF THE WATER CLOSET TO CENTERLINE OF THE DISPENSER AND 15" TO 48" ABOVE THE FINISH FLOOR TO TOP OF DISPENSER (ADA 604.7). DISPENSER SHALL NOT INTERFERE WITH GRAB BAR.

URINALS SHALL HAVE RIM AT 17" MAXIMUM ABOVE FINISH FLOOR (ADA 605.2).

MIRRORS AT LAVATORIES AND COUNTERTOPS SHALL BE MOUNTED WHERE THE BOTTOM OF THE MIRROR IS 40" MAXIMUM ABOVE FINISH FLOOR (ADA 603.3).

SHOWER NOTES:

SHOWER WATERPROOFING: WATERPROOFING SHALL BE EQUAL TO SHERWIN WILLIAMS "TOTAL GUARD BWB" (BULK WATER BARRIER) APPLIED AT MINIMUM 1/8" THICK. FINISH TOPCOAT TO BE EQUAL TO SHERWIN WILLIAMS "MACRO-POXY 646". INSTALL IN ACCORDANCE TO MANUFACTURERS RECOMMENDATIONS. TYPICAL ALL SHOWERS.

ALL SHOWER CEILINGS TO BE MOISTURE RESISTANT

CONTRACTOR IS TO PROVIDE AND INSTALL TOWEL BAR AT 40" to 48" ABOVE FINISH FLOOR.

CONTRACTOR IS TO PROVIDE AND INSTALL COLLAPSIBLE WATER RETAINER (SHOWER DAM FOR SHOWER THRESHOLD) AT HANDICAP SHOWER ENTRANCE, EQUAL TO "ACCESSIBLE DESIGN AND CONSULTING, INC."

SHOWER ACCESSORIES NOTES:

SHOWER CURTAIN ROD: CONTRACTOR IS TO PROVIDE AND INSTALL SHOWER CURTAIN ROD EQUAL TO "BRADLEY" MODEL #9531, SATIN FINISH STAINLESS STEEL 18 GA. AT ALL SHOWERS. VERIFY SIZE.

SHOWER CURTAIN: CONTRACTOR IS TO PROVIDE AND INSTALL SHOWER CURTAIN EQUAL TO "BRADLEY" MODEL #9537 ANTI-BACTERIAL WHITE AT ALL SHOWERS. VERIFY SIZE.

SHOWER CURTAIN HOOKS: CONTRACTOR IS TO PROVIDE AND INSTALL SHOWER CURTAIN HOOKS EQUAL TO "BRADLEY" MODEL #9536 AT ALL SHOWERS.

SHOWER ACCESSORIES NOTES:

SHOWER CURTAIN ROD: CONTRACTOR TO MOUNT ROD ON INSIDE WALL SURFACE OF SHOWER OPENING. CURTAIN ROD TO BE 1-1/4" DIA. STAINLESS STEEL W/SATIN FINISH, EQUAL TO "BOBRICK" B-6047. PROVIDE ROD FLANGES & BRACKETS TO MOUNT TO CONC. BLK.

HANDICAP SHOWER SEAT: EQUAL TO "BOBRICK" B-518 (FOLDING SHOWER SEAT) TO BE 32" LONG, 22" DEEP AND MOUNTED 18" A.F.F.

SHOWER CURTAIN HOOKS: EQUAL TO "BOBRICK" B-204-1

SHOWER CURTAIN: EQUAL TO "BOBRICK" B-204-3

TYP. SHOWER SEAT: EQUAL TO "BOBRICK" B-519 TO BE 18" LONG, 15" DEEP AND MOUNTED 18" A.F.F..

WASTE RECEPTACLE TO BE EQUAL TO "BOBRICK" WASHROOM EQUIPMENT, INC. #0828 @ EACH PAPER TOWEL DISPENSER

STAIR NOTES:

MINIMUM RISER HEIGHT: 7 INCHES
MAXIMUM TREAD DEPTH : 11 INCHES
MINIMUM HEAD ROOM: 6'-8" CLEAR
MINIMUM WIDTH: 44"
MINIMUM WIDTH: 36 INCHES (OCCUPANT LESS THAN 50) (IBC 1009.1)

STAIR HANDRAIL NOTES:

SH01. HANDRAILS SHALL BE INSTALLED ON BOTH SIDES OF STAIRS.

SH02. HANDRAIL HEIGHT SHALL BE UNIFORM ABOVE TREAD NOSING AND FINISHED SURFACE.

SH03. HANDRAILS SHALL BE MOUNTED BETWEEN 34" AND 38" ABOVE TREAD NOSING, LANDING, AND/OR FINISHED SURFACE.

SH04. HANDRAILS SHALL BE 1.25" TO 2" DIAMETER.

SH05. HANDRAILS SHALL EXTEND 12" HORIZONTALLY ABOVE THE TOP RISER AND CONTINUE TO SLOPE FOR THE DEPTH OF ONE TREAD BEYOND THE BOTTOM RISER.

SH06. HANDRAILS SHALL HAVE MINIMUM CLEARANCE OF 1.5" BETWEEN WALL AND HANDRAIL

SH07. HANDRAIL ASSEMBLIES SHALL RESIST A LOAD OF 50 POUNDS PER LINER FOOT AND SINGLE CONCENTRATED MINIMUM LOAD OF 200 POUNDS.

SH08. HANDRAILS SHALL BE WITHIN 30 INCHES OF ANY PORTION OF STAIR.

NOTE: ALL EXTERIOR EAVE TRIMS, INCLUDING FASCIA AND FRIEZE BOARDS, SOFFITS, AND CEILING SYSTEMS (INCLUDES PORCHES AND ENTRY CANOPIES) TO BE EQUAL "ALCOA" PRE-FINISHED ALUMINUM .040. NOTE ALL SOFFITS TO BE VENTILATED IN ACCORDANCE TO MANUFACTURER'S RECOMMENDATIONS.

SO2. PROVIDE BRICK WALL TIES AT 16" O.C. TYPICAL.
SO3. PROVIDE 1 INCH MINIMUM AIR SPACE BETWEEN BRICK AND SHEATHING

SO4. PROVIDE WEEP HOLES @ 48 INCHES O.C.

SO5. PROVIDE CONTINUOUS FLASHING
SO6. SLOPE GRADE AWAY FROM BUILDING

GUARDRAIL NOTES:

GUARDS SHALL BE LOCATED ALONG OPENINGS THAT ARE MORE THAN 30 INCHES ABOVE THE FLOOR OR FINISH GRADE BELOW.

GUARDS SHALL BE 42 INCHES MINIMUM HEIGHT.

GUARDS SHALL NOT ALLOW A 4 INCH DIAMETER SPHERE PASS THROUGH ANY OPENING TO A HEIGHT OF 34 INCHES. FROM 34 INCHES TO 42 INCHES AN 8 INCH SPHERE SHALL NOT PASS.

MILLWORK NOTES:

MILLWORK: ALL MILLWORK (CABINETS, SHELVES ...) INDICATED IN CONSTRUCTION DOCUMENTS, TO BE PROVIDED AND INSTALLED BY GENERAL CONTRACTOR.

1. SEE MILLWORK ELEVATIONS FOR DRAWER AND CABINET CONFIGURATIONS.
2. PROVIDE KV #1300 DRAWER SLIDES FOR ALL DRAWERS.
3. ALL CABINET HARDWARE TO BE - (PULLS EQUAL TO STANLEY #4484 W/ #4487 BASES. HINGES EQUAL TO STANLEY #1592 -1 W/SP46 MAGNETIC CATCHES).
4. CAULK BETWEEN ALL COUNTER TOPS & BACK SPLASHES. CAULK BETWEEN ALL BACK SPLASHES & WALLS
5. CLOSET SHELVING: ALL CLOSET SHELVES SHALL BE CUSTOM WIRE SHELVING SYSTEMS WITH SHELF HANGING ROD EQUAL TO "RYLEX" CLOSET SYSTEMS.

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CSI / Maintenance

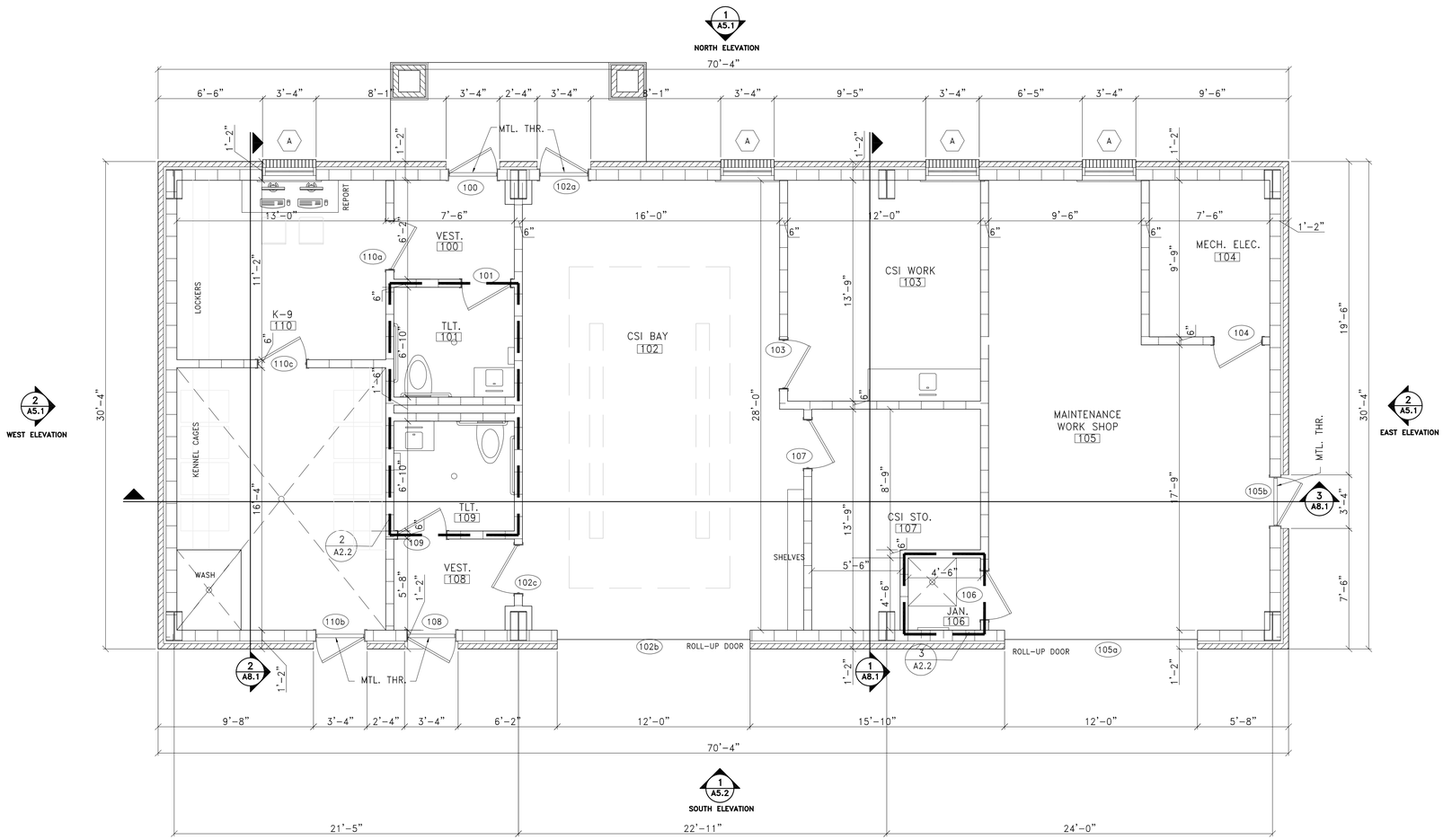
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Checked By:
Client No: ------
Architect No:

Donald O. McCleskey 1995 Hattiesburg, MS

T1.2



1 Floor Plan (BLDG. A)

SCALE: 1/4"=1'-0"

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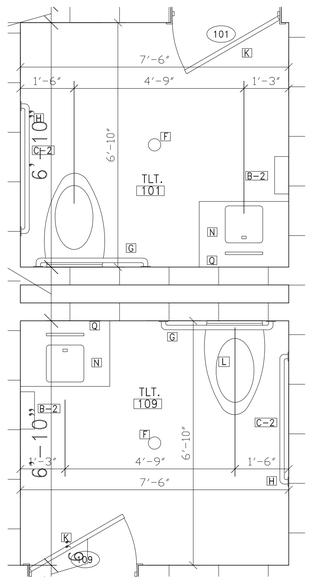
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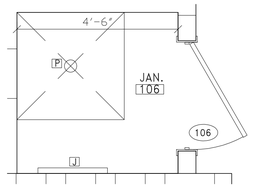
Donald O. McCleskey 1998 Hattiesburg, MS

A2.1



Bathroom Accessory Key

- B-2 SEMI-RECESSED TOWEL DISPENSER/WASTE RECEPTACLE
- C-2 PARTITION MOUNT TOILET TISSUE DISPENSER
- G 32" GRAB BAR
- H 42" GRAB BAR
- J MOP & BROOM HOLDER
- K COAT HOOK
- L TOILET RE: MECHANICAL
- N LAVATORY RE: MECHANICAL
- P MOP SINK RE: MECHANICAL
- Q MIRROR
- R SHOWER RE: MECHANICAL
- F FLOOR DRAIN RE: MECHANICAL



2 BLDG. A
Enlarged Restroom Plan
SCALE: 1/2"=1'-0"

3 BLDG. A
Enlarged Janitor Clo. Plan
SCALE: 1/2"=1'-0"

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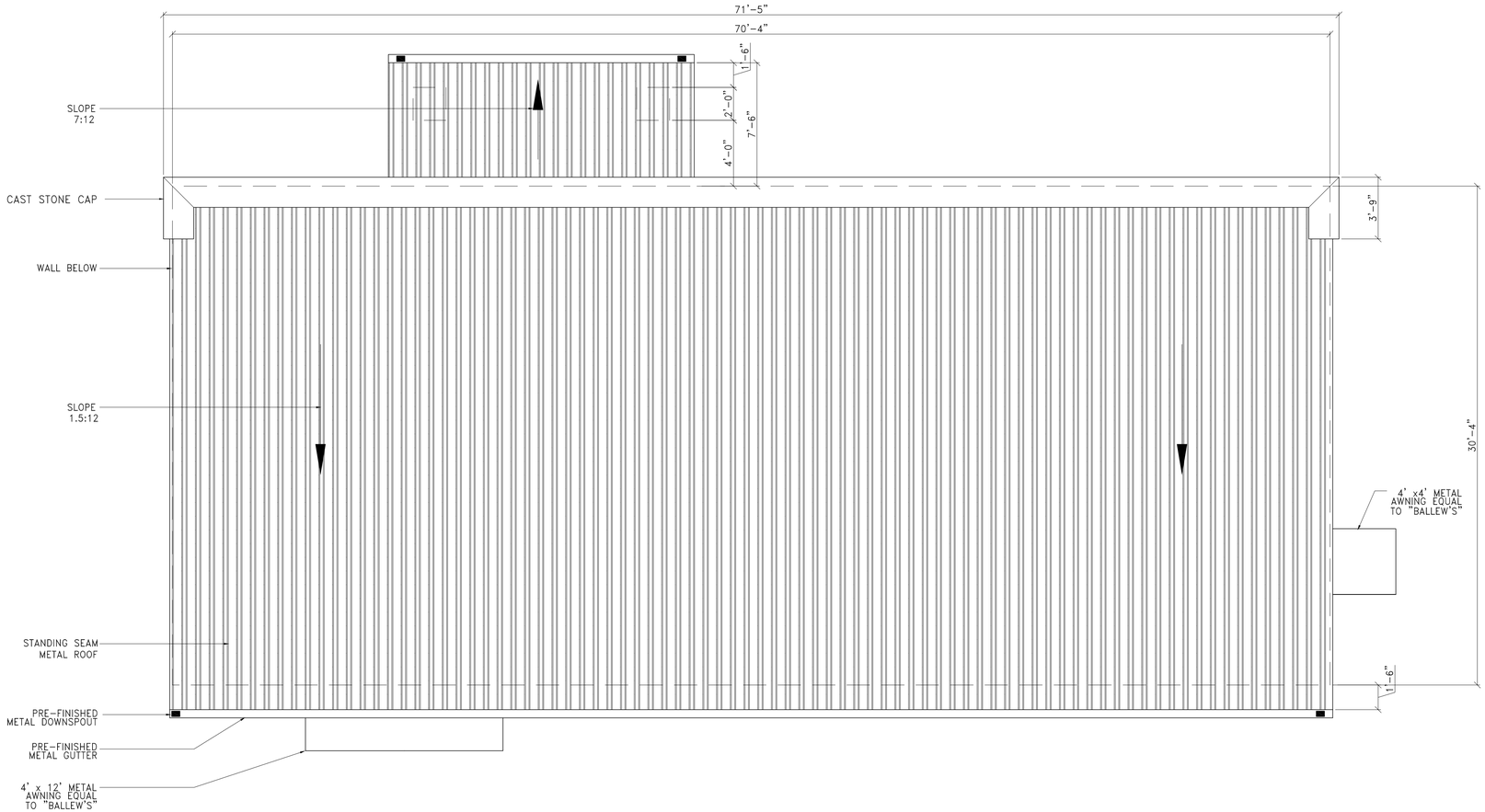
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Architect No:

REGISTERED ARCHITECT Donald O. McCleskey 1998 Hattiesburg, MS STATE OF MISSISSIPPI

A2.2



1 Roof Plan (BLDG. A)

SCALE: 1/4"=1'-0"

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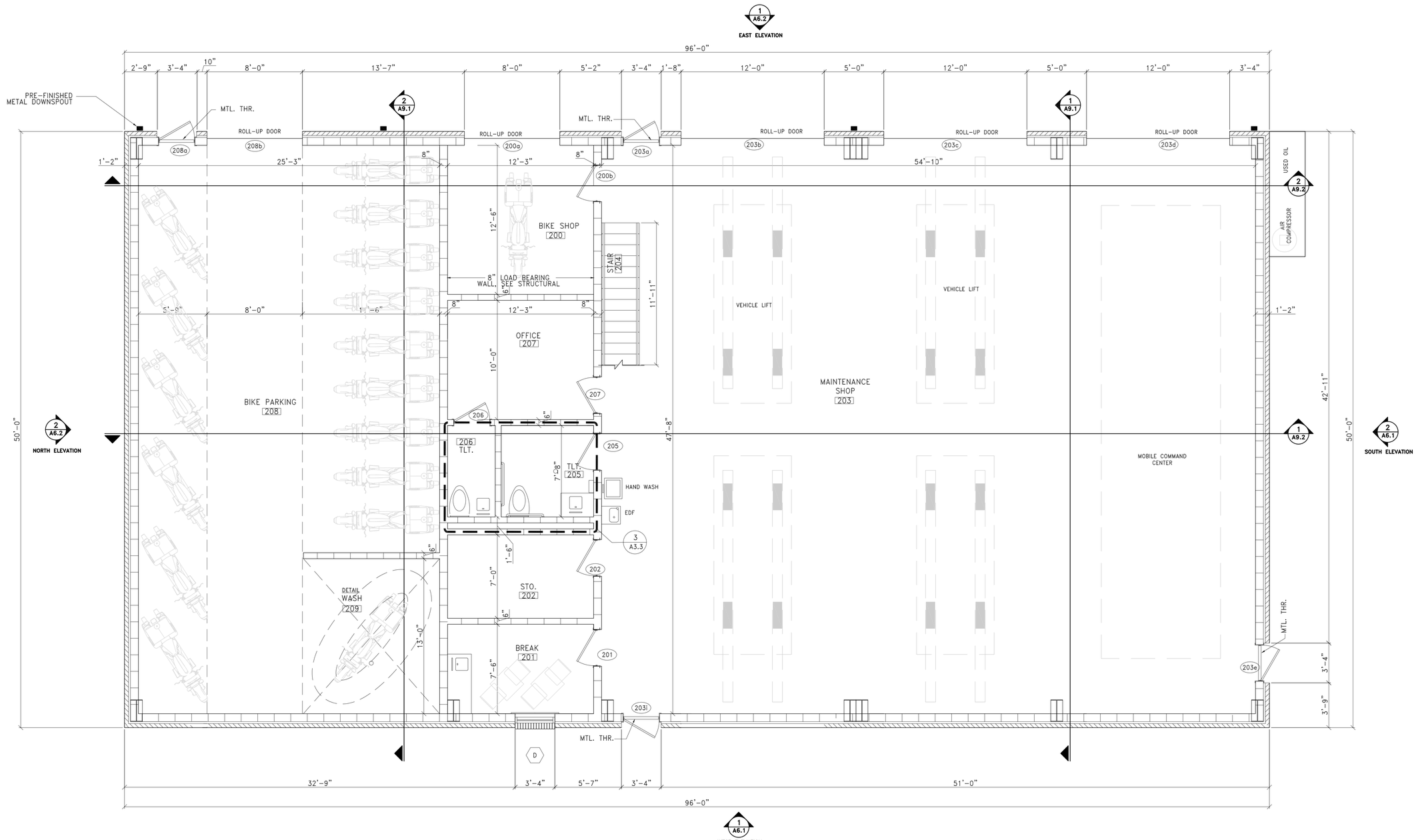
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Architect No:

REGISTERED ARCHITECT Donald O. McCleskey 1998 Hattiesburg, MS

A2.3

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Floor Plan (Bldg. B)

SCALE: 1/4"=1'-0"

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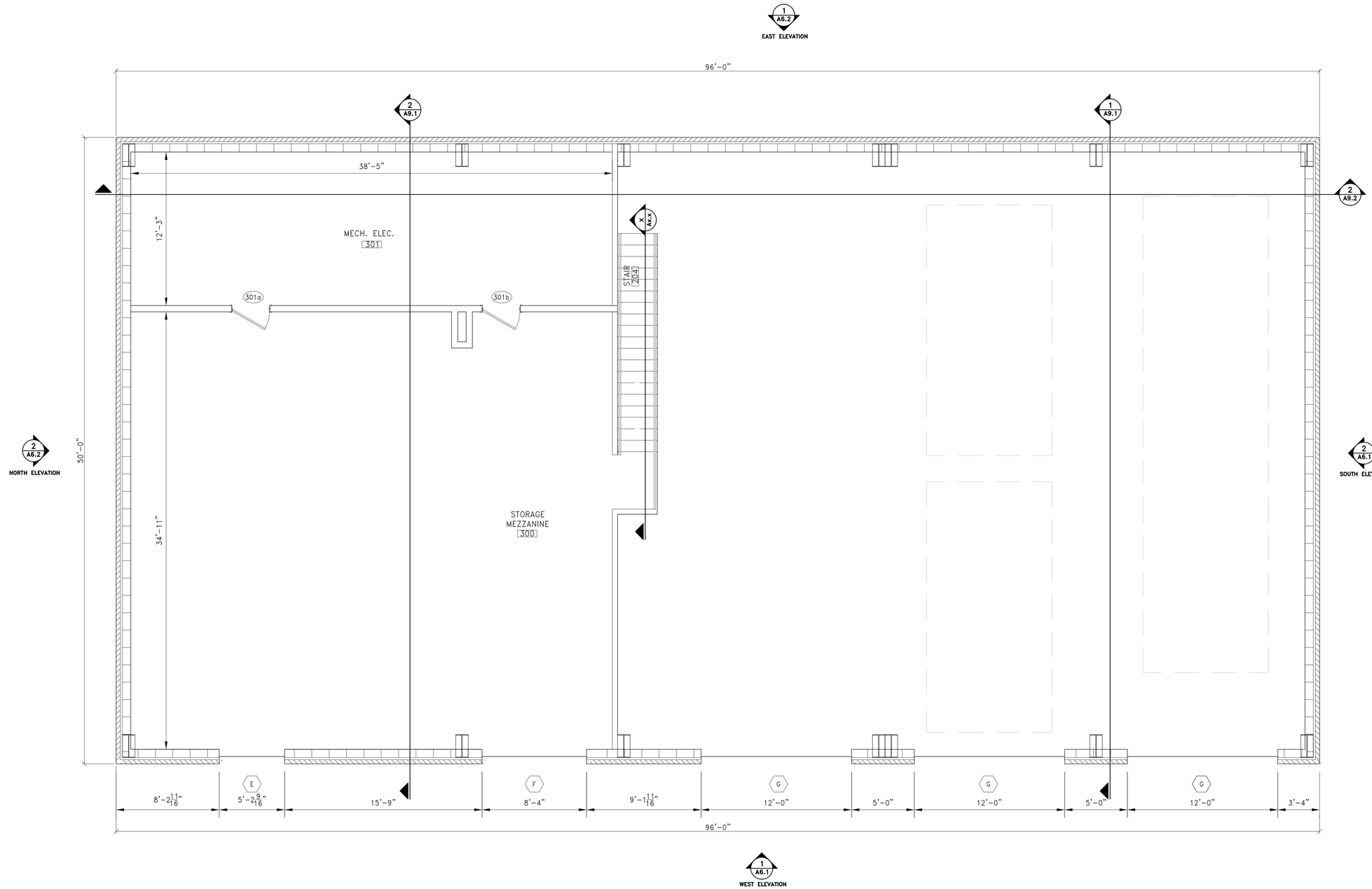
Client No: ------

Architect No:

Donald O. McCleskey 1998 Hattiesburg, MS

A3.1

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Storage Mezzanine Plan (Bldg. B)

SCALE: 1/4"=1'-0"

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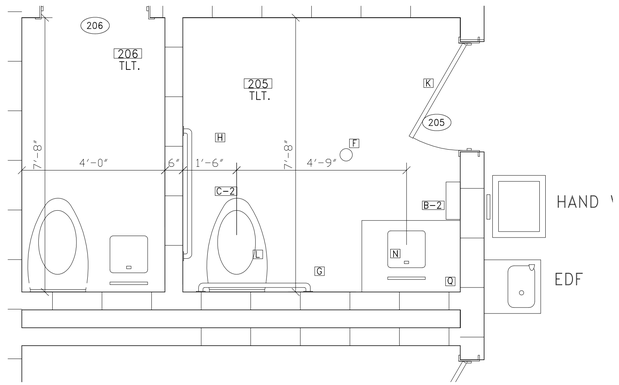
Donald O. McCleskey, Architect, 1995, Hattiesburg, MS

A3.2

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Bathroom Accessory Key

B-2 SEMI-RECESSED TOWEL DISPENSER/WASTE RECEPT
C-2 PARTITION MOUNT TOILET TISSUE DISPENSER
G 32" GRAB BAR
H 42" GRAB BAR
J MOP & BROOM HOLDER
K COAT HOOK
L TOILET RE: MECHANICAL
N LAVATORY RE: MECHANICAL
P MOP SINK RE: MECHANICAL
Q MIRROR
R SHOWER RE: MECHANICAL
F FLOOR DRAIN RE: MECHANICAL



3 Enlarged Restroom Plan (Bldg. B)
SCALE: 1/2"=1'-0"

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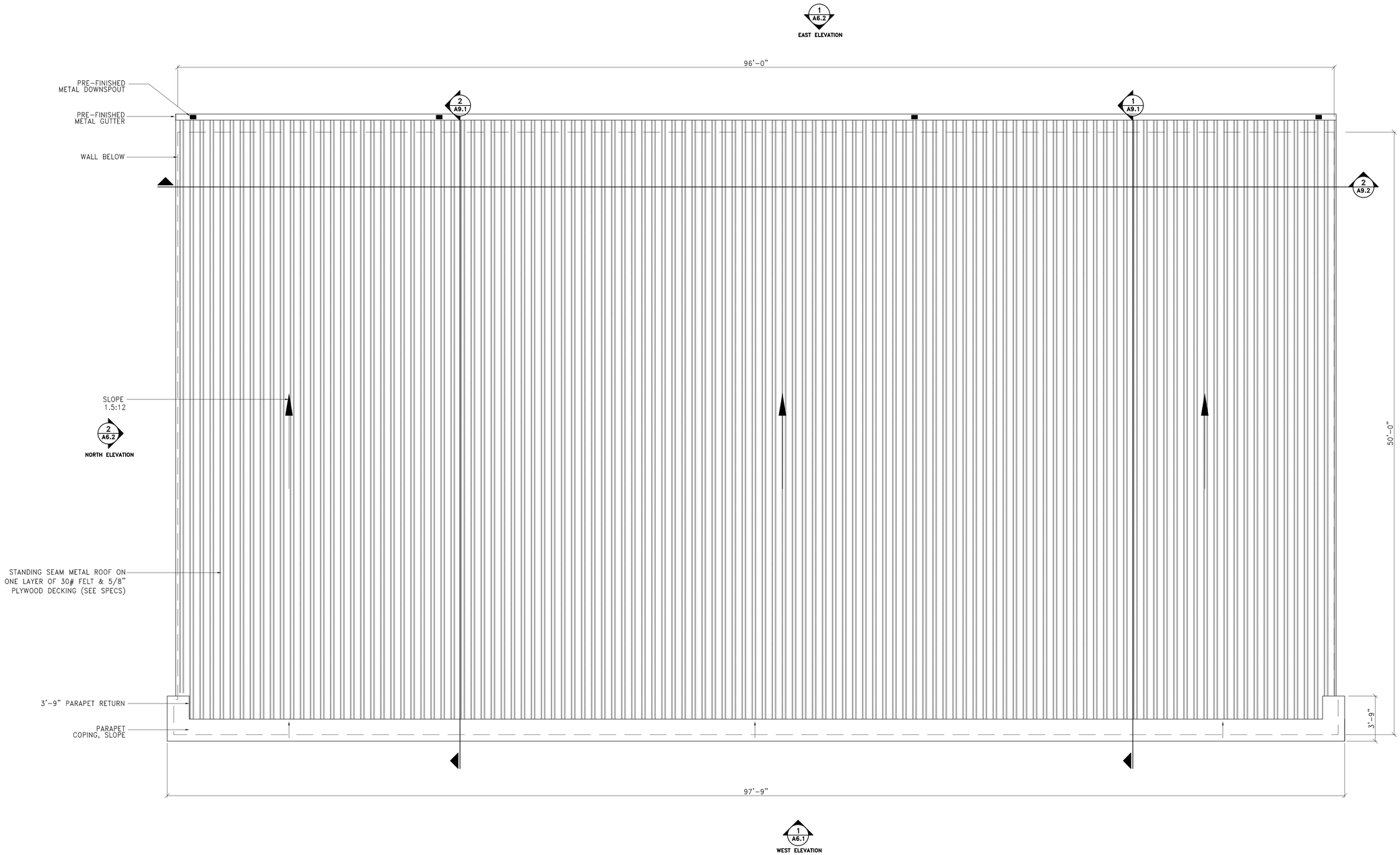
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A3.3



Roof Plan (Bldg. B)

SCALE: 1/4"=1'-0"

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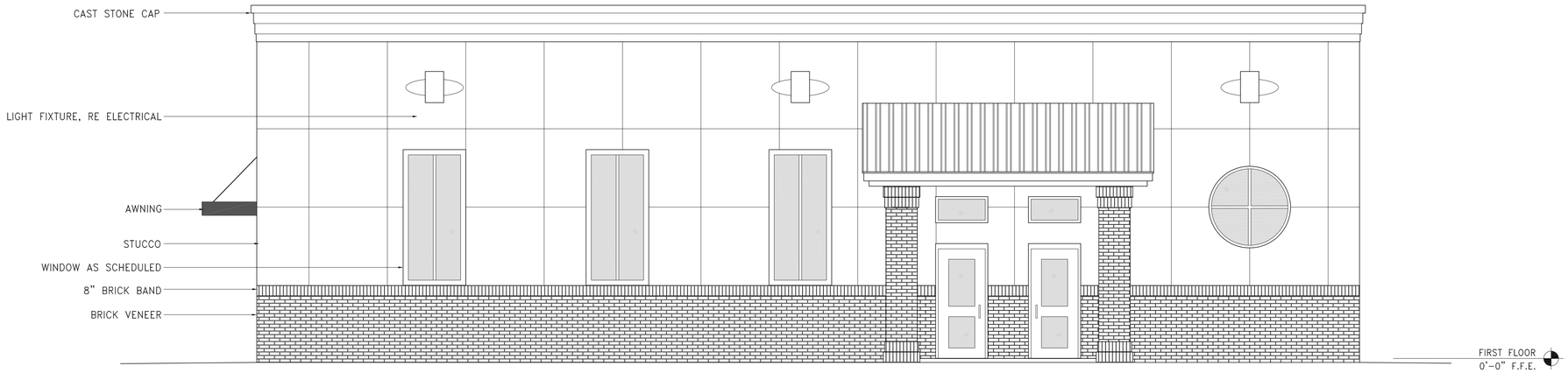
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Architect No:

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1995
Hattiesburg, MS

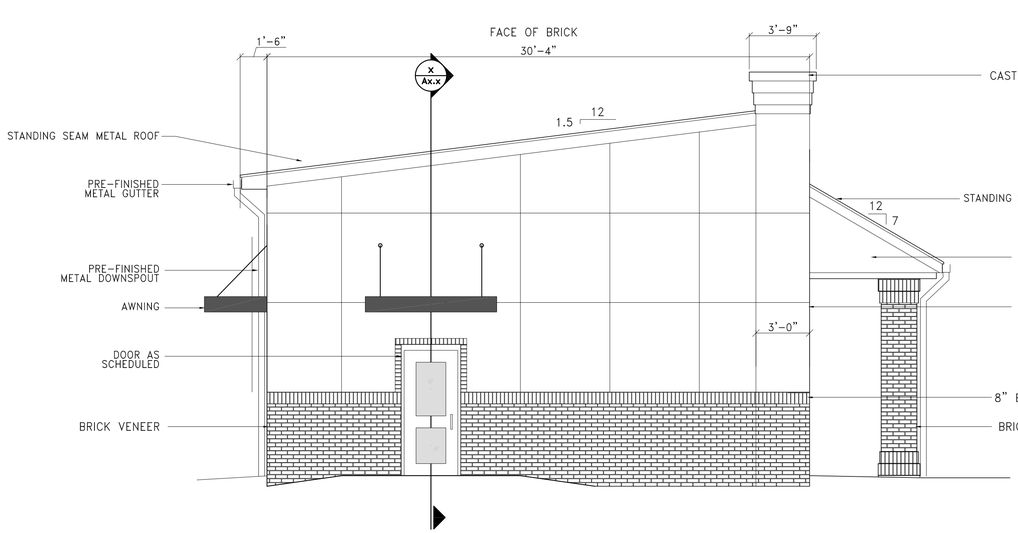
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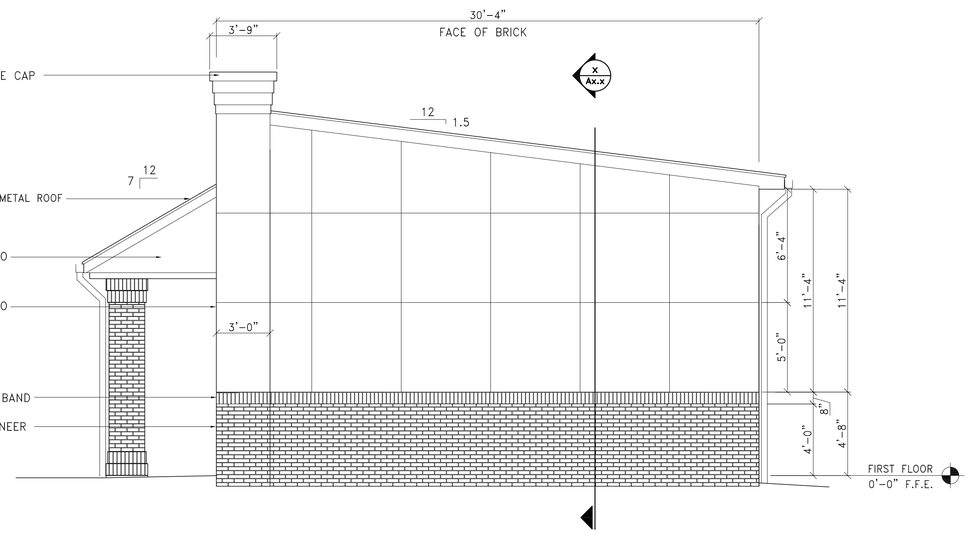
1 North Elevation (BLDG. A)

SCALE: 1/8"=1'-0"



2 East Elevation (BLDG. A)

SCALE: 1/8"=1'-0"



3 West Elevation (BLDG. A)

SCALE: 1/8"=1'-0"

CITY OF HATTIESBURG MISSISSIPPI

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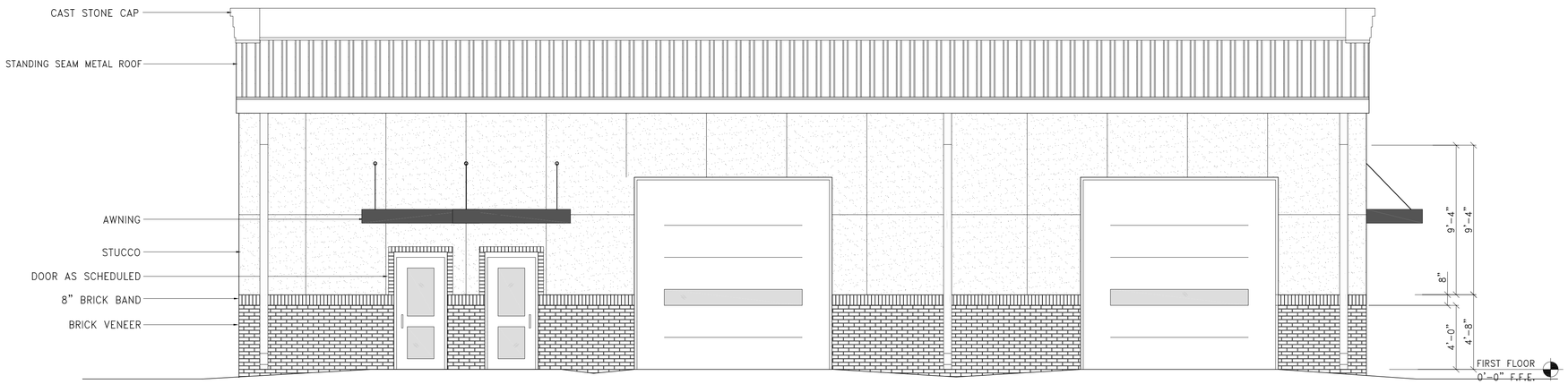
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Architect No:

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A5.1

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1 South Elevation (BLDG. A)

SCALE: 1/8"=1'-0"

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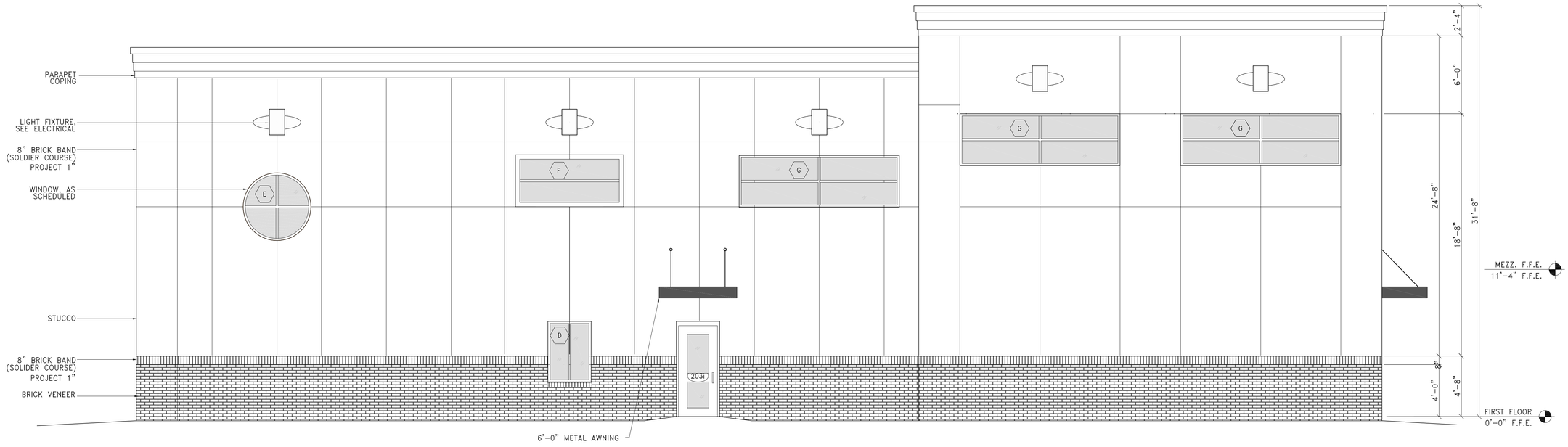
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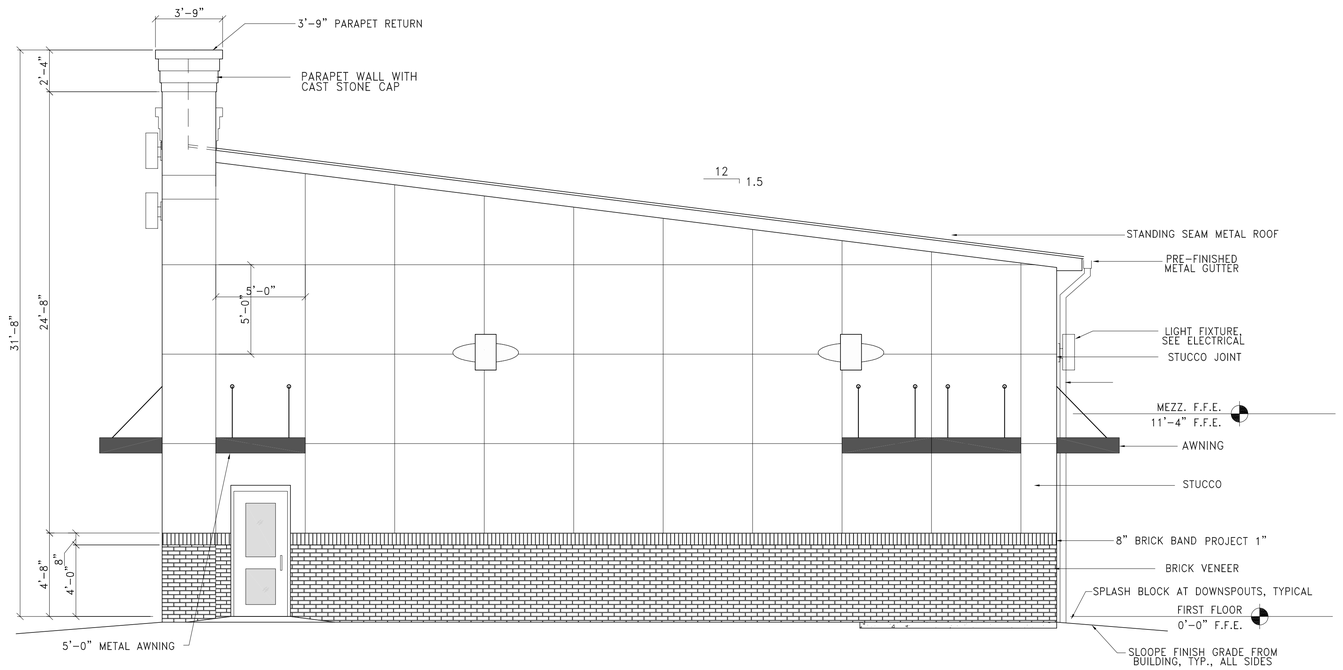
A5.2

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1 West Elevation (Bldg. B)

SCALE: 1/4"=1'-0"



2 South Elevation (Bldg. B)

SCALE: 1/4"=1'-0"

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ SOUTH SITE BUILDINGS ■ CSI / MAINTENANCE

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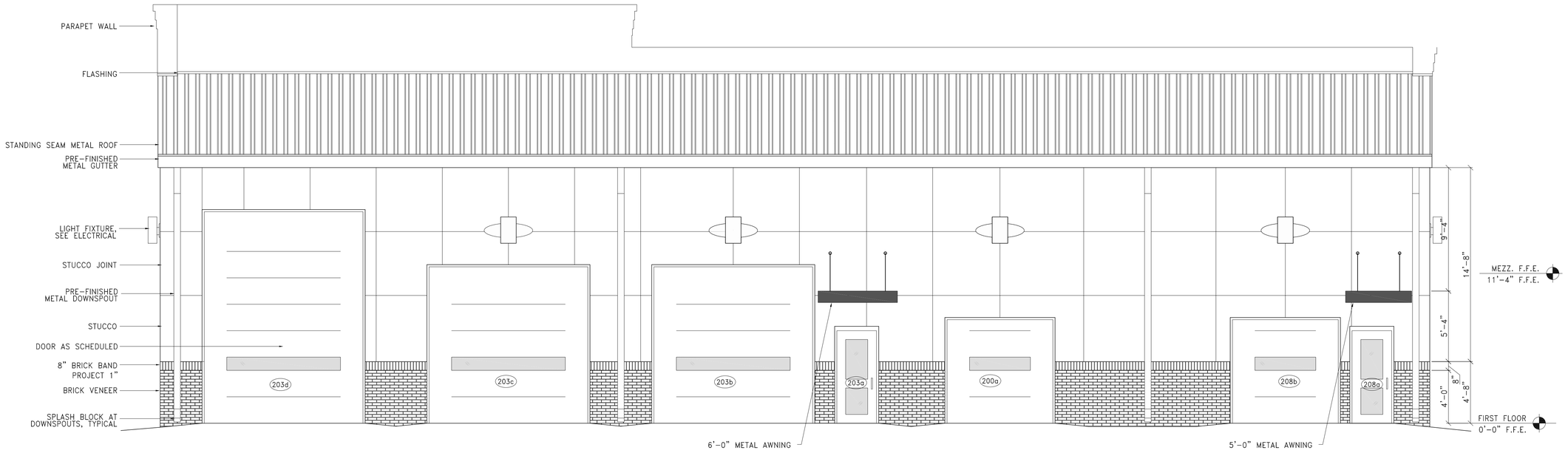
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Architect No:

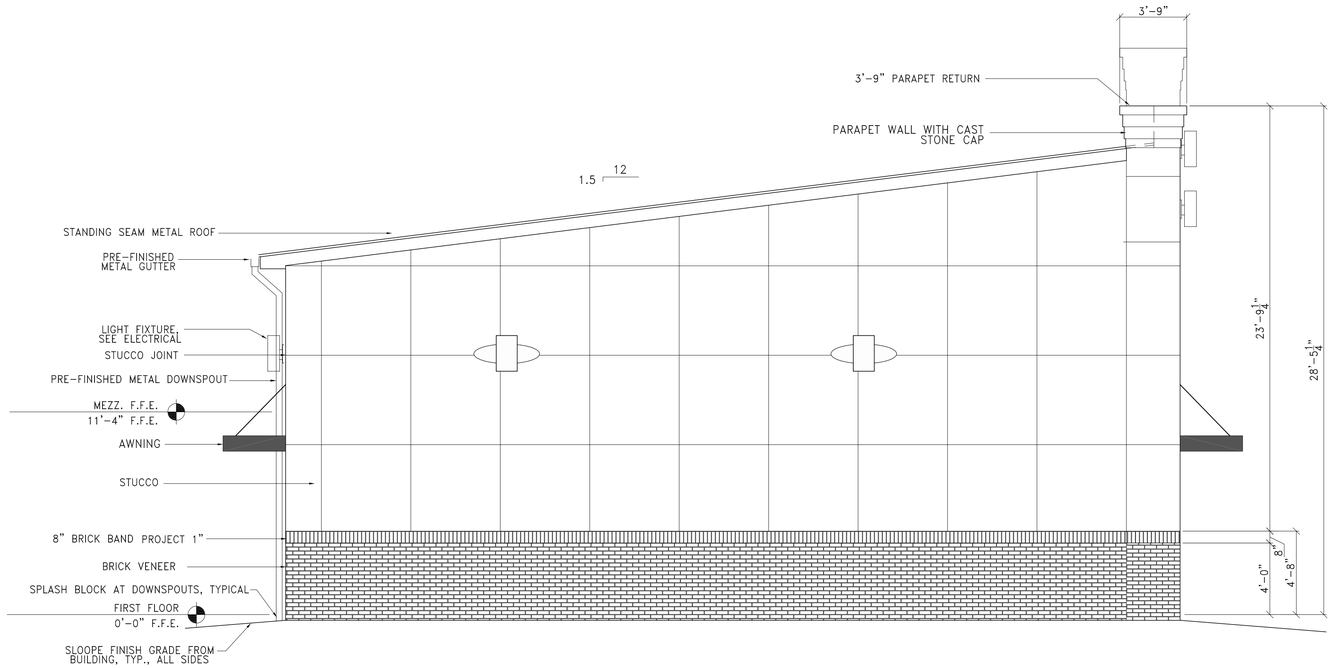
Donald O. McCleskey 1998 Hattiesburg, MS

A6.1



1 East Elevation (Bldg. B)

SCALE: 1/4"=1'-0"



2 North Elevation (Bldg. B)

SCALE: 1/4"=1'-0"

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ SOUTH SITE BUILDINGS ■ CSI / MAINTENANCE

HPSC South Site Buildings: CSI / Maintenance

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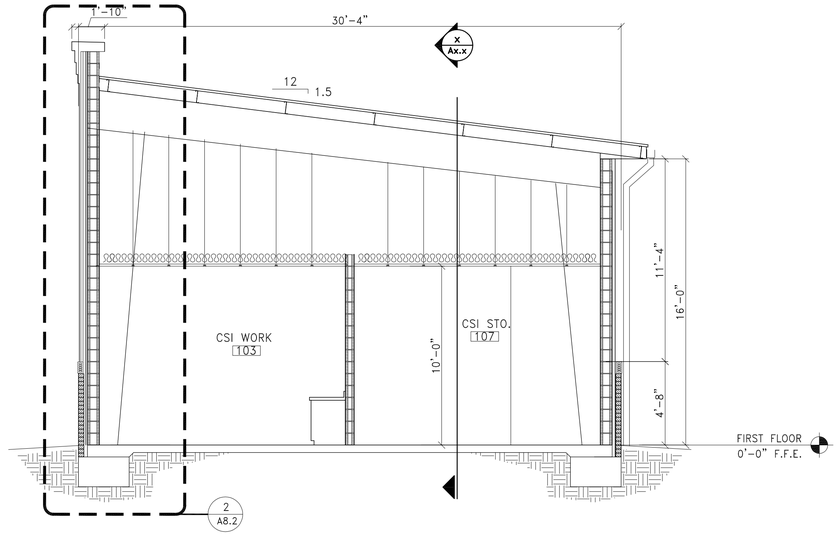
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Architect No:

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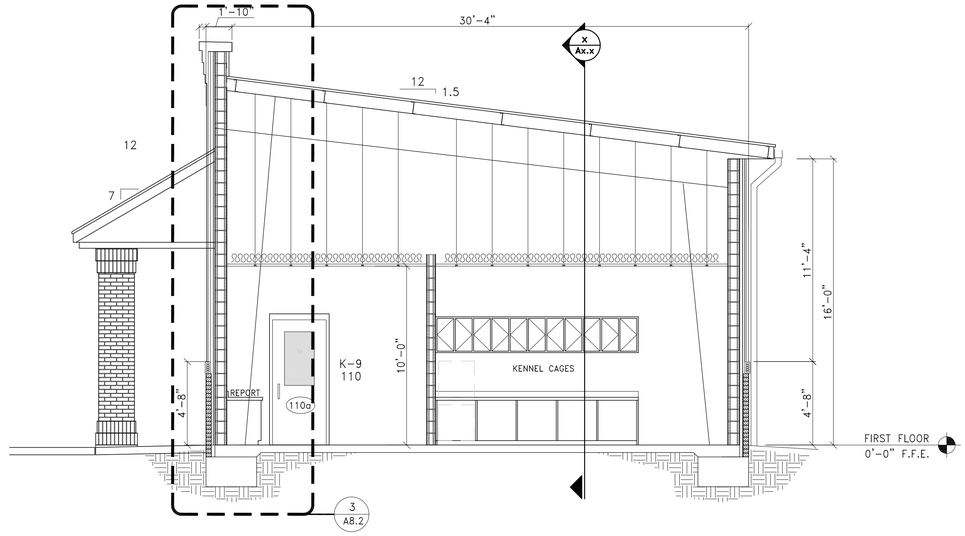
A6.2

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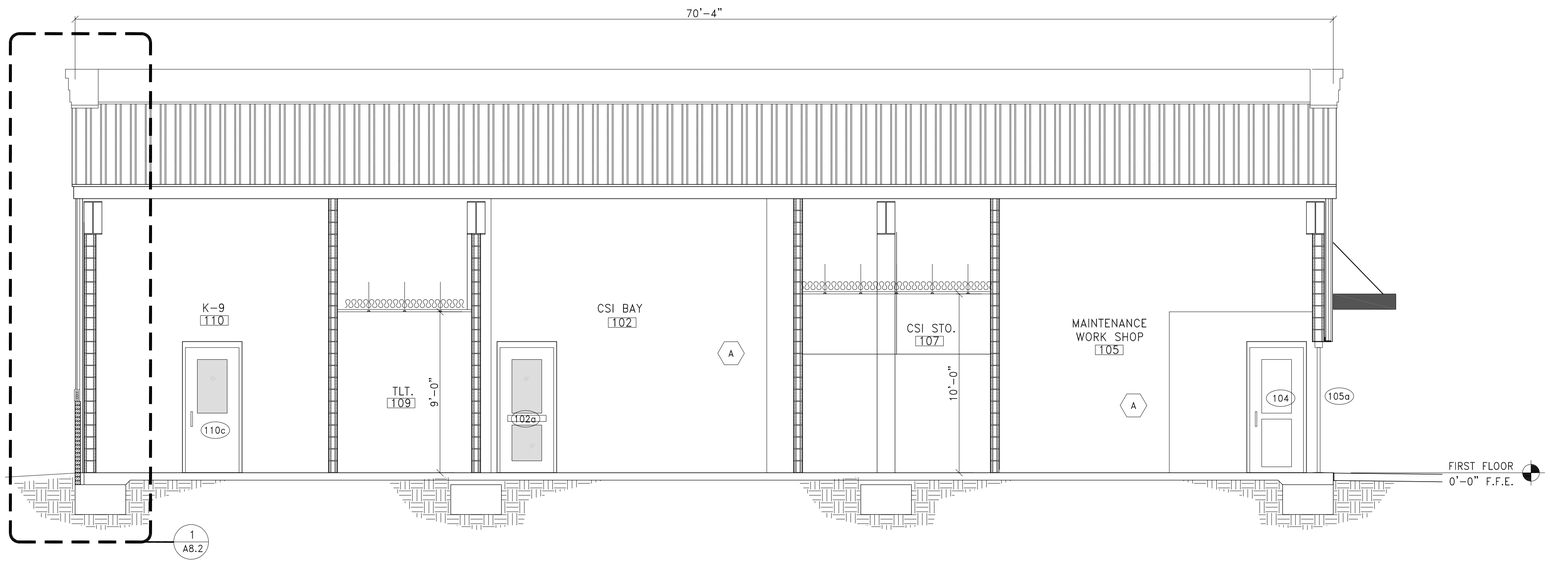
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SCALE: 1/4"=1'-0"



2 Building Section (BLDG. A)

SCALE: 1/4"=1'-0"



3 Building Section (BLDG. A)

SCALE: 1/4"=1'-0"

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ CSI / MAINTENANCE

SOUTH SITE BUILDINGS ■

HPSC South Site Buildings: CSI / Maintenance

Drawing Issued:

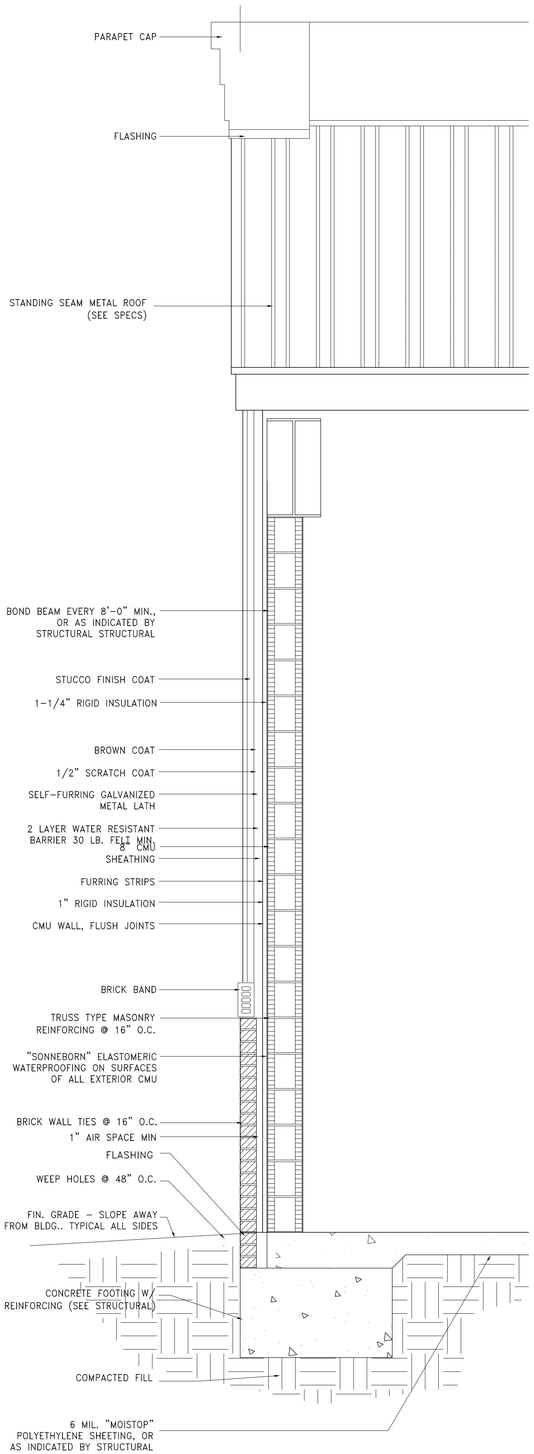
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Client No:	-------
Architect No:	

Donald O. McCleskey 1998 Hattiesburg, MS

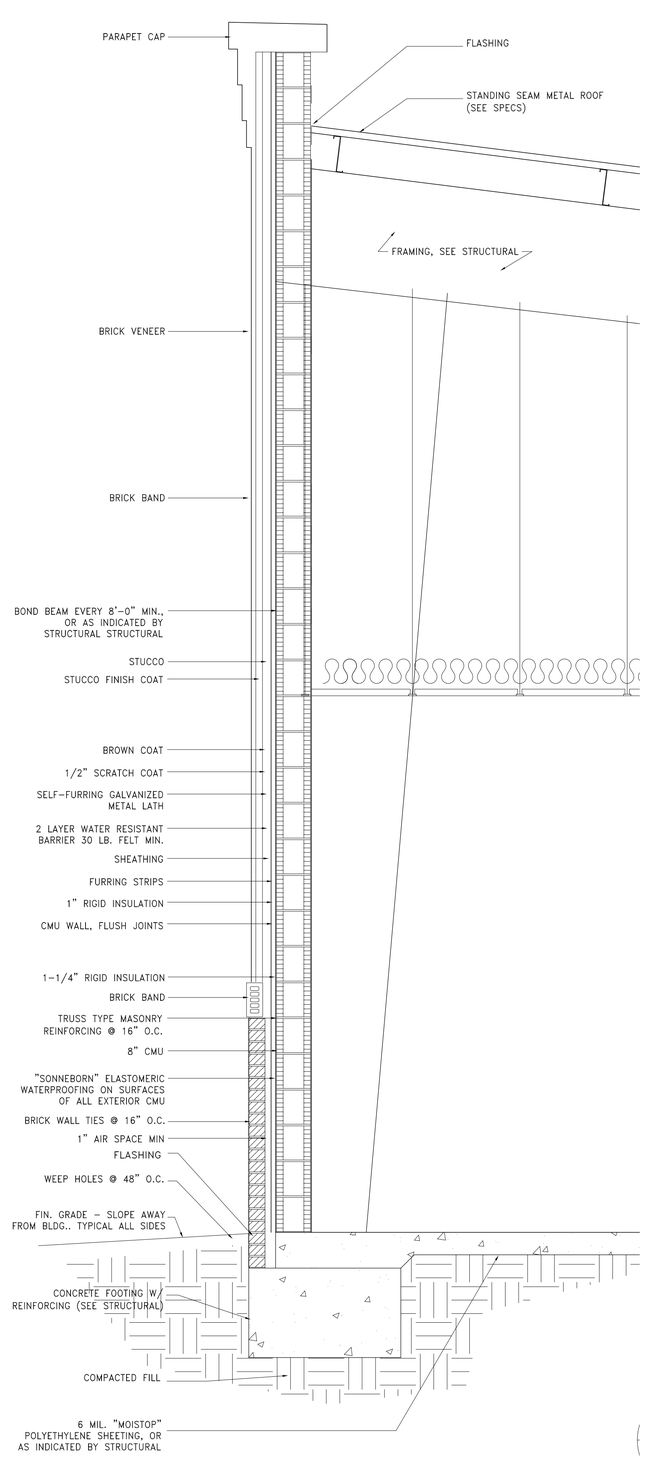
A8.1

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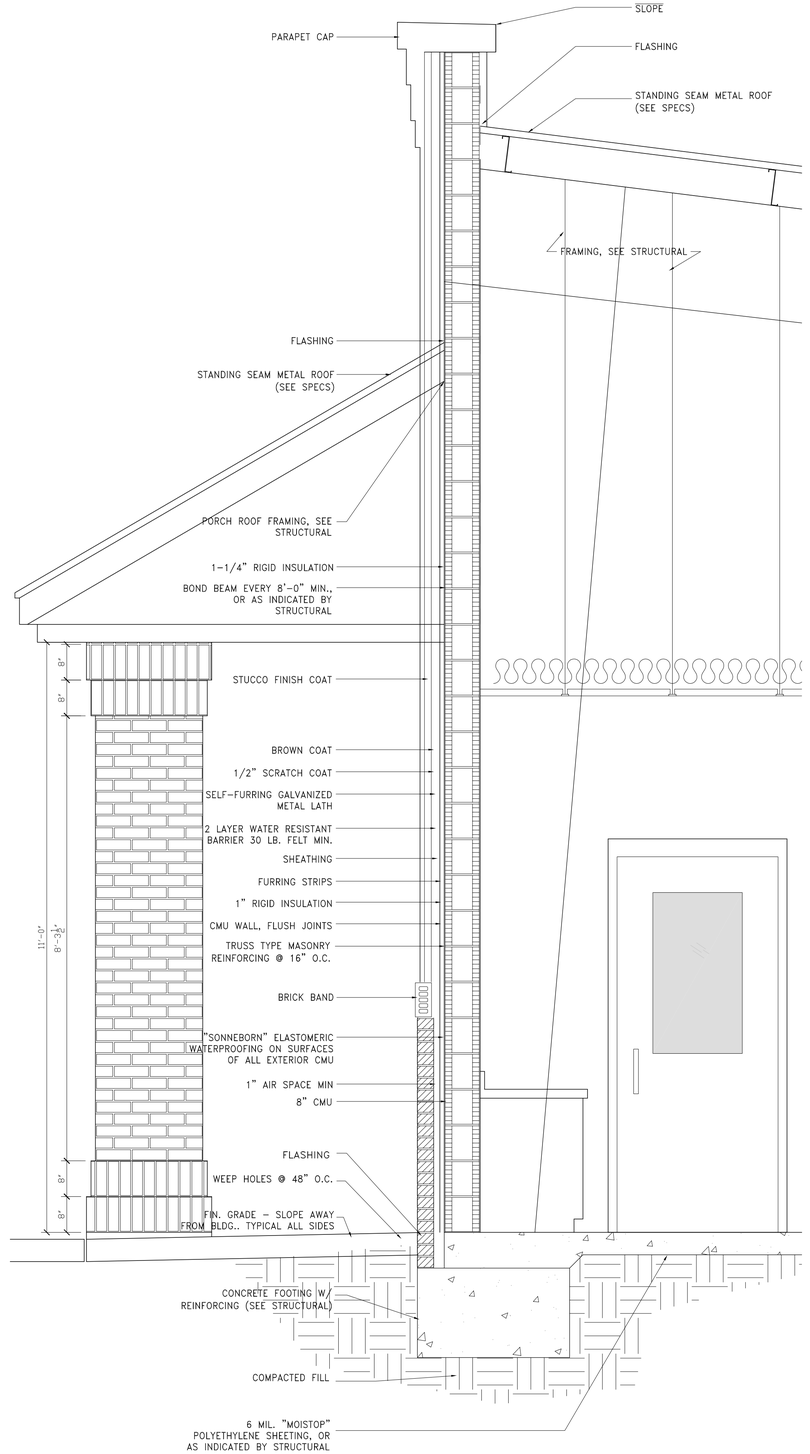
1 Wall Section (BLDG. A)

SCALE: 3/4"=1'-0"



2 Wall Section (BLDG. A)

SCALE: 3/4"=1'-0"



3 Wall Section (BLDG. A)

SCALE: 3/4"=1'-0"

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ SOUTH SITE BUILDINGS ■ CSI / MAINTENANCE ■

HPSC South Site Buildings: CSI / Maintenance

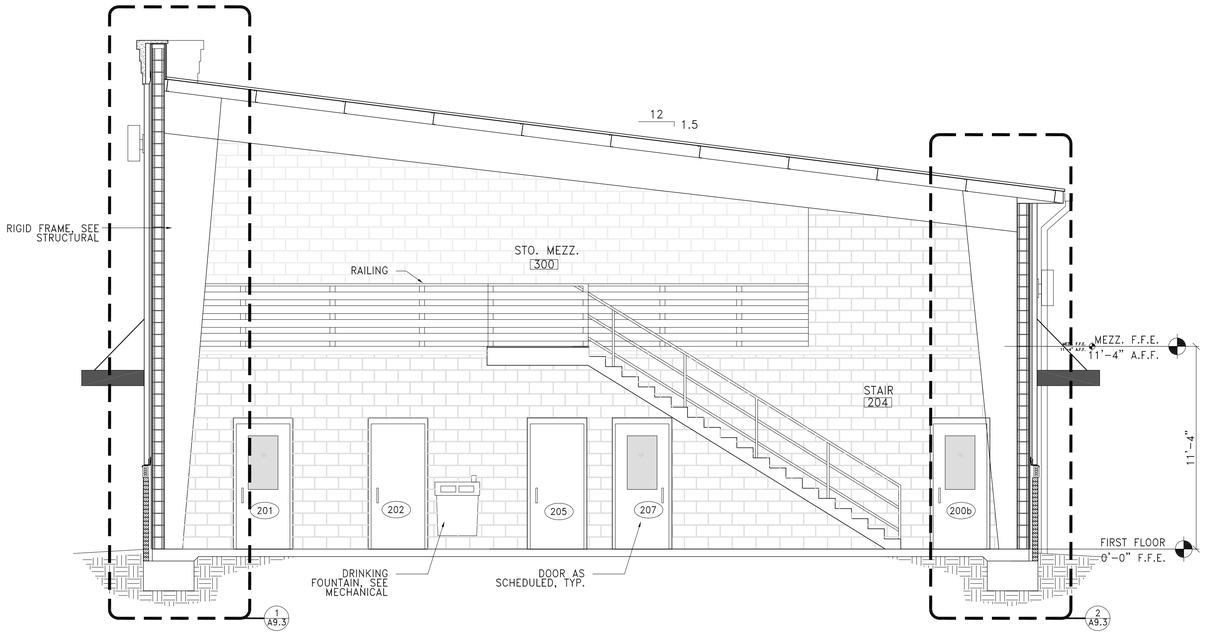
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Architect No:	

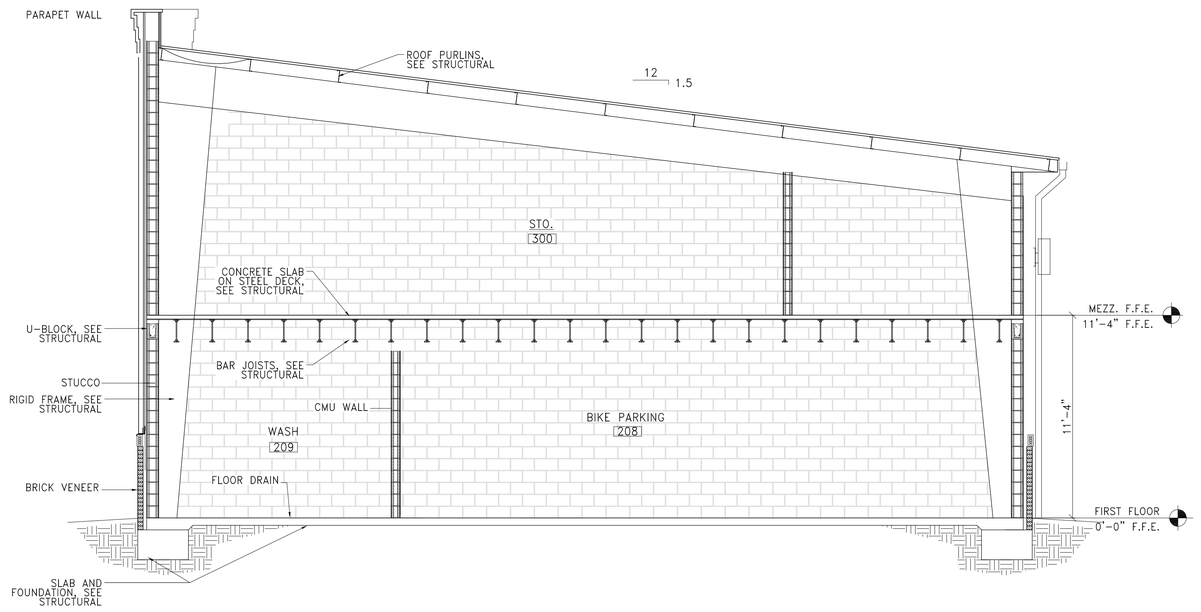
REGISTERED ARCHITECT Donald O. McCleskey 1998 Hattiesburg, MS STATE OF MISSISSIPPI

A8.2



1 Building Section (Bldg. B)

SCALE: 1/4"=1'-0"



2 Building Section (Bldg. B)

SCALE: 1/4"=1'-0"

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

SOUTH SITE BUILDINGS ■ CSI / MAINTENANCE ■ HATTIESBURG POLICE DEPARTMENT

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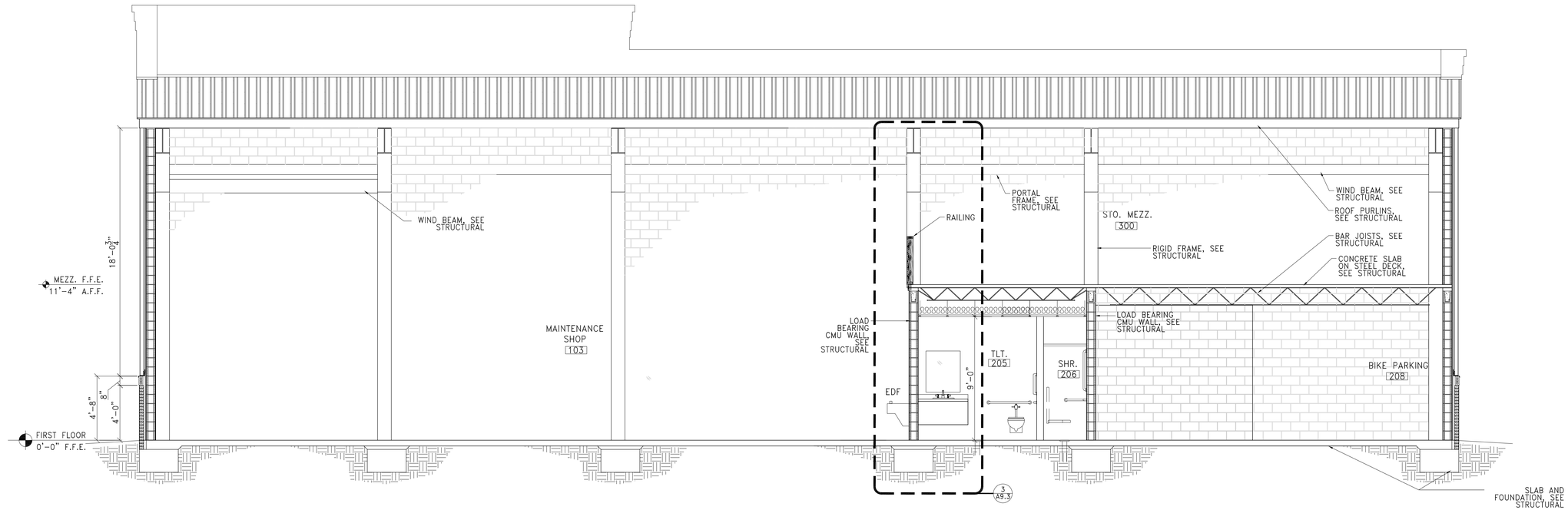
Client No: ------

Architect No:

Donald O. McCleskey 1995 Hattiesburg, MS

A9.1

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1 Building Section (Bldg. B)

SCALE: 1/4"=1'-0"



2 Building Section (Bldg. B)

SCALE: 1/4"=1'-0"

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

SOUTH SITE BUILDINGS ■ CSI / MAINTENANCE ■ HATTIESBURG POLICE DEPARTMENT

HPSC South Site Buildings: CSI / Maintenance

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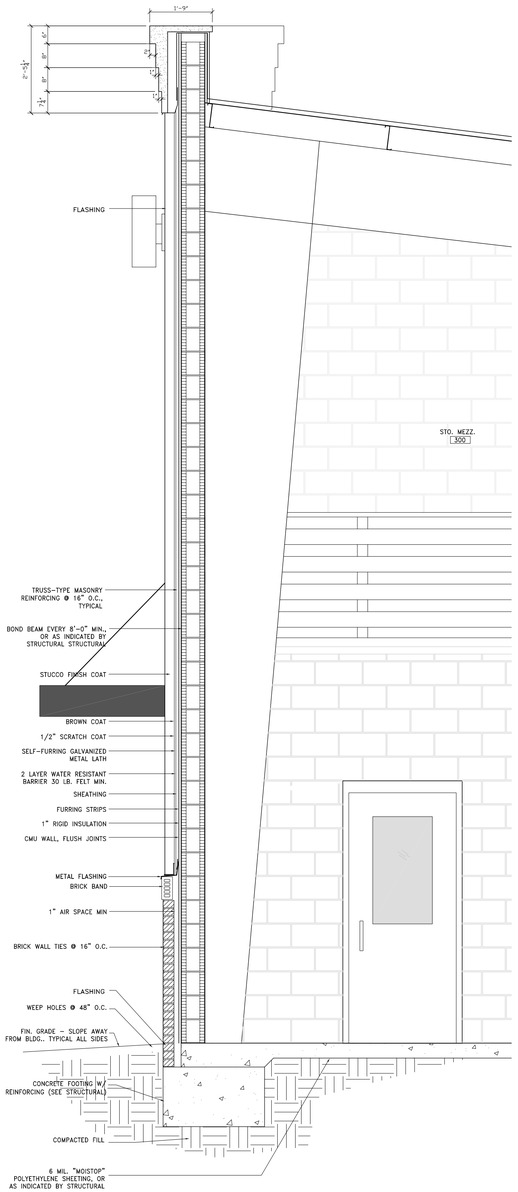
Client No: -------

Architect No:

Donald O. McCleskey 1999 Hattiesburg, MS

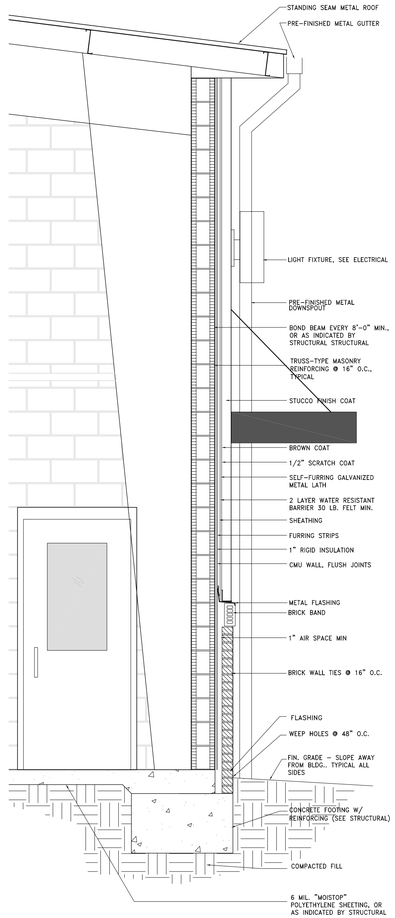
A9.2

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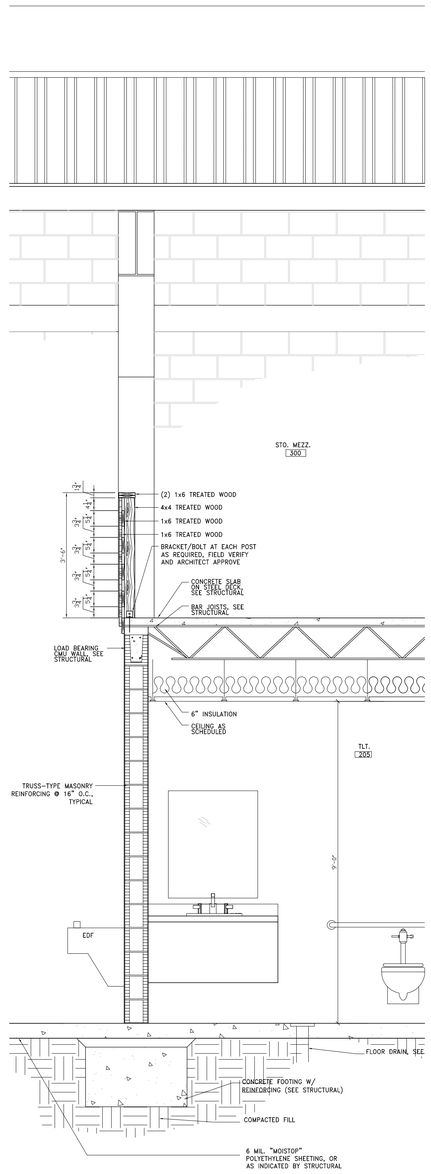
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SCALE: 1/2"=1'-0"



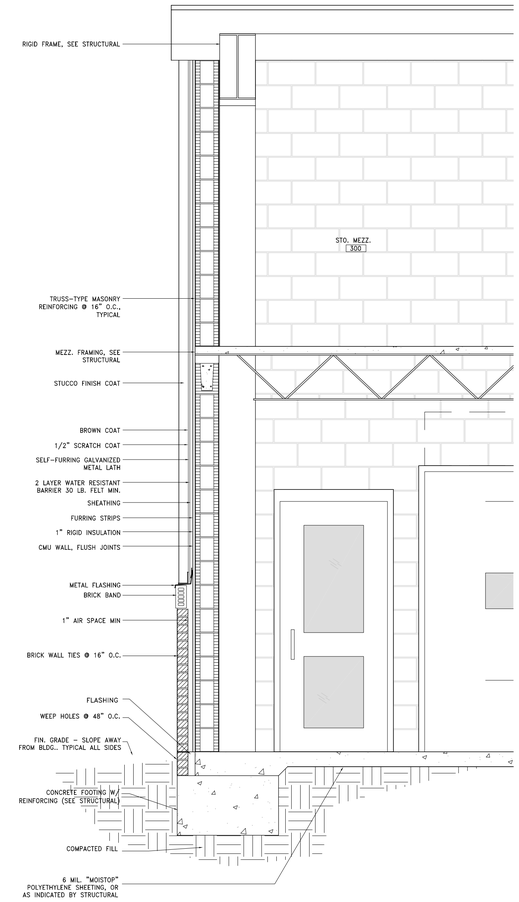
2 Wall Section (Bldg. B)

SCALE: 1/2"=1'-0"



3 Wall Section (Bldg. B)

SCALE: 1/2"=1'-0"



4 Wall Section (Bldg. B)

SCALE: 1/2"=1'-0"

CITY OF HATTIESBURG MISSISSIPPI

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Architect No:

Donald O. McCleskey 1998 Hattiesburg, MS

A9.3

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Door and Frame Schedule

	DOOR #	TYPE	DOOR SIZE (WxHxT)	DOOR MAT.	GLAZING	FRAME TYPE	HEAD	JAMB	NOTES
BUILDING A	100	A	3'-0" x 7'-0" x 0'-1-3/4"	ALUMINUM	GLASS	METAL	0'-4"	0'-2"	FULL GLASS EQUAL TO "STEELCRAFT" A-14 SERIES
	101		3'-0" x 7'-0" x 0'-1-3/4"	METAL	N/A				
	102a	A	3'-0" x 7'-0" x 0'-1-3/4"	ALUMINUM	TEMPERED GLASS				FULL GLASS EQUAL TO "STEELCRAFT" A-14 SERIES
	102b		12'-0" x 12'-0"	26 GA STEEL	17" x 5" VIEW PANELS				INSULATED ROLL-UP = TO "DBCI" 2750 SERIES
	102c	B	3'-0" x 7'-0" x 0'-1-3/4"	METAL	HALF GLASS		0'-4"	0'-2"	EQUAL TO "STEELCRAFT" B SERIES
	103	B	3'-0" x 7'-0" x 0'-1-3/4"	METAL	HALF GLASS				EQUAL TO "STEELCRAFT" B SERIES
	104	B	3'-0" x 7'-0" x 0'-1-3/4"	METAL	N/A				EQUAL TO "STEELCRAFT" B SERIES
	105a		12'-0" x 12'-0"	26 GA STEEL	17" x 5" VIEW PANELS				INSULATED ROLL-UP = TO "DBCI" 2750 SERIES
	105b	A	3'-0" x 7'-0" x 0'-1-3/4"	ALUMINUM	TEMPERED GLASS		0'-4"	0'-2"	FULL GLASS EQUAL TO "STEELCRAFT" A-14 SERIES
	106	B	3'-0" x 7'-0" x 0'-1-3/4"	METAL	N/A				EQUAL TO "STEELCRAFT" B SERIES
	107	B	3'-0" x 7'-0" x 0'-1-3/4"	METAL	N/A				EQUAL TO "STEELCRAFT" B SERIES
	108	A	3'-0" x 7'-0" x 0'-1-3/4"	ALUMINUM	TEMPERED GLASS				FULL GLASS EQUAL TO "STEELCRAFT" A-14 SERIES
	109	B	3'-0" x 7'-0" x 0'-1-3/4"	METAL	N/A				EQUAL TO "STEELCRAFT" B SERIES
	110a	B	3'-0" x 7'-0" x 0'-1-3/4"	METAL	HALF GLASS				EQUAL TO "STEELCRAFT" B SERIES
	110b	A	3'-0" x 7'-0" x 0'-1-3/4"	ALUMINUM	TEMPERED GLASS				FULL GLASS EQUAL TO "STEELCRAFT" A-14 SERIES
	110c	B	3'-0" x 7'-0" x 0'-1-3/4"	METAL	HALF GLASS	↓	↓	↓	EQUAL TO "STEELCRAFT" B SERIES
BUILDING B	200a		8'-0" x 8'-0"	26 GA STEEL	17" x 5" VIEW PANELS	METAL			INSULATED ROLL-UP = TO "DBCI" 2750 SERIES
	200b	B	3'-0" x 7'-0" x 0'-1-3/4"	METAL	HALF GLASS		0'-4"	0'-2"	EQUAL TO "STEELCRAFT" B SERIES
	201	B	3'-0" x 7'-0" x 0'-1-3/4"	METAL	HALF GLASS				EQUAL TO "STEELCRAFT" B SERIES
	202	B	3'-0" x 7'-0" x 0'-1-3/4"	METAL	N/A				EQUAL TO "STEELCRAFT" B SERIES
	203a	A	3'-0" x 7'-0" x 0'-1-3/4"	ALUMINUM	FROSTED GLASS				FULL GLASS EQUAL TO "STEELCRAFT" A-14 SERIES
	203b		12'-0" x 12'-0"	26 GA STEEL	17" x 5" VIEW PANELS				INSULATED ROLL-UP = TO "DBCI" 2750 SERIES
	203c		12'-0" x 12'-0"	26 GA STEEL	17" x 5" VIEW PANELS				INSULATED ROLL-UP = TO "DBCI" 2750 SERIES
	203d		12'-0" x 16'-0"	26 GA STEEL	17" x 5" VIEW PANELS				INSULATED ROLL-UP = TO "DBCI" 2750 SERIES
	203e	A	3'-0" x 7'-0" x 0'-1-3/4"	ALUMINUM	GLASS		0'-4"	0'-2"	FULL GLASS EQUAL TO "STEELCRAFT" A-14 SERIES
	203f		12'-0" x 15'-0"	26 GA STEEL	17" x 5" VIEW PANELS				INSULATED ROLL-UP = TO "OVERHEAD DOOR"
	203g		12'-0" x 12'-0"	26 GA STEEL	17" x 5" VIEW PANELS				INSULATED ROLL-UP = TO "OVERHEAD DOOR"
	203h		12'-0" x 12'-0"	26 GA STEEL	17" x 5" VIEW PANELS				INSULATED ROLL-UP = TO "OVERHEAD DOOR"
	203i	A	3'-0" x 7'-0" x 0'-1-3/4"	ALUMINUM	GLASS		0'-4"	0'-2"	FULL GLASS EQUAL TO "STEELCRAFT" A-14 SERIES
	205	B	3'-0" x 7'-0" x 0'-1-3/4"	METAL	N/A				EQUAL TO "STEELCRAFT" B SERIES
	207	B	3'-0" x 7'-0" x 0'-1-3/4"	METAL	HALF GLASS				EQUAL TO "STEELCRAFT" B SERIES
	208a	A	3'-0" x 7'-0" x 0'-1-3/4"	METAL	GLASS				FULL GLASS EQUAL TO "STEELCRAFT" A-14 SERIES
	208b		8'-0" x 8'-0"	26 GA STEEL	17" x 5" VIEW PANELS				INSULATED ROLL-UP = TO "DBCI" 2750 SERIES
	208c		8'-0" x 8'-0"	26 GA STEEL	GLASS	↓			INSULATED ROLL-UP = TO "OVERHEAD DOOR"
	301a	B	3'-0" x 7'-0" x 0'-1-3/4"	METAL	N/A		0'-4"	0'-2"	EQUAL TO "STEELCRAFT" B SERIES
	301b	B	3'-0" x 7'-0" x 0'-1-3/4"	METAL	N/A	↓	0'-4"	0'-2"	EQUAL TO "STEELCRAFT" B SERIES
BUILDING C	401								
	402								

OWNER TO SELECT FINISH / COLORS

Window Schedule

WINDOW TAG	# REQ.	WINDOW SIZE (WxH)	FRAME	HEAD	JAMB	SILL	GLAZING	NOTES
A	4	4'-0" x 8'-8"	FIXED ALUMINUM 2"x 3"				INSULATED IMPACT RESISTANT TINTED	EQUAL TO "KAWNEER" TRI-FAB ASI 451 SERIES
D	1	3'-4" x 4'-8"						
E	1	5'-4" ø						
F	2	8'-0" x 3'-4"						
G	1	12'-0" x 4'-0"	↓	↓	↓	↓	↓	↓

OWNER TO SELECT FINISH / COLORS

Room Finish Schedule

	ROOM #	ROOM NAME	FLOORS	BASE	WALLS	CEILINGS	CEILING HGT.	CABINETS	NOTES
BUILDING A	100	VEST.	TILE	RUBBER	PAINT	2x2 LAY IN	10'-0"	N/A	
	101	TLT.	TILE				9'-0"	STAIN	
	102	CSI BAY	SEALED CONC.			PAINT	VARIES	N/A	
	103	CSI WORK				2x2 LAY IN	10'-0"	STAIN	
	104	MECH. ELEC.				PAINT	VARIES	N/A	
	105	MAINTENANCE WORK SHOP							
	106	JAN.				2x2 LAY IN	9'-0"		
	107	CSI STO.					10'-0"		
	108	VEST.	TILE						
	109	TLT.	TILE				9'-0"	STAIN	
	110	K-9	SEALED CONC.				10'-0"		
BUILDING B	200	BIKE SHOP	SEALED CONC.	RUBBER	PAINT	PAINT	VARIES	N/A	
	201	BREAK	TILE			2x2 LAY IN	9'-0"	STAIN	
	202	STO.	SEALED CONC.					N/A	
	203	MAINTENANCE SHOP				PAINT	VARIES		
	204	STAIR							
	205	TLT.	TILE			2x2 LAY IN	9'-0"	STAIN	
	206	SHR.				2x2 LAY IN		N/A	
	207	OFFICE				2x2 LAY IN			
	208	BIKE PARKING	SEALED CONC.			PAINT	VARIES		
	209	WASH							
	301	STORAGE MEZZANINE	SEALED CONC.	RUBBER	PAINT	PAINT	VARIES	N/A	
	302	MECH. ELEC.							
BUILDING C	401								
	402								

OWNER TO SELECT COLORS

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ CSI / MAINTENANCE

SOUTH SITE BUILDINGS ■

HPSC South Site Buildings: CSI / Maintenance

Drawing Issued:

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Drawn By: BHJ

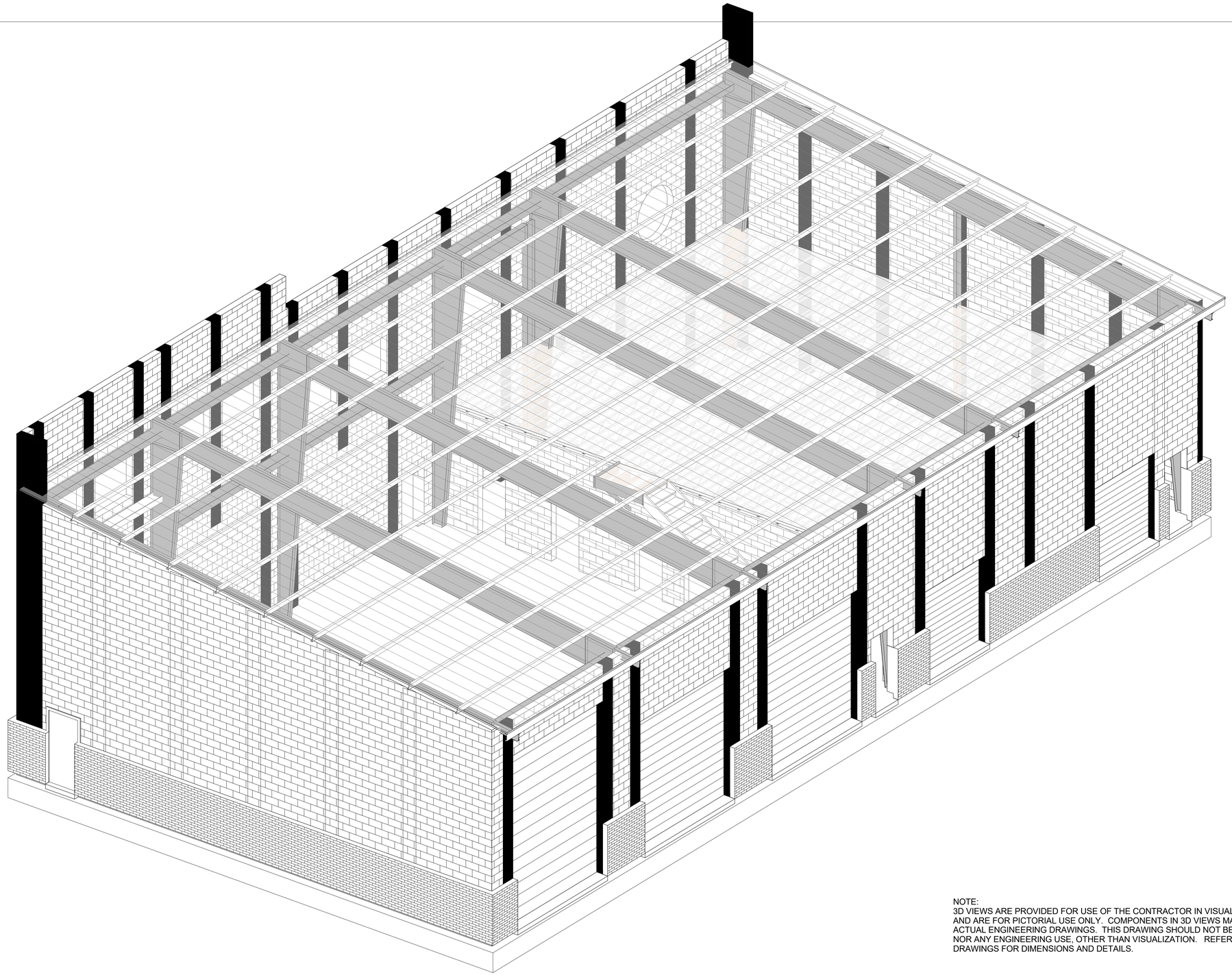
Checked By:

Client No: -------

Architect No:

REGISTERED ARCHITECT Donald O. McCleskey 1998 Hattiesburg, MS STATE OF MISSISSIPPI

A11.1



1 3D VIEW

NOTE:
3D VIEWS ARE PROVIDED FOR USE OF THE CONTRACTOR IN VISUALIZATION OF CONSTRUCTION AND ARE FOR PICTORIAL USE ONLY. COMPONENTS IN 3D VIEWS MAY VARY IN LOOKS TO THE ACTUAL ENGINEERING DRAWINGS. THIS DRAWING SHOULD NOT BE USED FOR SCALING NOR ANY ENGINEERING USE, OTHER THAN VISUALIZATION. REFERENCE ENGINEERING DRAWINGS FOR DIMENSIONS AND DETAILS.

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ HATTIESBURG FIRE DEPARTMENT ■ HATTIESBURG MUNICIPAL COURT

HPSC South Site Buildings

Drawing Issued:

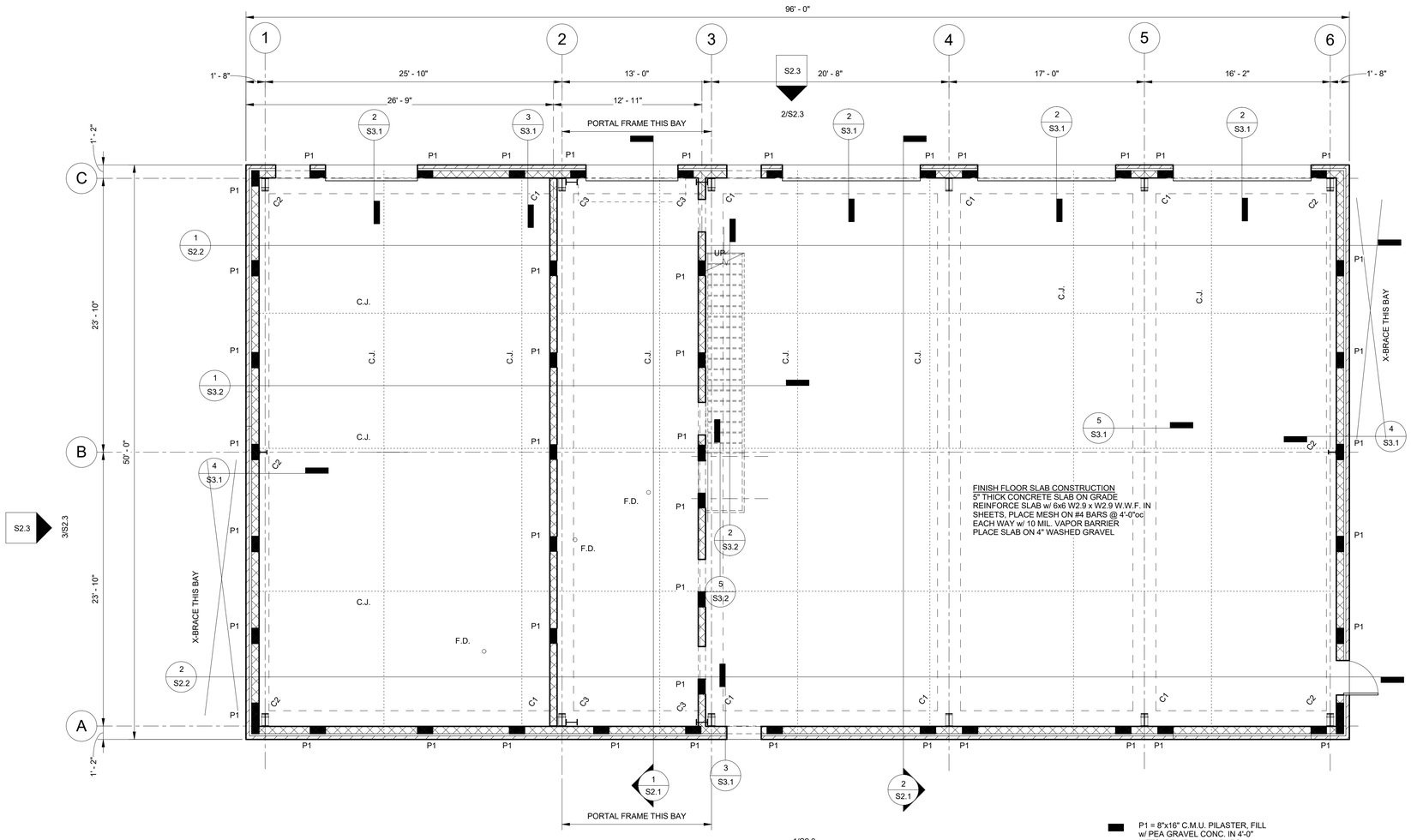
Date	Rev.	Description
08-31-2015		DD Check Set
11-19-2018		100% Bid Docs

Drawn By:	GS
Checked By:	MG
Client No:	-------
Architect No:	

LARRY MATTHEW GRIFFIN PROFESSIONAL ENGINEER #10248 STATE OF MISSISSIPPI
10/2/18

S0.1

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1 FOUNDATION PLAN
3/16" = 1'-0"

PRE-ENGINEERED METAL BUILDING NOTES

METAL BUILDING GRIDLINES CANNOT USE SAME NUMBERS OR LETTERS AS STRUCTURAL GRIDLINES UNLESS THEY ARE IN THE SAME LOCATION.

METAL BUILDING GRIDLINES MUST USE NUMBERS WHERE STRUCTURAL GRIDLINES USE NUMBERS, UNIQUE NUMBERS IF NOT IN SAME LOCATION OR SHOP DRAWINGS WILL BE REJECTED

METAL BLDG FRAMES DRIFT LIMITATION - H/200

SEISMIC NOTES:

BUILDING CLASSIFICATION CATEGORY IV

OCCUPANCY IMPORTANCE FACTOR - I=1.0

SITE CLASSIFICATION D

GENERAL NOTES:

1. All concrete shall conform to current ACI specifications and shall be as follows: regular sand and gravel with minimum of 3000psi compressive strength in 28 days in footings, curbs, piers, walks, and gradebeams. Concrete for floor slabs shall have a minimum 28 day compressive strength of 3500 psi, maximum slump of 5". All concrete shall incorporate 20% maximum fly ash content.

2. Provide necessary reinforcing steel accessories to hold bars in proper position.

3. Provide corner bars of same size and number as horizontal bars at all corners of gradebeams.

4. All reinforcing shall be deformed, ASTM 615, Grade 60.

5. All detailing and fabrication of reinforcing bars must follow the ACI "Manual of Standard Practice for Detailing Reinforced Concrete Structures."

6. All placing of reinforcing bars in the forms must follow the CRSI "Recommended Practice for Placing Reinforcing Bars."

7. All bars are to be supported in the forms with wire bar supports meeting the requirements of the ACI "Manual of Standard Practice for Detailing Reinforced Concrete Structures".

8. Lap splices as specifically called for, but as least 30 bar diameters (15" min.).

9. Welded wire fabric must have end laps of one full mesh plus 2" and wiring all laps securely together. Welded wire fabric should extend into supporting beams and walls for anchorage.

10. All concrete slabs on grade that are not otherwise provided for shall have reinforcing consisting of 6"x6"-W2.1x W2.1 welded wire fabric.

11. All reinforcing bars shall be securely wired together in the forms. Two-way mats of steel, column ties, and beam stirrups shall be tied sufficiently to hold them securely in place.

12. Provide keys of 2"x4" at construction joints. Control joints in slab on grade shall be sawed 1-1/4" deep within 8 hours of pouring slab. Seal all joints with sealant.

13. All reinforcing shall have concrete cover as specified in ACI-318.

14. Design live loads for roofs and wind are in accordance with the "International Building Code", 2012 Edition.

ULTIMATE WIND SPEED = 143 MPH
RISK CATEGORY IV
EXPOSURE CATEGORY = B

15. The contractor shall be responsible for the design, placement, and maintainance of any and all shoring, bracing, or tie-backs needed to support any part of the construction during the construction process. It is the contractor's responsibility to ensure the safety and integrity of the structure until the necessary permanent elements are in place.

STRUCTURAL NOTES:

1. Unless shown otherwise, the following loose lintel schedule shall be used.

Clear Spacing	Lintel angle for each 4" masonry thickness
0' to 4'-0"	3-1/2"x 3-1/2x 1/4"
4'-1" to 6'-0"	4"x 3-1/2"x 3/8"
6'-1" to 8'-0"	5"x 3-1/2"x 3/8"
8'-1" to 10'-0"	6"x 3-1/2"x 3/8"
over 10'-0"	consult engineer

2. All wide flange beams shall have a minimum yield strength of 50 ksi, and conform to ASTM A-992
3. All structural steel except as noted above shall conform ASTM specification A-36 or ASTM A-500, Grade B, as applicable.
4. No splices in structural steel shall be accepted without approval of the engineer except where shown on the drawings.
5. Bolts for structural steel shall be ASTM A-325 high-strength bolts. Anchor bolts shall be ASTM F1554 unless otherwise noted.
6. All welding rods used shall be grade 70xx.
7. All structural steel shall be manufactured and erected in accordance with the Ninth Edition of the American Institute of Steel Construction Manual.
8. Where possible, all bolt holes shall be shop drilled. Holes made at the job site shall be mechanically drilled. No burning of holes will be allowed.
9. All steel joists and bridging shall conform to the Steel Joist Institute standards of fabrication and erection. Joist bridging shall be as required by SJI. Do not connect bottom chord extensions until roof loads are in place. Concentrated loads on joists shall be placed at joist panel points, or the joist shall be reinforced as per SJI recommendations.

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HPSC South Site Buildings

Drawing Issued:

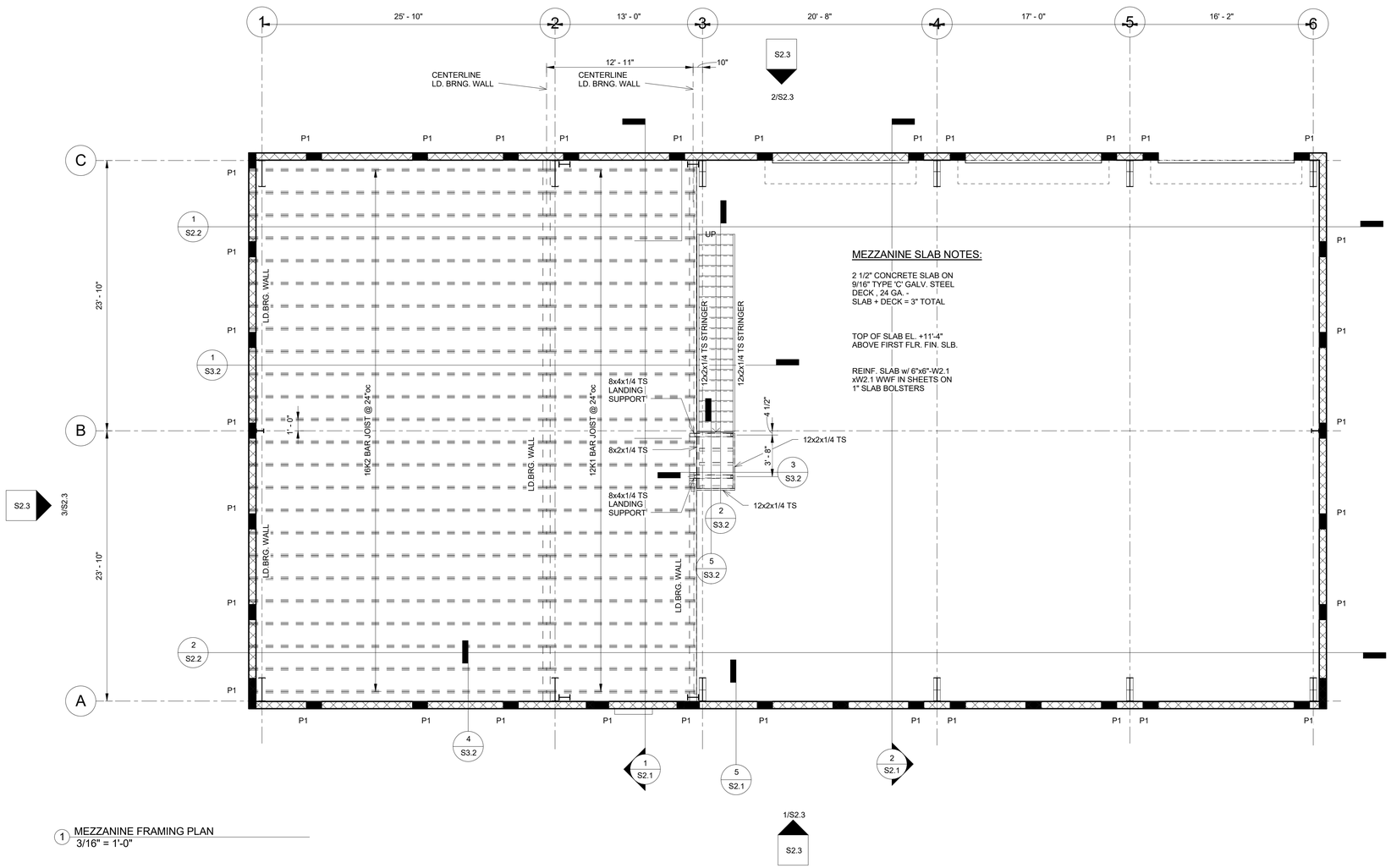
Date	Rev.	Description
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Drawn By: GS
Checked By: MG
Client No: ------
Architect No:

STATE OF MISSISSIPPI — LARRY W. MCCLESKEY — ENGINEER — 9708 — Larry W. McCleskey — 10/2/18

S1.1

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1 MEZZANINE FRAMING PLAN
3/16" = 1'-0"

MEZZANINE SLAB NOTES:

2 1/2" CONCRETE SLAB ON 9/16" TYPE 'C' GALV. STEEL DECK , 24 GA. - SLAB + DECK = 3" TOTAL

TOP OF SLAB EL. +11'-4" ABOVE FIRST FLR. FIN. SLB.

REINF. SLAB w/ 6"x6"-W2.1 xW2.1 WWF IN SHEETS ON 1" SLAB BOLSTERS

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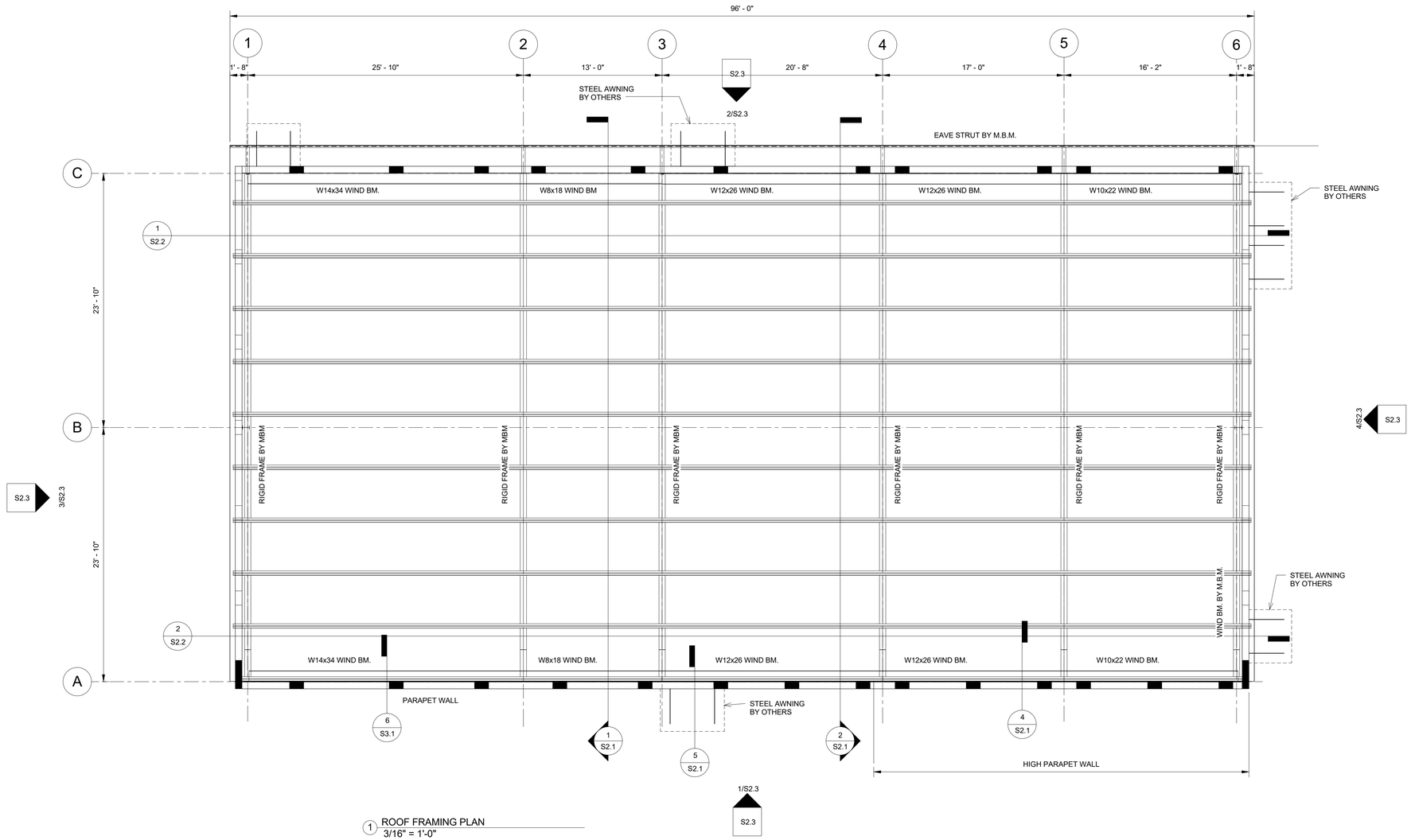
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Checked By: MG
Client No: -------
Architect No:

LARRY T. MCCLESKEY ENGINEER #10248 10/2/18

S1.2

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1 ROOF FRAMING PLAN
3/16" = 1'-0"

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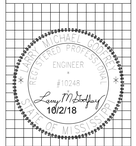
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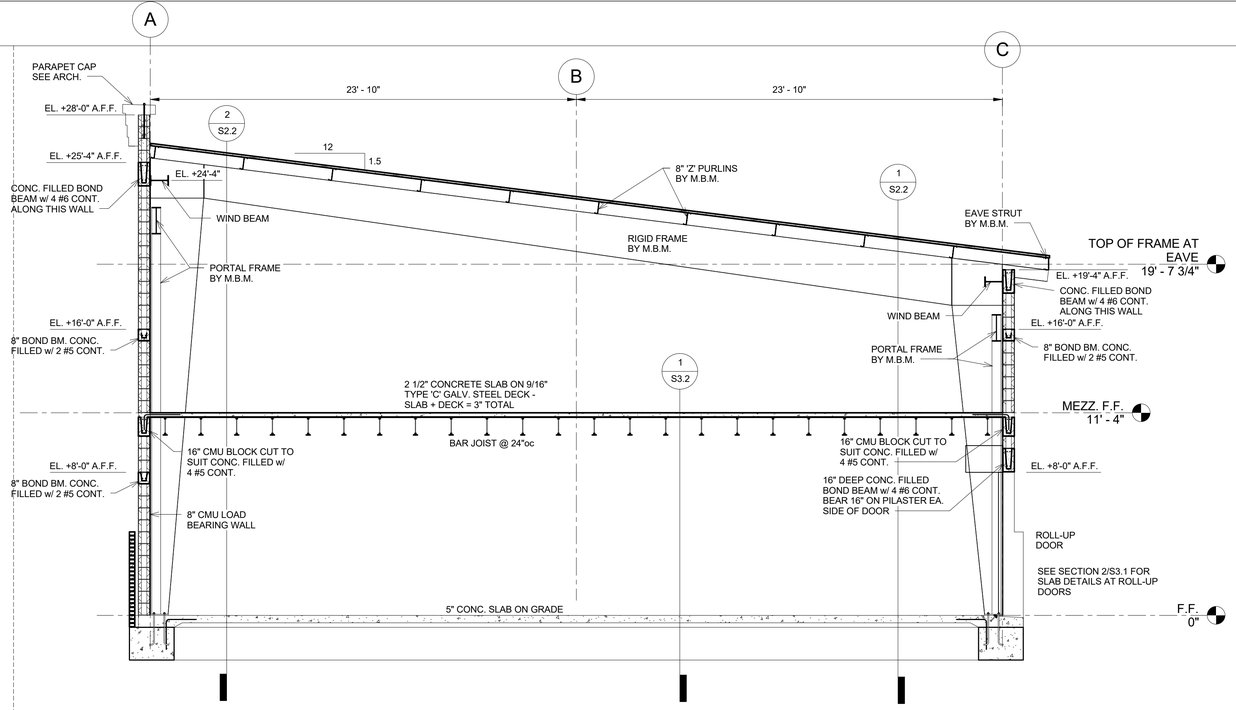
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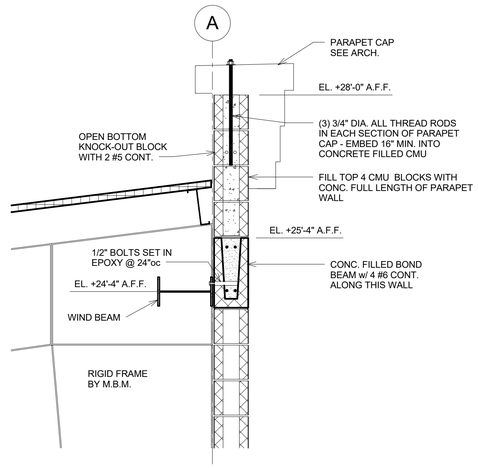


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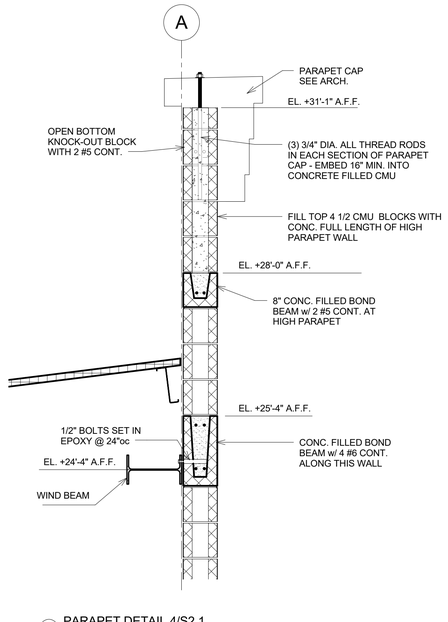
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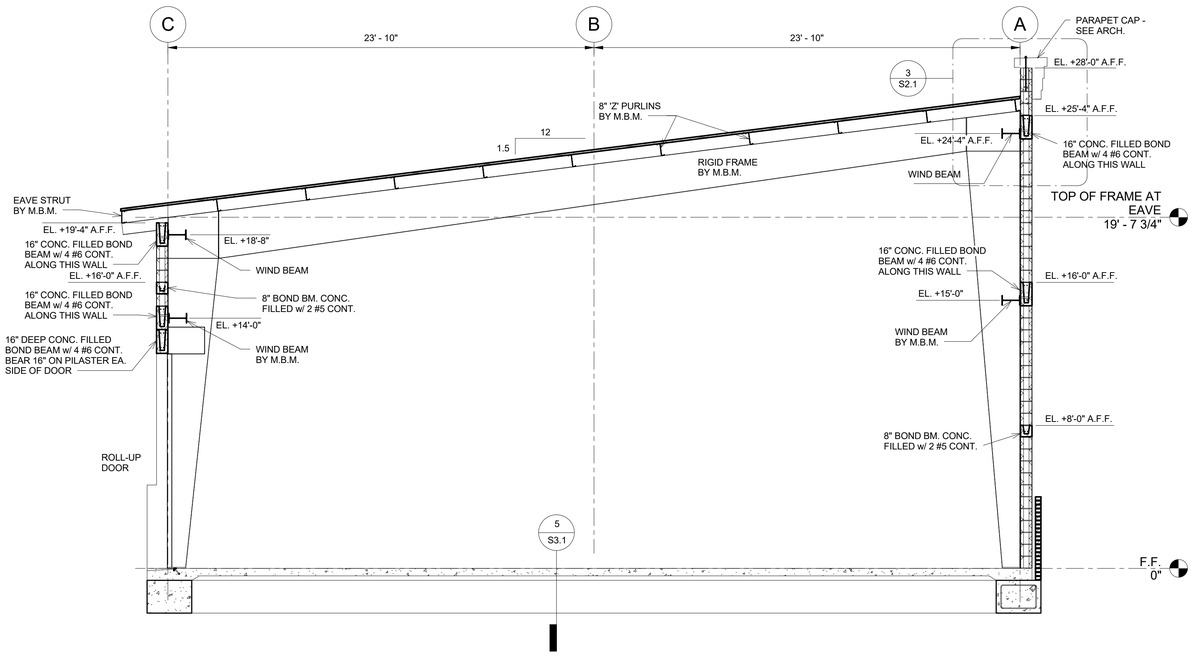
1 BUILDING SECTION 1/S2.1
1/4" = 1'-0"



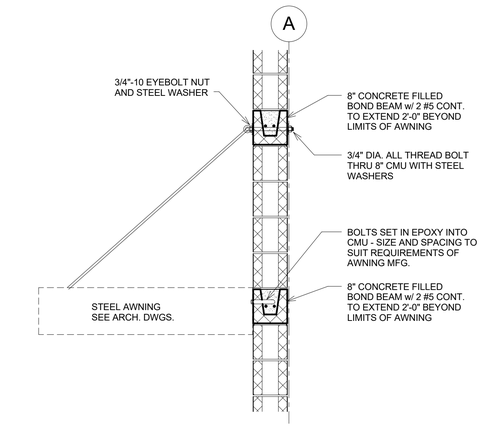
3 PARAPET DETAIL 3/S2.1
3/4" = 1'-0"



4 PARAPET DETAIL 4/S2.1
3/4" = 1'-0"



2 BUILDING SECTION 2/S2.1
1/4" = 1'-0"



5 AWNING ANCHORAGE DETAIL 5/S2.1
3/4" = 1'-0"

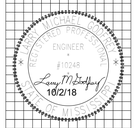
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HPSC South Site Buildings

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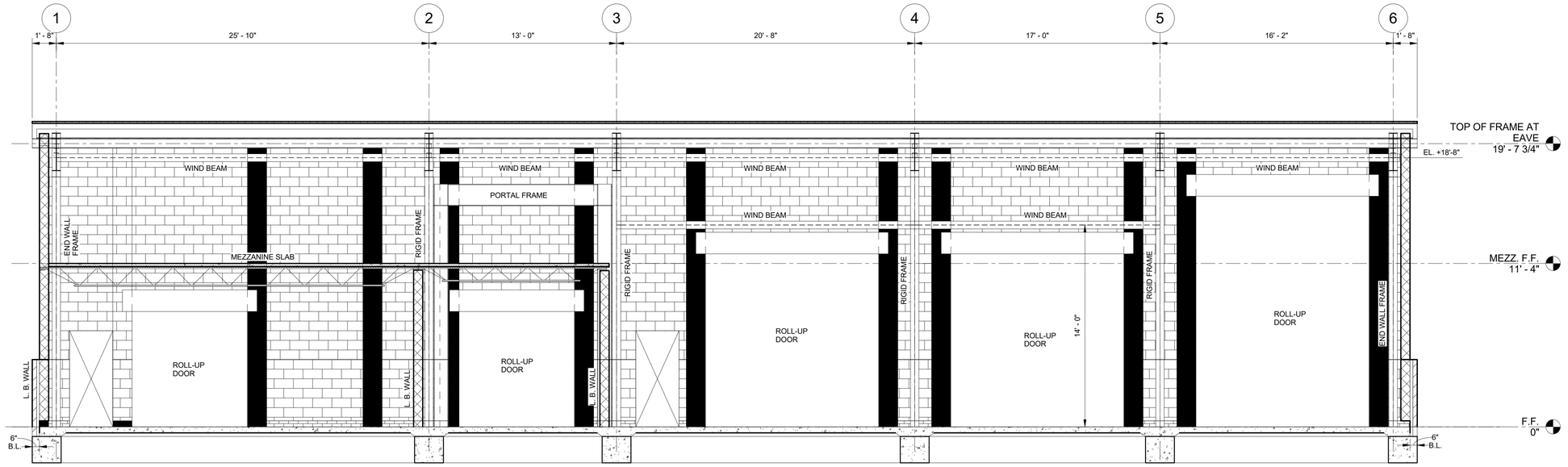
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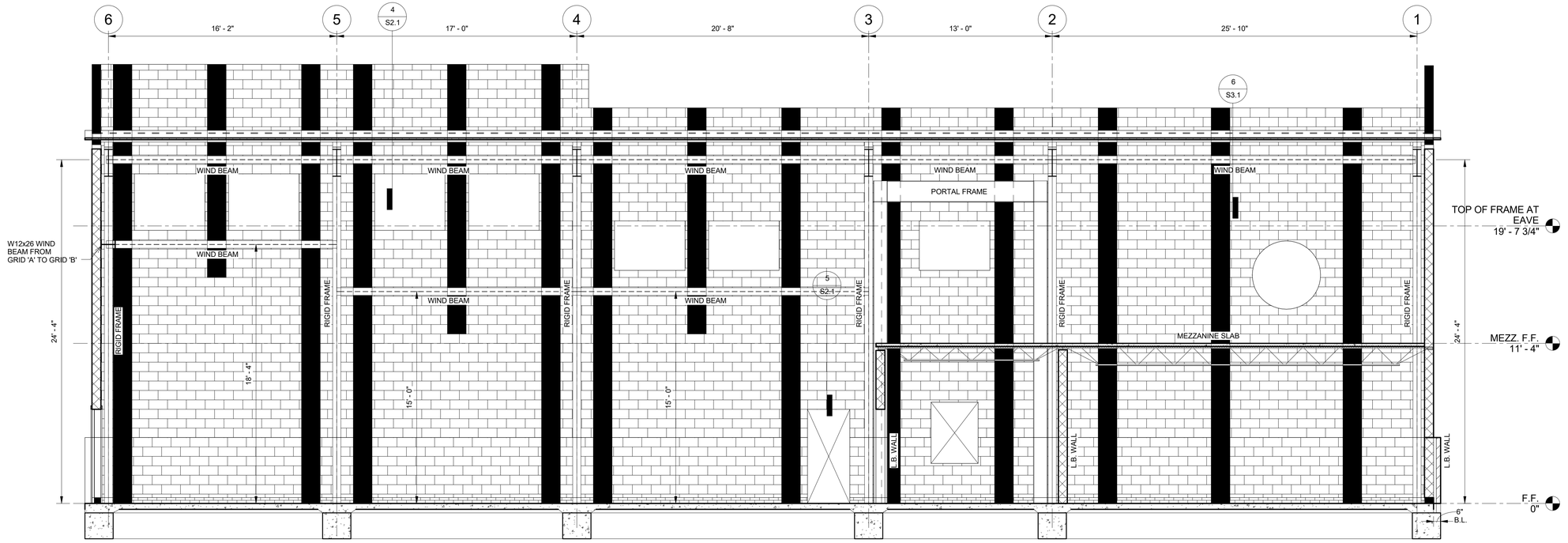


S2.1

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1 WALL ELEVATION 1/S2.2
1/4" = 1'-0"



2 WALL ELEVATION 2/S2.2
1/4" = 1'-0"

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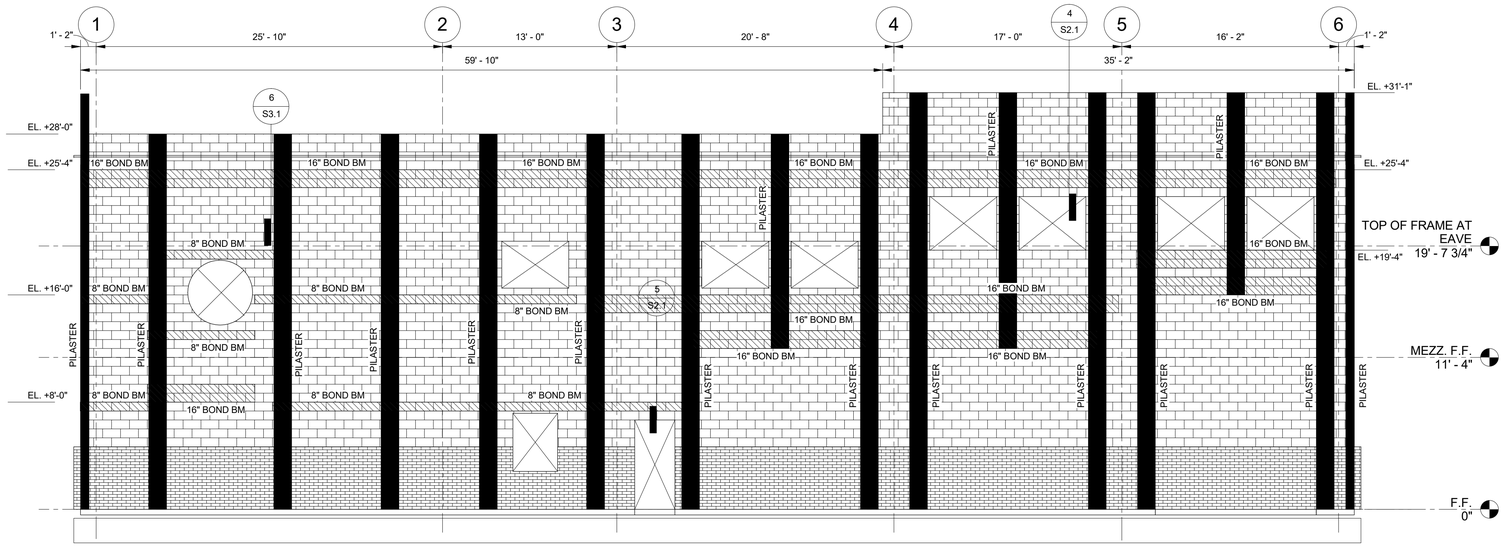
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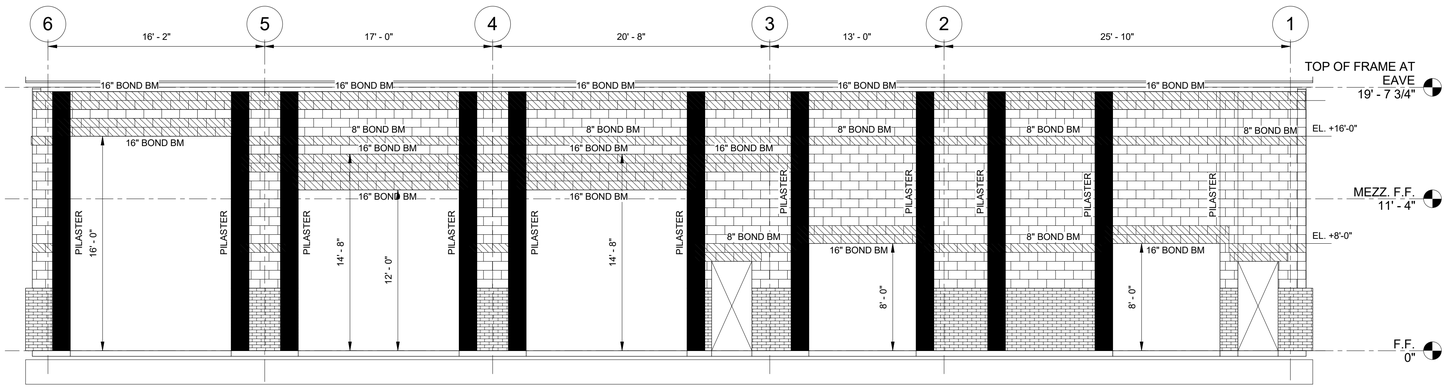
STATE OF MISSISSIPPI
LARRY MCCLESKEY
ENGINEER
#12345
10/2/18

S2.2

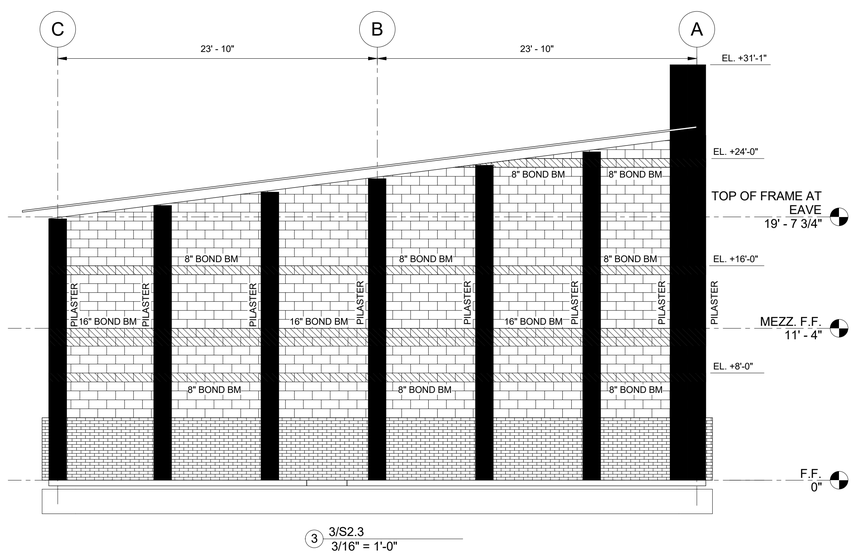
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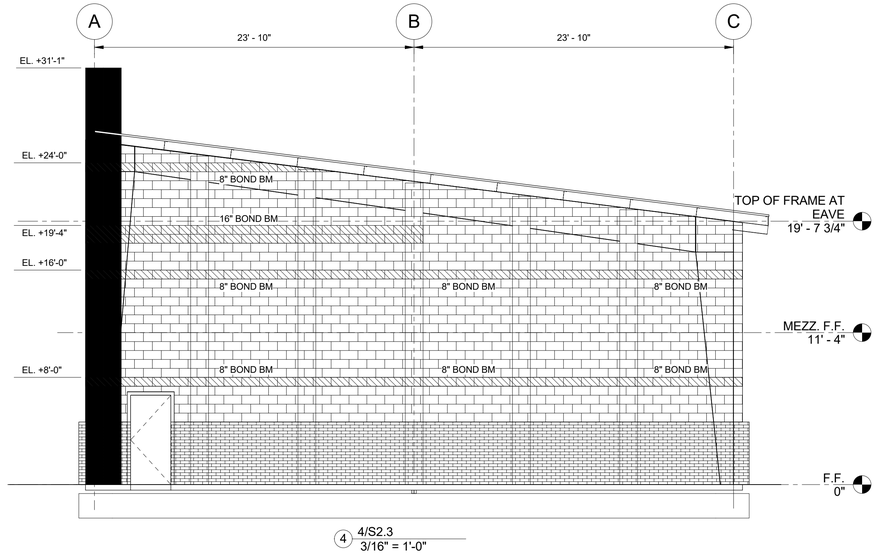
1 1/S2.3
3/16" = 1'-0"



2 2/S2.3
3/16" = 1'-0"



3 3/S2.3
3/16" = 1'-0"



4 4/S2.3
3/16" = 1'-0"

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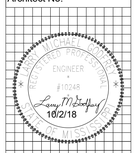
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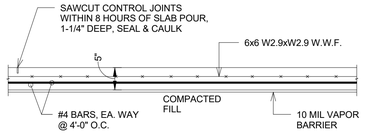
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Architect No:

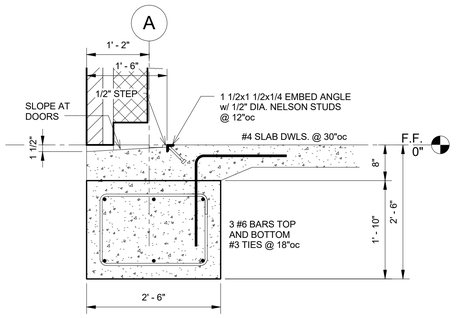


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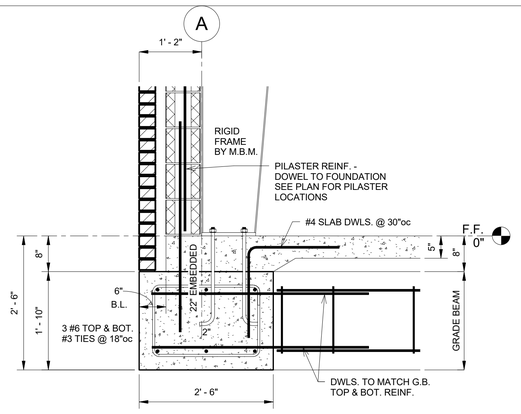
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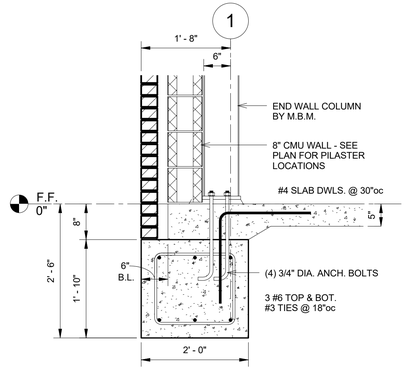
1 TYPICAL SLAB ON GRADE DETAIL
3/4" = 1'-0"



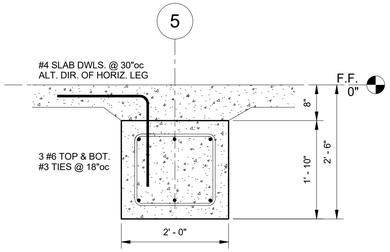
2 FOUNDATION DETAIL 2/S3.1
3/4" = 1'-0"



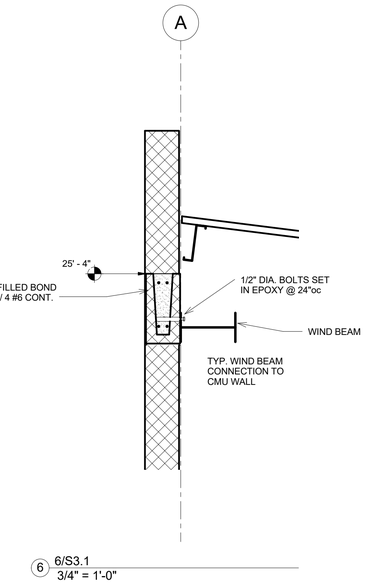
3 FOUNDATION DETAIL 3/S3.1
3/4" = 1'-0"



4 FOUNDATION DETAIL 4/S3.1
3/4" = 1'-0"



5 FOUNDATION DETAIL 5/S3.1
3/4" = 1'-0"



6 6/S3.1
3/4" = 1'-0"

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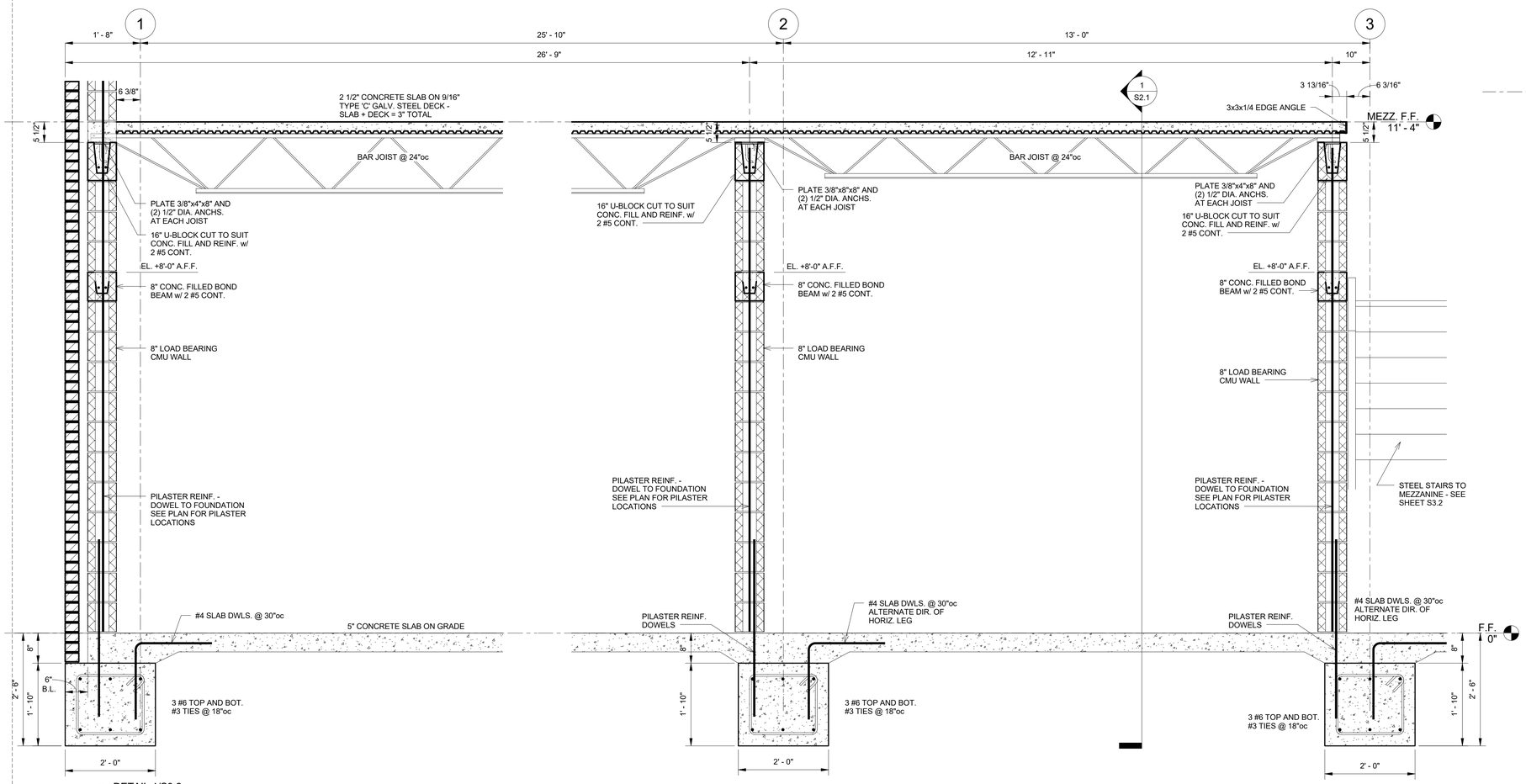
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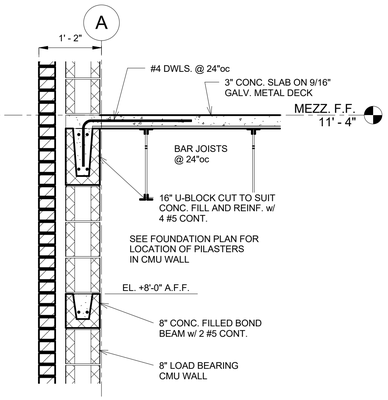


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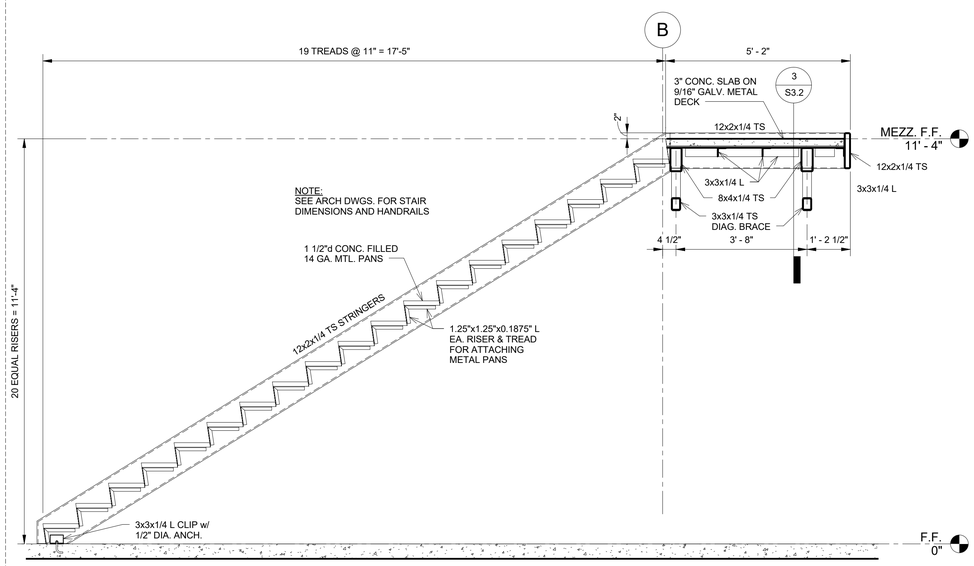
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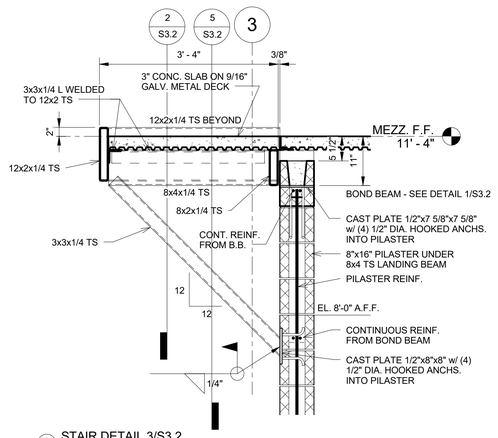
1 DETAIL 1/S3.2
3/4" = 1'-0"



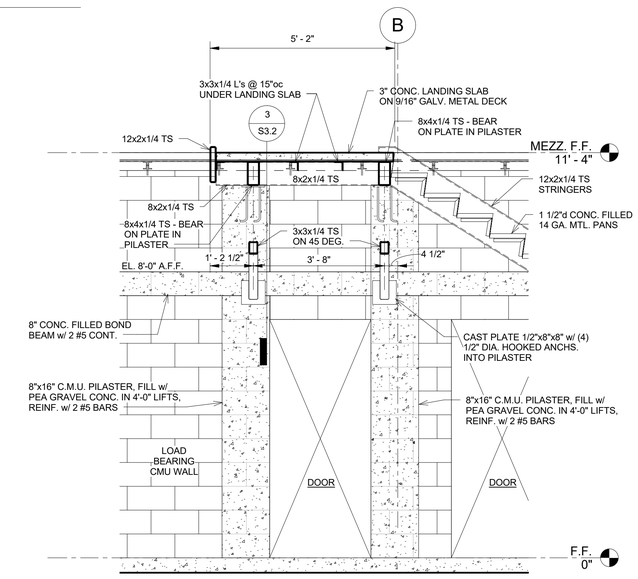
4 DETAIL 4/S3.2
3/4" = 1'-0"



2 STAIR DETAIL 2/S3.2
1/2" = 1'-0"



3 STAIR DETAIL 3/S3.2
3/4" = 1'-0"



5 STAIR DETAIL 5/S3.2
1/2" = 1'-0"

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Architect No:	

STATE OF MISSISSIPPI LARRY T. McCLESKEY ENGINEER #10248 10/2/18

S3.2

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PLUMBING ABBREVIATIONS

ABBREVIATIONS – PLUMBING	
AAV	AIR ADMITTANCE VALVE
AD	ACCESS DOOR
AHU	AIR HANDLING UNIT
AS	AIR SEPARATOR
BTU	BRITISH THERMAL UNIT
CFM	CUBIC FEET PER MINUTE
CTG	CEILING TRANSFER GRILLE
CG	CEILING GRILLE
CO	CLEAN OUT
CU	CONDENSING UNIT
CW	DOMESTIC COLD WATER
DIA	DIAMETER
DN	DOWN
ET	EXPANSION TANK
EWH	ELECTRIC WATER HEATER
EWT	ENTERING WATER TEMPERATURE
°F	DEGREES FAHRENHEIT
FC	FLEXIBLE CONNECTION (DUCT OR PIPE)
FLR	FLOOR
FT	FEET
GF	GAS FURNACE
GPM	GALLONS PER MINUTE
GWH	GAS WATER HEATER
HP	HORSE POWER
HR	HOUR
HW	HOT WATER

ABBREVIATIONS – PLUMBING	
ID	INSIDE DIMENSION
KW	KILOWATT
LBS	POUNDS
MAX	MAXIMUM
MBH	THOUSAND BTU PER HOUR
MFG	MANUFACTURER
MIN	MINIMUM
MUA	MAKE UP AIR UNIT
NC	NORMALLY CLOSED
NIC	NOT IN THIS CONTRACT
NO	NORMALLY OPEN
NTS	NOT TO SCALE
P	PUMP
PRV	PRESSURE REDUCING VALVE
PSI	POUNDS PER SQUARE INCH (GAUGE)
RPM	REVOLUTIONS PER MINUTE
RP	RECIRC PUMP
SQFT	SQUARE FEET
TYP	TYPICAL
VTR	VENT THRU ROOF
W/	WITH
EW	EXISTING DOMESTIC WATER
EDCW	EXISTING DOMESTIC COLD WATER
EDHW	EXISTING DOMESTIC HOT WATER
EDHWR	EXISTING DOMESTIC HOT WATER RECIRC
EG	EXISTING GAS (NATURAL)

PLUMBING LEGEND

PIPING LEGEND

	DOMESTIC COLD WATER
	DOMESTIC HOT WATER (110°)
	DOMESTIC HOT WATER RECALCULATING LINE (110°)
	SANITARY WASTE
	PLUMBING VENT
CD	CONDENSATE DRAIN
AD	AUXILIARY SAFETY PAN DRAIN
F	FIRE PROTECTION
G	GAS PIPING
	FIRE SPRINKLER HEAD
"A"	MECHANICAL SHOCK ARRESTOR; LETTER INDICATES PDI SIZE
WCO	WALL CLEANOUT
CO	CLEANOUT
FFCO	FLUSH FLOOR CLEANOUT
FGCO	2-WAY FLUSH GRADE CLEANOUT
	HOSE BIBB
	CONCRETE THRUST BLOCK
FM	FLOW METER
FS	FLOW SWITCH
	FIRESTOPPING
	PIPE SLEEVE
	BEAM PENETRATION
	PIPE CAP
	PIPE BLIND FLANGE
	UNION
	CAPPED PIPE WITH SHUT-OFF VALVE
	SHUT-OFF VALVE

PIPING LEGEND (CONT.)

	GLOBE VALVE
	CHECK VALVE
	AUTOMATIC THREE-WAY CONTROL VALVE
	AUTOMATIC TWO-WAY CONTROL VALVE
	RELIEF VALVE
	ANGLE RELIEF VALVE
	PRESSURE REDUCING VALVE (PRV)
	LUBRICATED PLUG VALVE
	SOLENOID VALVE
	BUTTERFLY VALVE (MANUAL)
	BALL VALVE
	PUMP
	REFRIGERANT EXPANSION VALVE
	SIGHT GLASS
	MANUAL AIR VENT
A	AUTOMATIC AIR VENT
	THERMOMETER
	PIPE SENSOR WELL (THERMOMETER)
	PRESSURE GAUGE AND COCK
	PRESSURE GAUGE WITH LOOP
	TEMPERATURE-PRESSURE TEST FITTING
℄	CENTER LINE
P 1	PLUMBING RISER DESIGNATION
	NEW CONNECTION TO EXISTING PIPING, DUCTWORK AND/OR EQUIPMENT

SHEET INDEX – PLUMBING

SHEET	TITLE
P0.1	PLUMBING LEGEND AND ABBREVIATIONS
P1.1	GROUND FLOOR PLAN - PLUMBING
P1.2	MEZZANINE FLOOR PLAN - PLUMBING
P5.1	PLUMBING DETAILS
P6.1	PLUMBING SCHEDULES
FP1.1	GROUND FLOOR PLAN - FIRE PROTECTION
FP1.2	MEZZANINE FLOOR PLAN - FIRE PROTECTION
FP5.1	FIRE PROTECTION NOTES AND DETAILS

GENERAL NOTES:

1 CONTRACTOR IS RESPONSIBLE FOR COORDINATING ALL PLUMBING AND FIRE PROTECTION INSTALLATIONS WITH OTHER TRADES SUCH AS ELECTRICAL, STRUCTURAL, HVAC, LIGHTING, CEILING CONSTRUCTION AND SUPPORTS, ETC. ANY CONFLICTS ARISING OUT OF A LACK OF CONSTRUCTION COORDINATION OR DUE TO LACK OF CONSIDERATION FOR THE NEEDS OF OTHER TRADES SHALL BE RESOLVED AT NO EXPENSE TO THE OWNER.

2 ALL PIPING SHALL BE INSTALLED IN SUCH A MANNER THAT CONFLICTS WITH AIR CONDITIONING DUCTS AND WITH CEILING LIGHTS WILL NOT OCCUR. IN SOME INSTANCES, WHERE INDICATED, PIPING SHALL BE INSTALLED WITH SLEEVES THROUGH BEAMS. CONTRACTOR SHALL BE RESPONSIBLE FOR FURNISHING THE SIZES OF SLEEVES AND THE ELEVATIONS AT WHICH OPENINGS ARE TO BE MADE PRIOR TO INSTALLATION OF STRUCTURAL MEMBERS.

3 FOR EVERY PIPE SLEEVE PENETRATING FIRE RATED WALLS AND SLABS, USE 3M OR EQUIVALENT FIRE BARRIER WRAP STRIP FS-165, 3M CAULK CP 25 AND 3M PUTTY 303, ASTM E-814, U.L. LISTED, CAPABLE OF RAPID EXPANSION WHEN EXPOSED TO HEAT. COMPLIES WITH BOCA, ICBO AND SSBC. PROVIDES 3 HOUR FIRE RATING.

4 ALL SANITARY AND STORM DRAINAGE PIPING SHALL BE INSTALLED AT 1/8" PER FOOT SLOPE UNLESS OTHERWISE NOTED. FIXTURE ARMS AND SMALL BRANCHES SHALL BE SLOPED IN ACCORDANCE WITH THE STANDARD PLUMBING CODE.

5 PROVIDE ACCESS PANELS FOR SHOCK ABSORBERS, VALVES AND CLEANOUT COVERS FOR CLEANOUT PLUGS AS SPECIFIED. EACH ITEM SHALL BE PROVIDED WITH ITS ACCESS PANEL OR COVER. ACCESS PANELS AND CLEANOUT COVERS SHALL BE EASILY ACCESSIBLE AND CONTRACTOR WILL BE RESPONSIBLE FOR LOCATING THESE ITEMS SO THAT SHOCK ABSORBER, VALVE OR CLEANOUT LIES WITHIN WALL OR CEILING IMMEDIATELY BEHIND COVER OR PANEL. CONTRACTOR SHALL COORDINATE THE LOCATION OF PANELS AND COVERS WITH OTHER TOILET ACCESSORIES AND FIXTURES AS WELL AS ARCHITECTURAL LAYOUT.

6 DURING FINAL PUNCH LIST INSPECTION, CONTRACTOR SHALL HAVE ALL CLEANOUT COVERS AND ACCESS PANELS OPENED AND ITEMS EXPOSED FOR VERIFICATION AS TO THEIR INSTALLATION BY CONTRACTING OFFICER.

7 PROVIDE AUTOMATIC RESEALS FOR ALL FLOOR DRAINS.

8 SPRINKLER HEAD LOCATIONS SHALL BE SYMMETRICAL WITH ROOM, LIGHTS, DIFFUSERS, ETC. AND COORDINATE WITH THE REFLECTIVE CEILING PLANS. HEADS SHALL BE AS FOLLOWS.

A. LAY-IN CEILING SHALL HAVE SEMI-RECESSED HEADS WITH ESCUTCHEON COLOR SELECTED BY THE ARCHITECT.

B. SHEET ROCK OR PLASTER CEILINGS SHALL HAVE FULLY CONCEALED HEADS WITH COLOR OF CAP SELECTED BY THE ARCHITECT.

9 ALL PIPING TO COMPLY WITH 2012 IBC SEISMIC DESIGN CATEGORY C, OCCUPANCY CATEGORY IV.

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ SOUTH SITE BUILDINGS ■ CSI / MAINTENANCE ■

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Client No: -------

Architect No:

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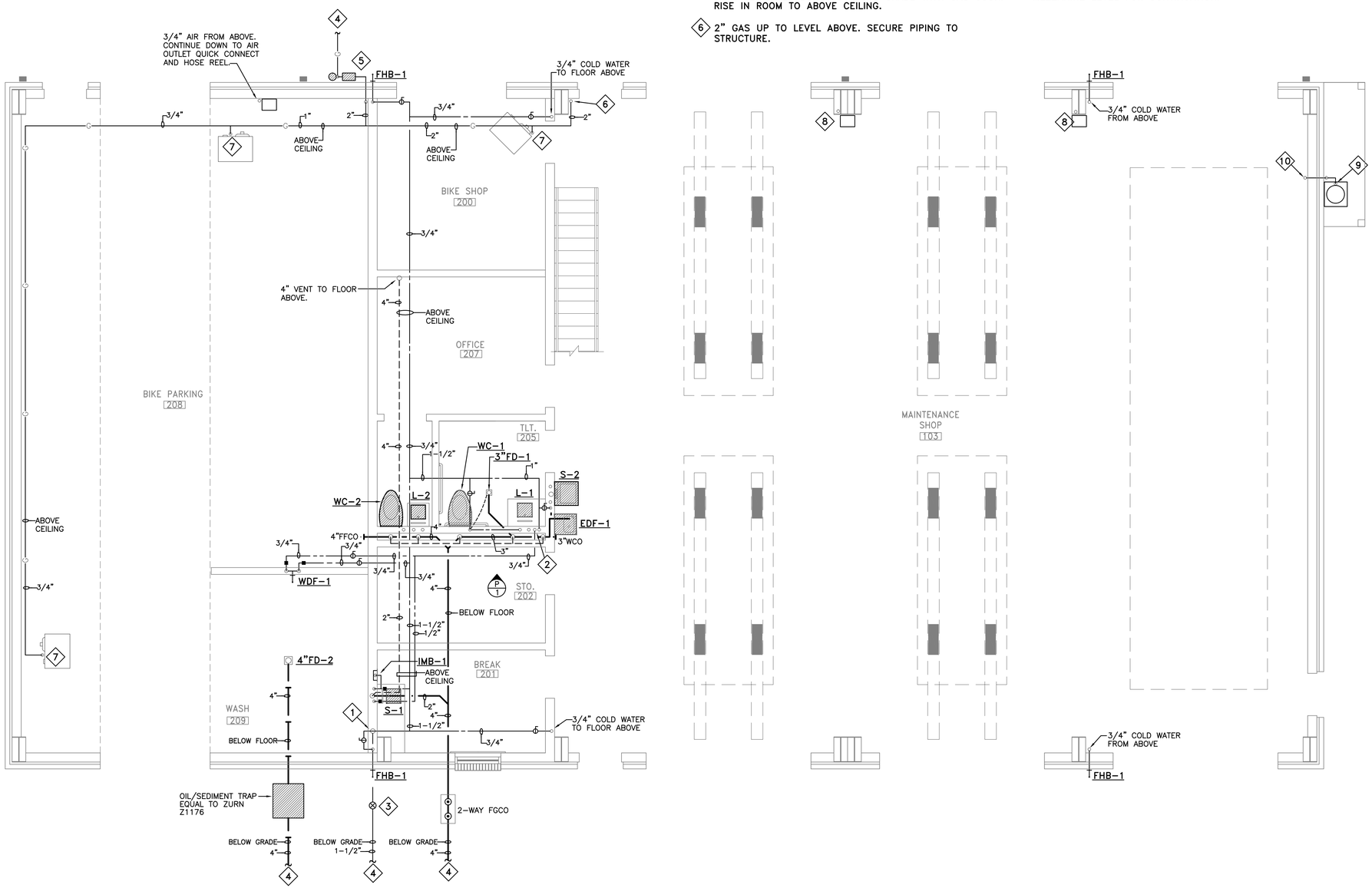
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ERG NO. 15-28.3

PLAN NOTES:

1. 1-1/4" COLD WATER MAIN UP TO ABOVE CEILING.
2. 1" COLD AND HOT WATER UP TO FLOOR ABOVE TO WATER HEATER.
3. CUT-OFF VALVE IN HEAVY DUTY BOX WITH COVER.
4. CONTINUATION UNDER ANOTHER DIVISION.
5. GAS METER AND REGULATOR BY UTILITY COMPANY AT CONTRACTOR'S EXPENSE. SIZE REGULATOR FOR 720 CFH AT 4 oz. ENTER BUILDING ABOVE GRADE WITH GAS COCK. RISE IN ROOM TO ABOVE CEILING.
6. 2" GAS UP TO LEVEL ABOVE. SECURE PIPING TO STRUCTURE.
7. GAS PIPING DOWN TO UNIT HEATER WITH GAS COCK, UNION AND DIRT LEG.
8. 3/4" AIR PIPING FROM ABOVE, SECURED TO COLUMN. PROVIDE AND CONNECT TO HOSE REEL ON FACE OF COLUMN.
9. 1" AIR DOWN TO EXISTING RELOCATED AIR COMPRESSOR. PLUMBING CONTRACTOR TO MAKE FINAL CONNECTION.
10. 1" AIR UP HIGH AS POSSIBLE IN STRUCTURE. SEE MEZZANINE LEVEL FOR CONTINUATION.



NORTH

LOWER LEVEL PLAN – PLUMBING

SCALE: 1/4" = 1'-0"

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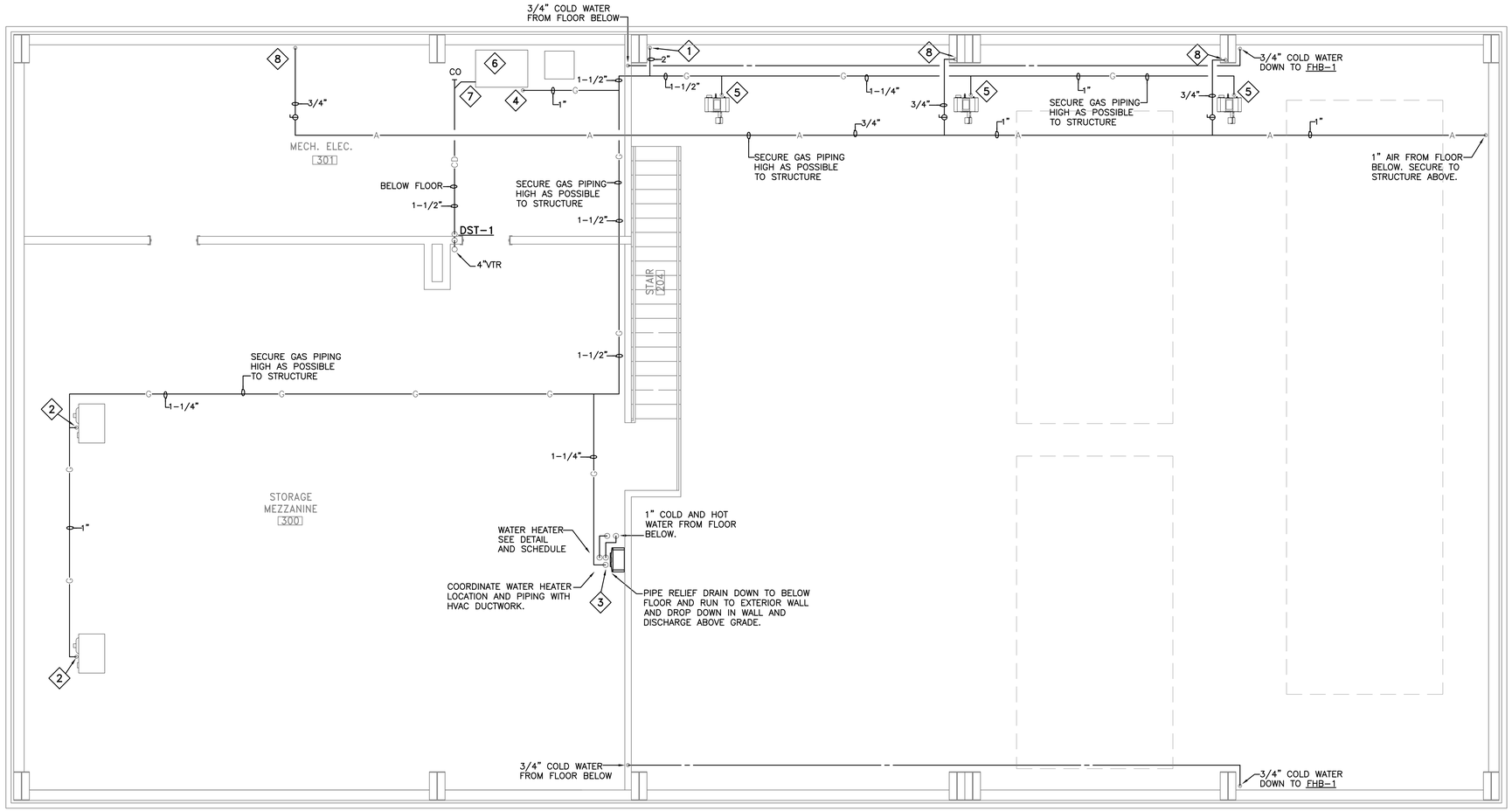
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PLAN NOTES:

1. GAS PIPING UP HIGH AS POSSIBLE AND SECURE PIPING TO STRUCTURE.
2. GAS PIPING DOWN TO UNIT HEATER WITH GAS COCK, UNION AND DIRT LEG.
3. GAS PIPING DOWN TO WATER HEATER WITH GAS COCK, UNION AND DIRT LEG.
4. GAS PIPING DOWN TO GAS FURNACE WITH GAS COCK, UNION AND DIRT LEG.
5. GAS PIPING DOWN TO INFRARED HEATER WITH GAS COCK, UNION AND DIRT LEG.
6. PIPE AUXILIARY DRAIN FROM SAFETY PAN DOWN IN EXTERIOR WALL AND DISCHARGE OUTSIDE ABOVE GRADE.
7. PIPE CONDENSATE DRAIN FROM UNIT TO BELOW FLOOR AND RUN HORIZONTALLY TO 4" VENT STACK AND CONNECT WITH A DEEP SEAL P-TRAP (DST-1). SLOPE PIPING AS REQUIRED AND WRAP WITH 3/4" ARMAFLEX.
8. 3/4" AIR DOWN. SEE LOWER LEVEL FOR CONTINUATION. SEE DETAIL.



NORTH

MEZZANINE LEVEL PLAN – PLUMBING

SCALE: 1/4" = 1'-0"

CITY OF HATTIESBURG MISSISSIPPI 1884

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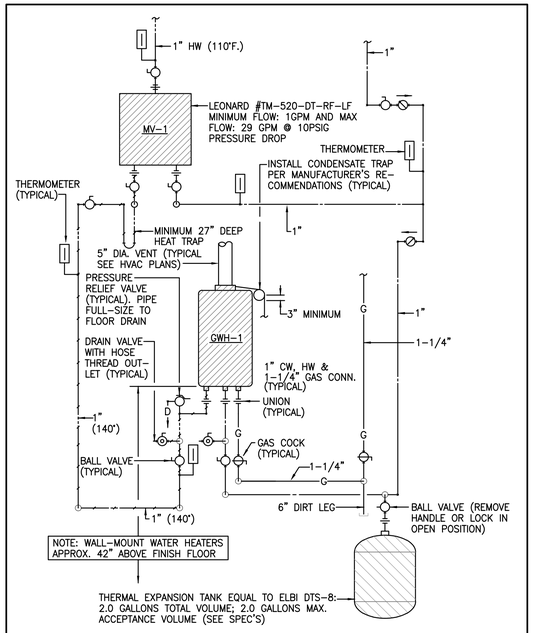
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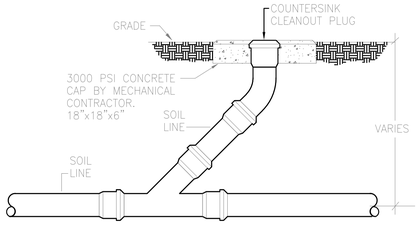
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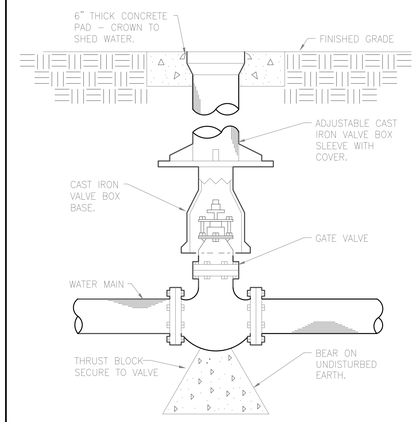
1 GAS TANKLESS WATER HEATER DETAIL

NOT TO SCALE



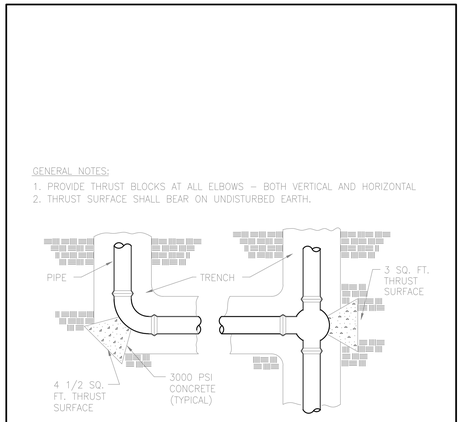
2 CLEANOUT DETAIL (FGCO)

NOT TO SCALE



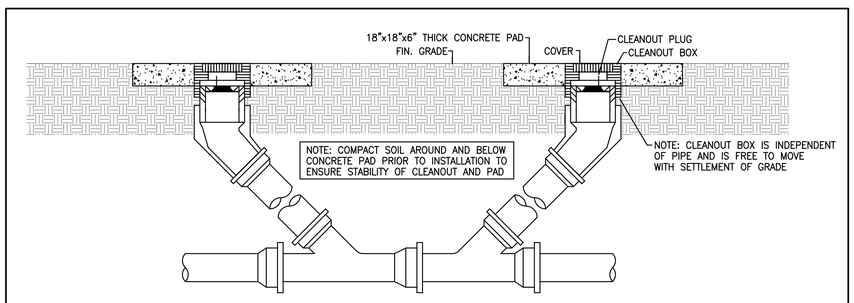
3 GATE VALVE BOX DETAL

NOT TO SCALE



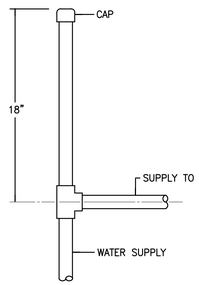
4 THRUST BLOCK DETAIL

NOT TO SCALE



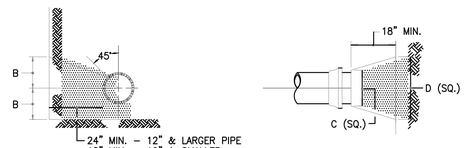
5 DETAIL OF EXTERIOR 2-WAY FLUSH GRADE CLEANOUT

NO SCALE



6 TYPICAL WATER SUPPLY AIR CHAMBER AT PLUMBING FIXTURE CONNECTION

NO SCALE



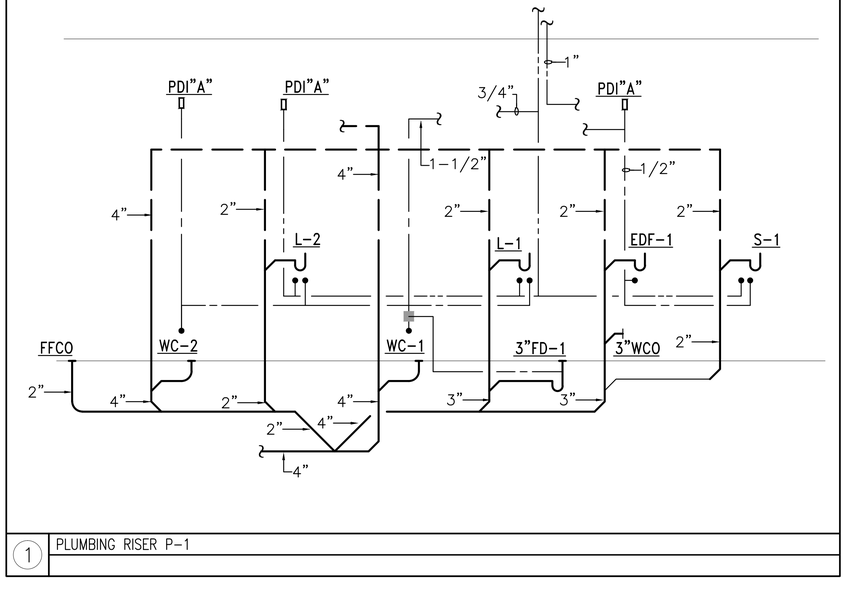
SECTION X - X
BENDS AND TEES

PLAN & ELEVATION
PLUGS

SIZE	1/4 BENDS		1/8 BENDS		1/16 BENDS		TEES		PLUGS	
	A	B	A	B	A	B	A	B	C	D
2	8	6	8	6	8	6	8	6	6	12
2-1/2	8	6	8	6	8	6	8	6	6	12
3	8	6	8	6	8	8	10	12	8	16
4	8	6	8	6	8	8	10	12	8	16
6	8	10	8	8	8	8	10	12	8	16
8	12	12	8	10	8	9	10	12	12	20

7 TYPICAL THRUST BLOCKS FOR WATER MAINS DETAIL

NO SCALE



1 PLUMBING RISER P-1

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HATTIESBURG ■ POLICE DEPARTMENT ■ SOUTH SITE BUILDINGS ■ CSI / MAINTENANCE

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ERG NO. 15-28.3

PLUMBING FIXTURE SCHEDULE

MARK	DESCRIPITION	MAKE	MODEL	SUPPLY FITTING	SUPPLY PIPE(S)	DRAIN	TRAP	ROUGH-IN SIZES				REMARKS
								C.W.	H.W.	WASTE	VENT	
WC-1	A.D.A. WATER CLOSET, FLR. MTD., FLUSH VALVE, TRAP PRIMER	KOHLER	K-4302	ZURN Z6000 ws1-yb-yc-df	K-7637	---	---	1"	--	4"	4"	W/ KOHLER K-4670-C OPEN FRONT SEAT, TRAP PRIMER, AND BOLT CAPS. WITH TRAP PRIMER EQUAL TO PPP. DUAL FLUSH
WC-2	WATER CLOSET, FLR. MTD., FLUSH VALVE	KOHLER	K-4330	ZURN Z6000 ws1-yb-yc-df	K-7637	---	---	1"	--	4"	4"	W/ KOHLER K-4670-C OPEN FRONT SEAT, AND BOLT CAPS. DUAL FLUSH
L-1	LAVATORY COUNTER MOUNTED	KOHLER	K-2196	KOHLER K-15243-4	ZURN Z8800LR	ZURN Z8743	ZURN 8700B	1/2"	1/2"	2"	2"	COORDINATE ROUGH-IN WITH DRAIN ASSEMBLY. INSULATE P-TRAP AND SUPPLY PIPES W/ TRUEBRO 102G/105.
L-2	LAVATORY WALL HUNG	KOHLER	K-1722	KOHLER K-15243-4	ZURN Z8800LR	ZURN Z8743	ZURN 8700B	1/2"	1/2"	2"	2"	COORDINATE ROUGH-IN WITH DRAIN ASSEMBLY. INSULATE P-TRAP AND SUPPLY PIPES W/ TRUEBRO 102G/105. PROVIDE AND INSTALL WALL CARRIER.
S-1	SINGLE COMP. SINK	ELKAY	DLR-2222-10	DELTA 23C644-R7	ZURN Z8800LR	LK-35	ZURN Z8702B-PC	1/2"	1/2"	2"	2"	
S-2	UTILITY SINK	ZURN	MS2620-DF1	-	---	---	---	1/2"	1/2"	2"	2"	
IMB-1	ICE MACHINE BOX	WATER TITE	9000	---	---	---	---	1/2"	--	--	--	
FHB-1	HOSE BIBB, FREEZEPROOF	WOODFORD	65	---	---	---	---	3/4"	--	--	--	WITH VACUUM BREAKER
TP-1	TRAP PRIMER	PPP	P1-500	---	---	---	---	1/2"	--	--	--	DISCHARGE FROM PRIMER TO DROP IN WALL DOWN TO BELOW FLOOR CONTINUE TO FLOOR DRAIN AND CONNECT TO PRIMER CONNECTION
FD-1	FLOOR DRAIN - POLISHED BRONZE WITH TRAP PRIMER CONNECTION	ZURN	ZB-415-B-P	---	---	---	---	--	--	3"	2"	WITH TRAP PRIMER CONNECTION
FD-2	FLOOR DRAIN	ZURN	ZB-415-B	---	---	---	---	--	--	2"	2"	
WDF-1	WASH DOWN FAUCET	LEONARD	SW-75-EVB-RF	---	---	---	---	3/4'	3/4"	-	-	WITH LEONARD HOSE ACCESSORIES "N2" NOZZLE AND "15 HDH" HOSE
DST-1	DEEP-SEAL P-TRAP	ZURN	Z1000	---	---	---	---	--	--	SEE PLAN	SEE PLAN	D.C.C.I. BODY & BRONZE FUNNEL DRAIN
EDF-1	ELECTRIC DRINKING FOUNTAIN	SUNROC	SRF-7200	---	ZURN Z8800LR	---	ZURN Z8702B-PC	1/2"	--	2"	2"	4.7 FLA. 1/5 HP., 120V, 1ø, BASE RATE 8.0 GPH.

WATER HEATER SCHEDULE

MARK	MAKE	MODEL	INPUT (MBH)	H.W. CAPACITY RANGE	VENT DIA.	CONTROLS	EFFICIENCY	REMARKS
GWH-1	RINNAI TANKLESS	REU-KCM20 25FFU-US	10.3 - 130	0.26 - 6.5 GPM	4"	120V/1PH	94%	TANKLESS HEATERS. SEE SPEC'S FURNISH VENT KIT & CONTROLS (SEE SPEC'S)

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

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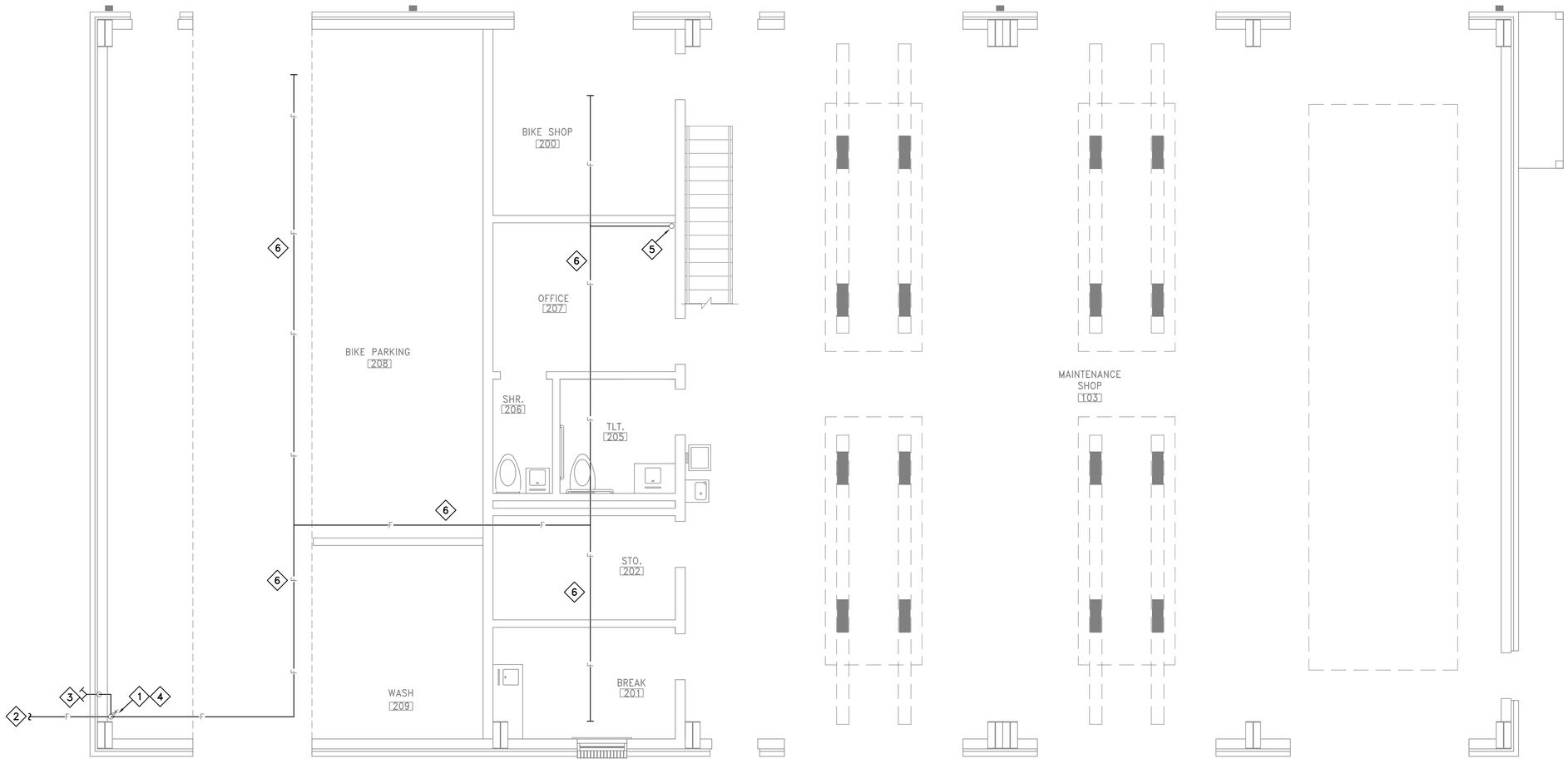
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NUMBERED NOTES:

1. FIRE PROTECTION PIPING UP IN MECHANICAL ROOM WITH VERTICAL BACKFLOW PREVENTER EQUAL TO WATTS 757OSY. CONTINUE WITH OS&Y VALVE WITH TAMPER SWITCH AND FLOW SWITCH. CONTINUE TO CALCULATED SPRINKLER SYSTEM. SEE DETAIL AND SPECIFICATIONS.
2. CONTINUATION UNDER ANOTHER DIVISION.
3. FIRE DEPARTMENT CONNECTION.
4. OS&Y VALVE WITH TAMPER SWITCH AND FLOW SWITCH.
5. FIRE PROTECTION MAIN TO FLOOR ABOVE.
6. FIRE PROTECTION MAIN. SEE CALCULATED SPRINKLER DRAWINGS BY SPRINKLER CONTRACTOR FOR EXACT LOCATION OF MAIN, RUN-OUTS AND SIZES.



NORTH

LOWER LEVEL PLAN – FIRE PROTECTION

SCALE: 1/4" = 1'-0"

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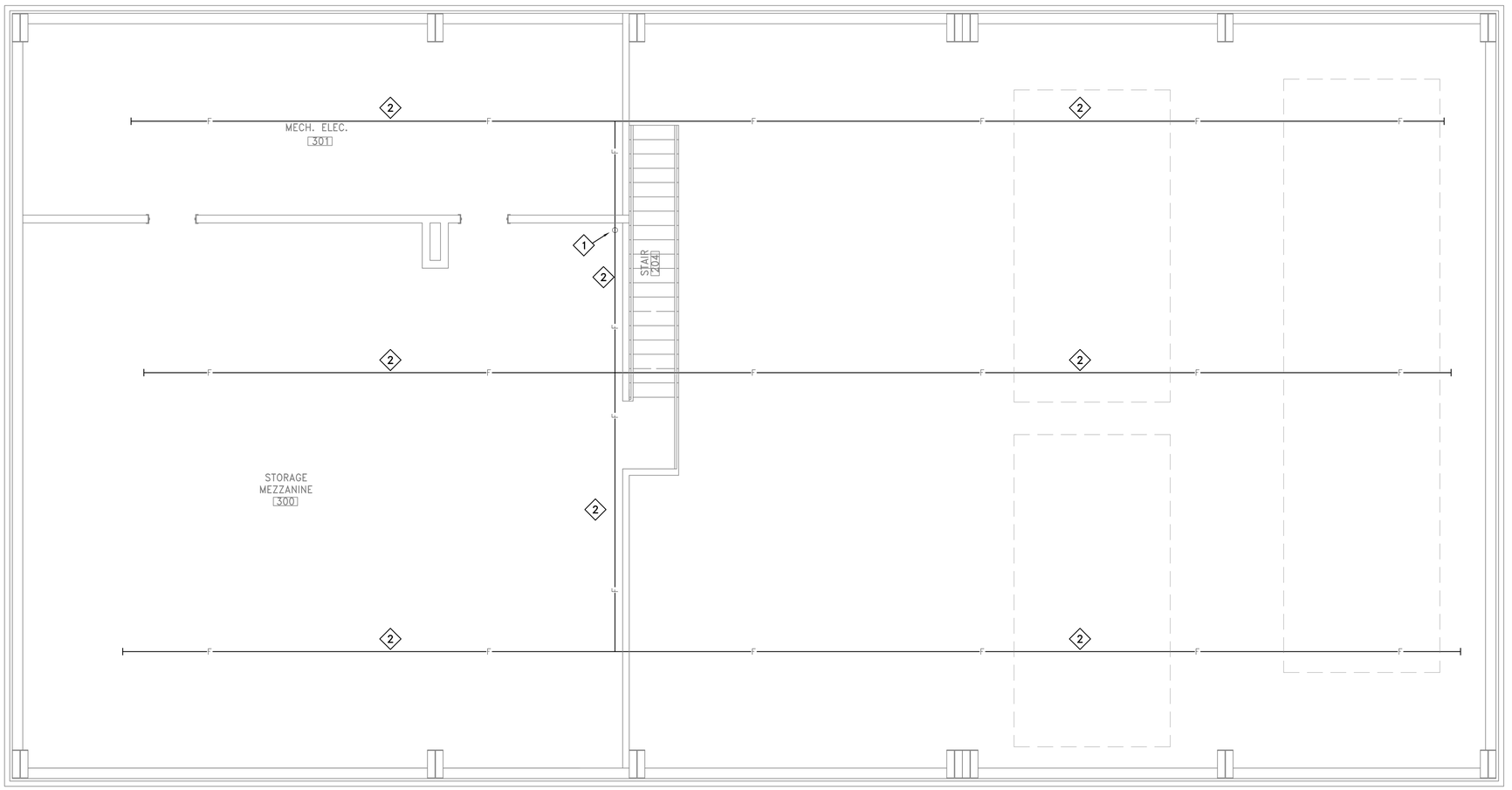
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NUMBERED NOTES:

1. FIRE PROTECTION MAIN FROM FLOOR BELOW.
2. FIRE PROTECTION MAIN. SEE CALCULATED SPRINKLER DRAWINGS BY SPRINKLER CONTRACTOR FOR EXACT LOCATION OF MAIN, RUN-OUTS AND SIZES.



NORTH

MEZZANINE LEVEL PLAN – FIRE PROTECTION

SCALE: 1/4" = 1'-0"

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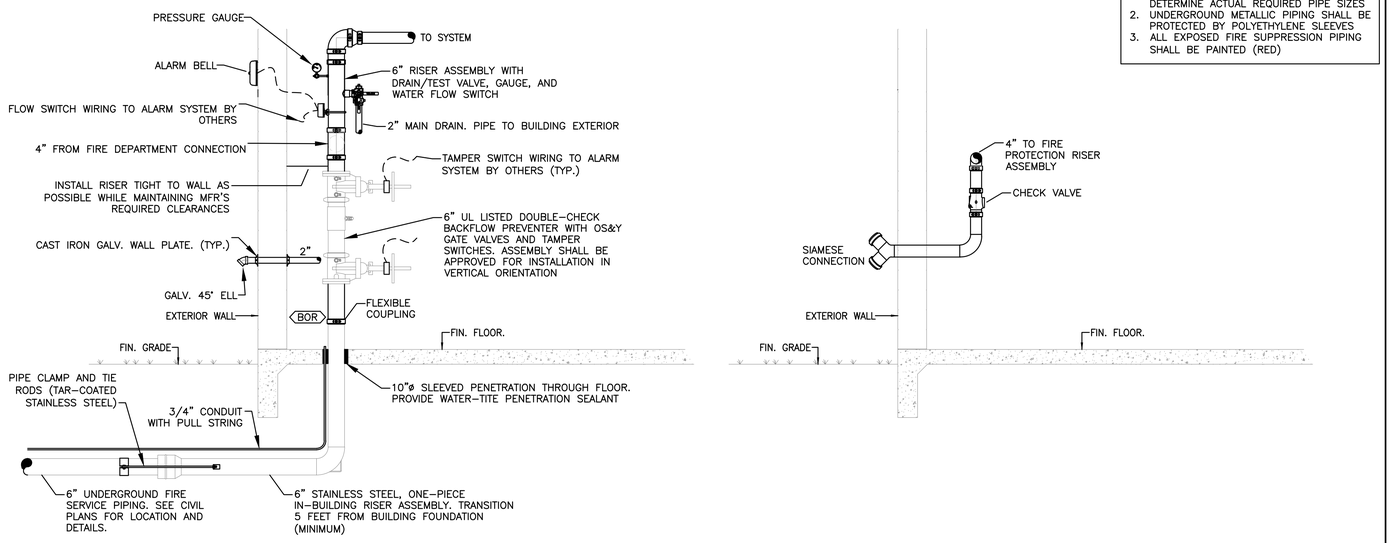
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NOTES:
1. FIRE PROTECTION CONTRACTOR SHALL DETERMINE ACTUAL REQUIRED PIPE SIZES
2. UNDERGROUND METALLIC PIPING SHALL BE PROTECTED BY POLYETHYLENE SLEEVES
3. ALL EXPOSED FIRE SUPPRESSION PIPING SHALL BE PAINTED (RED)

1 DETAIL OF WET PIPE FIRE PROTECTION RISER — NO SCALE

FIRE PROTECTION GENERAL NOTES

1) INCLUDE ALL LABOR, MATERIAL, EQUIPMENT AND SERVICE NECESSARY FOR AND REASONABLY INCIDENTAL TO THE DESIGN, FABRICATION AND INSTALLATION OF THE COMPLETE AUTOMATIC FIRE PROTECTION SYSTEMS AS INDICATED ON THE CONTRACT DRAWINGS AND AS SPECIFIED IN THE CONTRACT SPECIFICATIONS.

2) THE FIRE SPRINKLER SYSTEM DESCRIBED ON THE DRAWINGS AND IN THE SPECIFICATIONS SHALL BE FULLY DESIGNED BY THE FIRE PROTECTION CONTRACTOR(S). THE FIRE SUPPRESSION SYSTEM DRAWINGS AND SPECIFICATIONS ARE PERFORMANCE BASED ONLY. THE DESIGN BUILD CONTRACTOR(S) SHALL BE FULLY RESPONSIBLE FOR THE DESIGN AND TO PROVIDE ALL NECESSARY EQUIPMENT, HARDWARE, CONTROLS, SENSOR, ETC. PER LOCAL FIRE PROTECTION CODES.

3) IN GENERAL, WORK SHALL INCLUDE, BUT NOT BE LIMITED TO:
   A. COMPLETE OVERHEAD AUTOMATIC SPRINKLER SYSTEMS AS INDICATED ON THE CONTRACT DRAWINGS AND CONTRACT SPECIFICATIONS.
   B. CONNECTION TO UNDERGROUND FIRE SERVICE.
   C. SYSTEMS AND DEVICE TESTING.
   D. ALL NECESSARY PERMITS.

4) THE FIRE SPRINKLER SYSTEMS FOR PROTECTION OF THE SHOP BUILDING SHALL BE HYDRAULICALLY DESIGNED WET PIPE SPRINKLER SYSTEMS AS SPECIFIED IN THE FOLLOWING
   A. OFFICES, INCLUDING CORRIDORS, LOUNGES, AND SIMILAR SPACES SHALL BE DESIGNED FOR A LIGHT HAZARD OCCUPANCY TO PROVIDE A MINIMUM DESIGN DISCHARGE DENSITY OF 0.10 GPM PER SQ FT OVER THE HYDRAULIC CALCULATION AREA OR ROOM.
   B. SHOP AREA, MECHANICAL, MINOR STORAGE, AND SIMILAR AREAS OF THE BUILDINGS SHALL BE DESIGNED FOR AN ORDINARY HAZARD GROUP 1 OCCUPANCY. MAXIMUM SPRINKLER SPACING SHALL BE 130 SQ FT.
   C. ALL SPRINKLERS WITHIN THE PROJECT AREA SHALL BE NEW, QUICK RESPONSE, ORDINARY TEMPERATURE RATING (EXCEPT AS REQUIRED BY NFPA 13 - 2010 SECTION 8.3.2).
   D. CALCULATIONS SHALL INCLUDE AN INSIDE HOSE STREAM ALLOWANCE OF 100 GPM.

5) PIPE SIZES INDICATED ON THE CONTRACT DRAWINGS SHALL NOT BE REDUCED.

6) THE CONTRACTOR SHALL BE RESPONSIBLE FOR ESTABLISHING AND IMPLEMENTING ALL SAFETY PROGRAMS AND PROCEDURES FOR THIS PROJECT AND SHALL COMPLY WITH ALL FEDERAL, STATE AND LOCAL SAFETY AND HEALTH REGULATIONS.

7) THE CONTRACT DRAWINGS ARE DIAGRAMMATIC ONLY. PIPE LENGTHS (IF SHOWN) ARE APPROXIMATE CENTER TO CENTER LENGTHS BETWEEN FITTINGS. THE CONTRACTOR SHALL DETERMINE THE ACTUAL MEASUREMENTS AND MAKE ANY AND ALL SUCH LENGTH AND OFFSET ADJUSTEMENTS AS MAY BE NECESSARY TO COMPLETE THE INSTALLATION AT NO CHANGE IN THE CONTRACT PRICE. THE CONTRACT DRAWINGS ARE NOT INTENDED TO RELIEVE THE CONTRACTOR OF ANY RESPONSIBILITY FOR AVOIDING CONFLICTS OR OBSTRUCTIONS, OR FOR INSTALLING THE NUMBER OF SPRINKLERS AND SUPPLY PIPING AS REQUIRED TO PROVIDE COMPLETE PROTECTION OF THE DESIGNATED AREAS IN ACCORDANCE WITH THE REQUIREMENTS OF THE REFERENCED STANDARDS AND THESE SPECIFICATIONS. WRITTEN APPROVAL SHALL BE OBTAINED FROM THE PROFESSIONAL PRIOR TO MAKING ANY MAJOR DEVIATIONS FROM THE ARRANGEMENT AND LAYOUT SHOWN ON THE CONTRACT DRAWINGS.

8) ALL EQUIPMENT SHALL BE LISTED BY UNDERWRITER'S LABORATORIES AND/OR FACTORY MUTAL APPROVED.

9) SYSTEM, EQUIPMENT, INSTALLATION AND MATERIALS AND METHODS USED SHALL COMPLY WITH THE FOLLOWING:
   A. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) 1 FIRE CODE 2012 EDITION.
   B. NFPA 13 STANDARD FOR THE INSTALLATION OF SPRINKLER SYSTEMS 2010 EDITION.
   C. INTERNATIONAL BUILDING CODE - 2012
   D. MANUFACTURER'S RECOMMENDATIONS AND GUIDELINES.

10) ALL MATERIALS AND EQUIPMENT FURNISHED BY THE CONTRACTOR SHALL BE NEW, FIRST GRADE STANDARD, CURRENT PRODUCTS OF A MANUFACTURER REGULARLY ENGAGED IN THE PRODUCTION OF SUCH MATERIALS AND EQUIPMENT. WHERE TWO OR MORE PIECES OF EQUIPMENT PERFORMING THE SAME FUNCTION ARE REQUIRED, THEY SHALL BE THE PRODUCT OF ONE MANUFACTURER AND EXACT DUPLICATES.

11) PIPING SHALL BE NEW, DESIGNED FOR 300 PSI WORKING PRESSURE, CONFORMING TO ASTM SPECIFICATIONS, AND HAVE THE MANUFACTURER'S NAME OR BRAND ALONG WITH THE PIPE APPLICABLE ASTM STANDARD MARKED ON EACH LENGTH OF PIPE.

12) PIPING 2" DIAMETER AND SMALLER SHALL BE SCHEDULE 40 BLACK STEEL PIPE. PIPE SHALL BE MANUFACTUERED IN ACCORDANCE WITH SPECIFICATIONS ASTM A53 AND A135.

13) PIPING 2-1/2" DIAMETER AND LARGER SHALL BE SCHEDULE 10 BLACK STEEL PIPE MANUFACTURED IN ACCORDANCE WITH SPECIFICATION ASTM A135.

14) OTHER THIN-WALLED PIPING MATERIALS (SUCH AS SCHEDULE, 5, XL AND BLT THREADABLE THINWALLS, ETC.) WILL NOT BE PERMITTED.

15) ALL FIRE PROTECTION SYSTEM PIPING SHALL BE PROVIDED WITH FACTORY APPLIED ANTIMICROBIAL COATINGS TOINHIBIT MICROBIOLOGICALLY INFLUENCED CORROSION (MIC). ALLIED TUBE AND CONDUIT "ABF II", WHEATLAND TUBE COMPANY "MIC SHIELD" OR EQUAL.

16) THREADED FITTINGS SHALL BE CLASS 125 CAST IRON, BLACK, AND IN ACCORDANCE WITH ANSI B16.4 OR DUCTILE OR MALLEABLE IRON, 150 LB CLASS, BLACK, AND IN ACCORDANCE WITH ANSI B16.3. SCREWED JOINTS SHALL BE MADE UP WITH APPROVED TEFLON JOINT COMPOUND OR TAPE.

17) BOLT ON OR STRAP ON BRANCH AND OUTLET FITTINGS WILL NOT BE PERMITTED. SIMILARLY, HOLE CUT PIPING SYSTEM OR STRAPLESS OUTLETS WILL NOT BE PERMITTED.

18) GROOVED COUPLINGS SHALL BE UL LISTED AND/OR FM APPROVED FOR FIRE PROTECTION SERVICE. PLAIN-END TYPE PIPE FITTINGS AND COUPLINGS SHALL NOT BE USED.

19) ALL PENDENT AND SIDEWALL SPRINKLERS LOCATED WITHIN 7 FT OF THE FLOOR OR SUBJECT TO MECHANICAL DAMAGE SHALL BE PROVIDED WITH LISTED SPRINKLER GUARDS COMPATIBLE WITH THE SPRINKLER MODELS AND TYPES ON WHICH THEY ARE INSTALLED.

20) EXTRA SPRINKLERS IN THE QUANTIES REQUIRED BY NFPA 13, CABINETS, AND WRENCHES SHALL BE SUPPLIED AND DELIVERED TO THE PROFESSIONAL.

21) INSTALL HANGERS, FLEXIBLE CONNECTIONS, SWING JOINTS AND BRACING IN ACCORDANCE WITH NFPA 13.

22) SYSTEM PIPING SHALL BE INSTALLED SUCH THAT NO JOINTS, FITTINGS OR DEVICES OCCUR DIRECTLY OVER ELECTRICAL EQUIPMENT OR WITHIN THE CLEARANCE SPACE AS REQUIRED BY THE NATIONAL ELECTRIC CODE (NEC).

23) IMPAIRMENTS OF EXISTING FIRE PROTECTION SYSTEMS SHALL BE MINIMIZED, COORDINATED WITH THE PROFESSIONAL AND PERFORMED IN ACCORDANCE WITH NFPA 25. ALL EXISTING FIRE PROTECTION SYSTEMS SHALL BE RESTORED TO SERVICE AT THE END OF EACH WORKING DAY.

24) THE WORK PERFORMED ON THIS PROJECT OCCURS WITHIN AN EXISTING BUILDING. ALL EQUIPMENT AND MATERIAL TO BE FURNISHED AND INSTALLED ON THE PROJECT SHALL BE COORDINATED WITH THE SPACE CONSTRAINTS. ALL EQUIPMENT AND MATERIAL SHALL BE FABRICATED SUCH THAT COMPLETE SYSTEMS MAY BE BROKEN DOWNI INTO SECTION SUITABLE FOR LIFTING AND FITTING THROUGH PASSAGEWAYS WITHOUT MODIFCATION TO THE BUILDING UNLESS OTHERWISE NOTED, OR OTHER ARRANGEMENTS ARE MADE WITH THE PROFESSIONAL.

25) THE CONTACTOR SHALL BE RESPONSIBLE FOR ALL OPENINGS AND PENETRATIONS REQUIRED FOR THE FIRE PROTECTION PIPING.

26) CUTTING STRUCTURAL MEMBERS FOR THE PASSING OF FIRE PROTECTION PIPING OR PIPE HANGER FASTENING WILL NOT BE PERMITTED EXCEPT WITH APPROVAL OF THE PROFESSIONAL.

27) SUITABLE MEANS SHALL BE PROVIDED AT EACH HOLE OR PENETRATION TO MAINTAIN THE DESIGNED FIRE RESISTANCE RATING OF THE WALL, CEILING, OR FLOOR ASSEMBLY.

28) INSTALL SPLIT WALL PLATES OR ESCUTCHEONS WHERE EXPOSED PIPING PASSES THROUGH A FINISHED FLOOR, WALL OR CEILING. THEY SHALL FIT SNUGLY AROUND PIPING. THE FINISH OF ESCUTCHEONS OR WALL PLATES SHALL MATCH THE COLOR OF ADJACENT WALLS, CEILINGS, OR FLOORS.

29) UPON COMPLETION OF INSTALLATION AND WHILE PIPING IS STILL EXPOSED, HYDROSTATICALLY TEST THE SYSTEMS AT 200 PSI (OR 50 PSI IN EXCES OF THE SYSTEM WORKING PRESSURE, WHICHEVER IS GREATER) FOR A PERIOD OF 2 HOURS. PORTIONS OF THE SYSTEM MAY BE TESTED AS THEY ARE COMPLETED. SEVENTY-TWO HOUR NOTICE SHALL BE GIVEN TO THE PROFESSIONAL AND THE AUTHORITY HAVING JURISDICTION PRIOR TO ANY TEST. A PRE-INSTALLATION INSPECTION OF PIPE, FITTINGS, AND DEVICES IS REQUIRED.

30) SPRINKLER HEADS INSTALLED IN TILE CEILINGS SHALL BE INSTALLED IN THE CENTER OF THE TILES.

31) SPRINKLER SYSTEM DRAIN LINES SHALL BE ROUTED AS INDICATED ON FLOOR PLANS AND FULLY COORDINATED WITH ALL TRADES SUCH THAT IT AVOIDS THE TRAVEL PATH OF THE OVERHEAD CRANE . REFER TO SECTION 2 ON SHEET A304.

32) THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL LEAKS.

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Architect No:

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HVAC LEGEND AND ABBREVIATIONS

PIPING LEGEND

RS / RL	REFRIGERANT SUCTION / REFRIGERANT LIQUID
D / D	CONDENSATE DRAIN LINE
	UNION
	CAPPED PIPE WITH SHUT-OFF VALVE
	ELBOW TURNED UP
	ELBOW TURNED DOWN
	BOTTOM PIPE CONNECTION
	TOP PIPE CONNECTION
	SHUT-OFF VALVE
	GAS COCK
	BALANCING VALVE
	SOLENOID VALVE
	BUTTERFLY VALVE (MANUAL)
	BALL VALVE
	BALL VALVE, NORMALLY CLOSED
	SIGHT GLASS

DUCTWORK LEGEND

	RADIUS ELBOW
	ELBOW WITH TURNING VANES
	RECTANGULAR BRANCH TAKEOFF WITH BALANCING DAMPER
	RECTANGULAR SUPPLY DUCT UP
	RECTANGULAR SUPPLY DUCT DOWN
	RECTANGULAR RETURN OR EXHAUST DUCT UP
	RECTANGULAR RETURN OR EXHAUST DUCT DOWN
R	SLOPING RISE IN DUCTWORK
D	SLOPING DROP IN DUCTWORK
18x12 / 18x12	DUCT SIZE (CLEAR INSIDE DIMENSION) FIRST FIGURE INDICATES PLAN SIZE
18ϕ / 18ϕ	ROUND DUCT DIAMETER SIZE (CLEAR INSIDE DIMENSION)
	FLEXIBLE DUCT
	VOLUME DAMPER IN DUCT
M	MOTORIZED DAMPER

TAG (SEE SCHEDULE) — NECK SIZE

CFM OR "--" (-- MEANS NO BALANCE REQUIRED)

DIFFUSER, RETURN, & EXHAUST GRILLE TAG

DUCTWORK LEGEND (CONT.)

	RETURN/EXHAUST REGISTER OR GRILLE
	CEILING SUPPLY DIFFUSER
→	SUPPLY REGISTER WITH AIR OUTLET DEVICE DESIGNATION
←	RETURN OR EXHAUST REGISTER OR GRILLE WITH AIR INLET DEVICE DESIGNATION

CONTROLS LEGEND

CO2	CARBON DIOXIDE SENSOR
H	HUMIDITY SENSOR
T	TEMPERATURE SENSOR/THERMOSTAT
Tp	PROGRAMMABLE THERMOSTAT
S	TEMPERATURE SENSOR
P #	STATIC PRESSURE SENSOR WITH DESIGNATION
TN	NIGHT SET-BACK THERMOSTAT
WS	WALL SWITCH
RC	REMOTE CONTROLLER
ORT	0-6 HOUR OVERRIDE TIMER
T/C	TIME CLOCK
E/S	EMERGENCY SHUTOFF SWITCH
	WALL OR CEILING MOTION HEAT SENSOR

MISCELLANEOUS

DP	DIFFERENTIAL PRESSURE SENSOR
DP	DIFFERENTIAL PRESSURE SWITCH
ϕ	DIAMETER
HW / 1	RISER DESIGNATION (RISER SERVICE / RISER NUMBER)
2 / M3.1	SECTION DESIGNATION (SECTION NUMBER / DRAWING NUMBER)
1 / M2.1	DETAIL DESIGNATION (DETAIL NUMBER / DRAWING NUMBER)
CT / 1-1	EQUIPMENT DESIGNATION (EQUIPMENT TYPE / EQUIPMENT NUMBER)
T-3.24	TERMINAL DESIGNATION (3-24: THE NUMBER ON SYSTEM / SYSTEM)

ABBREVIATIONS – MECHANICAL

ACU	AIR CONDITIONING UNIT
BHP	BRAKE HORSE POWER
BTU	BRITISH THERMAL UNIT
CC	COOLING COIL
CD	CEILING DIFFUSER
CER	CEILING EXHAUST REGISTER
CRG	CEILING RETURN GRILLE
CFM	CUBIC FEET PER MINUTE
CG	CEILING GRILLE
CRA	CONDITIONING RETURN AIR
CSA	CONDITIONING SUPPLY AIR
DB	DRY BULB
DIA	DIAMETER
DN	DOWN
DX	DIRECT EXPANSION
EA	EXHAUST AIR
EAT	ENTERING AIR TEMPERATURE
EDB	ENTERING DRY BULB
EF	EXHAUST FAN
EFF	EFFICIENCY
EWB	ENTERING WET BULB
°F	DEGREES FAHRENHEIT
FC	FLEXIBLE CONNECTION (DUCT OR PIPE)
FLR	FLOOR
FLA	FULL LOAD AMPS
FT	FEET
GF	GAS FURNACE
GWH	GAS WATER HEATER
HP	HORSE POWER
HR	HOUR

ABBREVIATIONS – MECHANICAL

HRU	HEAT RECOVERY UNIT
ID	INSIDE DIMENSION
KW	KILOWATT
LAT	LEAVING AIR TEMPERATURE
LBS	POUNDS
LRA	LOCK ROTOR AMPS
MAX	MAXIMUM
MBH	THOUSAND BTU PER HOUR
MFG	MANUFACTURER
MFS	MAXIMUM FUSE SIZE
MIN	MINIMUM
MOCP	MAXIMUM OVERCURRENT PROTECTION
NC	NORMALLY CLOSED
NFA	NET FREE AREA
NIC	NOT IN THIS CONTRACT
NO	NORMALLY OPEN
NTS	NOT TO SCALE
OA	OUTSIDE AIR INTAKE
OBD	OPPOSED BLADE DAMPER
OD	OUTSIDE DIMENSION
PD	PRESSURE DROP
SENS	SENSIBLE
SP	STATIC PRESSURE
SQFT	SQUARE FEET
TYP	TYPICAL
VD	VOLUME DAMPER
VTR	VENT THRU ROOF
W/	WITH
WSR	WALL SUPPLY REGISTER
WB	WET BULB

GENERAL NOTES – HVAC

GENERAL RENOVATION REQUIREMENTS

A. ANY INDICATED MOUNTING HEIGHTS ARE APPROXIMATE. FINAL MOUNTING HEIGHT SHALL BE DETERMINED IN FIELD.

B. INSTALLATION OF ALL EQUIPMENT AND SYSTEMS SHALL BE IN ACCORDANCE WITH, MANUFACTURER'S REQUIREMENTS, STANDARD DETAILS, SECTIONS AND ELEVATIONS SHOWN ON THE DRAWINGS.

C. CONTRACTOR SHALL MAINTAIN A CLEAR SERVICE AREA AROUND ALL EQUIPMENT FOR MAINTENANCE.

SHEET INDEX – MECHANICAL HVAC

SHEET	TITLE
M0.1	HVAC LEGEND AND ABBREVIATIONS
M1.1	LOWER LEVEL PLAN - HVAC
M1.2	MEZZANINE LEVEL PLAN - HVAC
M5.1	MECHANICAL DETAILS
M5.2	MECHANICAL DETAILS
M6.1	MECHANICAL SCHEDULES
M7.1	CONTROL SCHEMATICS

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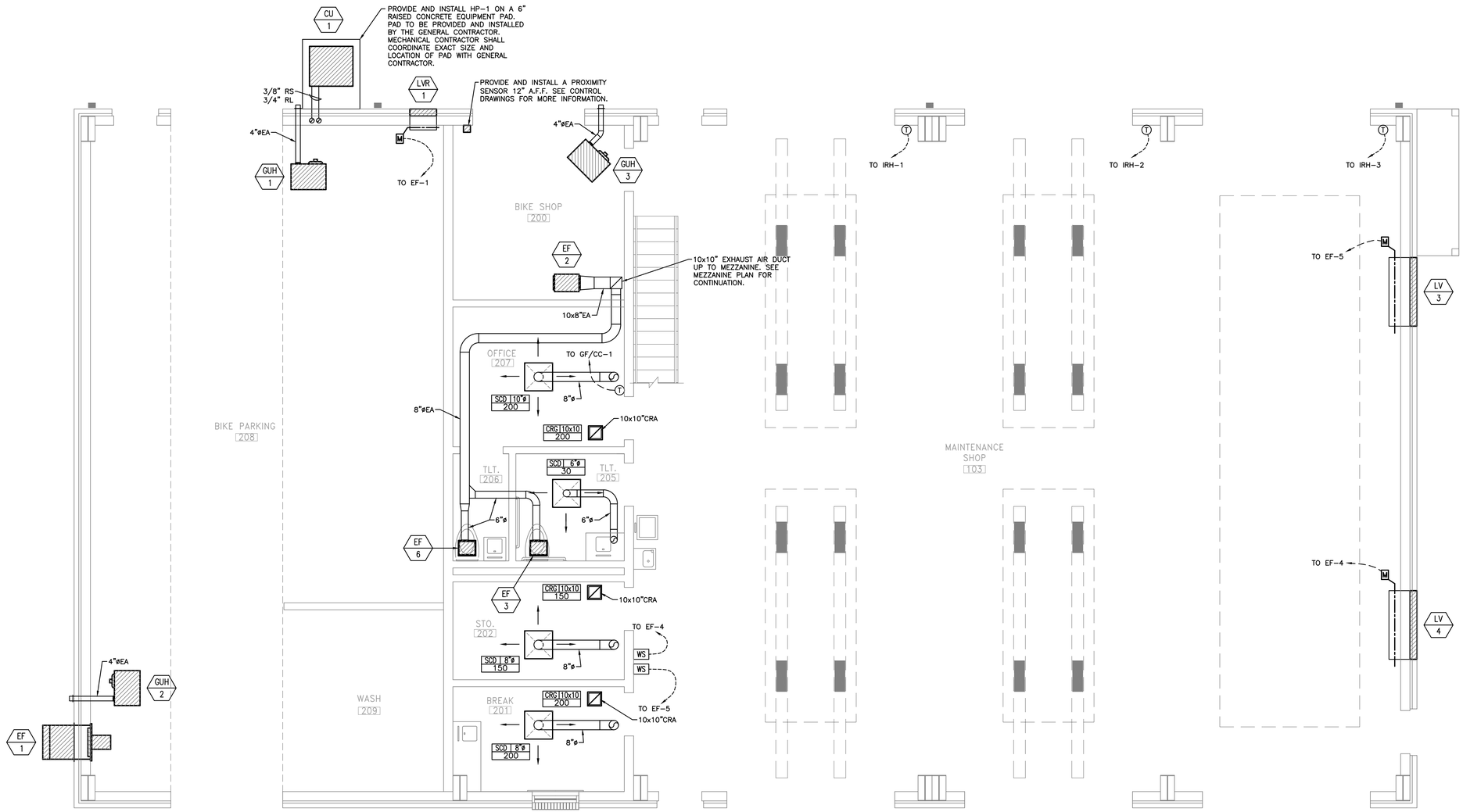
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NORTH

BUILDING B – LOWER LEVEL PLAN – HVAC

SCALE: 1/4" = 1'-0"

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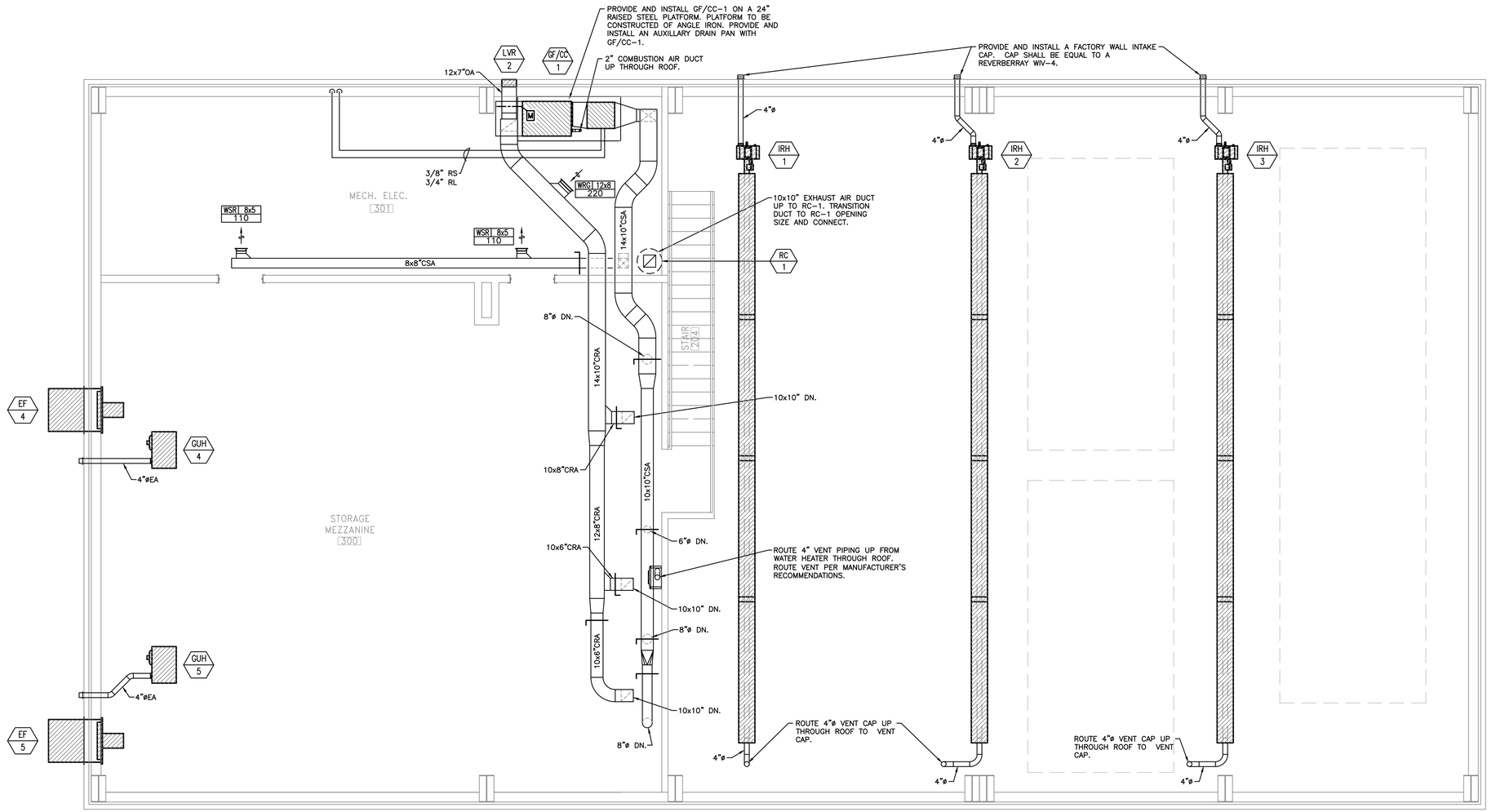
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NORTH

BUILDING B – MEZZANINE LEVEL PLAN – HVAC

SCALE: 1/4" = 1'-0"

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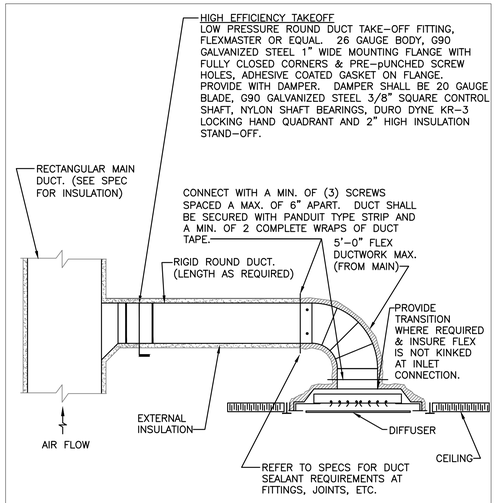
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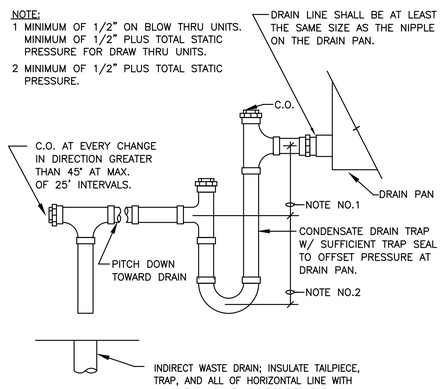
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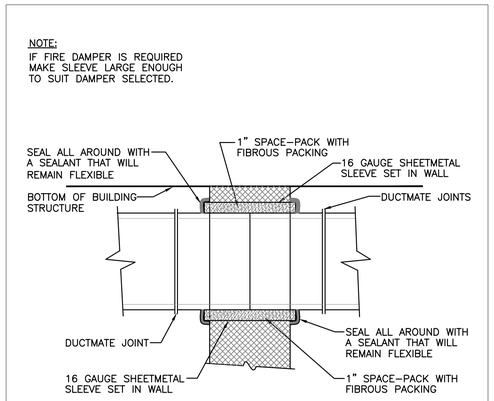
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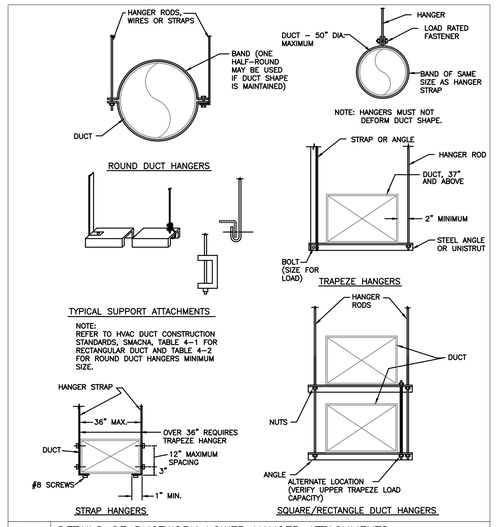
1 TYPICAL ROUND SUPPLY, RETURN, & EXHAUST BRANCH DUCT DETAIL — NO SCALE



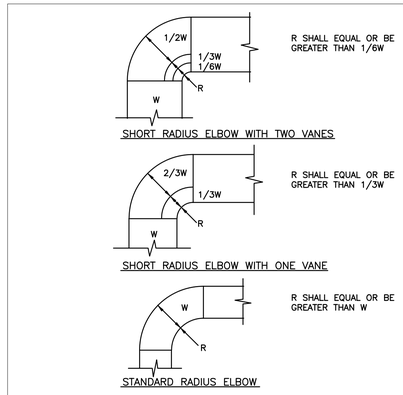
2 CONDENSATE DRAIN TRAP DETAIL — NO SCALE



3 DUCT PASSING THRU WALLS — NO SCALE



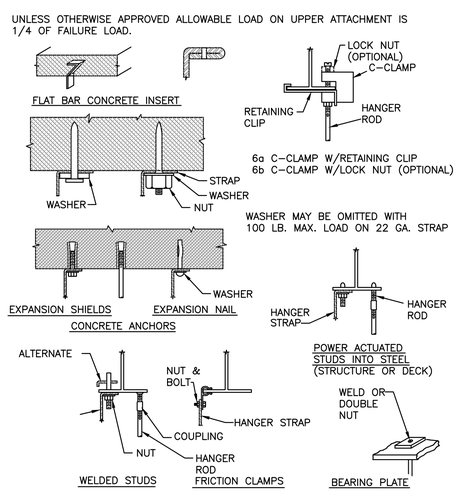
4 DETAILS OF DUCTWORK LOWER HANGER ATTACHMENTS — NO SCALE



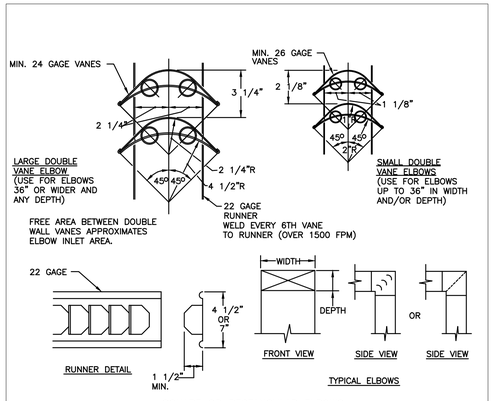
NOTES:

1. THE INTERIOR SURFACE OF ALL RADIUS ELBOWS SHALL BE MADE ROUND.
2. ALL RADIUS ELBOWS SHOWN ON PLANS SHALL BE STANDARD RADIUS ELBOWS. SHORT RADIUS ELBOWS SHALL BE USED ONLY WHERE APPROVED BY THE ENGINEER. ALL SHORT RADIUS ELBOWS SHALL HAVE VANES. VANES SHALL BE CONSTRUCTED, SUPPORTED AND FASTENED AS RECOMMENDED BY SMACNA.

5 DETAILS OF RADIUS ELBOWS — NO SCALE



6 UPPER ATTACHEMENT DEVICES — NO SCALE

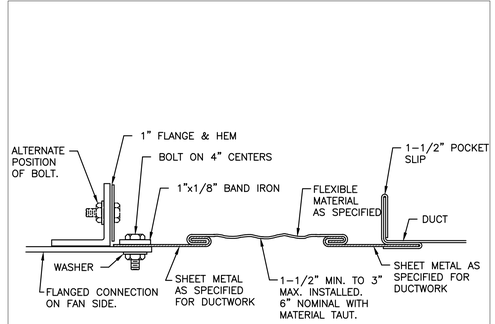


SQUARE OR RECTANGULAR ELBOWS

NOTES:

1. ALL SQUARE OR RECTANGULAR ELBOWS SHALL HAVE ONE OF THE TWO TYPES OF TURNING VANES SHOWN ABOVE. SINGLE VANE ELBOWS WILL NOT BE PERMITTED.
2. VANES SHALL BE CONSTRUCTED, SUPPORTED AND FASTENED AS RECOMMENDED BY SMACNA.
3. ALL ELBOWS SHOWN ON PLANS SHALL BE MADE RADIUS ELBOWS PROVIDED SPACE PERMITS RADIUS INSTALLATION. SQUARE OR RECTANGULAR ELBOWS SHALL BE USED ONLY WITH APPROVAL OF THE PROFESSIONAL.

7 TURNING VANES - TYPICAL — NO SCALE



8 RECTANGULAR FLEXIBLE CONNECTION — NO SCALE

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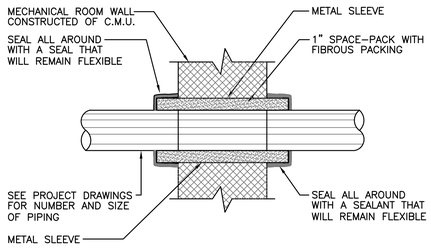
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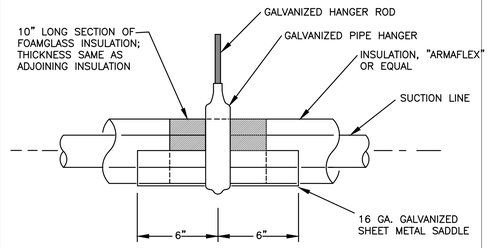
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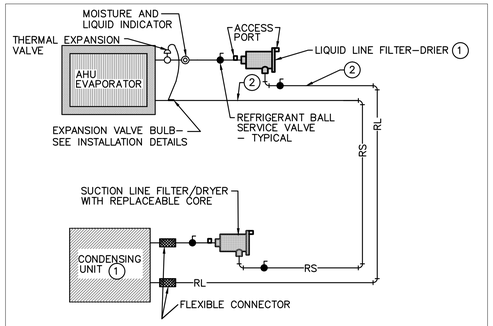
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9 DETAIL OF PIPES AND CONDUITS PASSING THRU WALLS — NO SCALE



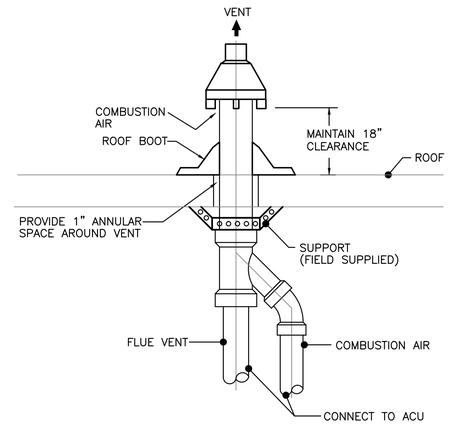
10 DETAIL OF HANGER FOR INSULATED SUCTION LINE — NO SCALE



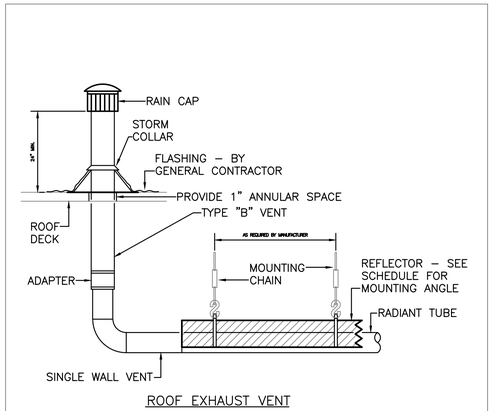
NOTES:

1. REMOVE THE FACTORY INSTALLED LIQUID LINE FILTER DRIER AND INSTALL A NEW ONE WITH EQUIVALENT VOLUME, FILTERING AND MOISTURE ABSORBING CHARACTERISTICS.
2. SLOPE SUCTION LINE AND LIQUID LINE 1/4" PER 10 FEET OF RUN TOWARDS THE EVAPORATOR
3. REFRIGERANT PIPE SIZES ARE BASED ON THE ROUTING AND LENGTHS SHOWN ON THE FLOOR PLANS. IF ANY DEVIATIONS ARE REQUIRED, CONTRACTOR SHALL SUBMIT DRAWINGS WITH THE DEVIATIONS TO THE EQUIPMENT MANUFACTURER FOR REVIEW AND APPROVAL.

11 TYPICAL REFRIGERANT CIRCUIT PIPING SCHEMATIC — NO SCALE



12 CONCENTRIC VENT DETAIL — NO SCALE



ROOF EXHAUST VENT

13 DETAILS OF VENTING FOR INFRA–RED TUBE HEATER — NO SCALE

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Checked By: C.MOORE
Client No: -------
Architect No:

CHAD E. MOORE — REGISTERED — ENGINEER — 20102 — 11/15/18 — STATE OF MISSISSIPPI

M5.2

Engineering Resource Group, Inc.
350 Edgewood Terrace Drive
Jackson, MS 39206
Phone: (601) 362-3552
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ERG NO. 15–28.3

AIR CONDITIONING UNIT SCHEDULE

TAG	BASIS OF DESIGN	TYPE	FAN				COOLING COIL SECTION					CONDENSING FURNACE			REMARKS	TAG
			TOTAL – CFM	O.A. – CFM	EXT. S.P. – INS. WATER	MOTOR HP – V – PH	TAG	MODEL	ENT. AIR TEMP. °Fdb °Fwb	CAPACITY, MBH TOT. HT.	CAPACITY, MBH SENS. HT.	INPUT, MBH	OUTPUT, MBH	FUEL		
GF 1	TRANE TUH2B060	VERTICAL	800	80	0.6	0.5 – 115 – 1	CC 1	4TXC	80.0 67.0	23.9	16.6	60.0	58.2	NATURAL GAS	CONCENTRIC VENT KIT, 4" FILTER HOUSING FOR 2" MERV 8 FILTERS	GF 1

AIR COOLED CONDENSING UNIT SCHEDULE

TAG	BASIS OF DESIGN	SERVES	AMBIENT AIR TEMP.	CAPACITY MBH	COMPRESSOR MOTOR		CONDENSER FAN MOTOR		MINIMUM CIRCUIT AMPACITY	MOCP AMPS	APPROXIMATE OPERATING WEIGHT, LBS	REMARKS	
					RLA	VOLTAGE	FLA	VOLTAGE					
CU 1	TRANE 4TTR	CC 1	95	23.9	13.0	208 – 1	0.74	208 – 1	18.0	20.0	276.0	R–410A REFRIGERANT, LOW AMBIENT KIT, ANTI–SHORT CYCLE TIMER, CRANKCASE HEATER	

POWER VENTILATOR SCHEDULE

TAG	BASIS OF DESIGN	TYPE	SERVES	CFM	ESP	RPM	SONES	ELECTRICAL BHP	ELECTRICAL HP	ELECTRICAL V/ø	ON/OFF	INTERLOCK	OP WT (LBS)	REMARKS	TAG
EF 1	GREENHECK SBE–2H24–5	SIDEWALL EXHAUST FAN	BIKE PARKING 208	2,500	0.3	884	15.2	---	1/2	115/1	WALL SWITCH	MOTORIZED DAMPER	70	BELT DRIVE, FACTORY MOUNTED DISCONNECT, WALL COLLAR, MOTORIZED DAMPER W/ACTUATOR, WEATHER HOOD	EF 1
EF 2	GREENHECK SQ–98–VG	INLINE EXHAUST FAN	BIKE SHOP 200	300	0.3	1112	7.9	---	1/4	115/1	WALL SWITCH	PROXIMITY SENSOR	49	DIRECT DRIVE, SOLID STATE SPEED CONTOLLER, INTEGRAL BACKDRAFT DAMPER, PLUG TYPE DISCONNECT, ISOLATION KIT	EF 2
EF 3	GREENHECK SP–B80	CEILING EXHAUST FAN	TOILET 205	50	0.375	809	2.5	54.3W	---	115/1	WALL SWITCH	---	10	DIRECT DRIVE, SOLID STATE SPEED CONTOLLER, INTEGRAL BACKDRAFT DAMPER, PLUG TYPE DISCONNECT, ISOLATION KIT	EF 3
EF 4	GREENHECK SBE–3L30–30	SIDEWALL EXHAUST FAN	MAINTENANCE SHOP 103	12,000	0.5	1008	32.0	---	3.0	208/3	WALL SWITCH	MOTORIZED DAMPER ON INTAKE LOUVER	201	BELT DRIVE, FACTORY MOUNTED DISCONNECT, WALL COLLAR, MOTORIZED DAMPER W/ACTUATOR, WEATHER HOOD	EF 4
EF 5	GREENHECK SBE–3L30–30	SIDEWALL EXHAUST FAN	MAINTENANCE SHOP 103	12,000	0.5	1008	32.0	---	3.0	208/3	WALL SWITCH	MOTORIZED DAMPER ON INTAKE LOUVER	201	BELT DRIVE, FACTORY MOUNTED DISCONNECT, WALL COLLAR, MOTORIZED DAMPER W/ACTUATOR, WEATHER HOOD	EF 5
EF 6	GREENHECK SP–B80	CEILING EXHAUST FAN	TOILET 206	50	0.375	809	2.5	54.3W	---	115/1	WALL SWITCH	---	10	DIRECT DRIVE, SOLID STATE SPEED CONTOLLER, INTEGRAL BACKDRAFT DAMPER, PLUG TYPE DISCONNECT, ISOLATION KIT	EF 6

WALL LOUVER SCHEDULE

TAG	BASIS OF DESIGN	LOCATION	SERVES	CFM	FREE AREA (SQFT)	PD	OVERALL SIZE, WxH, IN.	REMARKS	TAG
LV 1	GREENHECK EHH–601	BIKE PARKING 208	EF–1 INTAKE	2,500	2.56	0.198	23 x 37	FLUOROPOLYMER FINISH IN COLOR SELECTED BY ARCHITECT, ALUMINUM BIRDSCREEN	LV 1
LV 2	GREENHECK EHH–601	MECH. ELEC. 301	OA INTAKE	70	0.7	0.185	12 x 7	FLUOROPOLYMER FINISH IN COLOR SELECTED BY ARCHITECT, ALUMINUM BIRDSCREEN	LV 2
LV 3	GREENHECK EHH–601	MAINTENANCE SHOP 103	EF–5 INTAKE	12,000	11.0	0.247	59 x 56	FLUOROPOLYMER FINISH IN COLOR SELECTED BY ARCHITECT, ALUMINUM BIRDSCREEN	LV 3
LV 4	GREENHECK EHH–601	MAINTENANCE SHOP 103	EF–4 INTAKE	12,000	11.0	0.247	59 x 56	FLUOROPOLYMER FINISH IN COLOR SELECTED BY ARCHITECT, ALUMINUM BIRDSCREEN	LV 4

ROOF EXHAUST/INTAKE CAP SCHEDULE

NO.	MAKE AND MODEL	SERVES	FUNCTION	CAPACITY, CFM	PRESS. DROP, IN. W.C.	THROAT VELOCITY, FPM	THROAT SIZE, INCHES	REMARKS
RC 1	GREENHECK GRSR	EF–2 & EF–3	EXHAUST	360	0.047	632	10	GALVANIZED BIRDSCREEN, ROOF CURB FOR PITCHED ROOF, 1" THICK HOOD INSULATION

LOW INTENSITY GAS–FIRED INFRA–RED (TUBE) HEATER SCHEDULE

TAG	BASIS OF DESIGN	FUEL	INPUT, MBH	MOUNTING HEIGHT	MOUNTING ANGLE	LENGTH	VOLT – PH	RLA	APPROXIMATE OPERATING WEIGHT, LBS.	REMARKS	TAG
IRH 1	REVERBERRAY MP–40–80	NATURAL GAS	85.0	NOTE 1	30°	41'–1"	120 – 1	1.1	190	PROVIDE STAINLESS STEEL FLEXIBLE GAS CONNECTOR AND PRE–ASSEMBLED CHAIN MOUNTING KIT, ROOF VENTING KIT FOR COMMON VENTING, 4" ROOF COMBUSTION INTAKE	IRH 1
IRH 2	REVERBERRAY MP–40–80	NATURAL GAS	85.0	NOTE 1	30°	41'–1"	120 – 1	1.1	190	PROVIDE STAINLESS STEEL FLEXIBLE GAS CONNECTOR AND PRE–ASSEMBLED CHAIN MOUNTING KIT, ROOF VENTING KIT FOR COMMON VENTING, 4" ROOF COMBUSTION INTAKE	IRH 2
IRH 3	REVERBERRAY MP–40–80	NATURAL GAS	85.0	NOTE 1	30°	41'–1"	120 – 1	1.1	190	PROVIDE STAINLESS STEEL FLEXIBLE GAS CONNECTOR AND PRE–ASSEMBLED CHAIN MOUNTING KIT, ROOF VENTING KIT FOR COMMON VENTING, 4" ROOF COMBUSTION INTAKE	IRH 1

NOTE: 1) HEATER SHALL BE INSTALLED A MINIMUM OF 12' A.F.F. COORDINATE EXACT MOUNTING HEIGHT WITH VEHICLE LIFTS, BAY DOORS AND LIGHTS.

GAS FIRED UNIT HEATER SCHEDULE

NO.	MAKE AND MODEL	TYPE	INPUT MBH	CFM	VENT SIZE	MOTOR HP – V – PH	REMARKS
GUH 1	TRANE GTNE006	PROPELLAR	60.0	740	4"ø	1/12 – 120 – 1	PROVIDE WITH UNIT MOUNTED THERMOSTAT, FLUE VENT WALL CAP
GUH 2	TRANE GTNE003	PROPELLAR	30.0	370	4"ø	1/20 – 120 – 1	PROVIDE WITH UNIT MOUNTED THERMOSTAT, FLUE VENT WALL CAP
GUH 3	TRANE GTNE003	PROPELLAR	30.0	370	4"ø	1/20 – 120 – 1	PROVIDE WITH UNIT MOUNTED THERMOSTAT, FLUE VENT WALL CAP
GUH 4	TRANE GTNE007	PROPELLAR	75.0	920	4"ø	1/12 – 120 – 1	PROVIDE WITH UNIT MOUNTED THERMOSTAT, FLUE VENT WALL CAP
GUH 5	TRANE GTNE007	PROPELLAR	75.0	920	4"ø	1/12 – 120 – 1	PROVIDE WITH UNIT MOUNTED THERMOSTAT, FLUE VENT WALL CAP

AIR DISTRIBUTION DEVICE SCHEDULE

TAG	BASIS OF DESIGN	DESCRIPTION	FACE SIZE	MOUNT	REMARKS	TAG
SCD	PRICE SCD	SQUARE CONE SUPPLY DIFFUSER	24x24	LAY–IN		SCD
WSR	PRICE 520	DOUBLE DEFLECTION SUPPLY REGISTER	10x7	DUCT MOUNTED	PROVIDE WITH OPPOSED BLADE DAMPER	WSR
WRG	PRICE 530	LOUVERED RETURN REGISTER	14x10	WALL MOUNTED	PROVIDE WITH OPPOSED BLADE DAMPER	WRG
CRG	PRICE 80	EGG–CRATE FACE RETURN	12x12	LAY–IN		CRG
						CER

CITY OF HATTIESBURG MISSISSIPPI

HATTIESBURG PUBLIC SAFETY COMPLEX

HATTIESBURG POLICE DEPARTMENT ■ SOUTH SITE BUILDINGS ■ CSI / MAINTENANCE ■

HPSC South Site Buildings: CSI / Maintenance

Drawing Issued:

Date	Rev.	Description
08-31-2015		DD Check Set
12-1-2015		Pricing Set
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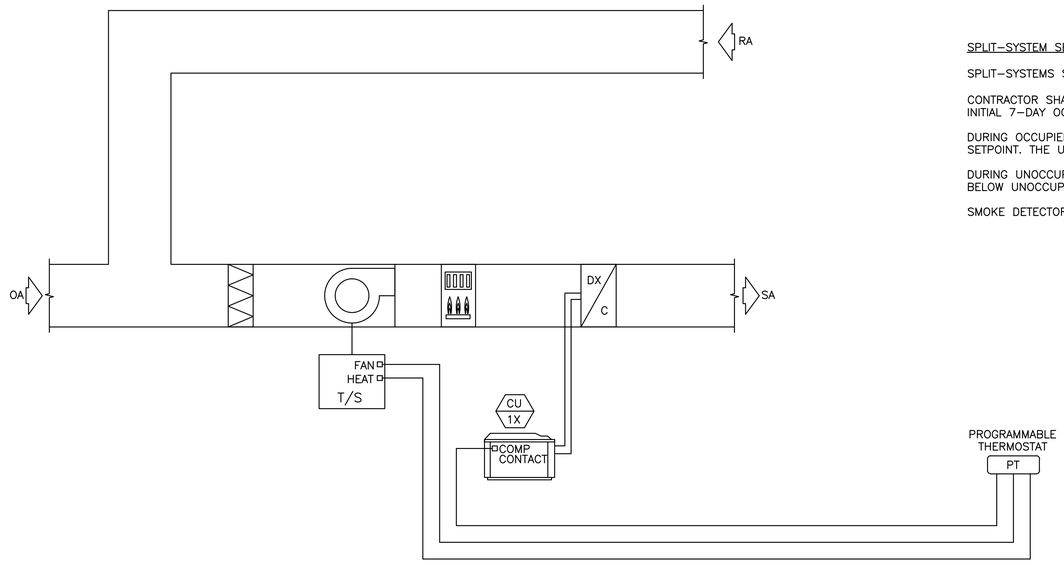
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CHAD E. MOORE REGISTERED PROFESSIONAL ENGINEER 20102 12/15/18 STATE OF MISSISSIPPI

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ERG NO. 15–28.3



1 M7.1 GAS FURNACE SPLIT-SYSTEM UNIT CONTROL SCHEMATIC

NO SCALE

SPLIT-SYSTEM SEQUENCE OF OPERATION:

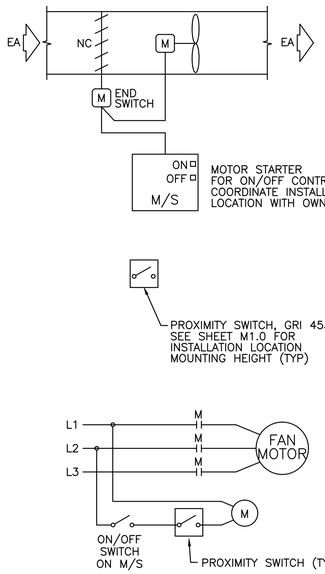
SPLIT-SYSTEMS SHALL OPERATE UNDER CONTROL OF A 1H/1C PROGRAMMABLE THERMOSTAT.

CONTRACTOR SHALL BE RESPONSIBLE FOR PROGRAMMING THERMOSTAT. CONTRACTOR SHALL VERIFY OWNER'S INITIAL 7-DAY OCCUPANCY SCHEDULE PRIOR TO PROGRAMMING.

DURING OCCUPIED MODE, THE SPLIT-SYSTEM SHALL CYCLE AS REQUIRED TO SATISFY SPACE THERMOSTAT SETPOINT. THE UNIT SHALL AUTOMATICALLY CHANGEOVER FROM HEATING TO COOLING.

DURING UNOCCUPIED MODE, THE SPLIT-SYSTEM SHALL NOT OPERATE UNLESS THE SPACE TEMPERATURE FALLS BELOW UNOCCUPIED HEATING SETPOINT OR RISES ABOVE THE UNOCCUPIED COOLING SETPOINT.

SMOKE DETECTORS SHALL BE HARDWIRE INTERLOCKED TO SHUTDOWN THE UNIT UPON DETECTION OF SMOKE.

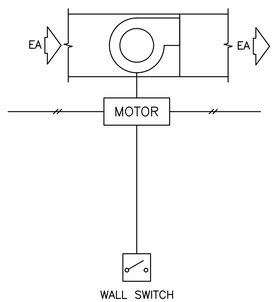


SEQUENCE OF OPERATION:

F-1 AND F-2 ARE THE VENTILATION FANS FOR THE GARAGE. FANS SHALL BE INTERLOCKED WITH OVERHEAD DOOR PROXIMITY SWITCH. PROXIMITY SWITCH SHALL BE MOUNTED SUCH THAT THE OVERHEAD DOOR MUST BE RAISED A MINIMUM OF 24 INCHES IN ORDER TO ENGAGE THE SWITCH. FAN IS CONTROLLED BY A WALL MOUNTED MOTOR STARTER (HOA SWITCH).

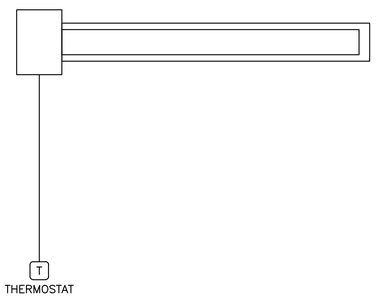
2 M7.1 SIDEWALL PROPELLER EXHAUST FAN CONTROL SCHEMATIC

NO SCALE



3 M7.1 EXHAUST FAN (WALL SWITCH CONTROLLED) CONTROL SCHEMATIC

NO SCALE



4 M7.1 INFRARED TUBE HEATER CONTROL SCHEMATIC

NO SCALE

HATTIESBURG PUBLIC SAFETY COMPLEX

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ELECTRICAL LEGEND

GENERAL NOTES

1. ALL EQUIPMENT AND DEVICES ARE TO BE FLUSH MOUNTED UNLESS OTHERWISE NOTED.
2. DEVICES NOTED AS "GFI" SHALL BE GROUND FAULT CIRCUIT INTERRUPTING DEVICES.
3. DEVICES NOTED AS "WP" SHALL BE WEATHERPROOF WHILE-IN-USE.
4. DEVICES NOTED AS "DL" SHALL BE RATED FOR DAMP LOCATION.
5. DEVICES NOTED AS "NL" SHALL BE NIGHT LIGHTS. PROVIDE UNSWITCHED POWER TO FIXTURE.
6. DEVICES NOTED AS "WG" SHALL BE PROVIDED AND INSTALLED WITH A WIRE GUARD.
7. DEVICES NOTED AS "TR" SHALL BE TAMPER RESISTANT.
8. PROVIDE UNSWITCHED POWER TO EMERGENCY BATTERY PACKS.

LUMINAIRES (See Light Fixture Schedule)

NOTE: THE NUMBER INSIDE THE CIRCLE IS THE CIRCUIT NUMBER. THE LETTER BESIDE THE SYMBOL IS THE FIXTURE TYPE DESCRIBED IN THE LIGHT FIXTURE SCHEDULE.

- 2'X2' RECESSED FIXTURE.
- 2'X4' RECESSED FIXTURE.
- 2'X2' RECESSED EMERGENCY FIXTURE.
- 2'X4' RECESSED EMERGENCY FIXTURE.
- SURFACE MOUNTED OR SUSPENDED FIXTURE.
- SURFACE MOUNTED OR SUSPENDED EMERGENCY FIXTURE.
- RECESSED CEILING FIXTURE.
- RECESSED EMERGENCY CEILING FIXTURE.
- PENDANT MOUNT FIXTURE.
- CEILING MOUNTED EXIT SIGN. PROVIDE CHEVRONS AS INDICATED BY ARROWS.
- WALL MOUNTED EXIT SIGN. PROVIDE CHEVRONS AS INDICATED BY ARROWS.
- WALL MOUNTED FIXTURE.
- WALL MOUNTED LINEAR FIXTURE.
- WALL MOUNTED EMERGENCY LINEAR FIXTURE.
- SITE ARM MOUNT POLE LIGHT FIXTURE.

MISCELLANEOUS

- CONTACTOR.
- PHOTOCELL.
- CEILING MOUNTED JUNCTION BOX.
- WALL MOUNTED JUNCTION BOX.
- FLEXIBLE CONNECTION TO EQUIPMENT.
- 20A RELAY. SEE DETAIL 1/E0.2.

GEAR

- FUSED DISCONNECT SWITCH. TEXT INDICATES AMPACITY/NUMBER OF POLES/ENCLOSURE TYPE; F-(RATING OF FUSES).
- NON-FUSED DISCONNECT SWITCH. TEXT INDICATES AMPACITY/NUMBER OF POLES/ENCLOSURE TYPE.
- MAGNETIC MOTOR STARTER.
- COMBINATION NON-FUSED DISCONNECT AND MAGNETIC MOTOR STARTER.
- ENCLOSED CIRCUIT BREAKER.
- PANELBOARD.

SWITCHES

- SINGLE-POLE, SINGLE-THROW SWITCH. MOUNT CENTERLINE OF BOX AT 45"A.F.F. UNLESS NOTED OTHERWISE.
- DOUBLE-POLE, SINGLE-THROW, 30 AMP SWITCH. MOUNT CENTERLINE OF BOX AT 45"A.F.F. UNLESS NOTED OTHERWISE.
- THREE-WAY SWITCH. MOUNT CENTERLINE OF BOX AT 45"A.F.F. UNLESS NOTED OTHERWISE.
- FOUR-WAY SWITCH. MOUNT CENTERLINE OF BOX AT 45"A.F.F. UNLESS NOTED OTHERWISE.
- AUTOMATIC WALL SWITCH. SENSORSWITCH #WSD-PDT OR APPROVED EQUAL. MOUNT CENTERLINE OF BOX AT 45" A.F.F. UNLESS NOTED OTHERWISE.
- DUAL TECHNOLOGY, DUAL RELAY WALL SWITCH. SENSORSWITCH #WSD-PDT-2P OR APPROVED EQUAL. MOUNT CENTERLINE OF BOX AT 45" A.F.F. UNLESS NOTED OTHERWISE.
- AUTOMATIC WALL SWITCH WITH INTEGRAL 0-10V DIMMER. LUTRON #MS-Z101 OR APPROVED EQUAL. MOUNT CENTERLINE OF BOX AT 45"A.F.F. UNLESS NOTED OTHERWISE.
- DIGITAL TIME SWITCH WITH ADJUSTABLE RANGE FROM 5 MINUTES TO 12 HOURS. FURNISH WITH AUDIBLE WARNING. SENSORSWITCH #PTS-60 OR APPROVED EQUAL. MOUNT CENTERLINE OF BOX AT 45" A.F.F. UNLESS NOTED OTHERWISE.
- HORSEPOWER RATED SWITCH WITH THERMAL OVERLOADS (MANUAL MOTOR STARTER).
- MD1 PASSIVE INFRARED AND ULTRASONIC DUAL TECHNOLOGY OCCUPANCY SENSOR WITH A 12' RADIAL COVERAGE. CEILING MOUNTED. SENSORSWITCH #CM-PDT-9 OR APPROVED EQUAL.
- MD2 PASSIVE INFRARED AND ULTRASONIC DUAL TECHNOLOGY OCCUPANCY SENSOR WITH A 28' RADIAL COVERAGE. CEILING MOUNTED. SENSORSWITCH #CM-PDT-10 OR APPROVED EQUAL.
- MDC PASSIVE INFRARED AND ULTRASONIC DUAL TECHNOLOGY OCCUPANCY SENSOR WITH A 2000 SQ. FT. COVERAGE. MOUNT IMMEDIATELY BELOW CEILING. SENSORSWITCH #WV-PDT-16 OR APPROVED EQUAL.
- PP1 POWER PACK MOUNTED ABOVE CEILING. SENSORSWITCH #PP20 OR APPROVED EQUAL.
- PP2 DUAL RELAY PACK MOUNTED ABOVE CEILING. SENSORSWITCH #PP20-2P OR APPROVED EQUAL.
- EPP EMERGENCY LIGHTING BYPASS SHUNT RELAY. SENSORSWITCH #PP16-SHUNT OR APPROVED EQUAL.
- DS DAYLIGHT SENSOR.

INTERCOM SYSTEM

- CEILING SPEAKER.
- HORN TYPE SPEAKER.
- CIS CALL-IN SWITCH.
- IMS INTERCOM MASTER STATION WITH DOOR RELEASE. DESKTOP MOUNT.
- VANDAL & WEATHER RESISTANT INTERCOM SUB STATION.

ACCESS CONTROL

- CARD READER.
- PX PUSH TO EXIT BUTTON.
- MOTION DETECTOR TO RELEASE MAGNETIC LOCK.
- ML MAGNETIC LOCK.
- ACP ACCESS CONTROL PANEL.
- CONNECTION TO MAGNETIC LOCK RELEASE SWITCH IN PANIC HARDWARE.
- DHO DOOR HOLD OPEN.
- PS POWER SUPPLY

CONDUIT AND WIRING

- CONDUCTORS IN CONDUIT CONCEALED WITHIN WALL OR CEILING. TIC MARKS INDICATE NUMBER OF CONDUCTORS. THE EQUIPMENT GROUNDING CONDUCTOR IS NOT SHOWN, BUT SHALL BE PROVIDED. SIZE THE EQUIPMENT GROUNDING CONDUCTOR AND THE CONDUIT PER THE NEC. THE ABSENCE OF TIC MARKS SIGNIFIES THAT TWO CONDUCTORS PLUS AN EQUIPMENT GROUNDING CONDUCTOR SHOULD BE PROVIDED. FOR EXAMPLE, THE MARKINGS TO THE LEFT SIGNIFY THAT THREE CONDUCTORS PLUS AN EQUIPMENT GROUNDING CONDUCTOR SHOULD BE PROVIDED.
- 10 THE TEXT INSIDE THE ARC INDICATES THE AWG SIZE OF THE CONDUCTORS THAT SHALL BE RUN IN THE CONDUIT. THE ABSENCE OF TEXT SIGNIFIES THAT THE CONDUCTORS SHOULD BE #12 AWG.
- CIRCUITRY RUN IN STRAIGHT LINE SEGMENTS SIGNIFIES EXPOSED SURFACE-MOUNTED RACEWAY (SEE SPECIFICATIONS).
- CONDUCTORS IN CONDUIT CONCEALED BELOW GRADE OR FLOOR. TIC MARKS INDICATE NUMBER OF CONDUCTORS. THE EQUIPMENT GROUNDING CONDUCTOR IS NOT SHOWN, BUT SHALL BE PROVIDED. SIZE THE EQUIPMENT GROUNDING CONDUCTOR AND THE CONDUIT PER THE NEC. THE ABSENCE OF TIC MARKS SIGNIFIES THAT TWO CONDUCTORS PLUS AN EQUIPMENT GROUNDING CONDUCTOR SHOULD BE PROVIDED. THE MARKINGS TO THE LEFT SIGNIFY THAT THREE CONDUCTORS PLUS AN EQUIPMENT GROUNDING CONDUCTOR SHOULD BE PROVIDED.
- LA-1 HOMERUN TO PANELBOARD. ARC DENOTES CONCEALED CIRCUITRY. TEXT DENOTES PANELBOARD NAME WITH CIRCUIT NUMBER. DEVICES HAVING CIRCUIT NUMBERS LOCATED BESIDE THEM MAY NOT SHOW THE CIRCUIT NUMBERS AT THE HOMERUN ARROWS.
- LA-1 PARTIAL HOMERUN TO PANELBOARD. COMBINE ALL PARTIAL HOMERUNS THAT ARE ON THE SAME CIRCUIT IN A JUNCTION BOX PRIOR TO ENTERING THE PANELBOARD.
- LOW VOLTAGE CONDUCTORS USED FOR MOTION DETECTOR CIRCUITRY. SEE MANUFACTURER'S RECOMMENDATIONS FOR CONDUCTOR REQUIREMENTS.

VOLTAGE DROP CHART FOR 20A, 1Ø CIRCUITS

Voltage	Circuit Length	Conductor Size (AWG)
120	< 90'	#12
120	> 90'	#10
120	> 145'	#8
120	> 230'	#6
277	< 200'	#12
277	> 200'	#10
277	> 325'	#8
277	> 525'	#6

VOLTAGE DROP CHART NOTES:
1) CIRCUIT SIZES INDICATED ON THE DRAWINGS ARE MINIMUM REQUIREMENTS. REFER TO THIS CHART FOR UPSIZING CONDUCTORS AS NEEDED.

2) DO NOT CONNECT CONDUCTORS LARGER THAN #10 DIRECTLY TO A RECEPTACLE OR A SWITCH. PROVIDE A JUNCTION BOX TO DOWNSIZE THE CONDUCTOR TO #12 AT THE DEVICE.

3) FOR CIRCUITS LONGER THAN THOSE LISTED ABOVE, CONSULT WITH THE ENGINEER FOR CONDUCTOR SIZES.

INTRUSION DETECTION SYSTEM

- KEYPAD.
- MOTION DETECTOR.
- GB GLASS BREAK DETECTOR.
- DC DOOR CONTACT.
- ALARM HORN.
- IDCP INTRUSION DETECTION CONTROL PANEL.

RECEPTACLES

- DUPLEX RECEPTACLE, NEMA 5-20R, MOUNTED 18" A.F.F. TO CENTERLINE OF BOX UNLESS NOTED OTHERWISE.
- DOUBLE DUPLEX RECEPTACLE, NEMA 5-20R, ONE COVER PLATE, MOUNTED 18" A.F.F. TO CENTERLINE OF BOX UNLESS NOTED OTHERWISE.
- DOUBLE DUPLEX RECEPTACLE, NEMA 5-20R, ONE COVER PLATE, MOUNTED WITH BOTTOM OF BOX 2" ABOVE COUNTER WITH BACKSPLASH, AND 6" ABOVE COUNTER WITHOUT BACKSPLASH. WHERE RECEPTACLE IS SHOWN IN AN AREA WITH NO COUNTER, MOUNT 45"A.F.F. TO CENTERLINE OF BOX.
- SWITCHED DUPLEX RECEPTACLE, NEMA 5-20R, MOUNTED 18" A.F.F. TO CENTERLINE OF BOX UNLESS NOTED OTHERWISE.
- DOUBLE DUPLEX RECEPTACLE, NEMA 5-20R, ONE COVER PLATE, MOUNTED 18" A.F.F. TO CENTERLINE OF BOX UNLESS NOTED OTHERWISE. ONE DUPLEX RECEPTACLE WILL BE SWITCHED AND ONE DUPLEX RECEPTACLE WILL BE UNSWITCHED.
- DOUBLE DUPLEX RECEPTACLE, NEMA 5-20R, ONE COVER PLATE, MOUNTED WITH BOTTOM OF BOX 2" ABOVE COUNTER WITH BACKSPLASH, AND 6" ABOVE COUNTER WITHOUT BACKSPLASH. WHERE RECEPTACLE IS SHOWN IN AN AREA WITH NO COUNTER, MOUNT 45"A.F.F. TO CENTERLINE OF BOX.
- DUPLEX RECEPTACLE, NEMA 5-20R, MOUNTED WITH BOTTOM OF BOX 2" ABOVE COUNTER WITH BACKSPLASH AND 6" ABOVE COUNTER WITHOUT BACKSPLASH. WHERE RECEPTACLE IS SHOWN IN AN AREA WITH NO COUNTER, MOUNT 45"A.F.F. TO CENTERLINE OF BOX.
- DF DUPLEX RECEPTACLE, NEMA 5-20R, FOR DRINKING FOUNTAIN FED FROM GFCI BREAKER. MOUNTED IN ACCORDANCE WITH MANUFACTURER'S ROUGH-IN REQUIREMENTS. VERIFY CONNECTION TYPE PRIOR TO BID. PROVIDE PROPER EQUIPMENT FOR CONNECTION TYPE REQUIRED.
- DUPLEX RECEPTACLE, NEMA 5-20R, MOUNTED IN THE CEILING UNLESS NOTED OTHERWISE.

COMMUNICATIONS

- COMBINATION TELEPHONE/DATA OUTLET MOUNTED 18" A.F.F. TO CENTERLINE OF BOX UNLESS NOTED OTHERWISE.
- COMBINATION TELEPHONE/DATA OUTLET MOUNTED WITH BOTTOM OF BOX 2" ABOVE COUNTER WITH BACKSPLASH, AND 6" ABOVE COUNTER WITHOUT BACKSPLASH.
- TELEPHONE OUTLET MOUNTED 18" A.F.F. TO CENTERLINE OF BOX UNLESS NOTED OTHERWISE.
- TELEPHONE OUTLET MOUNTED WITH BOTTOM OF BOX 2" ABOVE COUNTER WITH BACKSPLASH, AND 6" ABOVE COUNTER WITHOUT BACKSPLASH.
- DATA OUTLET MOUNTED 18" A.F.F. TO CENTERLINE OF BOX UNLESS NOTED OTHERWISE.
- DATA OUTLET MOUNTED WITH BOTTOM OF BOX 2" ABOVE COUNTER WITH BACKSPLASH, AND 6" ABOVE COUNTER WITHOUT BACKSPLASH.
- TELEVISION CABLE OUTLET MOUNTED 18" A.F.F. TO CENTERLINE OF BOX UNLESS NOTED OTHERWISE.

CCTV SYSTEM

- CEILING MOUNTED CAMERA.
- WALL MOUNTED CAMERA.
- INSIDE CORNER MOUNTED CAMERA.
- OUTSIDE CORNER MOUNTED CAMERA.
- WALL MOUNTED MONITOR.
- DESK MOUNTED MONITOR.

MASTER NOTES:

A. THE CONTRACTOR SHALL ABIDE BY ALL FEDERAL, STATE, AND/OR LOCAL CODES. IF A DISCREPANCY BETWEEN CODES OCCURS, THE MOST STRINGENT SHALL PREVAIL.

B. THE CONTRACTOR SHALL FIELD VERIFY EXISTING CONDITIONS PRIOR TO THE COMMENCEMENT OF ANY WORK. SHOULD DISCREPANCIES BE DISCOVERED, THE CONTRACTOR SHALL VERIFY INTENT WITH THE ENGINEER/OWNER BEFORE PROCEEDING.

C. COORDINATE LOCATIONS OF ALL CEILING MOUNTED DEVICES WITH OTHER TRADES PRIOR TO INSTALLATION.

D. COORDINATE ALL ROUGH-IN REQUIREMENTS FOR OWNER FURNISHED EQUIPMENT WITH THE OWNER PRIOR TO BEGINNING WORK. THESE DRAWINGS ARE BASED ON EXISTING BUILDING CONSTRUCTION DRAWINGS, SITE SURVEYS, AND OWNER FURNISHED EQUIPMENT SPECIFICATIONS.

E. COORDINATE WITH THE MILLWORK CONTRACTOR TO DETERMINE THE EXACT LOCATION OF OUTLETS BEING PLACED IN MILLWORK.

F. RECEPTACLES SHALL NOT BE CONNECTED IN A FEED-THRU MANNER. WIRE CONNECTIONS IN RECEPTACLE BOXES SHALL BE MADE IN A PIGTAIL MANNER AS SHOWN ON THE RECEPTACLE DETAIL.

G. PROVIDE A 4" HOUSEKEEPING PAD WITH 45° CHAMFERED EDGES FOR ALL FLOOR-MOUNTED ELECTRICAL EQUIPMENT (SWITCHBOARDS, PANELBOARDS, TRANSFORMERS, ETC.).

H. THE ELECTRICAL CONTRACTOR SHALL VERIFY THE CIRCUIT BREAKER (MOCP) AND WIRE SIZE (MCA) OF THE MECHANICAL EQUIPMENT WITH THE MECHANICAL CONTRACTOR PRIOR TO SUBMITTING EQUIPMENT BROCHURES OR BID PRICES. THE LOCAL DISCONNECTS FOR THE MECHANICAL EQUIPMENT DESIGNATED AS "W/E" SHALL ALSO BE VERIFIED WITH THE MECHANICAL CONTRACTOR PRIOR TO SUBMITTING BID PRICES. IF THE EQUIPMENT CAN'T BE SUPPLIED WITH DISCONNECTS AS SHOWN, THE ELECTRICAL CONTRACTOR SHALL PROVIDE APPROPRIATELY SIZED DISCONNECTS TO MEET THE NATIONAL ELECTRICAL CODE REQUIREMENTS.

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CITY OF HATTIESBURG — MISSISSIPPI

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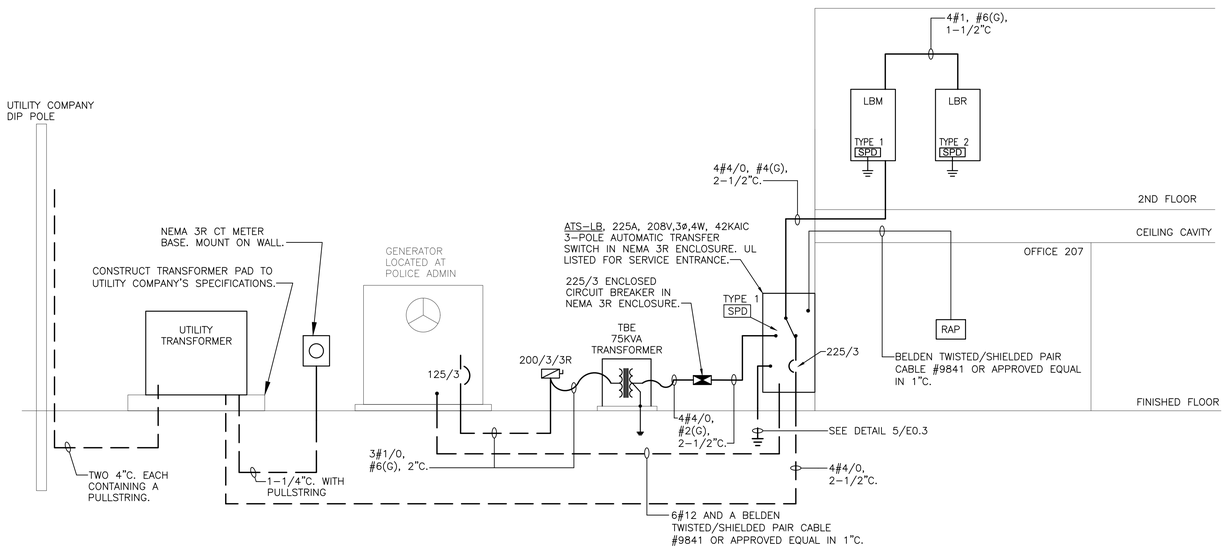
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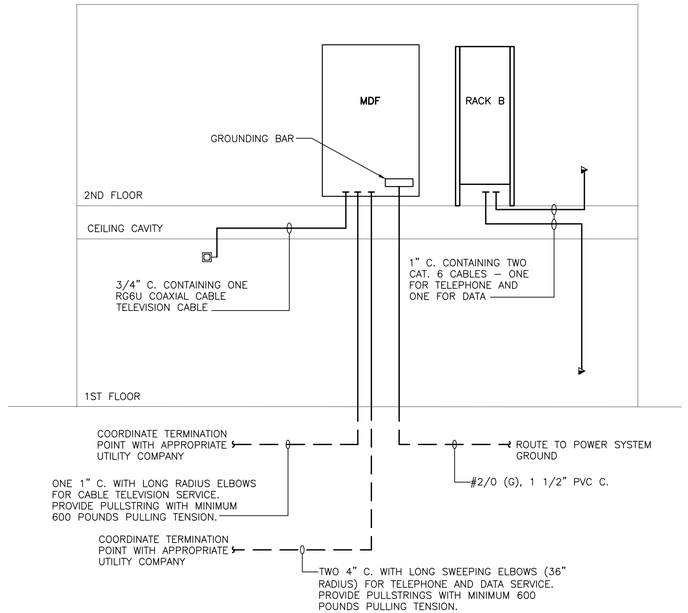
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Checked By:
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Architect No:

E0.0



1 E0.1 SINGLE LINE DIAGRAM - BLDG B

Scale: NONE



2 E0.1 TELECOMMUNICATIONS RISER DIAGRAM - BLDG B

Scale: NONE

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E0.1

PANEL	LOCATION:	BLDG B ELEC RM	LUG LOCATION:	BOTTOM FEED
LBM	VOLT:	208Y/120V, 3Ø, 4W	MAIN BUS:	MAIN LUGS ONLY
	BUS:	225A	MOUNTING:	SURFACE

PANELBOARD AIC RATING (A): 42,000

CIRCUIT NO.	BREAKER AMPS	BREAKER POLES	DESCRIPTION	PHASE LOAD (KVA) A		PHASE LOAD (KVA) B		PHASE LOAD (KVA) C		DESCRIPTION	BREAKER AMPS	BREAKER POLES	CIRCUIT NO.
1	100	3	PANEL LBR	6.5	1.8					VEHICLE LIFT	40	2	2
3	-	-	-			6.6	1.8			-	-	-	4
5	-	-	-					5.9	1.8	VEHICLE LIFT	40	2	6
7	15	1	GWH-1 (300)	0.5	1.8					-	-	-	8
9	20	1	GF/CC-1 (301)			1.2	1.8			VEHICLE LIFT	40	2	10
11	20	2	CU-1 (EXT)					1.4	1.8	-	-	-	12
13	-	-	-	1.4	1.8					VEHICLE LIFT	40	2	14
15	15	1	EF-1 (208)			1.2	1.8			-	-	-	16
17	15	1	EF-2 (200)					0.7	0.8	WHEEL ALIGNMENT	15	1	18
19	20	3	EF-4 (300)	1.3	0.4					IRH-1,2,3 (103)	15	1	20
21	-	-	-			1.3	0.9			GUH-1,2,3 (200,208)	15	1	22
23	-	-	-					1.3	0.6	GUH-4,5 (300)	15	1	24
25	20	3	EF-5 (300)	1.3	0.9					AIR COMPRESSOR	15	3	26
27	-	-	-			1.3	0.9			-	-	-	28
29	-	-	-					1.3	0.9	-	-	-	30
31	20	3	SPARE	0.0	0.0					SPARE	40	2	32
33	-	-	-			0.0	0.0			-	-	-	34
35	-	-	-					0.0	0.0	SPARE	30	3	36
37	60	3	SPD	0.0	0.0					-	-	-	38
39	-	-	-			0.0	0.0			-	-	-	40
41	-	-	-					0.0	0.0	SPARE	20	1	42
TOTAL				17.7		18.7		16.5					

PANEL	LOCATION:	BLDG B ELEC RM	LUG LOCATION:	TOP FEED
LBR	VOLT:	208Y/120V, 3Ø, 4W	MAIN BUS:	MAIN LUGS ONLY
	BUS:	100A	MOUNTING:	SURFACE

PANELBOARD AIC RATING (A): 42,000

CIRCUIT NO.	BREAKER AMPS	BREAKER POLES	DESCRIPTION	PHASE LOAD (KVA) A		PHASE LOAD (KVA) B		PHASE LOAD (KVA) C		DESCRIPTION	BREAKER AMPS	BREAKER POLES	CIRCUIT NO.
1	20	1	REC (103)	0.4	1.2					INTERIOR LTS.	20	1	2
3	20	1	REC (103)			0.4	1.1			INTERIOR LTS. (a) MAINTENANCE SHOP	20	1	4
5	20	1	REC (103)					0.4	0.7	INTERIOR LTS. (b) MAINTENANCE SHOP	20	1	6
7	20	1	REC (103)	0.4	0.9					REC. BIKE PARKING (208)	20	1	8
9	20	1	REC (103)			0.4	0.7			REC. BIKE PARKING (208)	20	1	10
11	20	1	REC (103)					0.7	0.7	REC. EXTERIOR	20	1	12
13	20*	1	REC (103)	0.2	0.7					REC. BIKE SHOP (202)	20	1	14
15	20*	1	REC (103)			0.2	0.7			REC. BIKE SHOP (202)	20	1	16
17	20*	1	REC (103)					0.2	0.7	REC. OFFICE (207)	20	1	18
19	20*	1	REC (103)	0.4	0.7					REC. OFFICE (207)	20	1	20
21	20*	1	REC (103)			0.4	0.4			REC. MAINTENANCE SHOP (203)	20	1	22
23	20*	1	REC (103)					0.2	0.2	REC. TLT (205)	20	1	24
25	20*	1	REC (103)	0.2	0.2					REC. MAINTENANCE SHOP (203)	20*	1	26
27	20*	1	REC (103)			0.2	0.9			REC. BREAK (201)/STORAGE (202)	20	1	28
29	20	1	REC (300)					0.9	0.2	REC. BREAK (201)	20	1	30
31	20	1	REC (301)	0.5	0.2					REC. BREAK (201)	20	1	32
33	20	1	REC- MECH CTRLS (301)			0.2	0.7			REC. EXTERIOR	20	1	34
35	20	1	REC (301)					0.4	0.2	EXTERIOR LTS.	20	1	36
37	20	1	ACP (301)	0.3	0.1					CONTACTOR CB CTRL	20	1	38
39	20	1	IDCP (301)			0.3	0.3			IMS (207)	20	1	40
41	20	1	MAG. LOCK POWER SUPPLY					0.3	0.2	SITE LIGHTS	20	1	42
43	20	1	MAG. LOCK POWER SUPPLY	0.3	0.0					SPARE	20	1	44
45	20	1	SPARE			0.0	0.0			SPARE	20	1	46
47	20	1	SPARE					0.0	0.0	SPARE	20	1	48
49	30	3	SPD	0.0	0.0					SPARE	20	1	50
51	-	-	-			0.0	0.0			SPARE	20	1	52
53	-	-	-					0.0	0.0	SPARE	20	1	54
TOTAL				6.5		6.6		5.9					

*BREAKER SHALL BE A GFCI BREAKER

LIGHTING FIXTURE SCHEDULE

TYPE	MANUFACTURER	PART NUMBER	LAMPS	MOUNTING	REMARKS
B2	LITHONIA	ZL1N-L48-3000LM-FST-MVOLT-35K-80CRI-WH	25W LED 3243 LUMENS	SUSPENDED	
B2E	LITHONIA	ZL1N-L48-3000LM-FST-120-35K-80CRI-E10WLCP-WH	25W LED 3243 LUMENS	SUSPENDED	STRIP FIXTURE WITH EMERGENCY BATTERY PACK
B3	LITHONIA	ZL1N-L48-5000LM-FST-MVOLT-35K-80CRI-WH	34W LED 4515 LUMENS	SUSPENDED	
B3E	LITHONIA	ZL1N-L48-5000LM-FST-120-35K-80CRI-E10WLCP-WH	34W LED 4515 LUMENS	SUSPENDED	STRIP FIXTURE WITH EMERGENCY BATTERY PACK
F	LITHONIA	WL2-08L-EZ1-LP835	7.5W LED 809 LUMENS	WALL MOUNT	
XA	LITHONIA	LQM-S-W-3-G-120/277-ELN	LED	UNIVERSAL	LED EXIT SIGN WITH EMERGENCY BATTERY
Y	LITHONIA	2GTL-4-30L-A12125-EZ1-LP835	23.3W LED 2983 LUMENS	RECESSED	2'x4' LENSED TROFFER
YE	LITHONIA	2GTL-4-30L-A12125-EZ1-LP835-EL14L	23.3W LED 2983 LUMENS	RECESSED	2'x4' LENSED TROFFER WITH EMERGENCY BATTERY PACK
Y2E	LITHONIA	2GTL-2-20L-A12125-EZ1-LP835-EL14L	18.39W LED 2248 LUMENS	RECESSED	2'x2' LENSED TROFFER WITH EMERGENCY BATTERY PACK
AA	GOTHAM	EVO-CYL-40-20-8AR-WD-LSS-MVOLT-EZ1-WM-XX	31.6W LED 2287 LUMENS	WALL	8" WALL MOUNTED LED CYLINDER
AAE	GOTHAM	EVO-CYL-40-20-8AR-WD-LSS-MVOLT-EZ1-WM-XX	31.6W LED 2287 LUMENS	WALL	8" WALL MOUNTED LED CYLINDER. PROVIDE WITH REMOTE MOUNTED BATTERY PACK.
BBE	LITHONIA	WSR LED-P1-40K-SR4-MVOLT-MVOLT-E2OWC-XX	20W LED 2189 LUMENS	WALL	WALL MOUNTED LED WALL PACK WITH EMERGENCY BATTERY PACK.
SA	LITHONIA	DSXO LED-P1-40K-T4M-MVOLT-SPA-XX	38W LED 4612 LUMENS	POLE 25' A.F.F.	POLE MOUNTED LED FIXTURE POLE: SSA-25-5G-DM19AS-XX
SA2	LITHONIA	DSXO LED-P1-40K-T4M-MVOLT-SPA-XX	38W LED 4612 LUMENS	POLE 25' A.F.F.	2-HEAD POLE MOUNTED LED FIXTURE POLE: SSA-25-5G-DM29AS-XX
SB	LITHONIA	DSXO LED-P1-40K-T5M-MVOLT-SPA-XX	38W LED 4891 LUMENS	POLE 25' A.F.F.	POLE MOUNTED LED FIXTURE POLE: SSA-25-5G-DM19AS-XX

FIXTURE SCHEDULE NOTES:

A. VERIFY ALL FINISH COLORS WITH ARCHITECT PRIOR TO SUBMITTING EQUIPMENT BROCHURES.

B. VERIFY CEILING TYPES WITH ARCHITECTURAL DRAWING AND PROVIDE THE NECESSARY HARDWARE TO MOUNT THE FIXTURE IN THE CEILING TYPE BEING INSTALLED.

C. VERIFY MOUNTING HEIGHT OF FIXTURES WITH ARCHITECTURAL DRAWINGS PRIOR TO SUBMITTING EQUIPMENT BROCHURES. IF NO HEIGHT IS SHOWN ON THE ARCHITECTURAL DRAWINGS, VERIFY HEIGHT WITH THE ARCHITECT PRIOR TO SUBMITTING EQUIPMENT BROCHURES.

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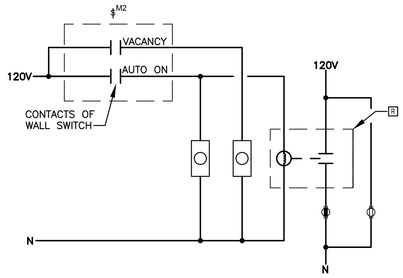
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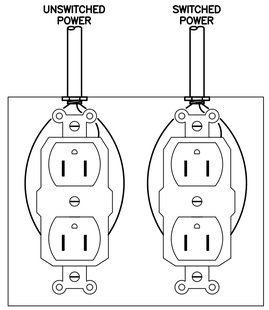
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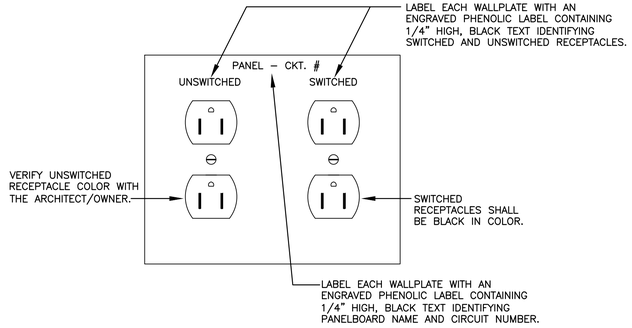
1 / E0.3 RECEPTACLE SWITCHING DETAIL (MULTIPLE FIXTURES)

Scale: NONE



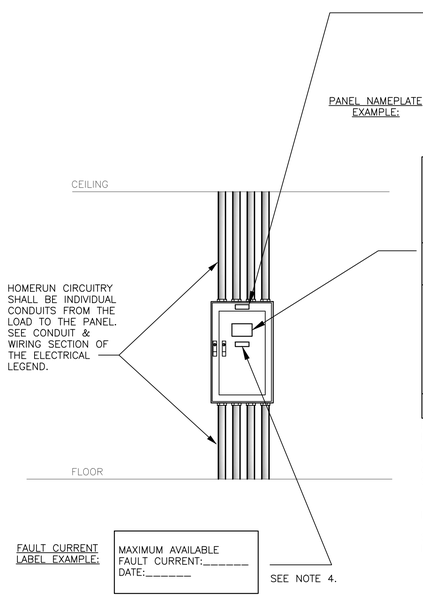
2 / E0.3 TYPICAL OFFICE QUAD RECEPTACLE DETAIL

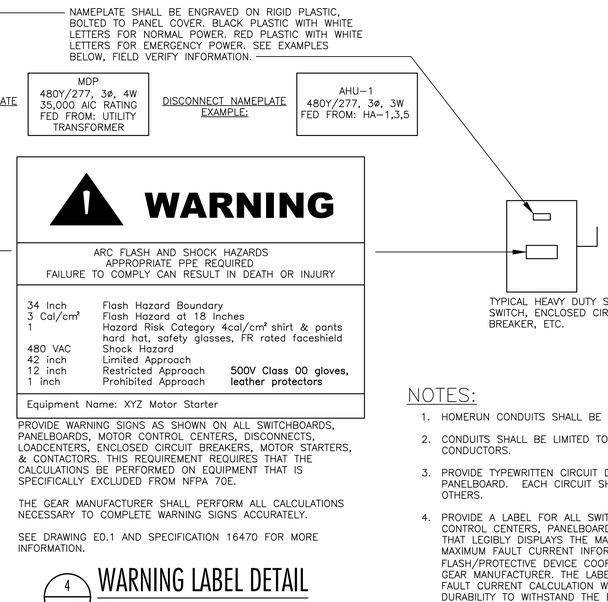
Scale: NONE



3 / E0.3 TYPICAL OFFICE QUAD RECEPTACLE COVER PLATE DETAIL

Scale: NONE





PROVIDE WARNING SIGNS AS SHOWN ON ALL SWITCHBOARDS, PANELBOARDS, MOTOR CONTROL CENTERS, DISCONNECTS, LOADCENTERS, ENCLOSED CIRCUIT BREAKERS, MOTOR STARTERS, & CONTACTORS. THIS REQUIREMENT REQUIRES THAT THE CALCULATIONS BE PERFORMED ON EQUIPMENT THAT IS SPECIFICALLY EXCLUDED FROM NFPA 70E.

THE GEAR MANUFACTURER SHALL PERFORM ALL CALCULATIONS NECESSARY TO COMPLETE WARNING SIGNS ACCURATELY.

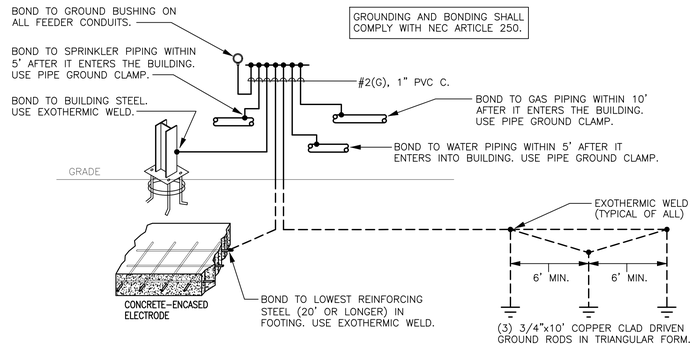
SEE DRAWING E0.1 AND SPECIFICATION 16470 FOR MORE INFORMATION.

4 / E0.3 WARNING LABEL DETAIL

Scale: NONE

NOTES:

1. HOMERUN CONDUITS SHALL BE SIZE 3/4" OR LARGER.
2. CONDUITS SHALL BE LIMITED TO THREE CURRENT CARRYING CONDUCTORS.
3. PROVIDE TYPEWRITTEN CIRCUIT DIRECTORIES INSIDE DOOR OF EACH PANELBOARD. EACH CIRCUIT SHALL BE DISTINGUISHED FROM ALL OTHERS.
4. PROVIDE A LABEL FOR ALL SWITCHGEAR, SWITCHBOARDS, MOTOR CONTROL CENTERS, PANELBOARDS, AND OTHER SERVICE EQUIPMENT THAT LEGIBLY DISPLAYS THE MAXIMUM AVAILABLE FAULT CURRENT. THE MAXIMUM FAULT CURRENT INFORMATION SHALL BE TAKEN FROM THE ARC FLASH/PROTECTIVE DEVICE COORDINATION STUDY PERFORMED BY THE GEAR MANUFACTURER. THE LABEL SHALL INCLUDE THE DATE THAT THE FAULT CURRENT CALCULATION WAS PERFORMED AND BE OF SUFFICIENT DURABILITY TO WITHSTAND THE ENVIRONMENT OF THE EQUIPMENT.



5 / E0.3 GROUNDING DETAIL

Scale: NONE

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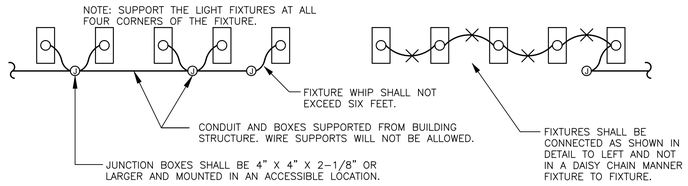
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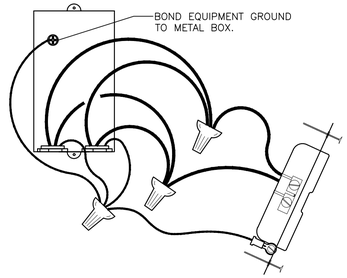
1 / E0.4 FIXTURE CONNECTION DETAIL
Scale: NONE

RECEPTACLE DETAIL NOTES:

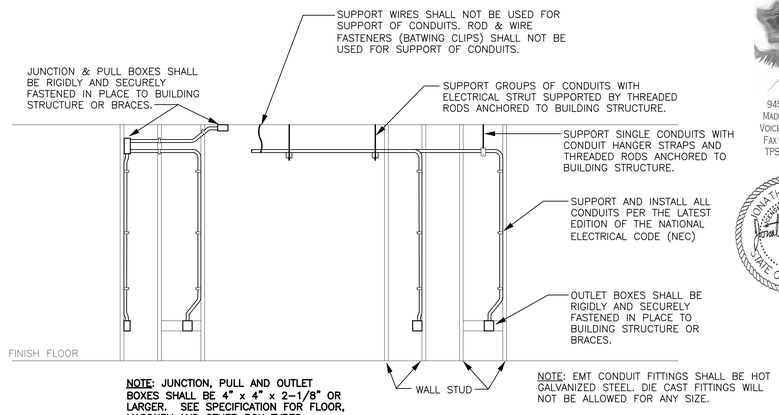
A. THESE DRAWINGS ARE BASED ON THE BEST INFORMATION AVAILABLE AT THE TIME OF DESIGN. COORDINATE WITH THE MILLWORK CONTRACTOR TO DETERMINE THE EXACT LOCATION OF OUTLETS BEING PLACED IN AND AROUND MILLWORK.

B. RECEPTACLES SHOWN AS GFI MAY BE NON GFI TYPE RECEPTACLES IF FED FROM A 20/1 GFI BREAKER OR THE LOAD SIDE OF A GFI RECEPTACLE IN THE SAME ROOM, ON THE SAME CIRCUIT AND RATED 20 AMP FEED-THRU CAPACITY. COVER PLATES SHALL BE CLEARLY MARKED GFI.

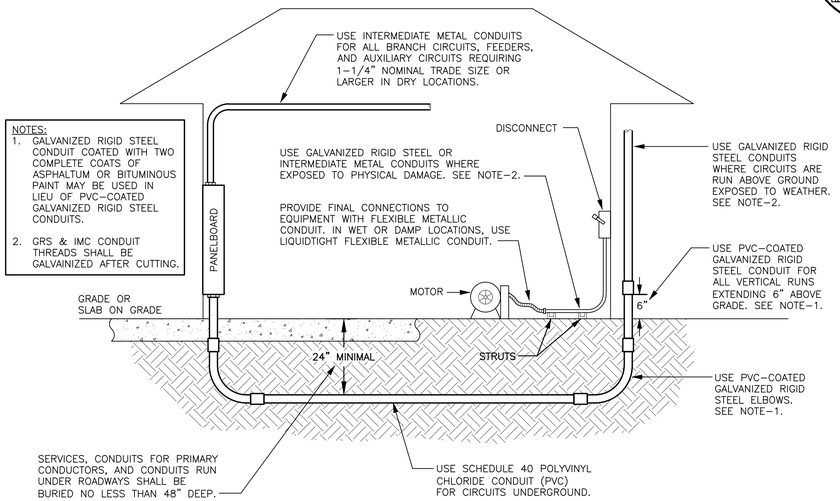
C. NON GFI RECEPTACLES SHALL NOT BE CONNECTED IN A FEED-THRU MANNER. WIRE CONNECTIONS IN RECEPTACLE BOXES SHALL BE MADE IN A PIGTAIL MANNER AS SHOWN IN RECEPTACLE DETAIL.



2 / E0.4 RECEPTACLE DETAIL
Scale: NONE

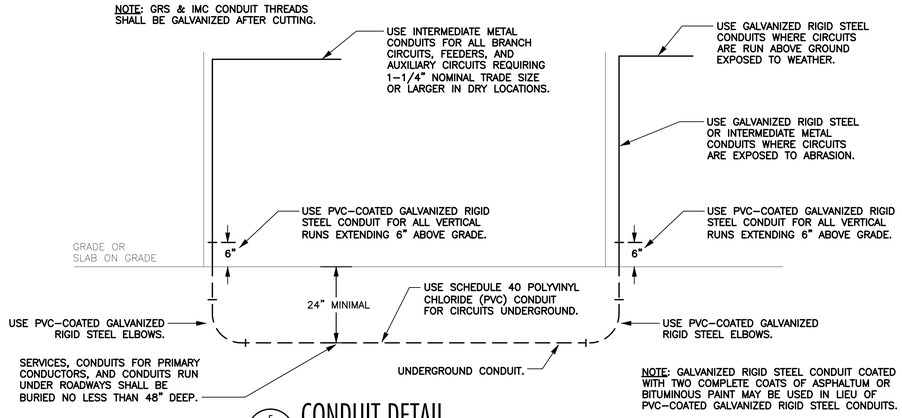


3 / E0.4 JUNCTION & OUTLET BOX DETAIL
Scale: NONE

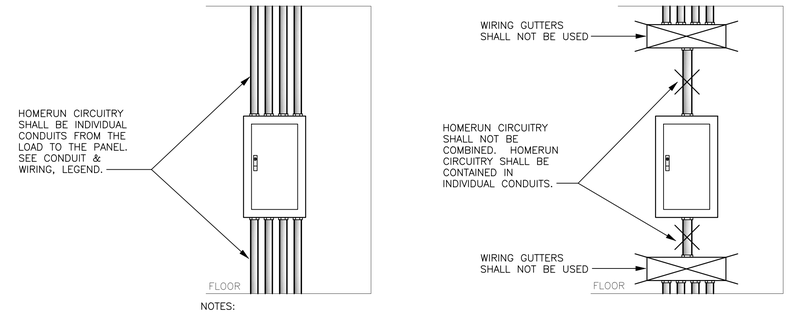


4 / E0.4 CONDUIT DETAIL
Scale: NONE

NOTE: GRS & IMC CONDUIT THREADS SHALL BE GALVANIZED AFTER CUTTING.



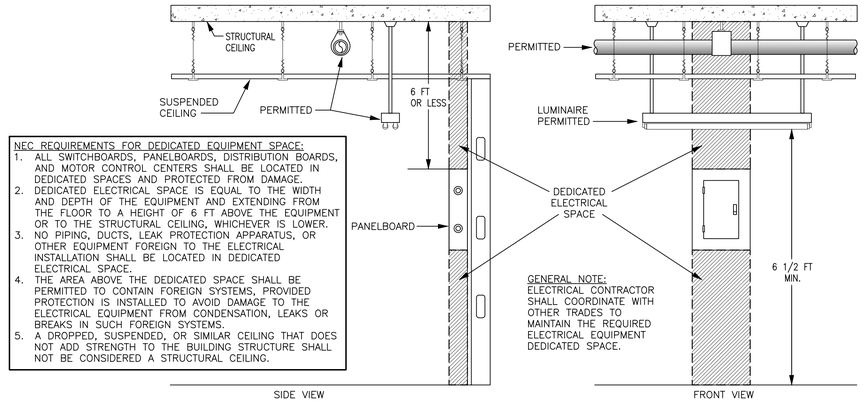
5 / E0.4 CONDUIT DETAIL
Scale: NONE



NOTES:

1. HOMERUN CONDUITS SHALL BE SIZE 3/4" OR LARGER.
2. CONDUITS SHALL BE LIMITED TO THREE CURRENT CARRYING CONDUCTORS

6 / E0.4 HOMERUN DETAIL
Scale: NONE



7 / E0.4 DEDICATED SPACE DETAIL
Scale: NONE

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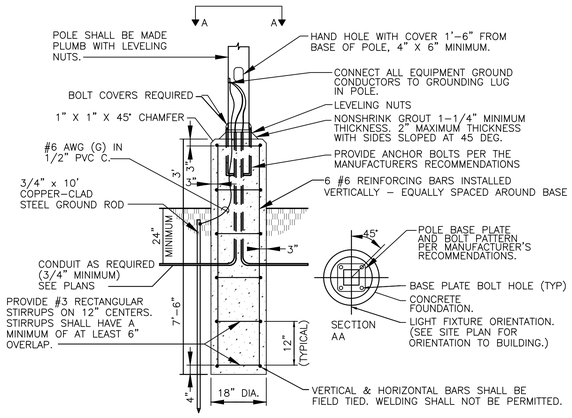
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Architect No:

E0.4

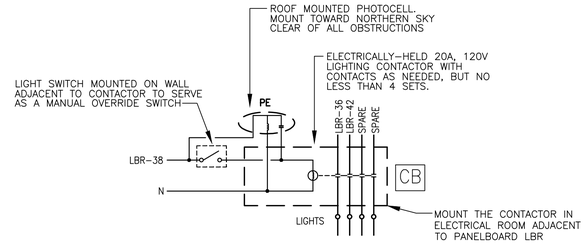
NOTES:

1. 3500 PSI MINIMUM 28 DAY COMPRESSIVE STRENGTH CONCRETE WITH GRADE 60 RE-BARS.
2. IF WATER IS PRESENT IN HOLE, REMOVE BEFORE POURING CONCRETE.
3. FOUNDATION EXCAVATION SHALL BE BY 24" AUGAR IN UNDISTURBED OR PROPERLY COMPACTED FILL.
4. MINIMUM ALLOWABLE SOIL BEARING PRESSURE 3000 PSF. NOTIFY ENGINEER IF BEARING PRESSURE IS LESS.
5. AIR ENTRAINMENT: 4 TO 6%.

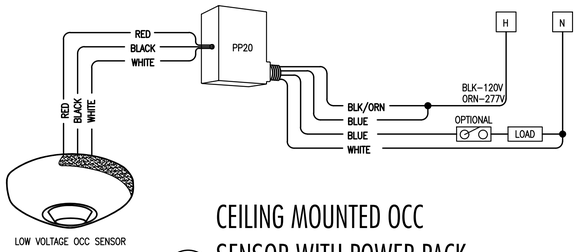


1 / E0.5 POLE BASE DETAIL
Scale: NONE

2 / E0.5 NOT USED
Scale: NONE

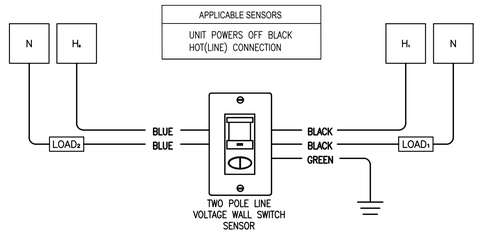


3 / E0.5 CONTACTOR "CB" DETAIL
Scale: NONE



CEILING MOUNTED OCC SENSOR WITH POWER PACK

4 / E0.5
Scale: NONE



TWO POLE LINE VOLTAGE WALL SWITCH SENSOR

5 / E0.5
Scale: NONE

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CITY OF HATTIESBURG MISSISSIPPI

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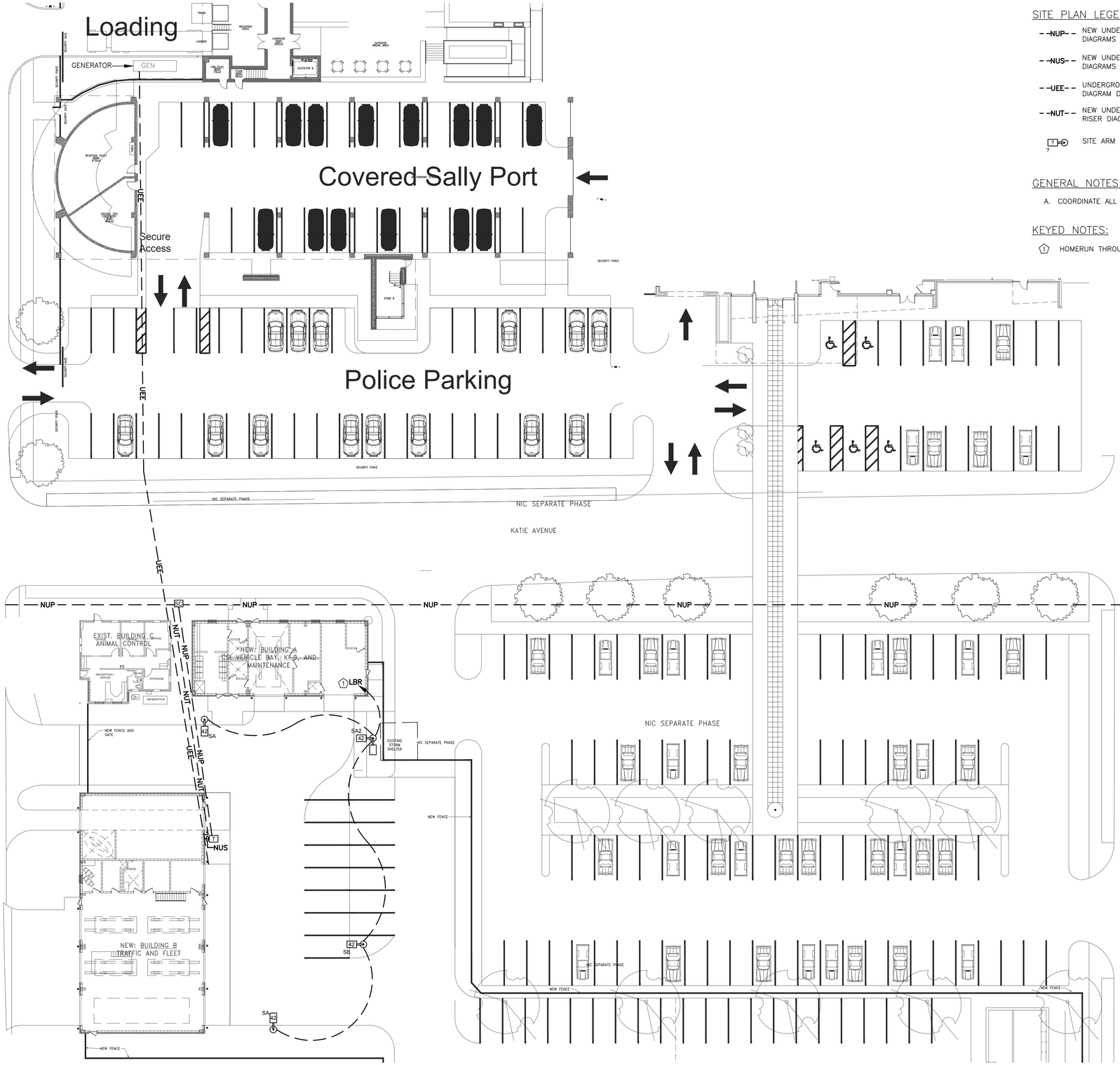
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Checked By:
Client No: -------
Architect No:

E0.5



1 E0.6 SITE PLAN
Scale: 1" = 20'-0"

SITE PLAN LEGEND

- NUP — NEW UNDERGROUND ELECTRICAL PRIMARY. SEE SINGLE LINE DIAGRAMS DETAILS 1 AND 3/E0.1.
- NUS — NEW UNDERGROUND ELECTRICAL SECONDARY. SEE SINGLE LINE DIAGRAMS DETAIL 1 AND 3/E0.1.
- UEE — UNDERGROUND CONDUCTORS TO GENERATOR. SEE ONE LINE DIAGRAM DETAILS 1 AND 3/E0.1.
- NUT — NEW UNDERGROUND TELECOMMUNICATIONS. SEE TELECOMMUNICATIONS RISER DIAGRAMS DETAIL 2/E0.1 AND DETAIL 4/E0.1.
- ? — SITE ARM MOUNT POLE LIGHT FIXTURE. SEE FIXTURE SCHEDULE.

GENERAL NOTES:

A. COORDINATE ALL ELECTRICAL UTILITY WORK WITH MISSISSIPPI POWER.

KEYED NOTES:

(1) HOMERUN THROUGH CONTACTS OF CONTACTOR "CB".

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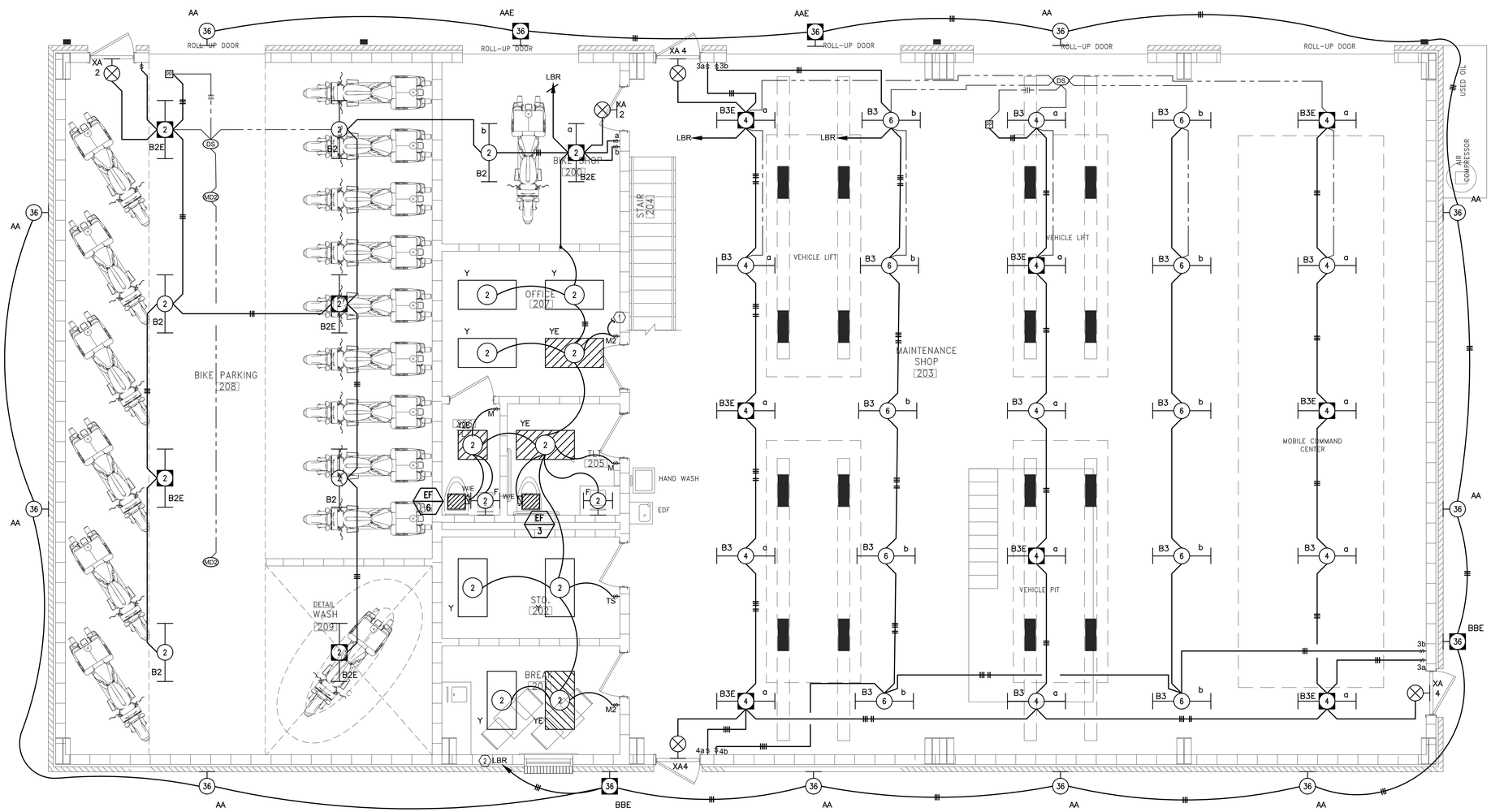
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Client No: -------
Architect No:

E0.6

KEYED NOTES:

1. CONNECT TO RECEPTACLE RELAY LOCATED IN THE ROOM. SEE SHEET E2.0 FOR CONTINUATION. SEE RECEPTACLE SWITCHING DETAILS ON E0.3.
2. HOMERUN THROUGH CONTACTS OF CONTACTOR CB. PROVIDE A CONSTANT HOT TO EMERGENCY BATTERY PACKS. SEE DETAIL 3/E0.5.



1 / E1.0 LIGHTING PLAN - BUILDING B

Scale: 1/4" = 1'-0"

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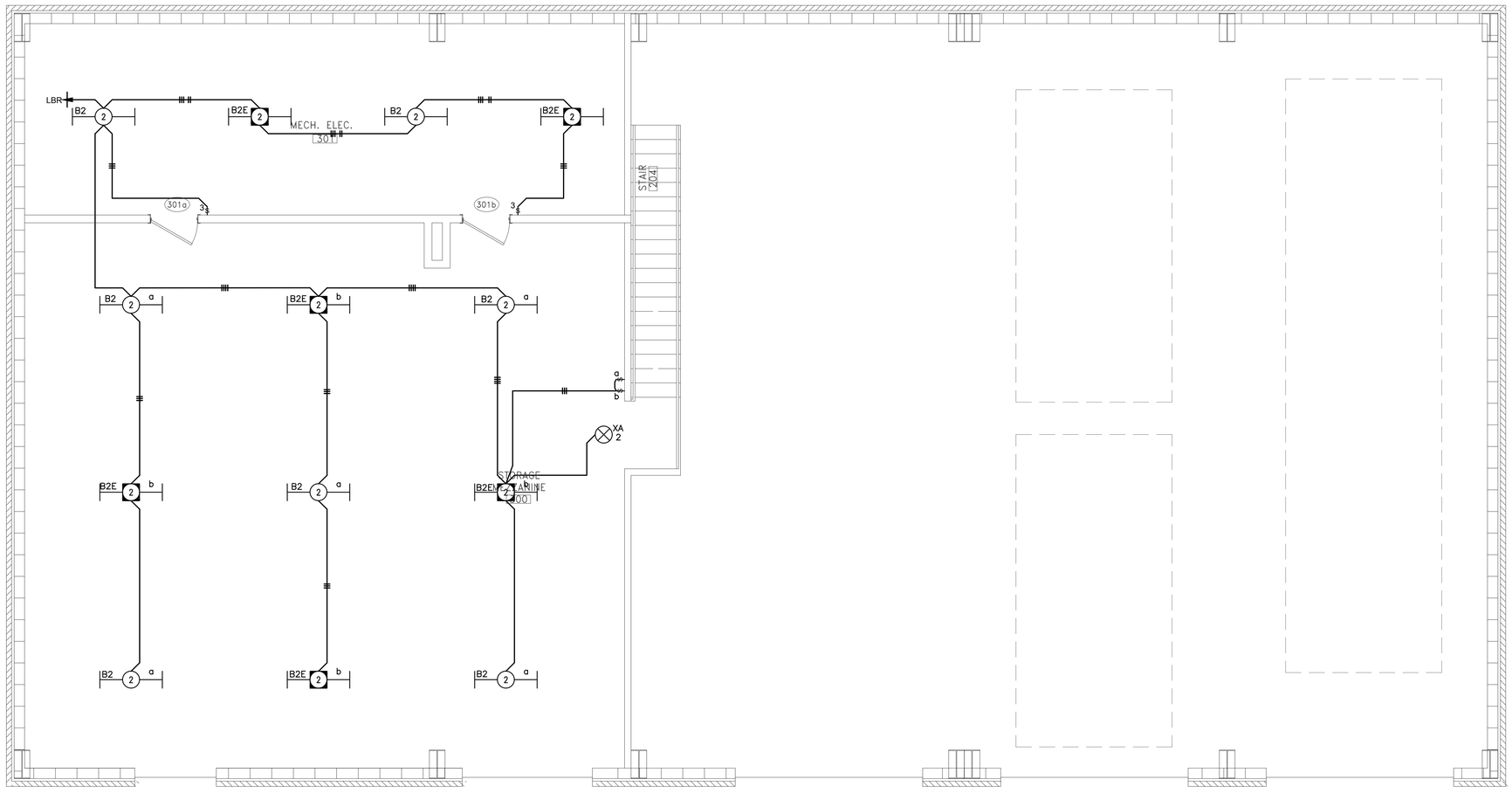
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LIGHTING PLAN - BUILDING B MEZZANINE

1 / E1.1

Scale: 1/4" = 1'-0"

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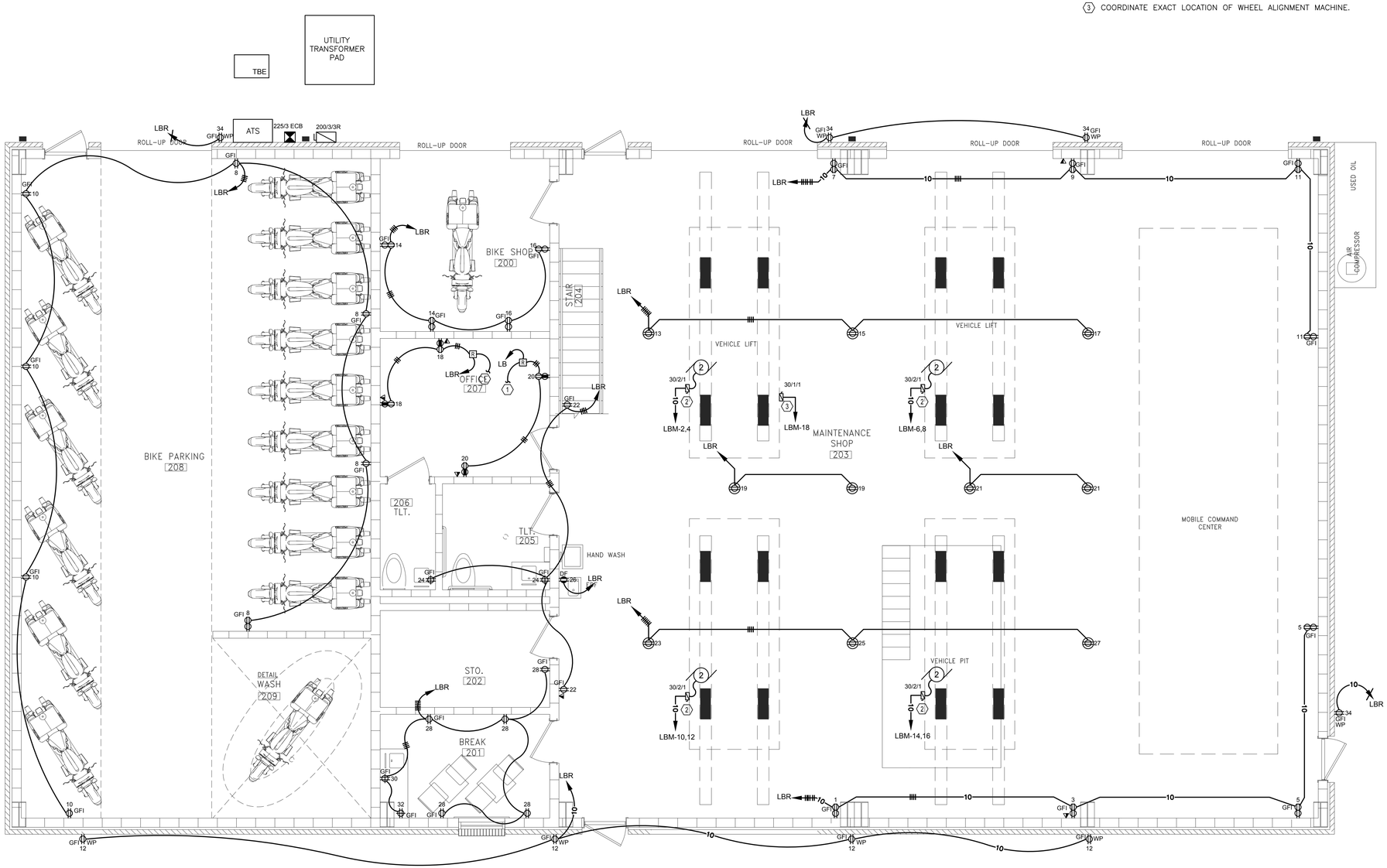
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Checked By:
Client No: -------
Architect No:

E1.1

KEYED NOTES:

1. CONNECT TO OCCUPANCY SENSOR LOCATED IN THE ROOM. SEE SHEET E1.0 FOR CONTINUATION. SEE RECEPTACLE SWITCHING DETAIL 1/E0.3 AND COVER PLATE DETAIL 3/E0.3.
2. COORDINATE EXACT MOTOR AND LIFT LOCATION PRIOR TO INSTALLATION OF CONDUIT AND DISCONNECT.
3. COORDINATE EXACT LOCATION OF WHEEL ALIGNMENT MACHINE.



1 / E2.0 POWER PLAN - BUILDING B
Scale: 1/4" = 1'-0"

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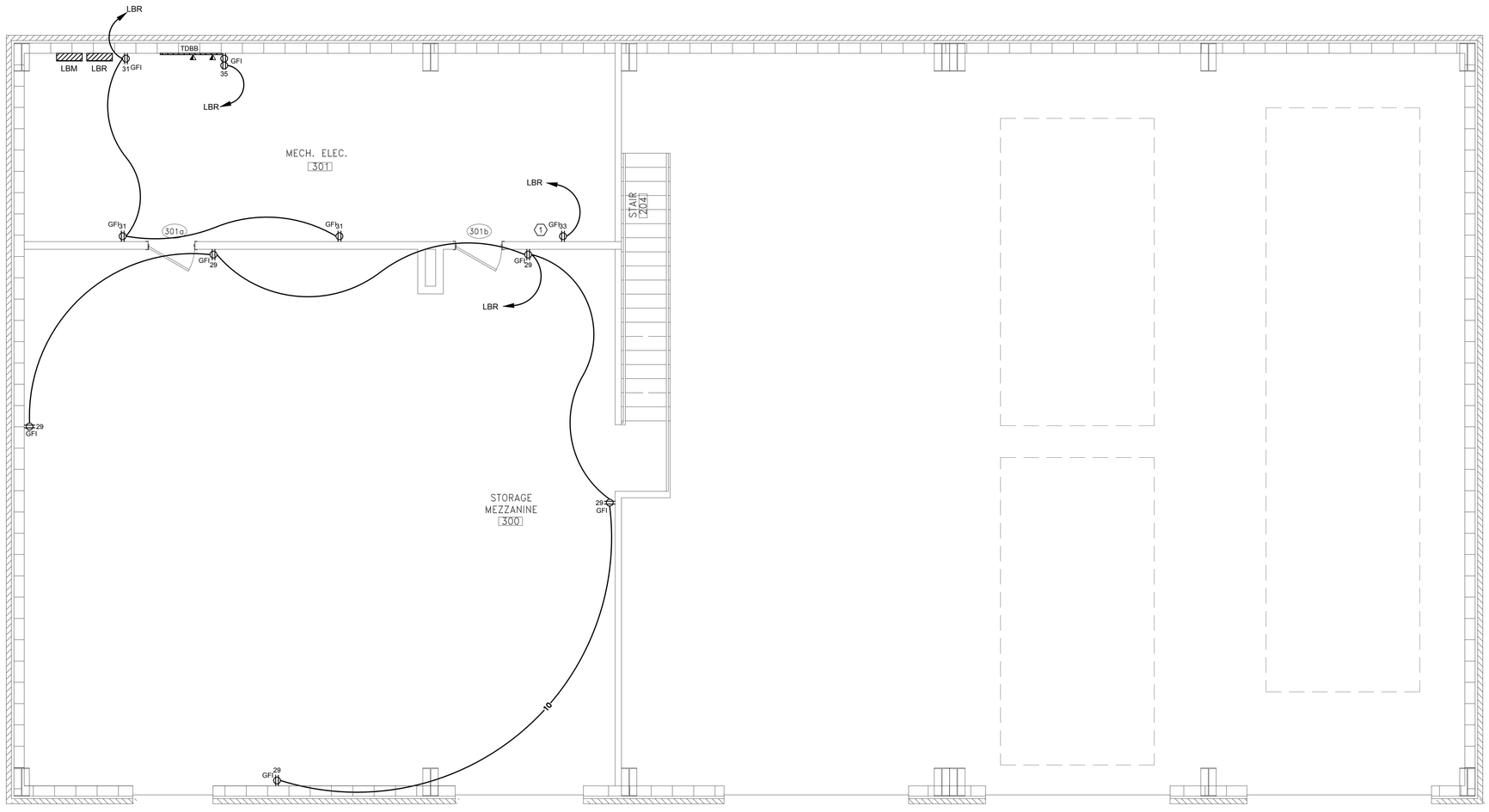
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Architect No:

E2.0

KEYED NOTES:

1. POWER PROVIDED FOR MECHANICAL CONTROLS. COORDINATE EXACT LOCATION AND TYPE OF CONNECTION WITH MECHANICAL CONTROLS CONTRACTOR.



1 / E2.1 POWER PLAN - BUILDING B MEZZANINE

Scale: 1/4" = 1'- 0"

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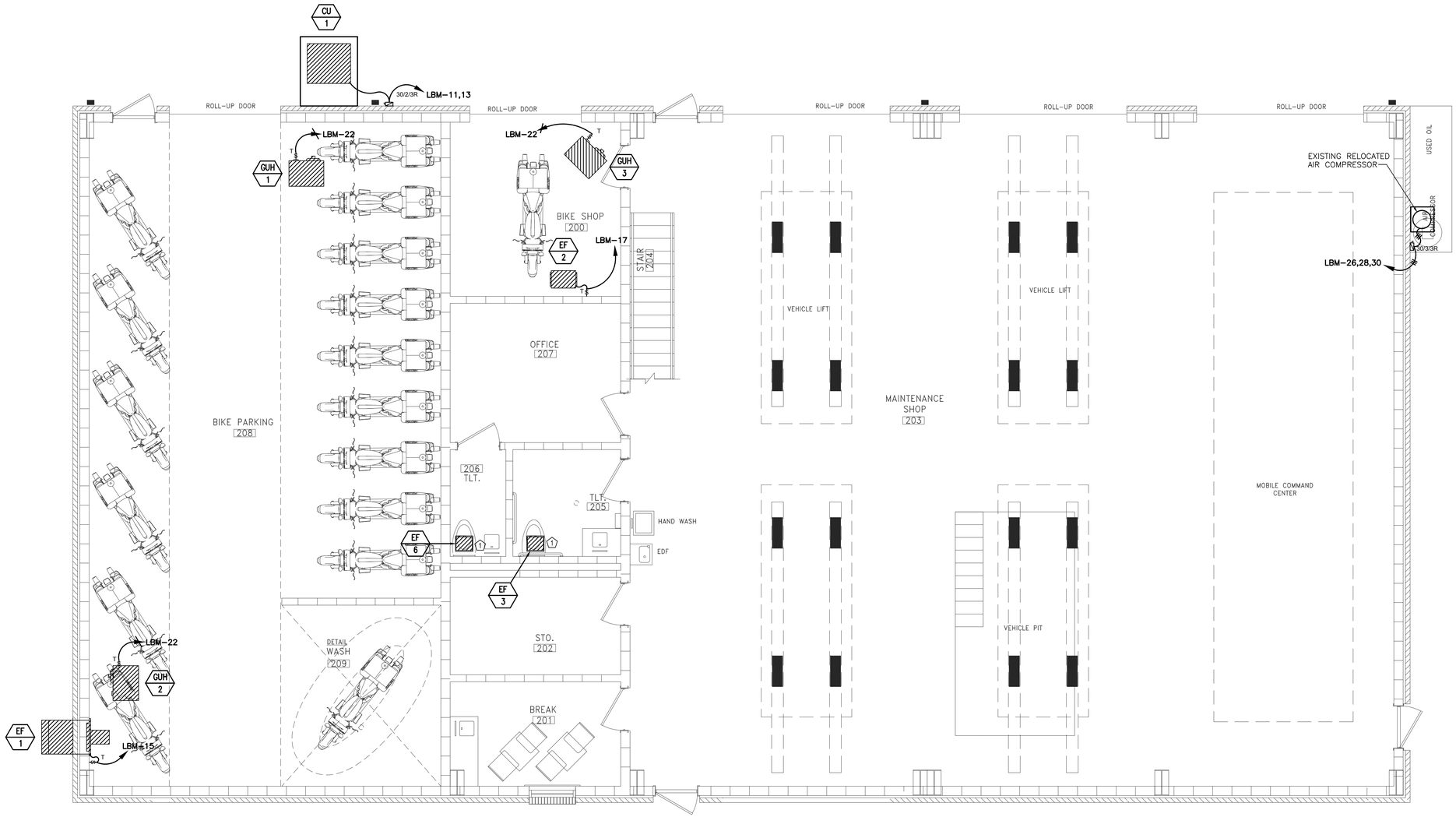
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E2.1



1/E3.0 MECH/AUXILIARY PLAN - BUILDING B

Scale: 1/4" = 1'-0"

KEYED NOTES:

(1) SEE LIGHTING PLAN E1.0 FOR CONNECTION.

GENERAL NOTES:

A. MECHANICAL INFORMATION AND EQUIPMENT CONNECTIONS SHOWN ON THE DRAWINGS ARE BASED ON THE BEST AVAILABLE INFORMATION AT THE TIME OF DESIGN. VERIFY ALL EQUIPMENT CONNECTION REQUIREMENTS WITH MECHANICAL EQUIPMENT BEING PROVIDED PRIOR TO SUBMITTING EQUIPMENT.

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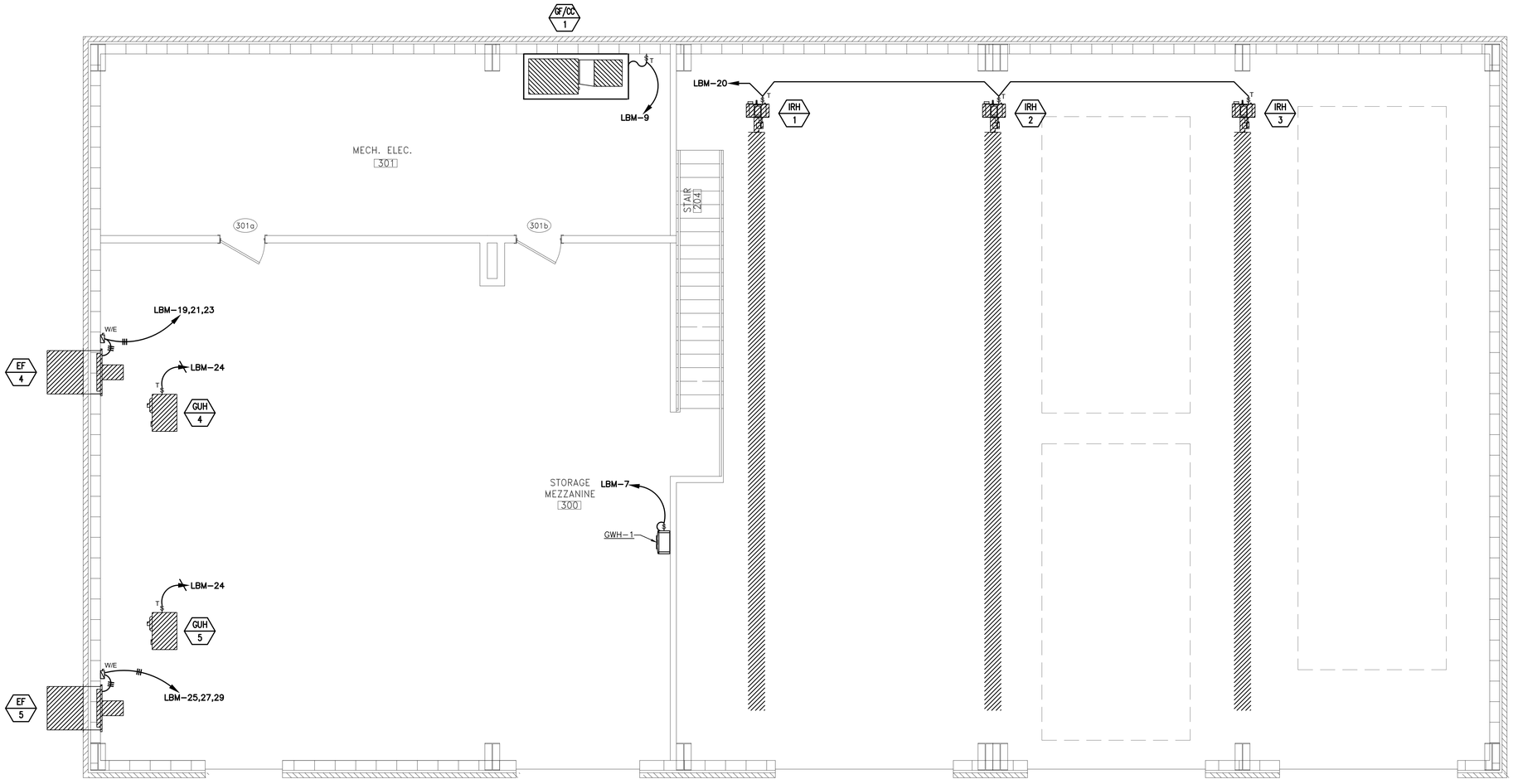
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E3.0



1 / E3.1 MECH/AUXILIARY PLAN - BUILDING B MEZZANINE

Scale: 1/4" = 1'-0"

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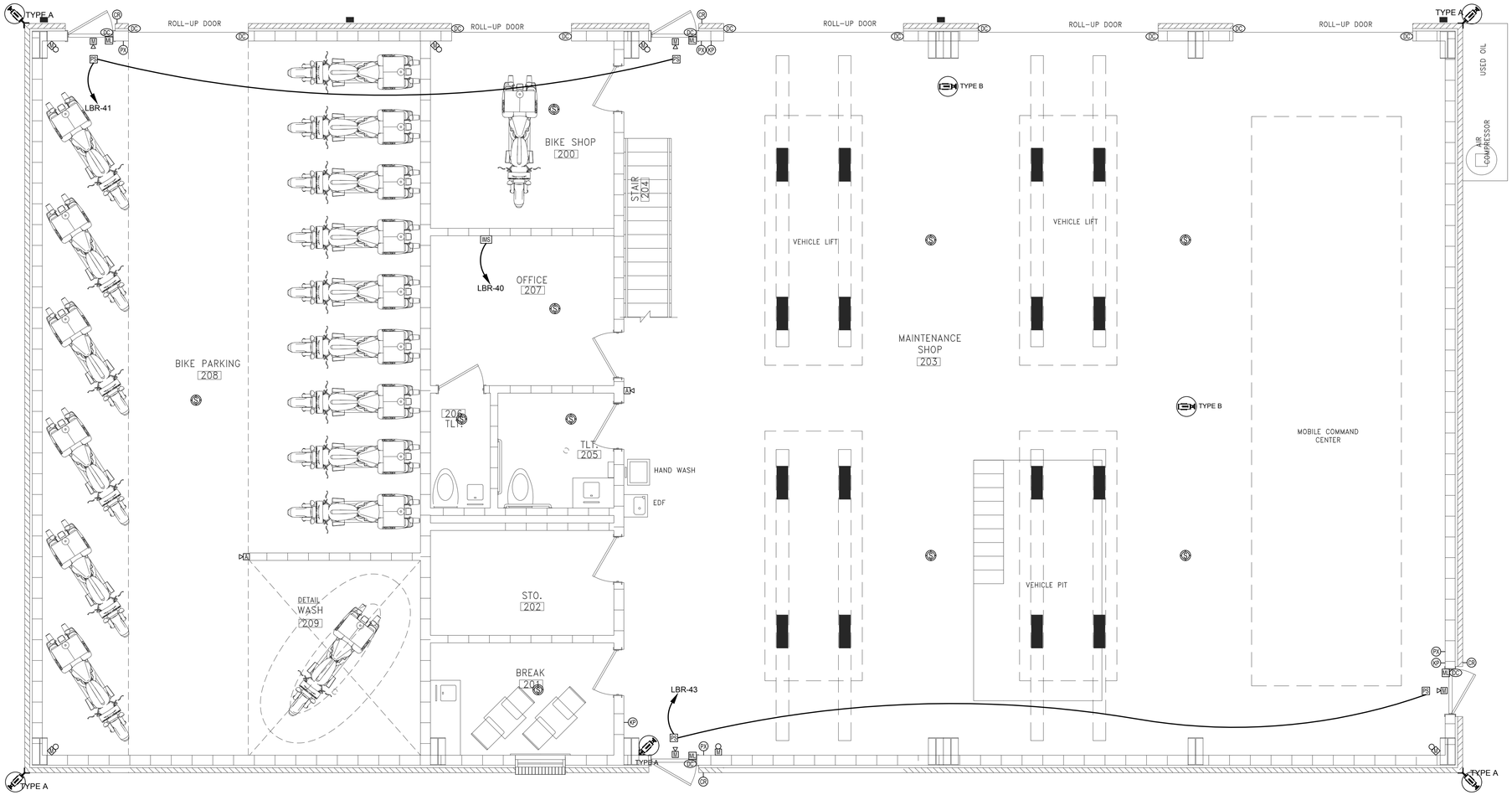
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E3.1



1 / E4.0 SECURITY PLAN - BUILDING B

Scale: 1/4" = 1'-0"

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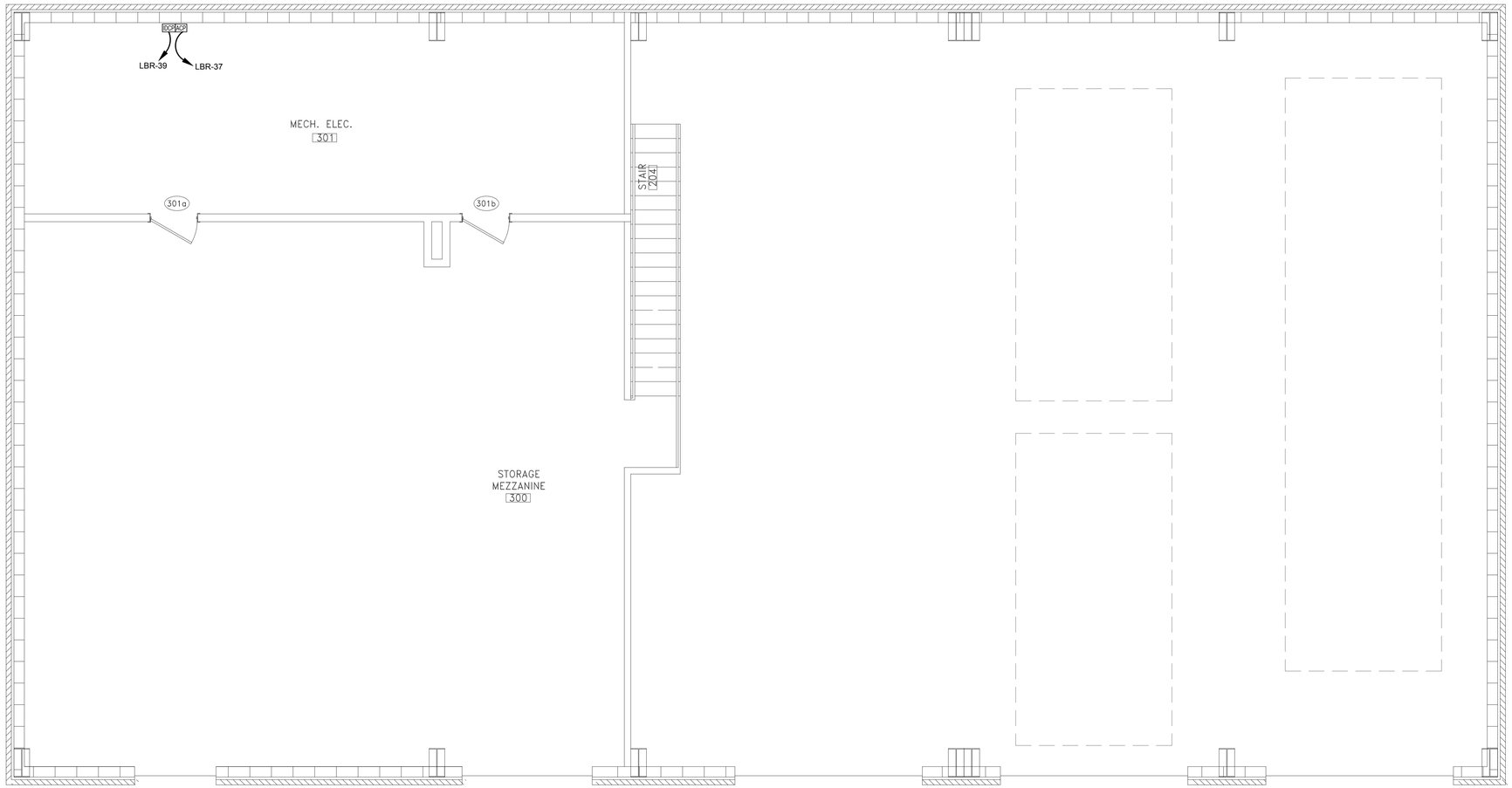
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1 / E4.1 SECURITY PLAN - BUILDING B MEZZANINE

Scale: 1/4" = 1'-0"

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E4.1

THE CITY OF HATTIESBURG

PUBLIC SAFETY COMPLEX

HISTORIC HOSPITAL BUILDING
POLICE AND COURT BUILDING

PROJECT MANUAL

VOLUME ONE

November 19, 2018

Albert & McCleskey Associates Architects
Hattiesburg, Mississippi

PROJECT MANUAL
FOR
THE CITY OF HATTIESBURG

PUBLIC SAFETY COMPLEX

HATTIESBURG, MISSISSIPPI

Corrected November 19, 2018



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ADVERTISEMENT FOR BIDS

Sealed bids will be received by the **City of Hattiesburg** at the Hattiesburg City Council Chamber located at **200 Forrest Street, Hattiesburg, MS, 39401** until **10:00 a.m.** local time on **Friday, December 21, 2018**, at which time all proposals will be opened and read aloud for:

Hattiesburg Public Safety Complex
701 James Street
Hattiesburg, Mississippi 39401

Bid documents may be obtained in hard copy form for a deposit of $500.00 per set of documents, made payable to Albert & McCleskey Associate Architects. 50% of the deposit will be refunded to all document holders upon the return of the documents to the Architect in good condition no later than 10 calendar days after the bid date. Official bid documents can be downloaded from Central Bidding at www.centralbidding.com. Electronic bids can be submitted at www.centralbidding.com. For any questions relating to the electronic bidding process, please call Central Bidding at 225-810-4814. Bid preparation shall be in accordance with Instructions to Bidders bound in the Project Manual.

A Pre-bid meeting will be held on Wednesday, December 5, 2018 at 10:00 a.m. at the Hattiesburg Public Safety Complex site. Attendance by all Bidders is strongly encouraged.

Each bid must be received in a sealed envelope which is marked in the lower left-hand corner with the legend, **"Hattiesburg Public Safety Complex Bid Package".**

No bid may be withdrawn for a period of sixty (60) days. The lowest and best proposal received will be accepted, subject to the provisions of Section 31-7-13 of the Mississippi Code of 1972, Annotated and Amended, and other applicable State law; but the Council reserves the right to reject any or all proposals received and to waive informalities or irregularities therein.

Authorized by:
Kermas Eaton
City of Hattiesburg

Publication Dates: November 22, 2018
November 29, 2018

Publish In: The Post and Clarion Ledger

MISSISSIPPI DEPARTMENT OF ARCHIVES & HISTORY
MISSISSIPPI LANDMARK
CONTRACTOR PREQUALIFICATION CRITERIA

HATTIESBURG PUBLIC SAFETY COMPLEX
HATTIESBURG, MISSISSIPPI

SENATE BILL NO. 2368, Regular Session 2011, "An Act to amend Section 31-7-13, Mississippi Code of 1972" (i.e., Involving the renovation or restoration, or both ... of any other historical building designated as a Mississippi Landmark.")

1. Because of the sensitive nature of the project to be undertaken, the General Contractor must have demonstrated experience working with projects employing the Secretary of the Interior's *Standards for the Treatment of Historic Properties,* as interpreted by the National Park Service and the Mississippi Department of Archives and History.

2. General Contractor shall submit documentation of successful completion of three (3) projects comparable in size and type of work with the proposed Mississippi landmark restoration project.

3. The General Contractor must demonstrate that he/she has a track record of completing work within the Contract time. Provide five (5) examples with references.

4. The General Contractor has completed the cited projects without incurring legal disputes or serious problems with or complaints from the project architect and/or managing agency in regard to his/her knowledge of preservation/restoration standards.

5. The General Contractor's company demonstrates that it employs office personnel capable of completing the legally required documentation in the State Construction System.

6. The General Contractor will submit the resume' of the proposed Project Superintendant for the construction of the project advertised.

INDEX

ADVERTISEMENT TO BID
MISSISSIPPI LANDMARK CONTRACTOR PREQUALIFICATION CRITERIA
INDEX OF SPECIFICATIONS
INDEX OF DRAWINGS
FORM OF PROPOSAL
SPECIFICATIONS

INDEX TO SPECIFICATIONS

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00 50 00	AGREEMENT FORM			
00 60 00	CONTRACT BOND			
00 65 00	CERTIFICATE OF INSURANCE INSTRUCTIONS			
00 70 00	GENERAL CONDITIONS			
00 80 00	SUPPLEMENTARY CONDITIONS			
00 90 00	ADDENDA			
00 95 00	ARCHITECT'S SPECIAL CONDITIONS			
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01 20 00	ALLOWANCES			
01 21 00	PROJECT MEETINGS			
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01 31 00	PROGRESS SCHEDULES			
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END OF INDEX OF DRAWINGS

FORM OF PROPOSAL

DATE: _____

PROPOSAL FROM: _____

(List Company Name)

TO OWNER: CITY OF HATTIESBURG
HATTIESBURG, MISSISSIPPI

PROJECT: HATTIESBURG PUBLIC SAFETY COMPLEX
HATTIESBURG, MISSISSIPPI

Ladies & Gentlemen:

Having carefully examined all Contract Documents and addenda for the construction of the project in caption, the undersigned purposes to furnish all labor, materials and services required for the construction in accordance with these documents for the sum as follows:

BASE BID:

_____

_____DOLLARS

($_____)

TIME: The undersigned agrees to complete the work within _____ calendar days from the date of the Notice to Proceed issued by the Architect. It is also agreed that this proposal/contract price will be valid for the minimum time of **60 DAYS** from the date of opening.

ALTERNATES: *(SEE SECTION 01 35 00)*

A. Alternate Number One: This Alternate adds all labor and materials required for the entire scope of work for public parking on south side of Katie Avenue.

B. Alternate Number Two: This Alternate adds pavement and parking for the Vehicular Maintenance Building.

COST BREAKDOWNS: N/A

UNIT PRICES: N/A

BID SECURITY:

Bid Security in the form of _____ is attached in the amount of $_____

ADDENDA:

Receipt of the following addenda is acknowledged:

Addendum No:_____Dated:_____ Addendum No:_____Dated:_____

Addendum No:_____Dated:_____ Addendum No:_____Dated:_____

Addendum No:_____Dated:_____ Addendum No:_____Dated:_____

GENERAL CONTRACTOR:

Mississippi Certificate of Responsibility No: _____

Resident Contractor: _____

Non-Resident Contractor*: _____

LIST THE FOLLOWING SUBCONTRACTORS THAT YOU INTEND TO USE:

- Roofing Subcontractor (Section 07 52 16):

  _____

- Glass/Storefront/Curtain Wall Subcontractor (Sections 08 43 13 / 08 44 13 / 08 80 00):

  _____

- Mechanical/Plumbing Subcontractor(s) (Divisions 22 / 23):

  _____

- Electrical Subcontractor (Division 26):

  _____

ACCEPTANCE:

I certify that I am authorized to enter into a binding contract, if this Proposal is accepted.

Signature: _____

Typed Name & Title: _____

Company Name: _____

Address: _____

City, State, Zip Code: _____

Phone, Fax, Email: _____

DIRECTIONS FOR MAILING:

See *INSTRUCTIONS TO BIDDERS [SECTION 00 10 00]* for mailing directions.

END OF FORM OF PROPOSAL

SECTION 00 10 00

INSTRUCTIONS TO BIDDERS

PART 1 - GENERAL

1.01 **QUESTIONS:** Questions shall be directed to the Professional. Bidders finding discrepancies in or omissions from the Drawings or Project Manual, or requiring clarification or interpretation of the Bidding Documents, shall submit written requests to the Architect within the proper timeframe as defined by the State of Mississippi Bid Laws. Interpretations, corrections and modifications of the Bidding Documents will be made by addendum. Specific cutoff dates regarding submission of questions or issuance of addenda shall be provided at the Pre-Bid Conference, if applicable, and/or by addendum. Any interpretations, corrections or modifications to the Bidding Documents made in any manner other than by addendum shall not be binding and shall not be relied upon when submitting bids. If Contractor does not notify the Professional about discrepancies within proper time during bidding, bids shall be based on the most expensive combination of quality and quantity of work indicated.

1.02 **BIDDER'S QUALIFICATIONS:**

A. **Certificate of Responsibility:** The Mississippi State Board of Contractors is responsible for issuing Certificates of Responsibility to Contractors. To be awarded a Contract for public work, Sections 31-3-15 and 31-3-21 of the **Mississippi Code 1972, Annotated** requires a Contractor to have a current Certificate of Responsibility at bid time and during the entire length of the job. The Certificate of Responsibility number issued becomes a significant item in all public bidding.

B. **Bid Under $50,000:** If a Bidder submits a bid not exceeding $50,000, no Certificate of Responsibility number is required; however, a notation stating the *bid does not exceed $50,000* must appear on the face of the envelope, or a Certificate of Responsibility number.

C. **Bid Over $50,000:** Each Bidder submitting a bid in excess of $50,000 must show its Certificate of Responsibility number on the bid and on the face of the envelope containing the bid.

D. **Joint Venture Bid:** When multiple Contractors submit a joint venture bid in excess of $50,000, a *joint venture* Certificate of Responsibility number must be shown on the bid and on the face of the envelope containing the bid. If the Multiple-Contractor joint venture has no *joint venture* Certificate of Responsibility number, each of the Contractors participating in the bid must indicate their individual Certificate of Responsibility numbers on the bid and on the face of the envelope.

1.03 **NON-RESIDENT BIDDER:** When a non-resident Bidder (a Contractor whose principal place of business is outside the State of Mississippi) submits a bid for a Mississippi public works project, one of the following is required and shall be submitted with the Proposal Form:

A. **Copy of Law:** If the non-resident Bidder's state has a resident Bidder preference law, a copy of that law shall be submitted with the Proposal Form.

B. **Statement:** If the state has no such law, then a statement indicating *the State of (Name of State) has no resident Contractor preference law* shall be submitted with the Proposal Form.

1.04 **DISQUALIFICATION OF BIDDER:** A Bidder may be disqualified for any of the following reasons:

A. Bidder being in arrears on existing Contracts.

B. Bidder being in litigation (currently or in the past) with the Owner, or the Using Agency.

C. Bidder having defaulted on a previous Contract.
D. Bidder being in litigation with the Architect currently or in past projects.

1.05 **CONDITIONS OF WORK:** Each Bidder must fully inform himself of all conditions relating to the construction of the Project and employment of labor thereon. Failure to do so will not relieve a successful Bidder of obligations to furnish all material and labor necessary to carry out the provisions of the Contract. Insofar as possible, the Bidder must employ methods, or means, which will not cause interruption of, or interference with, the work of any other Bidder, or Contractor.

1.06 **EXAMINATION OF SITE:** All Bidders, including the general Contractor and Subcontractors, shall visit the building site, compare the Drawings and Project Manual with any work in place and be informed of all conditions. Failure to visit the site will in no way relieve the successful Bidder from furnishing any materials or performing any work required to complete work in accordance with Drawings and Project Manual without additional cost to the Owner.

1.07 **LAWS AND REGULATIONS:** The Bidder's attention is directed to the fact that all applicable Federal, State and Local laws, rules and regulations of all authorities having jurisdiction over construction of the Project apply to the Contract.

1.08 **OBLIGATION OF BIDDER:** At the bid opening, each Bidder will be presumed to have inspected the site, read and become thoroughly familiar with the Drawings and the Project Manual, including all addenda.

1.09 **BIDDING DOCUMENTS:** The Bidding Documents include the Bidding Requirements and the proposed Contract Documents. The Bidding Requirements consist of the Advertisement or Invitation to Bid, Instructions to Bidders, Supplementary Instructions to Bidders, the Form of Proposal, and any other sample bidding and contract forms. The proposed Contract Documents consists of the Standard Form of Agreement Between Owner and Contractor, the General Conditions of the Contract for Construction (along with any Supplementary, Special or other Conditions), Drawings, Specifications and all addenda issued prior to the execution of the Contract.

1.10 **ISSUANCE OF BIDDING DOCUMENTS:** Only complete sets of Bidding Documents will be issued to Bidders. The Bidding Documents are to be viewed and considered in their entirety, and the Owner and Architect assume no responsibility for misunderstandings of the Bidding Documents due to the use of partial or incomplete sets. Bidding Documents are intended strictly for the purpose of obtaining bids on the work defined therein, and no license of use is granted by their issuance to a Bidder.

1.11 **BID DOCUMENT DEPOSIT AND RETURN:** Complete sets of Bidding Documents may be obtained from Plan House Printing on behalf of Albert & McCleskey Associates Architects, which may be contacted at 601-544-1970. The deposit amount and nature of its refundability shall be as defined in the Advertisement or Invitation to Bid. If designated as refundable, deposits will be refunded to Bidders who return complete and fully bound sets of Bidding Documents, free of any damage, markings, or annotations, to Albert & Robinson Architects at 514 Main Street, Hattiesburg, Mississippi, within 10 calendar days of the bid opening date. No partial refunds will be given for damaged Bidding Documents. Physical sets of Bidding Documents must be purchased through the website www.ar-architectsprojects.com. If a deposit is required, please make checks payable to Albert & McCleskey Associates Architects and mail to Plan House Printing at 1A Churchill Street, Hattiesburg, MS 39402.

1.12 **ELECTRONIC BIDDING DOCUMENTS:** In addition to physical sets of Bidding Documents, electronic copies, in PDF format, may be downloaded from Central Bidding at www.centralbidding.com. Electronic bids can be submitted at www.centralbidding.com. For any questions relating to the electronic bidding process, please call Central Bidding at 225-810-4814.

PART 2 - PROPOSAL FORM

2.01 **METHOD OF BIDDING:** Lump sum, single bids received on a general contract will include general, mechanical and electrical construction and all work shown on Drawings or specified in the Project Manual.

2.02 **PROPOSAL FORMS:** The Bidder shall make all proposals on forms provided and shall fill all applicable blank spaces without interlineations or alteration and must not contain recapitulation of the work to be done. All sums shall be expressed in both written and numerical formats with the written amount taking precedence should a discrepancy exist. No oral or telegraphic proposals shall be considered.

2.03 **TIME OF COMPLETION:** The Bidder shall agree to commence work on, or before, a date specified in a written *Notice to Proceed* and fully complete the Project within the calendar days indicated on the Proposal Form.

2.04 **ALTERNATES:** The Proposal Form shall contain a brief description of each alternate modifying the scope of work. The Bidder shall write out the numerical amount for each alternate. Refer to Section 01 35 00 entitled *Alternates* for additional information.

2.05 **SUBSTITUTIONS:** No substitutions, qualifications or redefining of the Specification requirements are allowed to be marked on the Proposal Form, unless specifically required by the Bid Documents. Refer to Section 01 63 00 entitled *Substitutions and Product Options* which covers procedures after the award of Contract.

2.06 **ADDENDA:** Any addenda to the Drawings or Project Manual issued before or during the time of bidding shall be included in the proposal and become a part of the Contract. Addenda will be issued only to those Bidders who have obtained complete sets of Bidding Documents directly from the office of Albert & McCleskey Associates Architects. Any Bidder who obtains Bidding Documents from any other source, such as plan rooms, shall be responsible for ensuring receipt of addenda from that same source. The Proposal Form will have ample space to indicate the receipt of addenda. When completing the Proposal Form, the Bidder shall list the addendum number and the date received in spaces provided.

2.07 **BIDDER IDENTIFICATION:**

A. **Signature:** The Proposal Form shall be signed by any individual authorized to enter into a binding agreement for the Business making the bid proposal.
B. **Name of Business:** The name appearing on the Proposal Form shall be the same as the name appearing in the current Mississippi State Board of Contractors Roster.
C. **Legal Address:** The address appearing on the Proposal Form shall be the same address appearing in the current Mississippi State Board of Contractors Roster.
D. **Certificate of Responsibility Number(s):** The Certificate of Responsibility Number(s) appearing on the Proposal Form shall be the same number appearing in the current Mississippi State Board of Contractors Roster.

2.08 **BID SECURITY:** The Bid Security shall be in the form of a Bid Bond or a Certified Check:

A. **Bid Bond:** The Bidder may submit a Bid Bond by a Surety licensed in the State of Mississippi in the amount of five percent (5%) of the base bid. The Bid Bond shall be duly executed by the Bidder, the Surety and a Mississippi resident agent. (No standard form is required for the Bid Bond.)
B. **Certified Check:** The Bidder may submit a certified check made out to the Owner's Name (listed on the Form of Proposal) in the amount of five percent (5%) of the base bid. All checks received from Bidders will be returned upon request, unless a Bidder is one (1) of the three (3) apparent low Bidders. The three (3) apparent low Bidder's checks will be held for Sixty (60) days, unless a Contract is awarded and executed in less time.

2.09 **POWER OF ATTORNEY:** Each bid security must be accompanied by an appropriate Power of Attorney. A Power of Attorney is not necessary to accompany a certified check.

PART 3 - SUBMITTING THE PROPOSAL FORM

3.01 **SUBMITTAL:** A bid must be either submitted electronically via www.centralbidding.com or physically delivered to the address indicated on the Advertisement for Bids prior to the time and date stated. If submitted physically, only one original Bid Proposal shall be submitted and shall be sealed in an opaque envelope marked, mailed or hand-delivered as follows:

(In upper left-hand corner)
Name of Firm
(As it appears in the current Mississippi
State Board of Contractors Roster)
BID FOR: **HATTIESBURG PUBLIC SAFETY COMPLEX**
BID OPENING: (*place bid date and time here)*

(Bid shall be addressed and delivered to)
BID FOR HATTIESBURG PUBLIC SAFETY COMPLEX
ATTENTION: ALBERT & MCCLESKEY ASSOCIATES ARCHITECTS
P.O. Box 1567
Hattiesburg, Mississippi 39403-1567

(In lower left-hand corner)
Certificate of Responsibility # _____ (for over $50,000.00)
Under $50,000.00 (add statement)

If the Bid is mailed or sent via private carrier, the bid envelope shall be placed inside a second envelope to prevent inadvertent, premature opening of the Proposal. If the bid is sent via private carrier then send it to: ALBERT & MCCLESKEY ASSOCIATES ARCHITECTS, 514 N Main St. Hattiesburg, MS 39401. **IT IS THE BIDDERS RESPONSIBILITY TO ENSURE THAT HIS OR HER BID HAS BEEN RECEIVED BY THE CONTACT LISTED ABOVE OR LISTED ON THE ADVERTISEMENT TO BID BEFORE THE BID OPENING TIME. THE OWNER RESERVES THE RIGHT TO WAIVE ANY BIDS NOT RECEIVED BY HIM BEFORE THE BID TIME.**

3.02 **MODIFICATION TO BID:** A bidder may modify the bid prior to the scheduled closing time indicated in the Advertisement for Bids in the following manner:

A. **Notification on Envelope:** A modification may be written on the outside of the sealed envelope containing the bid and initialed by an owner representative.

3.03 **WITHDRAWAL OF BID:** Any bid may be withdrawn prior to the scheduled time for opening of bids. However, bids may not be withdrawn until sixty (60) days after bid opening. Any withdrawn Bid, if fully compliant with the Instructions to Bidders, may be resubmitted up to the time and date indicated for Bid Opening.

PART 4 - BID OPENING AND AWARD OF CONTRACT

4.01 **OPENING OF BIDS:** Bids will be publicly opened shortly after the time stated in the Advertisement for Bids.

Bidder representatives are invited; however, attendance is not mandatory.

4.02 **IRREGULARITIES:** The omission of any information requested on the Proposal Form may be considered as an informality or irregularity by the awarding public body when, in its opinion, the omitted information does not alter the amounts contained in the submitted bid proposal or place other Bidders at a disadvantage.

4.03 **PROTEST:** Any protest must be delivered in writing to the Owner within twenty-four (24) hours after the bid opening.

4.04 **ERRORS:** Any claim of error and request for release from bid must be delivered in writing to the Owner within twenty- four (24) hours after the bid opening. The Bidder shall provide sufficient documentation with the written request clearly proving an error was made.

4.05 **AWARD OF CONTRACT:** The Owner reserves the right to reject any or all bids. A Contract will be awarded on the basis of the low base bid, or low combination of base bid and those alternates selected by the Owner in any order determined to be in the best interest of the Owner and which produces a total cost within available funds. Any Bid not accompanied by all data required by the Bidding Documents, including Bid Security, or any Bid which is considered to be incomplete or irregular in any way is subject to rejection.

4.06 **FAILURE TO ENTER INTO A CONTRACT:** The Bidder shall forfeit the Bid Security to the Owner as liquidated damages for failure, or refusal, to execute and deliver the Contract, Bond and Certificate of Insurance within ten (10) days after notice of the acceptance of the bid.

4.07 **SECURITY FOR FAITHFUL PERFORMANCE:** Simultaneously with delivery of the executed Contract, the Contractor will furnish a Performance Bond, or Bonds, as security for faithful performance of all Work in connection with this Contract; a Labor and Materials Payment Bond, as security for the payment of all persons supplying labor or materials for completion of the Work in connection with this Contract; and a Bond of Payment of Taxes and other Assessments, as security for payment of all taxes and assessments in connection with this Contract. The Surety on such Bond, or Bonds, will be a duly authorized surety company satisfactory to the Owner and meeting all of the following requirements:

A. Licensed at the time of award by the State of Mississippi's Commissioner of Insurance for the purpose of providing surety.
B. Listed at the time of award in the Department of the Treasury's **Federal Register** as a company holding certificates of authority as acceptable sureties on Federal Bonds, commonly referred to as the Treasury List.
C. All Bonds shall be executed on the form provided in the Project Manual under Section 00 60 00 entitled *Contract Bond*.
D. All Bonds shall be countersigned by a Mississippi resident agent with the name and address typed, or lettered legibly.
E. All Bonds must be accompanied by an appropriate Power of Attorney.

END OF SECTION

SECTION 00 50 00

AGREEMENT FORM

PART ONE - GENERAL

1.01 DESCRIPTION

A. SCOPE: The agreement form between the Owner and the Contractor shall be AIA Document A101, 2007 Edition, where the basis of payment is a stipulated sum.

B. COPY: Contractors are presumed to be familiar with this document, a copy of which may be obtained from the Professional or examined in this office.

C. LIQUIDATED DAMAGES: Time being of the essence and a matter of material consideration thereof, a reasonable estimate in advance is established to cover losses incurred by the Owner if the project is not substantially complete on the date set forth in the Contract Documents. The Contractor and his Surety will be liable for and will pay the Owner the sums stipulated in Paragraph 2.2 of the Standard Form of Agreement Between the Owner and the Contractor as fixed and agreed as liquidated damages for each calendar day of delay until the work is substantially complete unless circumstances dictate otherwise in the discretion of the Owner.

a. If the contract time is extended beyond the original contract date given in the Notice to Proceed, except for approved rain days and official extensions to the contract time by Change Order, the Architect will charge the rates specified in *Section 00 95 00 Architect's Special Conditions.*

THE AMOUNT OF LIQUIDATED DAMAGES SET FOR THIS PROJECT IS:

********** Five Hundred Dollars ($500.00) per day **********

D. APPLICATION FOR PAYMENT: See *Section 01 27 00 Applications for Payment* for requirements.

E. FORM OF PROPOSAL: The Contractor's "Form of Proposal" (bid form) is part of the Contract Documents.

F. CONTRACT TIME: To be filled in on the "Form of Proposal".

G. RETAINAGE: The Owner will retain, until the Work is one hundred percent (100%) complete, five percent (5%) of the amount due the Contractor on account of progress payments. No reduction in retainage will be made until final payment is made, except that when the initial contract award is in an amount equal to or greater than $750,000.00, then whenever such Work is fifty percent (50%) complete and on schedule and satisfactory, in the opinion of the Professional with concurrence of the Owner, fifty percent (50%) of the retainage will be returned to the Contractor and two and one half percent (2 1/2%) will be retained on all subsequent progress payments.

END OF SECTION

SECTION 00 60 00

CONTRACT BOND

I. PREAMBLE

KNOW ALL MEN BY THESE PRESENTS: THAT _____,
Principal, a _____, residing at _____, authorized to do business in the State of Mississippi under the laws thereof, and _____Surety, a corporation of the State of _____, authorized to do business in the State of Mississippi under the laws thereof, are held and firmly bound unto_____, Obligee, hereinafter referred to as "Owner," for the use and benefit of the Owner and those claimants and others set forth herein below and described in Sections 31-5-51 and 31-5-3, **Mississippi Code of 1972, Annotated**, as amended, in the amount of_____ _____Dollars ($_____ _____), lawful money of the United States, for the payment whereof Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these present.

WHEREAS, Principal has by written agreement dated _____, 20_____, entered into a Contract with the Owner for the following:

_____
_____
_____

as provided in said Contract and in accordance with the Contract Documents. All of the terms and provisions of the above mentioned Contract, drawings, Project Manual, and addenda are by reference made a part hereof and fully incorporated herein, and are hereinafter referred to as "the Contract." All of the terms and provisions of Sections 31-5-51, 31-5-3, supra, Section 31-5-53 of the **Mississippi Code of 1972, Annotated**, as amended, and all other code sections cited herein are also by reference made a part hereof and fully incorporated herein.

II. PERFORMANCE BOND

NOW, THEREFORE, the condition of this Performance Bond is such that if Principal shall promptly and faithfully perform said Contract, then this obligation shall be null and void; otherwise, it shall remain in full force and effect, subject however, to the following conditions:

Whenever the Owner has performed its obligation but the Principal has defaulted under the terms of the Contract, or any portion thereof, and the Owner has declared the Principal to be in default, the Surety shall promptly:

1. Remedy the default, or
2. Complete the Contract in accordance with its terms and conditions, or
3. Procure the completion of the Contract in accordance with its terms and conditions.

Even if there should be a succession of defaults, the Surety is responsible for completion of the Contract. The Surety shall provide sufficient funds to pay the cost of completion of the Contract in its entirety including other costs and damages for which the Surety may be liable there under, less the balance of the Contract price. The term "balance of the Contract price," as used in this paragraph, shall mean the total amount payable by Owner to Principal under the

Contract and any Change Orders thereto, less the amount paid by Owner to Principal.

III. LABOR AND MATERIAL PAYMENT BOND

NOW, THEREFORE, the condition of this Labor and Material Payment Bond is such that if Principal shall promptly make payments to all persons supplying labor or material used in the prosecution of the work under said Contract, then this obligation shall be null and void; otherwise, it shall remain in full force and effect; however, the Owner shall not be liable for the payment of any costs or expenses of any suit described in Subsection (2) of Section 31-5-51, supra.

IV. BOND FOR PAYMENT OF TAXES AND OTHER ASSESSMENTS

NOW THEREFORE, the condition of this Bond for Payment of Taxes and Other Assessments is such that if Principal shall promptly make payment of all taxes, licenses, assignments, contributions, damages, penalties, and interest thereon, when and as the same may lawfully be due the State of Mississippi, or any County, Municipality, Board, Department, Commission, or political subdivision thereof, by reason of and directly connected with the performance of said Contract or any part thereof as provided by Sections 27-65-1, 27-65-21, 27-67-1, and 31-5-3, **Mississippi Code 1972, Annotated**, or any other applicable statute or other authority, then this obligation shall be null and void; otherwise, it shall remain in full force and effect.

V. GENERAL CONDITIONS

The following conditions apply to all three (3) of the above-mentioned Bonds:

1. The Performance Bond is for an amount equal to the full amount of said Contract.
2. The Labor and Material Payment Bond is for an amount equal to the full amount of said Contract.
3. If any changes are made in the work, or any extensions of time are granted, or any increases in the total dollar amount of the Contract are made, such changes, extensions, increases, or other forbearance on the part of either the Owner or the Principal will not, in any way, release the Principal and Surety, or either of them, from their liability hereunder, or any portion thereof, notice to the Surety of any such change, extension, increase, or forbearance being expressly waived.
4. These Bonds are governed by and shall be construed in accordance with Mississippi law. Any inconsistency with these Bonds and any provision of Mississippi law shall be remedied by deleting the inconsistent portion of these Bonds and leaving the remaining consistent portions in full force and effect.

Signed and sealed this _____day of _____, 20_____.

SURETY _____

By: _____
(Signature)

_____
(Name and Title) (typed)

_____
(Address)

_____
(City/State/Zip/Phone)

_____
PRINCIPAL (typed)

BY:_____
(Signature)

_____
(Name and Title) (typed)

_____
(Address)

_____
(City/State/Zip/Phone)

COUNTERSIGNED:

_____
MISSISSIPPI RESIDENT AGENT
(**typed and with embossed seal on bond and p/a**)

_____
(Signature)

_____
(Name and Title) (typed)

_____
(Address)

_____
(City/State/Zip/**Phone**)

END OF SECTION

SECTION 00 65 00

CERTIFICATE OF INSURANCE INSTRUCTIONS

1. The *Certificate of Insurance* is a tabulation of insurance required for this Project as specified in Article 11 entitled *Insurance and Bonds* in the General Conditions (AIA Document A201, 2007 Edition).

2. The *Certificate of Insurance* must be completed, certified by the original signature of a Mississippi Resident Insurance Agency and bound in each set of the Contract Documents.

3. Indicate Insured, Project, Companies providing coverage, policy numbers and policy periods in the blanks as applicable.

4. If the "OWNERS/CONTRACTORS PROTECTIVE LIABILITY" insurance is part of the Commercial General Liability Insurance Policy, or included by endorsement, indicate the policy number and period of the CGL policy in the "OWNERS/CONTRACTORS PROTECTIVE LIABILITY" blank spaces.

5. Automobile Liability Insurance may be provided which covers Bodily Injury and Property Damage in one (1) Combined Single Limit, or may be provided with separate minimum limits as shown on the Certificate of Insurance and specified in Article 11 of the Supplementary Conditions. The person signing the Certificate of Insurance should show which option the Contractor has selected by marking out the coverage that is not provided under the policies indicated.

6. OTHER INSURANCE (if required) will be indicated by typing in the "OTHER" block and detailed in Article 11 of the Supplementary Conditions.

7. CERTIFICATION wording may not be changed without specific written approval from the Owner.

8. "Riders", Binders, TBA, TBD, or other unsolicited attachments, are not allowed as part of the *Certificate of Insurance* unless specifically requested in writing by the Owner, or specified as part of the requirements for this Project.

9. CAUTION: The *Certificate of Insurance* is intended to be used for all Projects. The Contractor must provide all insurance specified in the Contract Documents for this Project, whether indicated on this form, or not. The Contractor must verify all insurance has been provided as required.

STANDARD CONSTRUCTION CONTRACT CERTIFICATE OF INSURANCE

INSURED: (Contractor's Name & Address)					**COMPANIES PROVIDING COVERAGE**	
				A		
				B		
PROJECT: (Number, Name & Location)				**C**		
				D		
				E		
OWNER:				**F**		
				G		
Type Insurance	Co	Policy Number	Policy Period	Coverage and Minimum Amount		
General Liability Commercial General Liability				General Aggregate		$ 1,000,000
				Products Comp/Ops (Aggregate		$ 1,000.000
				Personal Injury (Per Occurrence)		$ 500,000
				BI & PD (Per Occurrence)		$ 500,000
				Fire Damage (Per Fire)		$ 50,000
				Medical Expense (Per Person)		$ 5,000
Owners/Contractors Protective Liability				General Aggregate		$ 1,000,000
				Per Occurrence		$ 500,000
Automobile Liability				Bodily Injury/Property Damage Combined Single Limit (Per Occurrence)		$ 500,000
				OR	Bodily Injury (Per Person)	$ 250,000
					Bodily Injury (Per Accident)	$ 500,000
					Property Damage (Per	$ 100,000
* Excess Liability (Umbrella on projects over $500,000)				Aggregate		$ 1,000,000
				Per Occurrence		$ 1,000,000
Workers' Compensation (As required by Statute) Employers' Liability				Accident (Per Occurrence)		$ 100,000
				Disease-Policy Limit		$ 500,000
				Disease-Per Employee		$ 100,000
* Property Insurance				Builders' Risk **OR** Installation Floater		Must be equal to Value of Work
Other						

Certification: I certify that these policies (subject to their terms, conditions and exclusions) have been (1) issued to the Insured for the coverages and at least the amounts as indicated by companies licensed in Mississippi; (2) countersigned by a Mississippi Resident Agent; and (3) endorsed to require the company to give thirty (30) days written notice to the Owner prior to cancellation of non-renewal of above.

Producing Agent: (Name, Address and Telephone)	
	(Signature & Date)
	(Name and Title of Authorized Representative)

Check if Mississippi Resident Agent
OR Countersign by MS Resident Agent

SECTION 00 70 00

GENERAL CONDITIONS

PART 1 - GENERAL

1.01 DESCRIPTION

A. **SCOPE:** The **General Conditions of the Contract for Construction**, AIA Document A201, 2007 Edition, Articles 1 through 15 inclusive, is a part of this Contract and is incorporated herein.

B. **COPY:** Contractors are presumed to be familiar with AIA Document A201, a copy of which may be obtained from the Professional, or examined in the Professional's office.

END OF SECTION

SECTION 00 80 00

SUPPLEMENTARY CONDITIONS

PART 1 - GENERAL

1.01 **DESCRIPTION**

A. **Owner:** These supplements are necessary because the Owner is a subdivision, of the State of Mississippi and occupies a different position from that of the usual Owner.

B. **Document:** The following supplements modify, change, delete from, or add to the **General Conditions of the Contract**, AIA Document A201, 2007. When any Article of the **General Conditions** is modified, or deleted, by these *Supplementary Conditions*, the unaltered provisions of that Article, Paragraph, Subparagraph, or Clause will remain in effect.

Article 1
GENERAL PROVISIONS

No supplementary conditions.

Article 2
OWNER

No supplementary conditions.

Article 3
CONTRACTOR

No supplementary conditions.

Article 4
ADMINISTRATION OF THE CONTRACT

No supplementary conditions.

Article 5
SUBCONTRACTORS

No supplementary conditions.

Article 6
CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

No supplementary conditions.

Article 8
TIME

8.1 **DEFINITIONS**

8.1.3 Change this Subparagraph to read as follows:

The date of Substantial Completion is the date certified by the Architect and approved by the Owner in accordance with Paragraph 9.8 entitled "Substantial Completion."

8.3.1 Change this Subparagraph to read as follows:

If the Contractor is delayed at any time in the commencement or progress of the Work by any act of neglect of the Owner or the Architect, or by any employee of either, or by changes ordered in the Work, or by labor disputes, fire, unusual delay in deliveries, unavoidable casualties or any causes beyond the Contractor's control, or by any other causes which the Architect determines may justify the delay, then the Contract Time may be extended by Change Order for such reasonable time as the Architect may determine, subject to the Owner's approval. Any claim for loss or any delay occasioned by any separate Contractor, or Subcontractor, shall be settled between the Contractor and such other separate Contractor, or Subcontractors.

Article 9
PAYMENTS AND COMPLETION

9.3 **APPLICATIONS FOR PAYMENT**

9.3.1 Add a new sentence to the end of this Subparagraph:

The form of Application for Payment will be AIA Document G702, Application and Certification for Payment, supported by AIA Document G703, Continuation Sheet, or a computer generated form containing similar data.

9.3.1.3 Add a new Clause to Subparagraph 9.3.1 as follows:

The Owner will retain, until the Work is one hundred percent (100%) complete, five percent (5%) of the amount due the Contractor on account of progress payments. No reduction in retainage will be made until final payment is made, except that when the initial contract award is in an amount equal to or greater than $750,000.00, then whenever such Work is fifty percent (50%) complete and on schedule and satisfactory, in the opinion of the Professional with concurrence of the Owner, fifty percent (50%) of the retainage will be returned to the Contractor and two and one half percent (2 1/2%) will be retained on all subsequent progress payments.

9.3.1.4 Add a new Clause to Subparagraph 9.3.1 as follows:

The Contractor must submit each month with this Application for Payment a separate letter stating that he is requesting an extension of time or that he had no need for an extension for that period of time. No payment on a monthly application will be made until the letter is received. Complete justification such as weather reports or other pertinent correspondence must be included for each day's request for extension. A Contractor's letter, or statement, will not be considered as adequate justification. The receipt of this request and data by the Owner will not be considered as Owner approval in any way.

9.3.2.1 Add a new Clause to Subparagraph 9.3.2 as follows:

Payment on materials stored at some location other than the building site, may be approved by the Architect and the Owner after the Contractor has submitted the following items:

.1 An acceptable Lease Agreement between the General Contractor and the owner of the land, or building, where the materials are stored covering the specific area where the materials are located.
.2 Consent of Surety, or other acceptable Bond, to cover the materials stored off-site.
.3 All Perils Insurance coverage for the full value of the materials stored off-site.
.4 A Bill of Sale from the Manufacturer to the General Contractor for the stored materials.
.5 A complete list and inventory of materials manufactured, stored and delivered to the storage site and of materials removed from the storage site and delivered to the job site.
.6 A review by the Architect of the materials stored off-site prior to release of payment.
.7 Guarantee no storage costs, additional delivery fees, or subsequent costs to the Owner.
.8 The Contractor shall compensate the Architect for time and travel for review of materials stored off-site located greater than 10 miles from the project site. Rates charged for this service are determined by the Architect's current rate schedule which is bound to the Project Manual under Section 00950 Architect's Special Conditions*.*

9.6.8 Add a new Subparagraph as follows:

The amount retained by the Contractor from each payment to each Subcontractor and material supplier will not exceed the percentage retained by the Owner from the Contractor.

9.7 **FAILURE OF PAYMENT**

9.7.1 Change this Subparagraph to read as follows:

The Contractor and the Owner shall be subject to the remedies as prescribed in Section 31-5-25 of the Mississippi Code 1972, Annotated.

9.8 **SUBSTANTIAL COMPLETION**

9.8.4 Add a new sentence at the end of this Subparagraph:

Substantial Completion shall not be established and final until the Owner approves the Architect's ***Certificate of Substantial Completion****.*

9.11 **LIQUIDATED DAMAGES**

9.11.1 Add a new Paragraph as follows:

Time being of the essence and a matter of material consideration thereof, a reasonable estimate in advance is established to cover losses incurred by the Owner if the project is not substantially complete on the date set forth in the Contract Documents. The Contractor and his Surety will be liable for and will pay the Owner the sums stipulated in Paragraph 2.2 of the Standard Form of Agreement Between the Owner and the Contractor as fixed and agreed as liquidated damages for each calendar day of delay until the work is substantially complete unless circumstances dictate otherwise in the discretion of the Owner. Amount will be $500.00 per day.

Article 10
PROTECTION OF PERSONS AND PROPERTY

10.2 **SAFETY OF PERSONS AND PROPERTY**

10.2.5 Change this Subparagraph to read as follows:

The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Clauses 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-Subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible for Clause 10.2.1.2. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Paragraph 3.18.

10.3 **HAZARDOUS MATERIALS**

10.3.2 Delete this Subparagraph in its entirety.

10.3.3 Delete this Subparagraph in its entirety.

10.5 Delete this Subparagraph in its entirety.

Article 11
INSURANCE AND BONDS

11.1 **CONTRACTOR'S LIABILITY INSURANCE**

11.1.4 Add a new Subparagraph as follows:

The Contractor's limits of liability shall be written for not less than the following:

.1 GENERAL LIABILITY: Commercial General Liability
(Including XCU)
General Aggregate..... $ 1,000,000.00 Aggregate
Products & Completed Operations..... $ 1,000,000.00 Aggregate
Personal & Advertising Injury..... $ 500,000.00 Per Occurrence
Bodily Injury & Property Damage..... $ 500,000.00 Per Occurrence
Fire Damage Liability..... $ 50,000.00 Per Occurrence
Medical Expense..... $ 5,000.00 Per Person

.2 OWNERS & CONTRACTORS PROTECTIVE LIABILITY:
Bodily Injury & Property Damage..... $ 1,000,000.00 Aggregate
Bodily Injury & Property Damage..... $ 500,000.00 Per Occurrence

.3 AUTOMOBILE LIABILITY:
(Owned, Non-owned & Hired Vehicles) Contractor Insurance Option Number 1:
Bodily Injury & Property Damage..... $ 500,000.00 Per Occurrence
(Combined Single Limit)
Contractor Insurance Option Number 2:
Bodily Injury..... $ 250,000.00 Per Person
Bodily Injury..... $ 500,000.00 Per Accident
Property Damage..... $ 100,000.00 Per Occurrence

.4 EXCESS LIABILITY:
(Umbrella on projects over $500,000)
Bodily Injury & Property Damage ..... $ 1,000,000.00 Aggregate
(Combined Single Limit)

.5 WORKERS' COMPENSATION: (As required by Statute)
EMPLOYERS' LIABILITY:
Accident ..... $ 100,000.00 Per Occurrence
Disease ..... $ 500,000.00 Policy Limit
Disease ..... $ 100,000.00 Per Employee

.6 PROPERTY INSURANCE:
Builder's Risk ..... $ Equal to Value of Work
or
Installation Floater ..... $ Equal to Value of Work

11.1.5 Add a new Subparagraph as follows:

Furnish one (1) copy of the Standard Construction Contract Certificate of Insurance Form for each copy of the Standard Form of Agreement Between Owner and Contractor specifically setting forth evidence of all coverage required by Subparagraphs 11.1.1, 11.1.2 and 11.1.3. Furnish to the Owner copies of any endorsements that are subsequently issued amending limits of coverage.

11.1.6 Add a new Subparagraph as follows:

If the coverages are provided on a per occurrence basis, the policy date or retroactive date shall predate the Contract; the termination date, or the policy, or applicable extended reporting period shall be no earlier than the termination date of coverages required to be maintained after final payment.

11.2 **OWNER'S LIABILITY INSURANCE**

11.2.1 Delete this Subparagraph in its entirety and substitute the following:

The Contractor shall purchase and maintain such insurance as will protect the Owner from his contingent liability to others for damages because of bodily injury, including death, and property damage, which may arise from operations under this Contract and other liability for damages which the Contractor is required to insure under any provision of this Contract. Certificate of this insurance will be filed with the Owner and will be the same limits set forth in 11.1.4.

11.3 **PROJECT MANAGEMENT PROTECTIVE LIABILITY INSURANCE**

Delete this Paragraph in its entirety.

11.4 **PROPERTY INSURANCE (BUILDER'S RISK OR INSTALLATION FLOATER)**

11.4.1 Change the first line in this Subparagraph to read as follows:

The Contractor shall purchase....

11.4.1.2 Delete this Clause under Subparagraph 11.4.1 in its entirety.

11.4.1.3 Change the following Clause in this Subparagraph to read as follows:

If the property insurance requires deductibles, the Contractor shall pay costs not covered because of such deductibles.

11.4.2 Delete this Subparagraph in its entirety.

11.4.3 Delete this Subparagraph in its entirety.

11.4.4 Delete this Subparagraph in its entirety.

11.4.5 Delete this Subparagraph in its entirety.

11.4.6 Delete this Subparagraph in its entirety.

11.4.10 Change this Subparagraph to read as follows:

The Owner as fiduciary shall have power to adjust and settle a loss with Insurers unless one of the parties in interest shall object in writing within five (5) days after occurrence of loss.

Article 12
UNCOVERING AND CORRECTION OF WORK

No supplementary conditions.

Article 13
MISCELLANEOUS PROVISIONS

No supplementary conditions.

Article 14
TERMINATION OR SUSPENSION OF THE CONTRACT

No supplementary conditions.

END OF SECTION

SECTION 00 90 00

ADDENDA

1.01 **ADDENDA**

Any Addendum issued on this Project will be included in Section 00 90 00 and become a part of the *Standard Form of Agreement Between the Owner and the Contractor*.

END OF SECTION

SECTION 00 95 00

ARCHITECT'S SPECIAL CONDITIONS

PART ONE - GENERAL

1.01 OWNERSHIP OF DRAWING AND SPECIFICATIONS

A. The drawings and specifications and copies thereof furnished by the Architect are his property. All such copies shall be returned to the office of the Architect and shall not be used on any other work. The drawings and specifications are instruments of the Architectural Service rendered.

1.02 VERIFICATION OF DIMENSIONS

A. Before ordering any materials or doing any work, each Contractor shall verify the dimensions and shall be responsible for the accuracy of such dimensions as they affect the work. No extra compensation will be allowed on account of differences between the dimensions shown on the drawings and actual dimensions.

1.03 PLANS AND SPECIFICATIONS

A. The specifications and the drawings are intended to be in agreement with each other, and to be mutually explanatory. They are also intended to be complementary and any work or materials called for by either shall be performed and/or furnished as if called for by both.

B. RELATION OF PLANS AND SPECIFICATIONS:
   1. The Architect shall be notified of any discrepancies in the documents.
   2. To be equal authority and priority, should they disagree in themselves, or with each other, **bids shall be based on the most expensive combination of quality and quantity of work indicated**. The appropriate Work, in the event of the above mentioned disagreement shall be determined by the Architect.
   3. Written dimensions take precedence over scale measurements.
   4. Large scale details take precedence over smaller scale details.
   5. Architectural Drawings take precedence in regard to dimensions, when in conflict with Mechanical and Structural Drawings, except for the size of structural members.
   6. Specifically titled drawings and sections of the specifications take precedence over indication of the item in a collateral way.
   7. Existing conditions take precedence over Drawings and Specifications for dimensions.

1.04 FIRES AND TRASH DISPOSAL

A. No open fires shall be permitted. Trash and construction debris shall be removed from the site and properly disposed of by the Contractor.

1.05 COLOR SCHEDULES

A. Color schedules will be prepared by the Architect after the Contractor has furnished all necessary submittals, samples, and color chips from the actual suppliers and subcontractors. Delivery of these materials to the Architect shall occur within 30 days after the Notice to Proceed.

1.06 WORKMANSHIP

A. All work as described or required shall be executed in a neat, skillful manner, in accordance with the best recognized trade practice. Only competent workmen (including the superintendent) who work and perform their duties satisfactorily shall be employed on the project, and when requested by the Architect, the Contractor shall discharge and shall not re-employ on the project any person who commits trespass or who is, in the opinion of the Architect, dangerous, disorderly, insubordinate, incompetent, or otherwise objectionable. Poor or expedient workmanship and substandard materials will not be tolerated. Craftsmen and subcontractors hired for this Project are expected to be of extraordinary quality who takes pride in their work.

1.07 CERTIFIED DRUG FREE WORKPLACE CERTIFICATION

A. The General Contractor and all Subcontractors shall be enrolled in a certified drug free workplace program that provides periodic and random drug testing to all of employees.

B. Proof of enrollment in a certified drug free workplace program must be submitted within 10 days after the bid opening.

1.08 SAFETY PROGRAM

A. The General Contractor and all Subcontractors shall be enrolled in a certified safety program.

B. Proof of enrollment in a certified safety program must be submitted within 10 days after the bid opening.

1.09 JOB SITE BEHAVIOR

A. The job site shall be maintained as a clean, safe and healthy work environment:
   a. Drug, alcohol, and tobacco use is strictly prohibited.
   b. Foul language and behavior is strictly prohibited.
   c. Workers shall remain fully clad at all times, including but not limited shirts and shoes.
   d. <u>All workers shall wear some kind of identification of their employment affiliation either on their shirts or hard hats at all times. This includes all general contractors and subcontractors.</u>

1.10 NON-COMPLIANCE WITH CONTRACT DOCUMENTS

A. The Architect will charge the rates specified in *Section 00 95 00 Architect's Special Conditions for* any time spent by the Architect or his Consultants pertaining to the Contractor's inability (purposeful or accidental) in following the Contract Documents.

1.11 COMPENSATION TO THE ARCHITECT

A. The Architect shall be compensated by the Contractor for certain instances specified in this Project Manual.
B. The Contractor shall compensate the Architect for those instances required by this Project Manual within 30 days of the date stated on the Architect's Invoice for services. The Architect will not execute any further Applications for Payment until any and all of the Architect's outstanding invoices have been paid.
C. The following page includes the Architect's current compensation rates for the duration of this project.

END OF SECTION

SECTION 01 11 00

SUMMARY OF WORK

1.01 **WORK COVERED BY CONTRACT DOCUMENTS**

A. **Work Covered**: Work covered by the Contract Documents is as shown in drawings and described in words in the Project Manual. The Project Title and location is indicated on the first page of this Project Manual.

B. **Start of Work**: Work shall be started immediately upon issuance of a *Notice to Proceed*. Prior to this, all Contracts and beginning documents will have been executed and insurance in force.

C. **Time of Completion**: The completion of this Work is to be on, or before, the time indicated in the *Standard Form of Agreement Between the Owner and the Contractor*.

D. **Contractor's Duties**:
1. Except as specifically noted, provide and pay for:
   a. Labor, materials and equipment.
   b. Tools, construction equipment and machinery.
   c. Water, heat and utilities required for construction.
   d. Other facilities and services necessary for proper execution and completion of the Work.
2. Pay legally required sales, consumer, use, payroll, privilege and other taxes.
3. Secure and pay for, as necessary for proper execution and completion of work, and as applicable at the time of the receipt of the bids:
   a. Permits.
   b. Government fees.
   c. Licenses.
4. Give required notices.
5. Comply with codes, ordinances, rules, regulations, orders and other legal requirements of public authorities which bear on performance of work.
6. Promptly submit written notice to Professional of observed variance of Contract Documents from legal requirements. It is not the Contractor's responsibility to make certain that drawings and specifications comply with codes and regulations. Appropriate modifications to Contract Documents will adjust necessary changes. Assume responsibility for work known to be contrary to such requirements, without notice.
7. Enforce strict discipline and good order among employees. Do not employ or work unfit persons, or persons, not skilled in assigned task.
8. Provide a written safety plan.

E. **Hazardous Materials**: The Prime General Contractor is responsible for the removal and disposal of any hazardous materials encountered in the performance of the Contract requirements. Hazardous Containing Materials [HCM] include, but are not limited to, Asbestos and Lead Paint and should be identified and removed as a part of the Contract. The absence of details does not relieve the Prime General Contractor from the responsibility of removal and disposal; but, a Change Order could be executed in the absence of identified HCM in the documents.

F. **Subcontractor's List:** The Prime General Contractor will submit to the Owner a list of all Subcontractors to be used on the Project within seven (7) days after written notice of contract award by the Owner. Any Subcontractor listed must be acceptable to the Owner.

G. **Coordination**: The Prime General Contractor is responsible for the coordination of the total project. All other Prime Contractors and all Subcontractors will cooperate with the Prime General Contractor so as to facilitate the general progress of the Work. Each trade shall afford all other trades every reasonable opportunity for the installation of their work. Refer to Section 01 41 00 entitled *Project Coordination*.

1.02 **CONTRACTS**

A. **Contracts**: Construct work under a single Prime General Contract. Refer to Section 00 50 00 entitled *Agreement Form*.

1.03 **WORK BY OTHERS**

Work by Others shall be described in each appropriate Project Manual section and noted on the Drawings.

1.04 **OWNER-FURNISHED PRODUCTS**

A. **Products Furnished by Owner**: Products furnished by Owner shall be described in each appropriate Project Manual section and noted on the Drawings.

B. **Products**: Delivered and unloaded at site.

C. **Owner's Duties**:
1. Schedule delivery date with Supplier in accordance with construction schedule.
2. Obtain installation drawings and instructions.
3. Submit claims for transportation damages.
4. Arrange Guarantees, Warranties, etc..

D. **Contractor's Duties**:
1. Designate required delivery date for each product in construction schedule.
2. Promptly inspect delivered products, report missing, damaged, or defective items.
3. Handle at site, including uncrating and storage.
4. Protect from exposure to elements and from damage.
5. Repair or replace damaged items resulting from Contractor's operations.
6. Install and make final connections.

1.05 **CONTRACTOR'S USE OF PREMISES**

A. Confine operations at site to areas permitted by:
1. Law.
2. Ordinances.
3. Permits.
4. Contract Documents.
5. Owner.

B. Do not unreasonably encumber site with materials or equipment.

C. Do not load structure with weight that will endanger structure.

D. Assume full responsibility for protection and safekeeping of products stored on premises.

E. Move any stored products which interfere with operations of Owner or other Contractors.

F. Obtain and pay for use of additional storage or work areas needed for operations.

G. Limit use of site for work and storage to the area indicated in the drawings.

H. The Contractor, all Subcontractors, and all employees thereof shall designate the employee parking area. This designated parking area is not to be used for material storage or staging. The Contractor shall be responsible for keeping this area clean and shall check to ensure such at the end of each day.

I. Material storage and trailers for material storage shall be located within the Construction Limits as indicated on the drawings or as directed by the Owner.

1.06 **SUMMARY OF WORK SUPPLEMENT**

A. Refer to Section 01 90 00 entitled *Division One Supplement* for Project specific summary of work requirements

1.07 **GOVERNING PROVISIONS**

A. As required by all provisions listed or shown in these Contract Documents.

END OF SECTION

SECTION 01 20 00

ALLOWANCES

1.01 DESCRIPTION

A. **Related Work Specified Elsewhere**: Sections of Specifications as listed under Schedule of Allowances.

B. **Allowances for Products**:
   1. Purchase products under each allowance as directed by the Professional.
   2. Amount of each allowance includes:
      a. Net cost of product.
      b. Delivery and unloading at site.
      c. Applicable taxes.
   3. In addition to amounts of allowances, include in bid, for inclusion in Contract sum, Contractor's costs for:
      a. Handling at site, including uncrating and storage.
      b. Protection from elements and damage.
      c. Labor, installation and finishing.
      d. Other expenses required to complete installation.
      e. Overhead and profit.

C. **Selection of Products**:
   1. **Architect's Duties**: Consult with Contractor in consideration of products and Suppliers; make selections, designate products to be used; and, notify Contractor in writing.
   2. **Contractor's Duties**: Assist Professional in determining qualified Suppliers; obtain multiple proposals from Suppliers when requested by the Professional; and, make appropriate recommendations for consideration of the Professional. Contractor must then provide the Professional with an itemized invoice for Allowance items. Upon notification of selection, enter into Purchase Agreement with designated Supplier.

D. **Delivery**: The Contractor is responsible for arranging all delivery and unloading and should promptly inspect products for damage or defects and submit claims for transportation damage.

E. **Installation**: Comply with requirements of referenced specification section.

F. **Adjustment of Costs**: Should actual purchase cost be more, or less, than the specified allowance amount, the Contract Sum will be adjusted by Change Order equal to the amount of the difference.

1.02 SCHEDULE OF ALLOWANCES

A. Refer to Section 01 90 00 entitled *Division One Supplement* for Project specific Schedule of Allowances.

END OF SECTION

SECTION 01 21 00

PROJECT MEETINGS

1.01 **DESCRIPTION**

A. **Contractor's Responsibilities**: The General Contractor will administer all progress meetings which include the following:
   1. Prepare agenda
   2. Distribute written notice of meetings seven (7) days in advance
   3. Make physical arrangements for and presiding at the meetings
   4. Record minutes
   5. Distribute copies of the minutes to participants within four (4) days

B. **Pre-Construction Meeting**: The Architect will schedule a pre-construction meeting as soon as possible after the award of Contract and the issuance of a *Notice to Proceed*.
   1. **Attendance**:
      a. Owner
      b. Professional and Consultants
      c. General Contractor
      d. Major Subcontractors, including mechanical and electrical
      e. Representatives of governmental, or other regulatory agencies
   2. **Minimum Agenda**: (prepared by the General Contractor)
      a. Distribute and discuss list of major Subcontractors and construction schedule
      b. Critical work sequencing
      c. Designation of responsible personnel
      d. Procedures for maintaining record documents
      e. Use of premises, including office and storage areas
      f. Owner's requirements
      g. Security procedures
      h. Housekeeping procedures
   3. **Utilities**: A written agreement must be reached on how all utilities will be furnished and the rates the Contractor will be charged. This agreement should be resolved at this meeting. Refer to Section 01 50 00 entitled *Construction Facilities and Temporary Controls* of this Project Manual for additional utility requirements.

C. **Progress Meetings**:
   1. The Contractor will schedule regular meetings at the time of the pre-construction conference
   2. Hold all meetings as progress of work dictates
   3. **Attendance**:
      a. Owner
      b. Professional and Consultants
      c. General Contractor
      d. Subcontractors, as pertinent to the agenda
   4. **Minimum Agenda**:
      a. Review, approve minutes of the previous meeting
      b. Review work progress since last meeting
      c. Note field reviews, problems and decisions
      d. Identify problems which impede planned progress
      e. Review off-site fabrication problems

f. Revise construction schedule, as indicated
g. Plan progress during the next work period
h. Review proposed changes
i. Review Submittal Logs, RFI Logs & RFP Logs
j. Review Contractor's Builder's Risk Insurance
k. Review Contract Completion Date
l. Complete other current business

5. **Compensation to the Architect:**
   a. On-site meetings must be represented by the general contractor. Any time a meeting occurs between a sub-contractor and the Architect without representation from the general contractor, the Architect will charge the rates specified in *Section 00 95 00 Architect's Special Conditions.*

END OF SECTION

SECTION 01 27 00

APPLICATIONS FOR PAYMENT

1.01 SCOPE

A. This Section describes procedures for preparing and submitting Applications for Payment by the Contractor.

1.02 APPLICATIONS FOR PAYMENT

A. **Format**:
1. Applications for Payments will be prepared on AIA forms G702 - *Application and Certificate for Payment* and G703 - *Continuation Sheet*; or, a computer generated form containing similar data may be used.

B. **Preparation of Application**:
1. Present required information in typewritten form
2. Execute certification by signature of authorized officer
3. Use data from approved *Schedule of Values*. Provide dollar value in each column for each line item for portion of Work performed and for stored products.
4. List each authorized Change Order as an extension on continuation sheet, listing Change Order number and dollar amount as for an original Item of Work.
5. Prepare Application for Final Payment as specified in Section 01 77 00 entitled *Contract Closeout.*

C. **Submittal Procedures**:
1. Submit five (5) copies of each Application for Payment
2. Submit an updated construction schedule with each Application for Payment as described in Section 01 31 00 entitled *Progress Schedule.*
3. Submit requests for payment at intervals agreed upon by the Professional, Owner and Contractor.
4. Submit requests to the Professional at agreed upon times, or as may be directed otherwise.

D. **Substantiating Data**:
1. Submit data justifying dollar amounts in question when such information is needed.
2. Provide one (1) copy of the data with a cover letter for each submittal.
3. Indicate the Application number, date and line item number and description.

1.03 COMPENSATION TO THE ARCHITECT

1. Contractor will review a preliminary copy of payment. After the Architect reviews an Application for Payment once without approving it, the Contractor shall compensate the Architect for each time the Architect reviews an unapproved Application for Payment. The Architect will charge the rates specified in *Section 00 95 00 Architect's Special Conditions.*

END OF SECTION

SECTION 01 29 00

SCHEDULE OF VALUES

1.01 **DESCRIPTION**

A. **Scope**: Submit a *Schedule of Values* to the Professional at least ten (10) days prior to submitting the first Application for Payment. Upon the Professional's request, the Contractor will provide supportive data substantiating their correctness. Use *Schedule of Values* only as basis for Contractor's Application for Payment.

B. **Form of Submittal**: Submit Schedule of Values on AIA Document G703, or computer generated form containing similar style, using Table of Contents of these Specifications as basis for format for listing costs of work for sections under Divisions 2-16. Identify each line item with number and title as listed in Table of Contents in these Specifications.

C. **Preparing Schedule of Values**:
1. Itemize separate line item cost for each of the following general cost items: Performance and Payment Bonds, field supervision and layout, temporary facilities and controls, mobilization and taxes.
2. Itemize separate line item cost for work required by each Section of these Specifications. Break down installed cost into labor and materials with overhead and profit.
3. For each line item which has installed value of more than $20,000 break down costs to list major products for operations under each item, rounding figures to nearest dollar. Make sum of total costs of all items listed in Schedule equal to total Contract sum.
4. If a value line item scope of work or material is determined not necessary and removed from the contract, then the Schedule of Values line item will be used as the real cost for that item.

D. **Preparing Schedule of Unit Material Values**:
1. Submit separate Schedule of unit prices for materials to be stored on which progress payments will be made. Make form of submittal parallel to Schedule of Values with each line item identified same as line item in Schedule of Values. Include in unit prices only: cost of material, delivery, unloading at site, and sales tax.
2. Make sure unit prices multiplied by quantities equal material cost of that item in Schedule of Values.

E. **Review and Resubmittal**: After Professional's review, if requested, revise and resubmit Schedule of Values in same manner.
1. After the Architect reviews the Schedule of Values twice without approving it, the Contractor shall compensate the Architect for each time the Architect reviews an unapproved Schedule of Values. The Architect will charge the rates specified in *Section 00950 Architect's Special Conditions.*

END OF SECTION

SECTION 01 31 00

PROGRESS SCHEDULES

1.01 **DESCRIPTION**

A. **Scope**: Provide projected construction schedules for entire work and revise periodically and at the request of the Architect. The following is a minimum requirement and other type schedules are acceptable with Owner's approval. This type of schedule is acceptable for any Project whose initial Contract award amount if **less than** one (1) million dollars ($1,000,000).

B. **Form of Schedules**: Prepare in form of horizontal bar chart.
1. Provide separate horizontal bar column for each trade or operation.
2. Place in order of the Table of Contents of Specifications.
3. Identify each column by major Specification section number.
4. Identify the first work day of each week by horizontal time scale.
5. Scale and space to allow for updating.
6. Payment Expectation Schedule: The General Contractor shall provide a Payment Expectation Schedule that projects the anticipated amount of ALL monthly Applications for Payment for this project. It must be completed and approved BEFORE the first Application for Payment is submitted. This Payment Expectation Schedule will directly correlate with the Progress Schedule.

C. **Contents of Schedule**:
1. Provide complete sequence of construction by activity.
2. Indicate dates for beginning and completion of each stage of construction.
3. Identify work of separate floors, separate phases, or other logically grouped activities.
4. Show projected percentage of completion for each item of work as of first day of month.

D. **Updating**:
1. Show all changes occurring since previous submission of updated schedule.
2. Indicate progress of each activity and completion dates.
3. Provide dates of all mock-ups and major review dates.

E. **Submittals**:
1. Submit initial schedules to the Professional within fifteen (15) days after date of Notice to Proceed.
2. Submit to Professional periodically updated schedules accurately depicting progress to first day of each month.
3. Submit two (2) copies, one (1) to be retained by the Professional and the other forwarded to the Owner.

A. Rain Days:
1. For a rain day to be considered, the Mississippi Branch Experiment Station located nearest to site must have documented it at over 1/10". Their telephone number is 1-601-795-4525. The Contractor shall figure the following number of rain days for each month listed below in his schedule: January-7 days; February-6 days; March-7 days; April-5 days; May-6 days; June-6 days; July-9 days; August-7 days; September-6 days; October-4 days; November-5 days; December-7 days.
2. Request for rain days shall not be made unless the number of days per month amounting to 1/10" or more exceeds the number of days on the above chart.

3. Request for rain days shall not be made after the plywood and felt is completed on the building and conditions are such that work can continue in the dry.
4. Rain Days do not provide the General Contractor delayed overhead costs.

END OF SECTION

SECTION 01 33 00

SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

1.01 **DESCRIPTION**

A. Scope: Submit to the Professional shop drawings, product data and samples required by Specification sections.

B. Shop Drawings: Original drawings prepared by Contractor, Subcontractor, Supplier, or Distributor which illustrate some portion of the Work; showing fabrication, layout, setting, or erection details.

1. Prepared by a qualified detailer.
2. Identify details by reference to sheet and detail numbers shown on Contract drawings.
3. Minimum sheet size: 8 1/2" x 11"
4. Reproductions for submittals: Opaque diazo or xerographic prints.

C. **Product Data**:

1. **Manufacturer's Standard Schematic Drawings**: Modify drawings to delete information which is not applicable to the Project. Supplement standard information to provide additional information applicable to the Project.
2. **Manufacturer's Catalog Sheets, Brochures, Diagrams, Schedules, Performance Charts, Illustrations and Other Standard Descriptive Data**: Clearly mark each copy to identify pertinent materials, products, or models. Show dimensions and clearances required. Show performance characteristics and capacities, wiring diagrams and controls.

D. **Samples**: Physical examples to illustrate materials, equipment or workmanship and to establish standard by which completed work is judged.

1. **Office Samples**: Of sufficient size and quantity to clearly illustrate functional characteristics of products or material with integrally related parts and attachment devices and full range of color samples. After review, samples remain the property of the Professional until completion of the construction project.

E. **Field Samples and Mock-ups**:

1 . Erect on project site at location acceptable to Professional. Construct each sample, or mock-up, completely including work of all trades required in finished work.
2. The Superintendent shall get samples of all major materials at full size before ordering the remaining quantities of specified materials. If samples are not approved before the materials are delivered, then the Contractor will be responsible (for the additional time and cost) for replacing non-approved materials with materials that match the approved field sample or mock-up. The mock-up samples will be installed in the size and locations as called for in the drawings. Where mock-ups shown in drawings do not designate size, they shall be 4 ft by 4 by ft min or shall be approved by Architect for size and location. Most mock-up samples will be installed in place but a few will be installed on the ground outside the building for permanent comparison (exemplifying the quality of work expected) to installed work. Required mock-up samples are shown in the drawings and will be designated "MUS" and identified by materials expected, size and location. Any mock-ups required by the specifications that are not shown in the drawings will still abide by the requirements of this Section.

F. **Contractor's Responsibilities**:

1. Review shop drawings, product data and samples prior to submission.
2. Verify field measurements, field construction criteria, catalog numbers and similar data.
3. Coordinate each submittal with requirements of work and of Contract Documents.

4. Contractor's responsibility for errors and omissions in submittals is not relieved by the Professional's review of submittals.
5. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved by Professional's review of submittals unless Professional gives written acceptance of specific deviations.
6. Notify Professional in writing at the time of submission of deviations in submittals from requirements of Contract Documents.
7. Begin no work requiring submittals until the return of submittals bearing Professional's stamp and initials, or signature indicating review.
8. After Professional's review, distribute copies.

G. **Submission Requirements**:
1. Schedule submission with ample time before dates reviewed submittals will be needed.
2. Submit number of copies of shop drawings and product data which Contractor requires for distribution, plus one (1) copy to be retained by the Professional. Provide two (2) copies to be retained by the Professional for all submittals seeking a Civil, Structural, Mechanical or Electrical review.
3. Submit number of samples specified in each Specification section.
4. Accompany submittals with transmittal letter, in duplicate, containing date, Project title and number; Contractor's name and address; the number of each shop drawings, product data and samples submitted; notification of deviations from Contract Documents; and, other pertinent data.
5. Submittals shall include:
   a. Date and revision dates.
   b. Project title and number.
   c. The names of the Professional, Contractor, Supplier, Manufacturer and separate detailer, when pertinent.
   d. Identification of product, or material.
   e. Relation to adjacent structure, or materials.
   f. Field dimensions clearly identified as such.
   g. Specification section number.
   h. Applicable standards such as ASTM number, or federal specifications.
   i. A blank space (2" x 3") for the Professional's stamp.
   j. Identification of deviations from Contract Documents.
   k. Contractor's stamp, initialed or signed, certifying the review of submittal, verification of field measurements and compliance with Contract Documents.
6. All shop drawings and product submittals shall be provided as soon as possible to prevent dealing with discontinued products and delays in the project. Untimely submission will be considered mismanagement by the Contractor.

H. **Resubmission Requirements**:
1. **Shop Drawings**: Revise initial drawings, as required, and resubmit as specified for initial submittal. Indicate on the drawings any changes which have been made other than those required by the Professional.
2. **Product Data and Samples**: Submit new data and samples, as required, for initial submittal.

I. **Distribution of Submittals After Review**:
1. Distribute copies of shop drawings and product data which carry Professional's stamp to Contractor's file, job site file, Subcontractor, Supplier and Fabricator.

2. Distribute samples as directed.

J. **Professional's Duties:**

1. Review submittals with reasonable promptness.
2. Review for design concept of Project and information given in Contract Documents.
3. Review of separate item does not constitute review of an assembly in which item functions.
4. Affix stamp and initials, or signature, certifying the review of submittal.
5. Return submittals to Contractor for distribution.

K. **Compensation to the Architect:** After the Architect reviews any submittal twice without approving it, the Contractor shall compensate the Architect for each time the Architect reviews an unapproved submittals. The Architect will charge the rates specified in *Section 00 95 00 Architect's Special Conditions.*

END OF SECTION

SECTION 013324: STRUCTURAL SUBMITTALS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Structural submittals include shop drawings, diagrams, illustrations, schedules, performance charts, nomenclature charts, samples, brochures and other data prepared by the Contractor or any subcontractor, manufacturer, supplier, fabricator, or distributor and which illustrate some portion of the Project.

1.2 RELATED SECTIONS

A. Division 1 Sections

1.3 SUBMITTAL PROCEDURES

A. Submittals shall be accompanied by a transmittal letter with the following information:

1. Project name.
2. Contractor's name.
3. Date submitted.
4. Description of items submitted; identify Work and product by Specification Section.
5. Number of drawings and other pertinent data.

B. Provide blank space on each submittal for the Architect/Structural Engineer's review stamp.

C. Submit four prints of each shop drawing and four copies of other structural submittals.

D. Contractor shall direct specific attention on the submittal to any deviation from the Construction Documents.

1.4 CONTRACTOR RESPONSIBILITY

A. Contractor shall make all submittals in advance of installation or construction to allow the Architect/Structural Engineer sufficient time for review.

B. Contractor shall review all submittals and shall stamp and sign each sheet of shop drawings and product data and sign each sample to certify compliance with requirements of Construction Documents. SUBMITTALS RECEIVED WITHOUT THE CONTRACTOR'S STAMP OF REVIEW WILL BE RETURNED TO THE CONTRACTOR FOR REVIEW AND RESUBMITTAL.

C. Contractor shall understand that the submittal of the required documents does not constitute compliance with the requirements of the Construction Documents; only submittals reviewed by the Architect/Structural Engineer constitute compliance.

D. It is the Contractor's responsibility to furnish equipment, materials, and labor for the Project which meets the requirements of the codes and authorities quoted as well as the Construction Documents. Proprietary items specified herein only establish a minimum functional and aesthetic standard and it is incumbent upon the Contractor to ascertain conformance of these proprietary items or any proposed substitution with the codes and authorities.

E. By reviewing, approving and submitting shop drawings, product data, or samples, Contractor thereby represents that he has determined and verified all field measurements, field construction criteria, materials, member sizes catalog numbers, and similar data and that he has checked and coordinated shop drawings with the requirements of the Project and of the Construction Documents.

F. Work requiring shop drawings, whether called for by the Construction Documents or requested by the Contractor, shall not commence until the Architect/Structural Engineer has reviewed the submission. Work may commence if the Contractor verifies the accuracy of the Architect/Structural Engineer's corrections and notations and complies with them without exception and without requesting change in Contract Sum or Contract Time.

1.5 ARCHITECT / STRUCTURAL ENGINEER REVIEW

A. Architect/Structural Engineer will review submittals with reasonable promptness.

B. Architect/Structural Engineer's review or corrections refer only to the general arrangement and conformance of the subject of the submittals with the design concept of the Project and with the information given in the Construction Documents. Under no conditions should the Contractor consider the review to include the dimensions, quantities, and details of the items nor the approval of an assembly in which the item functions.

C. Architect/Structural Engineer's review shall not relieve the Contractor from responsibility for errors or omissions in the submittals.

D. Architect/Structural Engineer's review of submittals shall not relieve the Contractor of responsibility for any deviation from the requirements of the Construction Documents unless the Contractor has directed specific attention to the deviation at the time of submission and the Architect/Structural Engineer has given written approval to the specific deviation.

E. Architect/Structural Engineer's review of submittals shall not be construed as authorizing any change in the Contract Sum or Contract Time.

1.6 SHOP DRAWINGS

A. Present in a clear and thorough manner. Title each drawing with Project name and number; identify each element of drawings by reference to sheet number and detail of Construction Documents.

B. Reproduction of Structural Drawings for shop drawings is not permitted. Electronic drawing files will not be provided to the Contractor.

C. Identify field dimensions; show relationship to adjacent or critical features of Work or products.

D. A copy of the marked structural shop drawings with the Architect/Structural Engineer's review stamp is to be maintained at the job site.

1.7 PRODUCT DATA

A. Submit only pages that are pertinent; mark each copy of standard printed data to identify pertinent products, referenced to Specification Section and Article number. Show reference standards, performance characteristics, and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions; and required clearances.

B. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the Work. Delete information that is not applicable.

C. Provide manufacturer's preparation, assembly, and installation instructions.

1.8 SAMPLES

A. Submit full range of manufacturer's standard finishes, except where more restrictive requirements are specified, indicating colors, textures, and patterns.

B. Submit samples to illustrate functional characteristics of products, including parts and attachments as required by Architect/Structural Engineer.

C. Approved samples that are of proper size may be incorporated in Work.

D. Label each sample with identification.

E. Field Finishes: Provide full samples at Project, at location acceptable to Architect/Structural Engineer, as required by individual Specification Section. Install each sample complete and finished. Acceptable finishes in place may be retained in completed Work.

1.9 RESUBMITTALS

A. When submittals are returned to the Contractor with the Architect/Structural Engineer's corrections the Contractor shall make the required corrections. Upon request, resubmit one corrected set.

B. Contractor shall direct specific attention on the resubmittal to all revisions including those requested by the Architect/Structural Engineer on previous submission.

1.10 DISTRIBUTION

A. Distribute reproductions of shop drawings, copies of product data, and samples which bear the Architect/Structural Engineer's review stamp to job site file, Record Documents file, subcontractors, suppliers, other affected contractors, and other entities requiring information.

B. Work shall be in accordance with and performed from the reviewed drawings.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01 35 00

ALTERNATES

1.01 DESCRIPTION

A. **Scope**: This section describes the changes to be made under each alternate.

B. **General**: The referenced Specification sections contain the pertinent requirements for materials and methods to achieve the work described herein. Coordinate related work and modify surrounding work, as required, to complete the Project under each alternate designated in the Contract.

1.02 DESCRIPTION OF ALTERNATES

A. Refer to Section 01 90 00 entitled *Division One Supplement* for Project specific description of project Alternates.

END OF SECTION

SECTION 01 35 28: SEISMIC REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS

PART 1 GENERAL

1.1 PREFACE

A. Nonstructural components that are permanently installed in or on the building shall be and installed to resist vertical loads and lateral forces stated in the IBC 2012/ ASCE 7-10 Chapter 13.

B. Project is located on a site with the following Seismicity:

Structural Risk Category =	IV	*IBC 2012, Table 1604.5, page 336*
Seismic Importance Factor, I =	1.5	*ASCE 7-10 Table 1.5-2, page 5*
Soil Site Class =	D	*ASCE 7-10 Table 20.3-1 page 204, or as provided by Geotechnical Eng.*
Spectral Acceleration, S_S =	0.119	*ASCE 7-10 Figures 22-1 to 22-6, or USGS Seismic Maps*
Spectral Acceleration, S_1 =	0.068	*ASCE 7-10 Figures 22-2 to 22-6, or USGS Seismic Maps*
S_{DS} =	0.127	*SDS = 2*SMS/3, IBC 2012 Eqn. 16-39, page 367*
S_{D1} =	0.109	*SD1 = 2*SM1/3, IBC 2012 Eqn. 16-40, page 367*
Seismic Design Category =	C	

1.2 RELATED WORK

A. Division 01, Section 013300 – Submittal Procedures.

1.3 EQUIPMENT AND NON-STRUCTURAL ELEMENTS

A. Equipment and non-structural elements shall comply with the requirements of the referenced codes above. Suppliers of equipment, assemblies, and systems shall be responsible for proper design and for furnishing adequate proof of proper design in accordance with the applicable building codes.

B. Pieces of equipment are to be constructed so that seismic bracing items are concealed, as may be the case with transformers, vacuum systems, pumps, HVAC units and other mechanical equipment, and shall be installed, braced and anchored to meet the requirements of the applicable building codes.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01 41 00

PROJECT COORDINATION

1.01 **DESCRIPTION**

A. **Scope**: To set forth procedures, conditions and responsibility for coordination of the total project.

B. **Project Coordinator**: The General Contractor will designate one (1) individual as Superintendent, as referred to in the General Conditions. Prior to beginning the Work, the name and qualifications will be submitted, in writing, to the Professional. Upon the approval of the Professional and the Owner, the Project Coordinator will remain until the Project is completed and cannot be removed during construction without the written consent of the Owner and the Professional.

C. **Superintendent**:
1. The Superintendent will write down all instructions given by Professionals on site reviews and will send copies to the Owner and Architect within 4 working days.
2. The Superintendent shall be accompanied by the Architect during the review of the work at all times. If the Superintendent is not present with a note pad to make notes of issues, then the Architect will leave the job site.
3. The Superintendent must be at the job site at all times during the working day. It is understood that sometime the Superintendent must leave the job for various reasons. When this occurs, the Contractor shall notify the Architect. If the Superintendent must be away from the job site for more than an hour, than the Contractor shall supply a suitable temporary Superintendent to replace him during his absence.

1.02 **DUTIES OF PROJECT COORDINATOR**

A. **General**:
1. **Coordination**: Coordinate the work of all Subcontractors and Material Suppliers.
2. **Supervision**: Supervise the activities of every phase of work taking place on the Project.
3. **Mechanical/Electrical**: Take special care to coordinate and supervise the work of the plumbing, heating and cooling and electrical Subcontractors.
4. **Communication**: Establish lines of authority and communication at the job site.
5. **Location**: The Project Coordinator must be present on the job all of the time.
6. **Permits**: Assist in obtaining building and special permits required for construction.

B. **Interpretations of Contract Documents**:
1. **Consultation**: Consult with Architects and Engineers to obtain interpretations.
2. **Assistance**: Assist in resolution of any questions.
3. **Transmission**: Transmit written interpretations to concerned parties.

C. **Cessation of Work**: Stop all work not in accordance with the requirements of the Contract Documents.

D. **Division One**: Coordinate and assist in the preparation of all requirements of Division One and specifically as follows:
1. **Cutting and Patching**: Supervise and control all cutting and patching of other trades' work.
2. **Project Meetings**: Schedule and preside at all project meetings. The Contractor must provide complete and comprehensive meeting minutes within 4 working days of any project meetings.
3. **Construction Schedules**: Prepare and submit all construction schedules; supervise work to

monitor compliance with schedules.

4. **Shop Drawings, Product Data and Samples**: Administer the processing of all submittals required by the Project Manual.
5. **Schedule of Values**: Assist in preparation and be knowledgeable of each entry in the Schedule of Values.
6. **Testing**: Coordinate all required testing.
7. **Temporary Facilities and Controls**: Allocate, maintain and monitor all temporary facilities.
8. **Substitutions and Product Options**: Administer the processing of all substitutions.
9. **Project Closeout**: Conduct final inspections and assist in collection and preparation of closeout documents.
10. **Cleaning**: Direct and execute a continuing cleaning program throughout construction, requiring each trade to dispose their own debris.
11. **Project Record Documents**: Maintain up-to-date project record documents. These documents are to be presented at all monthly project meetings for review by the Architect.
12. **Safety Measures**: Plan and enforce all safety requirements.

E. **Changes**: Recommend and assist in the preparation of requests to the Professional for any changes in the Contract.

F. **Application for Payment**: Assist in the preparation and be knowledgeable of each entry in the Application and Certificate for Payment.

1.03 **SUBCONTRACTOR'S DUTIES**

A. **General**: The Subcontractor is responsible for coordinating and supervising employees in the work to be accomplished under their part of the Contract.

B. **Schedules**: Conduct work to assure compliance with construction schedules.

C. **Suppliers**: Transmit all instructions to Material Suppliers.

D. **Cooperation**: Cooperate with the Project Coordinator and other Subcontractors.

1.04 **OWNER-PURCHASED PRODUCTS**

A. **General**: Cooperate, accept delivery, arrange storage and protect Owner-purchased products until installation, or final acceptance.

END OF SECTION

SECTION 01 42 00

ABBREVIATIONS AND STANDARDS

PART ONE - GENERAL

1.01 THE CONTRACT DOCUMENTS

B. **DRAWINGS**: The drawings are those enumerated in the list of drawings and identified in the agreement. The drawings, in many instances, are schematic and do not define exact locations of every part and piece of equipment. Items furnished may vary in dimension from the specific item called for in the Contract Documents. In such cases, determine exact position of each part by "on the job" measurements and drawings from equipment suppliers. Coordinate with other Work.

C. **SPECIFICATION SECTIONS**: Each section governs the complete work of the title, along with work related to the title, no matter where such work is shown on the drawings or mentioned in the specifications.

D. **SPECIFICATION FORM**: These specifications are of the abbreviated, simplified or streamlined type and include incomplete sentences. Omission of words or phrases such as "The contractor shall", "in conformity therewith", "shall be", "as noted on the drawings", "according to the plans", "a", "the", and "all" are intentional. Omitted words or phrases shall be supplied by inference in the same manner as they are when a "note" occurs on the drawings.

E. **ARCHITECT'S AUTHORITY**: Wherever the words "equal", "approved equal", "approved", "satisfactory", "directed", "submitted", "inspected", "selected", or similar words or phrases are used, it shall be assumed that these are actions or opinions of the Architect. An example of such completed phrase is "approved by the Architect."

F. **APPLICABILITY OF WORK AND WORK RESTRICTIONS**: (Unless specifically noted otherwise) The Contractor shall perform all work shown, mentioned or inferred and shall comply with all work restrictions.

1.02 REFERENCE STANDARDS AND INDUSTRY SPECIFICATIONS

A. **MINIMUM SPECIFICATIONS**: Any material or operation specified by reference to published specifications of a manufacturer, a society, an association, a code, or other published standard, shall comply with requirements on the listed document which is current and has been officially published on date of receipt of bids. In cases of a conflict within the Contract Documents or between Contract Documents and Governing Codes the more stringent requirements shall govern.

B. **CERTIFICATION**: The Contractor, when requested, shall furnish a sworn affidavit from the manufacturer certifying that materials and manufacturers products delivered to the job meet requirements specified. However, sworn affidavit shall not relieve the Contractor for responsibility of compliance with any added requirements of Contract Documents.

END OF SECTION

SECTION 014524: STRUCTURAL SPECIAL INSPECTIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Section summarizes the responsibility of the Contractor and the Special Inspector in the performance of the special inspections required in the Construction Documents.

B. Neither the observation of the Architect/Structural Engineer in the administration of the contract, nor tests/inspections by the Special Inspector, nor approvals by persons other than the Architect/Structural Engineer shall relieve the Contractor from his obligation to perform the Work in accordance with the Construction Documents.

1.2 RELATED SECTIONS

A. Section 013324 - Structural Submittals.

B. Section 014500 - Quality Control.

1.3 REFERENCES

A. ASTM E329 – Standard Specification for Agencies Engaged in Construction Inspection and/or Testing.

B. American Council of Independent Laboratories – Recommended Requirements for Independent Laboratories Qualifications.

1.4 SELECTION AND PAYMENT

A. Owner will employ and pay for the structural testing/inspection services that are required by the Construction Documents.

B. Contractor shall pay for any additional structural testing/inspection required for Work or materials not complying with Construction Documents due to negligence or nonconformance.

C. Contractor shall pay for any additional structural testing/inspection required for his convenience.

1.5 STRUCTURAL TESTING/INSPECTION REQUIREMENT SUMMARY

A. Refer to the Structural Quality Assurance Plan in the Structural Drawings for the required tests/inspections.

1.6 STRUCTURAL TESTING/INSPECTION AGENCY'S QUALIFICATIONS

A. Provide inspectors qualified to perform special inspections as required by the Building Code and the Construction Documents.
   1. Inspectors shall have a minimum of two years' experience.
   2. Where required, the Inspectors shall be approved by the local building authority.

B. Comply with the American Council of Independent Laboratories recommended requirements.

C. Comply with ASTM E329.

D. Maintain properly calibrated equipment; calibrated within the past 12 months with devices of accuracy traceable to either National Bureau of Standards (NBS) or accepted values of natural physical constants.

PART 2 MATERIALS

Not Used.

PART 3 EXECUTION

3.1 STRUCTURAL PRECONSTRUCTION MEETING

A. A structural preconstruction meeting may be conducted at the construction site by the Structural Engineer to discuss quality issues. The parties involved may be the Architect, Contractor, Special Inspector, appropriate subcontractors, suppliers, and detailers.

3.2 SPECIAL INSPECTOR'S RESPONSIBILITIES

A. Cooperate with the Contractor and provide timely service.

B. Upon arriving at the construction site, sign in and notify the Contractor of presence.

C. Select the representative samples that are to be tested/inspected.

D. Perform tests/inspections as outlined in Construction Documents, the applicable codes, and as directed by the Structural Engineer.

E. Report results of tests/inspections in accordance with the Construction Documents and the Building Code. Work and materials not complying with Construction Documents shall be immediately reported to the Contractor and Structural Engineer.

F. Leave copies of field notes with the Contractor prior to leaving the construction site. Field notes shall include the message given to the Contractor, date, time of message, name of Contractor's representative informed, type and location of Work or materials tested/inspected, whether the work or materials complies with Construction Documents and name of the Structural Testing/Inspection Agency's representative.

G. Report and distribute results of tests/inspections promptly in the form of written reports as directed by the Structural Engineer.

H. Special Inspector shall not alter requirements of Construction Documents, approve or reject any portion of the Work, or perform duties of the Contractor.

I. Submit written confirmation at end of construction that, to the best of their knowledge, the structural Work conforms to the Construction Documents.

3.3 CONTRACTOR'S RESPONSIBILITIES

A. Provide copy of Construction Documents to the Special Inspector.

B. Arrange the preconstruction meeting to discuss quality issues.

C. Notify the Special Inspector sufficiently in advance of operations to allow assignment of personnel and scheduling of tests.

D. Cooperate with Special Inspector and provide access to Work.

E. Provide samples of materials to be tested in required quantities.

F. Furnish copies of mill test reports when requested.

G. Provide storage space for Special Inspector's exclusive use, such as for storing and curing concrete testing samples.

H. Provide labor to assist the Special Inspector in performing tests/inspections.

3.4 OPTIONS

A. If the Structural Testing/Inspection Agency is located at such a distance from the Project that travel expenses will be a consideration, or if the amount of sampling performed is minor, and by mutual agreement of the Architect/Structural Engineer and Contractor, the Contractor may be requested to take samples and forward them to the Structural Testing/Inspection Agency for testing/inspection.

END OF SECTION

SECTION 01 50 00

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

1.01 DESCRIPTION

A. **Scope**: Work required under this section consists of all temporary construction facilities, services and related items to complete the work indicated on the drawings and described in the Project Manual.

B. **Standards**:
1. Conform to or exceed all temporary construction requirements stated in the current edition of the **International Building Code** [Chapter entitled *Safeguards During Construction*].
2. Refer to Article 10.1.1 in Section 00 70 00 entitled *General Conditions*.

C. **Materials**: All materials required by the Work of this section shall be as specified in the respective sections.

1.02 FACILITIES AND CONTROLS

A. **Access**: The Prime General Contractor shall provide an adequate access and/or roads to the site of the structure, if required for the prosecution of work; and, should also provide and maintain at least two (2) temporary, or permanent, accesses to each working elevation to be permanently occupied. If requested, the Architect will be provided keys to access the site after hours.

B. **Hoisting Facilities**: The Prime General Contractor shall be responsible for providing suitable capacity and hoisting facilities for all people and materials.

C. **Field Office and Sheds**: At all times, the Prime General Contractor shall provide and maintain a weatherproof office with telephone, which may also be used by Subcontractors, the Owner and the Professional. Office location will be approved by the Owner. Each general and individual Contractor shall provide suitable watertight/dampproof sheds to house their construction materials.

D. **Sanitation Facilities**: The Prime General Contractor is responsible for furnishing adequate temporary toilet facilities on the job site.

E. **Drinking Water**: The Prime General Contractor shall provide at all times sanitary drinking water facilities for all workmen on the job including ice, when required, and paper cups, etc..

F. **Fire Protection**: The Prime General Contractor shall provide general temporary fire protection. Subcontractors will be responsible for their own.

G. **Storage**: The Prime General Contractor shall coordinate the allocation of storage areas to the various Subcontractors.

H. **Temporary Heat**: The Prime General Contractor shall provide heat, fuel and services, as necessary, to protect all work from dampness and cold until final acceptance. If in the late stages of the construction, mechanical and electrical installations will permit, the mechanical and electrical facilities may be used to provide heat and ventilation. However, the Owner is saved harmless of any costs of operation or responsibility as to acceptance of mechanical and/or electrical installations.

I. **Utilities**: The Prime General Contractor shall make arrangements for and furnish all water, electricity (lighting and power) and other utilities necessary for construction purposes. The prime general contractor should then propose to the Owner and Architect how these utilities will be furnished. If the Owner's existing utilities must be used in order to provide these requirements, then a written agreement must be reached on how all utilities (water and electricity) will be furnished and the rates the Contractor will be charged. If the written agreement is not filed with the Owner, the Contractor waives all rights as to the rates charged. The Owner will then determine all utility rates and assess the charges before final payment is rendered.

J. **Utility Hook-up**:
Water: See Civil Drawings
Natural Gas: See Civil Drawings
Electricity: Mississippi Power

(Note: See Civil and Electrical Drawings for Utility Information and Contact Info if the information is not listed above; if info listed above is different from those listed in Civil and Electrical Drawings then default with info in drawings and call Architect for clarification).

K. **Project Sign**:
1. The requirements and layout for this sign are located in *Section 01 90 00 Division One Supplement*.
2. No other signs shall be displayed on the job site without permission of the Professional. The display of sign advertisements is strictly prohibited.

END OF SECTION

SECTION 01 63 00

SUBSTITUTIONS AND PRODUCT OPTIONS

1.01 DESCRIPTION

A. **Scope**: To set forth the procedure and conditions for substitutions and to give the product options available to the Contractor.

1.02 PRODUCTS LIST

A. Within thirty (30) days after the Contract has been signed, the Contractor will submit to the Professional five (5) copies of a complete list of all products proposed for installation.
B. Tabulate the list by Specification sections.
C. For products specified under reference standards, include with listing of each product:
   1. Name and address of Manufacturer.
   2. Trade name.
   3. Model, or catalog designation.
   4. Manufacturer's data.
   5. Performance and test data.
   6. Reference standards.

1.03 CONTRACTOR'S OPTIONS

A. For products specified only by reference standards, select any product meeting product standards by any Manufacturer.

B. For products specified by naming a minimum of three (3) products or Manufacturers, select any product and Manufacturer named.

C. For product specified by naming one (1) or more products, but indicating the option of selecting equivalent products by stating "or equal" after specified product, Contractor must submit request, as required for substitution, for any product not specifically named.

D. For products specified by naming only one (1) product and Manufacturer, an equivalent product will always be accepted if it is equal in all respects. The Contractor must submit a request for substitution as set forth in this Section.

E. For products specified by naming only one (1) product and Manufacturer and stating no substitutions will be accepted, there is no option and no substitutions will be allowed. This option must have written approval by the Owner before bidding.

1.04 SUBSTITUTIONS

A. Professional will not consider requests for substitutions during bidding.

B. Within thirty (30) days after the Contract has been signed, the Professional will consider formal requests from the Contractor for substitution of products in place of those specified. Submit five (5) copies of the request for substitutions. Include in the request:
   1. Complete data substantiating compliance of proposed substitutions with Contract Documents.

2. For products:
    a. Product identification including Manufacturer's name and address.
    b. Manufacturer's literature: Product description, performance and test data and reference standards.
    c. Samples.
    d. Name and address of similar products on which product was used and date of installation.
3. For construction methods:
    a. Detailed description of proposed method.
    b. Drawings illustrating methods.
4. Itemized comparison of proposed substitutions with product or method specified.
5. Data relating to changes in construction schedule.
6. Accurate cost data on proposed substitution in comparison with product or method specified.

C. In making request for substitution, Contractor represents:
1. Proposed product, or method, has been investigated and determined that it is equal or superior in all respects to that specified.
2. The same guarantee will be provided for substitutions as for product or method specified.
3. Installation of accepted substitutions will be coordinated into the Work, making such changes required of work to be complete in all respects.
4. All claims for additional costs related to substitution which consequently become apparent will be waived.
5. Cost data is complete and includes all related costs under the Contract.

D. Substitutions will not be considered if:
1. Indicated, or implied, on shop drawings or product data submittals without formal request submitted in accordance with this Section.
2. Acceptance will require substantial revision of Contract Documents.
3. In the Professional's judgment, the product, or material, is not equal.

END OF SECTION

SECTION 01 65 00

STARTING OF SYSTEMS

1.01 GENERAL

A. **Scope**: This Section describes the procedures for start up of all building equipment and systems including necessary demonstration and instructions.

1.02 STARTING SYSTEMS

A. Coordinate Schedule for start-up of various equipment and systems.

B. Notify Professional and Owner seven (7) days prior to start-up of each system.

C. Verify each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, or other conditions which may cause damage.

D. Verify that tests, meter readings and specified electrical characteristics agree with those required by the equipment or system manufacturer.

E. Verify wiring and support components for equipment are complete and tested.

F. Execute start-up under supervision of responsible Contractors' personnel in accordance with manufacturers' instructions.

G. When specified in individual specification Sections, require Manufacturer to provide authorized representative to be present at site to inspect, check and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

H. Submit a written report that equipment or system has been properly installed and is functioning correctly.

1.03 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of Products to Owner's personnel prior to date of Substantial Completion.

B. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.

C. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at agreed-upon times, at designated location.

D. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

E. Owner Training by the Equipment Manufacturer may be done during NON-BUSINESS HOURS; Manufacturer shall include pricing for overtime pay in the bid associated with training sessions that occur after 5pm, before 8am or during weekends to accommodate the Owner’s scheduling.

END OF SECTION

SECTION 01 73 00

CUTTING AND PATCHING

1.01 GENERAL DESCRIPTION

A. **Scope**: To set forth broad, general conditions covering cutting and patching that applies to everyone and everything on the job.

B. Execute cutting including excavating, fitting, or patching of work required to:
1. Make several parts fit properly.
2. Uncover work to provide for installation of ill-timed work.
3. Remove and replace defective work.
4. Remove and replace work not conforming to Contract requirements.
5. Install specified work in existing construction.

C. In addition to Contract requirements, upon Professional's written instructions:
1. Uncover work for observation of covered work.
2. Remove samples of installed materials for testing.
3. Remove work to provide alteration of existing work.

D. Do not cut or alter work of another Contractor without permission.

E. **Payment of Costs**: Costs caused by ill-timed, or defective work or work not conforming to Contract Documents will be borne by party responsible for ill-timed, defective work, or non-conforming work.

1.02 MATERIALS/PRODUCTS

A. **Materials for Replacement or Work Removed**: Comply with Specifications for type of work to be accomplished.

1.03 EXECUTION

A. **Inspection**: Inspect existing conditions of work, including elements subject to movement, or damage during cutting and patching.

B. **Preparation Prior to Cutting**: Provide shoring, bracing and support, as required, to maintain structural integrity of the building. Provide protection for other portions of work and protection from the elements.

C. **Performance**:
1. Execute cutting and demolition by methods which prevent damage to other work and will provide surfaces to receive installation of repairs and new work.
2. Execute excavating and backfilling by methods which prevent damage to other work and prevent settlement.
3. Restore work which has been cut or removed; install new products to provide completed work in accordance with requirements of Contract Documents.
4. Refinish entire surfaces, as necessary, to provide an even finish. Refinish continuous surfaces to the nearest intersection and assemblies entirely.

END OF SECTION

SECTION 01 74 00

CLEANING

1.01 DESCRIPTION

A. **Scope**: Maintain premises and adjacent public properties from accumulations of waste, debris and rubbish caused by operations. At completion of work, remove waste materials, rubbish, tools, equipment, machinery and surplus materials and clean all sight-exposed surfaces; leave Project clean and ready for occupancy.

1.02 PRODUCTS

A. **Materials**: Use only cleaning materials recommended by Manufacturer of surface to be cleaned. Use cleaning materials only on surfaces recommended by the cleaning materials Manufacturer.

1.03 EXECUTION

A. **During Construction**: Execute cleaning to insure that building, grounds and adjacent public properties are maintained free from accumulations of waste materials and rubbish. The Contractor shall wet down dry materials and rubbish to lay dust and prevent blowing dust. At reasonable intervals during progress of work, at least daily, the Contractor shall clean site and adjacent public properties and dispose of waste materials, debris and rubbish. Remove waste materials, debris and rubbish from site and legally dispose of at public or private dumping areas off Owner's property. Vacuum clean interior building areas when ready to receive finish painting and continue vacuum cleaning on an as-needed basis until building is ready for substantial completion or occupancy. Handle materials in a controlled manner with as few handlings as possible; do not drop or throw materials from heights. The Contractor shall schedule cleaning operations so that dust or other contaminants resulting from cleaning process will not fall on wet or newly painted surfaces. Contractor shall broom clean daily.

B. **Final Cleaning**: Employ experienced workmen, or professional cleaners, for final cleaning. In preparation for substantial completion or occupancy, conduct final inspection of sight-exposed interior and exterior surfaces and concealed spaces. Remove grease, dust, dirt, stains, labels, fingerprints and other foreign materials from sight- exposed finishes. Repair, patch and touch up marred surfaces to specified finish to match adjacent surfaces. Broom clean paved surfaces; rake clean other surfaces of grounds. Replace air conditioning filters, if units were operated during construction. Clean ducts, blowers and coils if air conditioning units were operated without filters during construction. Maintain cleaning until Project, or respective portions thereof, is occupied by Owner.

END OF SECTION

SECTION 01 75 00

PROJECT RECORD DOCUMENTS

1.01 **DESCRIPTION**

A. **Scope**: To set forth the procedure and requirements for keeping project record documents.

1. Provide G.P.S. coordinates for the underground on the record drawings.

B. **Maintenance Documents**:
1. Maintain one (1) copy of all of the following: Contract drawings, Project Manual, Addenda, Change Order(s), reviewed shop drawings, reviewed submittals, hardware schedules, filed and laboratory test records, equipment brochures, parts lists, operating instructions and other modifications to the Contract.
2. Store documents apart from documents used for construction.
3. Maintain documents in clean, dry, legible condition. Do not use record documents for construction purposes.
4. Make documents available, at all times, for inspection by the Professional and the Owner.

C. **Recording**:
1. **General**: Mark all modifications in red pencil. Keep record documents current. Do not permanently conceal any work until required information has been recorded.
2. **Contract Drawings**: Legibly mark to record actual construction.
   a. Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements.
   b. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
   c. Field changes in dimension and detail.
   d. Changes made by change order(s) or field order(s).
   e. All Subcontractors shall assist the General Contractor in providing the project record documents. This will assist the Owner in maintenance as well as future modifications to the building and site.
3. **Project Manual and Addenda**: Legibly mark up each section to record Manufacturer, trade name, catalog number and Supplier of each product and item of equipment actually installed.
4. **Shop Drawings**: Maintain as record documents. Legibly mark drawings to record changes made after review.
5. **Project Record Drawings in CAD Format**: Contractor is to make project record changes on Architect provided CAD drawings as well. These changes will reflect construction and building systems and shall be as accurate as possible.

D. **Equipment Training:** All training required by the Mechanical, Electrical, etc. specifications of regarding operations of equipment shall be recorded digitally by the General Contractor and distributed to the Owner (via close-out documents), Architect and Engineers.

E. **Submittal**: At completion of Project, deliver two (2) copies of each record document to the Professional, who will transmit both sets to the Owner. The Contractor shall clearly itemize all Project Record Documents on his transmittal.

END OF SECTION

SECTION 01 77 00

CONTRACT CLOSEOUT

1.01 **DESCRIPTION**

A. **Scope**: The work required in this Section consists of the final inspections and the submission of all closeout documents and related items to complete the Work indicated on the Drawings and described in the Project Manual. Note that Final Inspection assumes all requirements of Substantial Completion have been met (see *Substantial Completion* in the *A201 Contract General Conditions*).

1.02 **FINAL INSPECTIONS**

A. **Professional's Inspection**: The Contractor shall make written request for a final inspection to the Professional; notice to be given ten (10) days prior to the inspection. A list of any deficiencies, compiled by the Professional, will be corrected by the Contractor. If, in the Professional's judgment, the Project is not ready for a final inspection, the Professional may schedule another inspection.
   1. The Architect shall make one visit for Substantial Completion and one visit for Final Inspection. The Contractor shall compensate the Architect for each additional time the Architect visits the site regarding Substantial Completion and/or Final Inspection. The Architect will charge the rates specified in *Section 00 95 00 Architect's Special Conditions.*
   2. If the Contractor's list contains an unreasonable number of items (deemed by the Architect), the Architect will not visit the site for Final Inspection until most of these corrections have been made.

B. **Owner's Inspection**: After the Professional has ascertained the Project to be ready; an Owner's inspection will be scheduled within ten (10) days thereafter. The Contractor will have ten (10) days after the Owner's acceptance to make any corrections of punch list items and to submit closeout documents.

C. **Correction of Work Before Final Payment**: The Contractor shall promptly remove from the Owner's premises all materials condemned for failure to conform to the Contract, whether incorporated in the Work or not, and the Contractor shall, at his own expense, replace such condemned materials with those conforming to the requirements of the Contract. Failure to remedy such defects after ten (10) days written notice will allow the Owner to make good such defects and such costs shall be deducted from the balance due the Contractor, or charged to the Contractor in the event no payment is due.

D. **Training:** The Contractor shall coordinate with the Owner all training required by the Specifications. The Contractor will video (at the Contractor's expense) all sessions and provide two (2) copies to the Owner and one (1) to the Architect as part of the Contract Closeout.

1.03 **CLOSEOUT DOCUMENTS**

Unless otherwise notified, the Contractor shall submit to the Owner through the Professional, three (3) copies of the following before final payment is made:

A. **Request for Final Payment**: AIA Document G702, current edition, completed in full or a computer generated form having similar data.

B. **Consent of Surety Company to Final Payment**: AIA Document G707, current edition, completed in full

by the Bonding company.

C. **Power of Attorney**: Closeout documents should be accompanied by an appropriate Power of Attorney.

D. **Release of Liens and Certification that All Bills Have Been Paid**: AIA Document G706A, current edition, completed in full or a sworn statement and affidavit from the Contractor to the Owner stating that all bills for this job have been paid and that the Owner is released from any and all claims and/or damages.

E. **Contractor's Affidavit of Payment of Debts and Claims**: AIA Document G706, current edition, completed in full.

F. **Guarantee of Work**: Sworn statement that all work is guaranteed against defects in materials and workmanship for one (1) year from date of Owner's acceptance, except where specified for longer periods.
   1. Word the Guarantee as follows:
      We hereby guarantee all work performed by us on the above captioned Project to be free from defective materials and workmanship for a period of one (1) year or such longer period of time as may be called for in the Contract Documents for such portions of the Work. Note: The Contractor shall not modify or add additional clauses or amendments to this statement.
   2. All guarantees and warranties shall be obtained in the Owner's name.
   3. Within the Guaranty period, if repairs or changes are requested in connection with guaranteed work which, in the opinion of the Owner, are rendered necessary as a result of the use of materials, equipment or workmanship which are inferior, defective or not in accordance with the terms of the Contract, the Contractor shall promptly, upon receipt of notice from and without expense to the Owner, place in satisfactory condition building, site, equipment or contents thereof. The Contractor shall make good any work, materials, equipment or contents of said buildings or site which may be disturbed by fulfilling any such Guaranty.
   4. If, after notice, the Contractor fails to proceed promptly to comply with the terms of the Guaranty, the Owner may have the defects corrected and the Contractor and his Sureties shall be liable for all expense incurred.
   5. All special guarantees applicable to definite parts of the work stipulated in the Project Manual or other documents forming part of the Contract shall be subject to the terms of this paragraph during the first year of the life of such special guaranty.

G. **Project Record Document**: Furnish all other record documents as set forth in Section 01720 entitled *Project Record Documents*.

H. **Additional Documents Specified Within the Project Manual**: Provide all additional certificates, warranties, guarantees, bonds or documents as called for in the individual sections of the Project Manual. The Contractor is responsible for examining the Project Manual for these requirements.

END OF SECTION

SECTION 01 90 00

DIVISION ONE SUPPLEMENT

PART 1 - SUMMARY OF WORK SUPPLEMENT

1.01 WORK SEQUENCE

A. Owner will NOT occupy the building during construction, coordinate with Owner's Representative in scheduling work to vacate the areas as the Contractor requires.

B. Construct work in stages as follows:
1. N/A
2. _____
3. _____

1.02 PARTIAL OWNER OCCUPANCY

A. Schedule early completion of designated areas for Owner's usage prior to substantial completion of entire Project.

1. N/A
2. _____

B. Owner will occupy areas for purpose of N/A

C. Contractor will provide:
1. Access for Owner's personnel
2. Operation of heating, ventilating, air conditioning and electrical systems
3. N/A

D. Prior to occupancy, execute a *Certificate of Substantial Completion* for designated areas.

E. Upon occupancy, Owner shall provide:
1. N/A
2. _____

PART 2 - ALLOWANCE SUPPLEMENT

2.01 SCHEDULE OF ALLOWANCES

A. Include in the Bid, for inclusion in the Contract Sum, the amount of $175,000.00 for the complete A/V equipment at the direction of the General Contractor / Architect, BAI and Owner. (Refer to section 11 52 00 Audio Visual Equipment.)

B. Include in the Bid, for inclusion in the Contract Sum, the amount of $200,000.00 for purchase of Door Hardware (Refer to Section 08 71 00, Door Hardware)

C. Include in the Bid, for inclusion in the Contract Sum, the amount of $50,000.00 for purchase of any Signage not included in Section 10 14 23.

D. Include in the Bid, for inclusion in the Contract Sum, the amount of $15,000.00 for purchase of Toilet Accessories (Refer to Section 10 28 00, Toilet, Bath and Laundry Accessories)

E. Include in the Bid, for inclusion in the Contract Sum, the amount of $1,500.00 for purchase of one light fixture located on the Police Lobby on the third floor; Allowance is for fixture only - include all electrical including the junction box for this fixture in the base bid.

F. Include in the Bid, for inclusion in the Contract Sum, the amount of $1,500.00 for purchase of one light fixture located in the parking lot south of Katie Ave; Allowance is for fixture only - include all electrical including the junction box for this fixture in the base bid.

G. Include in the Bid, for inclusion in the Contract Sum, the amount of $9,000.00 for purchase of one round stained glass window located in the Court Lobby; Allowance is for glass and materials only - include all installation cost in the base bid.

H. Include in the Bid, for inclusion in the Contract Sum, the amount of $13,000.00 for purchase of the stained glass letters reading "PUBLIC SAFETY" on the Police Lobby curtain wall above the main entrance . Allowance is for glass and materials only - include all installation cost in the base bid.

I. Include in the Bid, for inclusion in the Contract Sum, the amount of $36,000.00 for purchase of Crime Scene Laboratory [B238] equipment; Allowance is for purchase of equipment only - include all installation cost in the base bid.

J. Include in the Bid, for inclusion in the Contract Sum, the amount of $1,500.00 for purchase and installation of any terracotta replacement required as a result of discovery during the construction process ; Allowance only covers unforeseen conditions. All work shown in drawings is NOT included in this allowance. Any terracotta that is damaged by the Contractor is NOT included in this allowance.

PART 3 - ALTERNATE SUPPLEMENT

3.01 **DESCRIPTION OF ALTERNATES**

A. Alternate Number One: This Alternate adds all labor and materials required for the entire scope of work for public parking on south side of Katie Avenue.

B. Alternate Number Two: This Alternate adds pavement and parking for the Vehicular Maintenance Building.

PART 4 – PROJECT SIGN SUPPLEMENT

4.01 **Project Sign Requirements**: General Contractor to provide a project sign with image provided by Albert and Associates Architects.

END OF SECTION

SECTION 02 30 00

SUBSURFACE CONDITIONS

1.01 **DESCRIPTION**

A. **Geotechnical Investigation**: A Geotechnical Investigation has been prepared in regards to this project and paid for by the Owner. This report was obtained from the Owner for use by the Structural Engineer in design.

B. **Examination**: A copy of this report is included in this section of the specifications. It is available for the Contractor's information only and is not a warranty of subsurface conditions.

C. **Additional Investigation**: Contractor should visit the site and acquaint himself with conditions. Prior to bidding, the Contractor may make his own investigations to satisfy himself with site and subsurface conditions.

1.02 **COPY OF THE GEOTECHNICAL INVESTIGATION**

A. A copy of the Geotechnical Investigation follows this section.

END OF SECTION

Terracon GeoReport

Public Safety Complex Police and Court Building
Hattiesburg, Mississippi
July 1, 2016
Terracon Project No. EB165058

Prepared for:
Albert & Associates Architects, P.A.
Hattiesburg, Mississippi

Prepared by:
Terracon Consultants, Inc.
Ridgeland, Mississippi

terracon.com

Terracon

Environmental ■ Facilities ■ Geotechnical ■ Materials

July 1, 2016

Albert & Associates Architects, P.A.
518 Main Street
Hattiesburg, Mississippi 39403-1567

Attn: Mr. Larry Albert
P: [601] 544 1970
E: larry@albertassociates.com

Re: Geotechnical Engineering Report
Public Service Complex Police and Court Building
Hattiesburg, Mississippi
Terracon Project Number: EB165058

Mr. Albert:

We have completed the geotechnical engineering services for the above-referenced project. This work was performed in accordance with our proposal number PEB165058 dated May 11, 2016, as authorized on May 11, 2016.

This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations, floor slabs and pavements for the proposed project.

We should collaborate with you as you finalize the designs. We should also review the pertinent aspects of the plans and specifications and provide construction materials and engineering testing services when the project moves into construction. If you have any questions concerning this report, or if we may be of further service, please contact us.

Sincerely,
Terracon Consultants, Inc.

Nick K. Leber, E.I.
Staff Engineer
Geotechnical Services

JEFFREY WAYNE WILLIAMS REGISTERED PROFESSIONAL ENGINEER 16392 STATE OF MISSISSIPPI

Jeffrey W. Williams, P.E.
Senior Engineer
Geotechnical Services
Mississippi PE No. 16392

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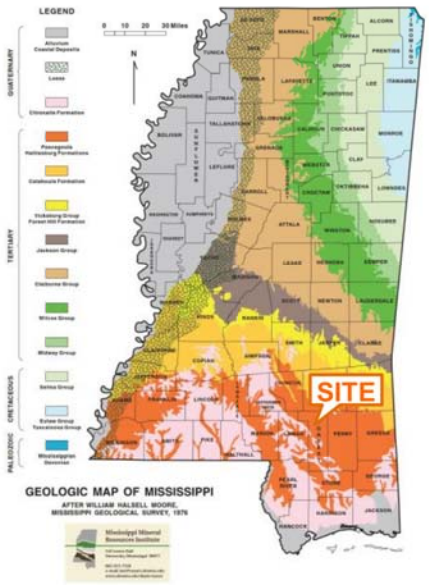
PROJECT DESCRIPTION

Our initial understanding of the project was provided in our Stage 1 submittal in Project Understanding. Our understanding of the project conditions is as follows.

ITEM	DESCRIPTION
Project Location	Northeast of the intersection of Katie Avenue and Edwards Street in Hattiesburg, Mississippi (approximately 31° 18.872' N, -89° 17.144' W) See Site Location
Proposed Structure	The project will consist of a building that will contain Police and Court areas. The Court area will be a three-story steel frame structure with brick facing, concrete floors, steel trusses, and a flat roof. The Police area will be a three to four-story concrete framed structure with precast concrete panel facing, concrete floors, and a flat roof. The building will have a footprint of about 25,000 square feet.
Building construction	The proposed building will be a combination of concrete framed (Police area) and steel-framed (Court area) with either brick facing or precast concrete panel facing. Columns will be spaced at approximate 25-foot to 30-foot spacing.
Maximum loads	Columns: 400 kips maximum (interior) and 210 kips (exterior) Walls: 12 kips per linear foot maximum Slabs: 150 pounds per square foot maximum
Grading/Slopes	Finished floor elevation is expected to be at Elev. 155 feet, MSL, which is the parking area finished grade Nominal grade changes of up to 2 feet of cut and 2 feet of fill will be required to develop final grade. Final slope angles of as steep as 2(H): 1(V) are expected.
Estimated Start of Construction	July 2016

SITE CONDITIONS

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publically available geologic and topographic maps.

ITEM	DESCRIPTION
Parcel Information	Northeast of the intersection of Katie Avenue and Edwards Street in Hattiesburg, Mississippi See **Site Location**
Existing improvements	Existing pavements and buildings are located within the planned building area and are located directly west of the site
Current ground cover	Various, existing building, parking and drive areas and sidewalks
Existing topography	The site is relatively flat with a maximum elevation difference of about 2 feet
Geology	The soils at this site are sediments of the Hattiesburg-Pascagoula formation. This formation is generally characterized as a gray homogeneous marine clay deposit occurring at thicknesses of 150 feet or more. The formation may also contain localized areas of sandy clay or sand layers, lenses or beds. The weathered clays found within the upper oxidized portion of the surface outcrop of the Hattiesburg-Pascagoula formation typically reveal moderate amounts of expansion and contraction due to changes in moisture content. According to a preliminary geotechnical investigation report dated October 16, 2015 by Albert & Associates Architects, P.A. and GEOCON Laboratories, the soils at the site consist of topsoil and pavement materials underlain by lean clays to a depth of about 10 feet to 15 feet, at which depth the clays are underlain by silty sands. 

GEOTECHNICAL MODEL AND GROUNDWATER CONDITIONS

Based on the results of the borings, subsurface conditions on the project site can be generalized as follows:

STRATUM	TYPICAL STRATUM BASE (FEET)	MATERIAL DESCRIPTION	CONSISTENCY/DENSITY
Surface	0.2	Asphalt	N/A
1	1 to 2	Clayey Sand (SC)	Medium Dense
2	6 to 8	Fat Clay (CH)	Stiff
3	23 to 53	Sandy Lean Clay (CL) or Lean Clay with Sand (CL)	Medium Stiff to Very Stiff
4	38	Silty Sand (SM)	Medium Dense
5	Termination[1]	Poorly Graded Sand with Silt (SP-SM)	Medium Dense
Notable Variations	Asphalt was only present at Boring B-01.		

1. Borings B-01 and B-02 were terminated in this stratum.

The table includes generalizations and does not reflect specific conditions at each exploration point. Conditions encountered at each boring location are indicated on the individual boring logs. Stratification boundaries on the boring logs represent the approximate location of changes in soil types; in situ, the transition between materials may be gradual. Details for each boring can be found on the boring logs in **Exploration Results**.

Groundwater Conditions

The boreholes were observed while drilling and after completion for the presence and level of groundwater. Specific observations of groundwater level as recorded for each boring are noted on the boring logs in Appendix A, and are summarized below.

Groundwater was not observed in the borings while drilling or for the short duration that the borings were allowed to remain open. However, this does not necessarily mean these borings terminated above groundwater, or that the water levels summarized above are stable groundwater levels. Long term observations in piezometers or observation wells sealed from the influence of surface water are often required to define the field or in-situ groundwater level in materials of this type.

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff, and other factors that are not evident at the time of drilling. Therefore, the groundwater levels that may prevail during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the boring logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for this project.

EXPLORATION AND TESTING PROCEDURES

Field Exploration

Our field exploration work included the drilling and sampling of exploratory soil borings consistent with the following schedule.

NUMBER OF BORINGS	BORING DEPTH	PLANNED LOCATION
2	60	Building

The locations of field exploration points were established in the field by Terracon's exploration team using a hand-held GPS unit to establish boring locations with reference to known points. The accuracy of the exploration points is usually within 20 feet of the noted location.

We advanced the soil borings with a tractor-mounted drill rig using continuous flight augers (solid stem). We primarily obtained samples using the split-barrel sampling procedure. In the split-barrel sampling procedure, a standard, 2-inch O.D., split-barrel sampling spoon is driven into the boring with a 140-pound automatic SPT (Standard Penetration Test) hammer falling 30 inches. We recorded the number of blows required to advance the sampling spoon the last 12 inches of an 18-inch sampling interval as the standard penetration resistance value, N.

We also obtained representative samples by thin-walled tube samples to secure relatively undisturbed samples. Shelby tube samples were obtained hydraulically pushing a seamless steel tube with a sharpened cutting edge into the boring to obtain a relatively undisturbed sample of cohesive soil.

We reported the sampling depths, penetration distances, and the standard penetration resistance values on the boring logs. In the field, we placed the samples into containers, sealed them, and returned them to the laboratory for observation, testing and classification.

Our exploration team prepared field boring logs as part of the drilling operations. These field logs include visual classifications of the materials encountered during drilling and our interpretation of the subsurface conditions between samples. Final boring logs were prepared from the field logs. The final boring logs represent the engineer's interpretation of the field logs and include modifications based on observations and tests of the samples in the laboratory.

Laboratory Testing

The project engineer reviewed the field data and assigned various laboratory tests to better understand the engineering properties of the various soil strata as necessary for this project. Procedural standards noted below are for reference to methodology in general. In some cases, variations to methods are applied as a result of local practice or professional judgment. Standards noted below include reference to other, related standards. Such references are not necessarily applicable to describe the specific test performed.

- ASTM D2216-10 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
- ASTM D4318-10e1 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- ASTM D422-63(2007)e2 Standard Test Method for Particle-Size Analysis of Soils
- ASTM D2166/D2166M-13 Standard Test Method for Unconfined Compressive Strength of Cohesive Soil

The laboratory testing program may often include examination of soil samples by an engineer. Based on the material's texture and plasticity, we describe and classify the soil samples in accordance with the *Unified Soil Classification System*.

SITE CLASSIFICATION FOR SEISMIC DESIGN

Design of buildings and other structures subject to earthquake ground motions requires classification of the upper 100 feet of the site profile in accordance with Chapter 20 of ASCE 7. The Site Class types are listed below and are basically defined by an average value of either shear wave velocity, standard penetration resistance, or undrained shear strength.

- A. Hard Rock
- B. Rock
- C. Very dense soil and soft rock
- D. Stiff soil
- E. Soft clay soil
- F. Soils vulnerable to potential failure or collapse under seismic loading

Based on the results of our site characterization program, we conclude that Site Class D is appropriate for the subject site. Note that the scope of services did not include site profile determination to a depth of 100 feet. Explorations for this project extended to a maximum depth of 60 feet and the site classification assumes that materials encountered at the bottom of the deepest exploration continue to a depth of 100 feet. Based upon our **Expected Geotechnical Conditions**, we expect that the soil conditions below the maximum explored depth are consistent with the Site Class noted for this site.

GEOTECHNICAL OVERVIEW

Based on the results of the subsurface exploration, laboratory testing, and our analyses, it is our opinion that the proposed building can be supported on a shallow foundation system and slab-on-grade bearing on *Rammed Aggregate Piers (RAP)* improved soils or on a drilled shaft deep foundation system. The column dead loads would need to be reduced significantly to make shallow foundations on unimproved soils achievable.

Due to the large loads from the proposed building, mitigation of the soil will be required to limit the post-construction settlement to acceptable levels and allow for proper support of the building on a shallow foundation system. An economical and proven mitigation method for this site is *Rammed Aggregate Piers (RAP)* to be installed below the foundations and floor slabs carrying the large loads. RAP can be rapidly constructed at the project site and would provide a higher bearing capacity. The RAP would serve to improve the strength (e.g., modulus) of the existing lean clays (CL), allowing for an increase in the bearing capacity along with a reduction in total settlement to within tolerable limits.

The process is designed and performed only by specialty contractors. The specific design (depth and spacing) of the RAP units is developed in order to limit settlements to tolerable limits. We can provided contact information for RAP specialty contractors upon request.

As described in our **Exploration Results** and **Geotechnical Model**, fat clay (CH) soils are present at a depth of about 4 to 6 feet below existing grades in Boring B-01 and at a depth of about 2 to 8 feet in Boring B-02. The fat clay (CH) soils exhibit a moderate potential for shrink/swell related movement with variation in the moisture content of the soils. The expansive clays are not expected to have a significant influence on the building due to their limited thickness and their depth beneath the ground surface.

The foundation type of the proposed building is unknown at the time of the report. Provided this information is released, other foundation options may be explored. Final grades will greatly affect the post-construction settlements. This office should be notified upon completion of site grading plans to revisit the mitigation recommendations contained herein.

SITE PREPARATION

Our recommended site preparation specifications are included in this GeoReport as **Site Preparation Specifications**. These specifications include critical quality criteria as necessary to render the site in the state anticipated by our geotechnical engineering for foundations.

All existing above and below grade improvements (i.e. buildings, pavements, etc..) within the proposed development area, including concrete footings, slabs, asphalt and Portland cement pavement, any vegetation and topsoil, or other loose, soft or otherwise unsuitable material should be removed from the entire construction area.

Stripped materials consisting of vegetation and organic materials should be wasted off site, or used to vegetate landscaped areas or exposed slopes after completion of grading operations. Stripping depths between our boring locations and across the site could vary considerably as such we recommend actual stripping depths be evaluated by a representative of Terracon during construction to aid in preventing removal of excess material. The demolition phase may also encounter buried foundations, old fills, or other past site improvements. Former utility lines and utility backfill should be removed from beneath the building, and the resulting excavations should be properly backfilled as outlined herein. These conditions should be evaluated at the time of construction by the geotechnical engineer.

The in-place soils must be stable prior to the placement of fill materials or structures. After achieving finished subgrade elevation in cut areas, and prior to placing fill in any areas that are currently below finished subgrade elevation, the exposed subgrade should be evaluated to confirm that all soft, yielding and unsuitable materials have been removed. During this evaluation, those areas which are at finished subgrade or are to receive fill should be proof-rolled with a loaded tandem-axle dump truck or similar pneumatic-tired equipment with a minimum weight of 15 tons and a maximum weight of 25 tons. Proof-rolling will help reveal the presence of unstable materials that were not identified during our drilling program.

Any areas that yield or pump under proof-roll equipment should be mitigated. Mitigation might include processing to remove excess moisture, overexcavation and backfilling, chemical stabilization, or modification with geotextile reinforcement. Should mitigation of wet and pumping soils be required, our office should be notified so that appropriate mitigation can be prescribed by the project geotechnical engineer.

Material Types

Engineered fill should meet the following material property requirements:

FILL TYPE [1]	USCS CLASSIFICATION	Physical Properties	Acceptable Location for Placement
Lean Clay	CL	10 ≤ PI ≤ 25 LL ≤ 45	All locations and elevations
Clayey Sand	SC	6 ≤ PI ≤ 25 LL ≤ 45	All locations and elevations
On-Site Soils [2]	CL, SC	10 ≤ PI ≤ 25 LL ≤ 45	Typically appear suitable for re-use as fill

1. Controlled, compacted fill should consist of approved materials that are free of organic matter and debris. A sample of each material type should be submitted to the geotechnical engineer for evaluation.
2. Delineation of fat clays and lean clays should be performed in the field by a qualified geotechnical engineer or their representative, and could require additional laboratory testing.

Compaction Requirements

Engineered fill should be placed in accordance with the following requirements:

ITEM	DESCRIPTION
Fill Lift Thickness	9 inches or less in loose thickness when heavy, self-propelled compaction equipment is used 4 to 6 inches in loose thickness when hand-guided equipment (i.e. jumping jack or plate compactor) is used
Compaction Requirements [1]	98% of the material's standard Proctor maximum dry density (ASTM D 698), with stability present
Moisture Content	Within -2 to +2 percent of optimum moisture content as determined by the standard Proctor test at the time of placement and compaction
Minimum Testing Frequency Requirements	Building Area: 1 test per 2,500 square feet per lift Pavement Area: 1 test per 5,000 square feet per lift Utility Trench: 1 test per 100 linear feet per lift

1. The moisture content and compaction should be measured for each lift of engineered fill during placement. Should the results of the in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the test should be reworked and retested as required until the specified moisture and compaction requirements are achieved. The zone of fill compacted to meet this criteria should extend at least 5 feet horizontally beyond the building footprint.

Utility Trench Backfill

All trench excavations should be made with sufficient working space to permit construction including backfill placement and compaction. Utility trenches are a common source of water infiltration and migration. Utility trench backfill should consist of engineered fill as described above.

Grading and Drainage

All grades must provide effective drainage away from the building during and after construction. Water permitted to pond next to the building can result in greater soil movements than those discussed in this report. These greater movements can result in unacceptable differential floor slab and/or foundation movements, cracked slabs and walls, and roof leaks. Estimated movements described in this report are based on effective drainage for the life of the structure and cannot be relied upon if effective drainage is not maintained. The roof should have gutters/drains with downspouts that discharge onto splash blocks at a distance of at least 10 feet from the building.

Earthwork Construction Considerations

Although the exposed subgrade is anticipated to be relatively stable upon initial exposure, unstable subgrade conditions could develop during general construction operations, particularly if the soils are wetted or subjected to repetitive construction traffic. Soils exposed beneath existing pavements and slabs may be relatively wet and unstable. The use of light construction equipment would aid in reducing subgrade disturbance. Should unstable subgrade conditions develop, stabilization measures will need to be employed.

It is anticipated that shallow excavations for the proposed construction can be accomplished with conventional earthmoving equipment. Upon completion of filling and grading, care should be taken to maintain the subgrade moisture content prior to construction of floor slabs. Construction traffic over the completed subgrade should be avoided to the extent practical. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. If the subgrade should become frozen, desiccated, saturated, or disturbed, the affected material should be removed or these materials should be scarified, moisture conditioned, and recompacted prior to floor slab construction and observed by Terracon.

Surface water should not be allowed to pond on the site and soak into the soil during construction. Construction staging should provide drainage of surface water and precipitation away from the building areas. Any water that collects over or adjacent to construction areas should be promptly removed, along with any softened or disturbed soils. Surface water control in the form of sloping

surfaces, drainage ditches and trenches, and sump pits and pumps will be important to avoid ponding and associated delays due to precipitation and seepage.

As a minimum, excavations should be performed in accordance with OSHA 29 CFR, Part 1926, Subpart P, “Excavations” and its appendices, and in accordance with any applicable local, state, and federal safety regulations. The contractor should be aware that slope height, slope inclination, and excavation depth should in no instance exceed those specified by these safety regulations. Flatter slopes than those dictated by these regulations may be required depending upon the soil conditions encountered and other external factors. These regulations are strictly enforced and if they are not followed, the owner, contractor, and/or earthwork and utility subcontractor could be liable and subject to substantial penalties.

Construction site safety is the sole responsibility of the contractor who controls the means, methods and sequencing of construction operations. Under no circumstances shall the information provided herein be interpreted to mean that Terracon is assuming any responsibility for construction site safety or the contractor's activities; such responsibility shall neither be implied nor inferred.

Terracon should be retained during the construction phase of the project to observe earthwork and to perform necessary tests and observations during subgrade preparation; proofrolling; placement and compaction of controlled compacted fills; backfilling of excavations into the completed subgrade, and just prior to construction of building floor slabs.

SHALLOW FOUNDATIONS

Provided the site preparation recommendations outlined in this report are implemented, the soil conditions are conducive for support of the planned structure using shallow foundations provided the high column loads can be accommodated. The following paragraphs summarize design recommendations and construction considerations for a shallow foundation system.

Design Parameters

PARAMETER	ISOLATED COLUMNS	CONTINUOUS
Maximum net allowable bearing pressure on existing soils or engineered fill [1]	2,000 psf	2,000 psf
Required bearing stratum [2]	Stiff or better native soil or compacted engineered fill. Bearing stratum should be verified by Terracon.	
Minimum foundation width dimensions	24 inches	18 inches
Minimum embedment below finished grade	18 inches	18 inches
Uplift Resistance [3]	Total unit weight of concrete below grade (145 pcf) + total unit weight of soil above footing (110 pcf).	
Ultimate coefficient of sliding friction [4]	0.32	
Ultimate passive pressure [4]	250 pcf, equivalent fluid density	
Est. total settlement from structural loads [5]	< 2 inch	< 2 inch
Estimated differential settlement [5]	< 1 inch over 30 feet	<1 inch over 40 feet
Estimated shrink/swell movement	< 1 inch	< 1 inch

1. The maximum net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. An appropriate factor of safety has been applied. These bearing pressure values can be increased by 1/3 for transient loads.
2. Unsuitable or soft soils should be undercut, and the footings should be deepened to bear on the competent bearing stratum or could bear on lean concrete extending from the foundation base to competent bearing stratum.
3. Apply Factor of safety of at least 1.5 to this value when designing for uplift forces.
4. The shallow foundation excavation sides must be nearly vertical and the concrete should be placed neat against these vertical faces for the passive earth pressure values to be valid. Passive resistance in the upper 3 feet of the soil profile should be neglected. If passive resistance is used to resist lateral loads, the base friction should be neglected. Apply a factor of safety of at least 2.0 to this value when designing for lateral force resistance.
5. Settlements as a result of the structural loads as noted in **Project Description**.
6. Differential settlement between areas and existing structures may be on the order of the total settlement.

Rammed Aggregate Pier (RAP) Considerations

The RAP would reinforce the existing subsoils on the site and allow shallow foundation support of the structural loads of the building. This allows for a significantly higher design bearing pressure for footing design while controlling total and differential settlements by modifying the ground response parameters of the composite soil mass below the footings.

The subgrade should be stripped of the existing topsoil and vegetation and all utilities should be removed and/or rerouted. Next, proof-rolling with a loaded tandem-axle dump truck should be utilized in order to delineate any areas within the building area that will require stabilization prior to fill placement in order to establish finish grade.

RAP is typically a proprietary system that is provided as a design-build service. The elements are required to be constructed by an installer licensed by the RAP designer, who should provide detailed design calculations sealed by a professional engineer licensed in the State of Mississippi.

The RAP support elements are typically constructed by drilled a 24 to 36-inch hole, removing a volume of soil, then building a bottom bulb to clean, open-graded stone while vertically pre-stressing and pre-straining subsoils underlying the bottom bulb. The piers are built on top of the bottom bulb, using well-graded base course stone placed in thin lifts (12-inches compacted thickness). The proprietary design calculations should demonstrate that RAP reinforcement is estimated to control long-term total and differential settlements to less than 1-inch and ½ - inch, respectively.

In order to verify that the RAP is properly installed, it is recommended that a geotechnical engineer or qualified soils technician who is independent of the contractor perform continuous inspection during RAP installation. An accurate record should be kept of the date, depth of penetration, bearing material and other pertinent data for each compacted stone column.

The base of all foundation excavations should be free of water and soft soil, and the top of the RAP elements should be exposed prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Should the soils at bearing level become excessively dry, disturbed or saturated, or frozen, the affected soils should be removed prior to placing concrete. A lean concrete mud-mat should be placed over the bearing soils if the excavations must remain open for an extended period of time. It is recommended that the geotechnical engineer be retained to observe and test the soil foundation bearing materials.

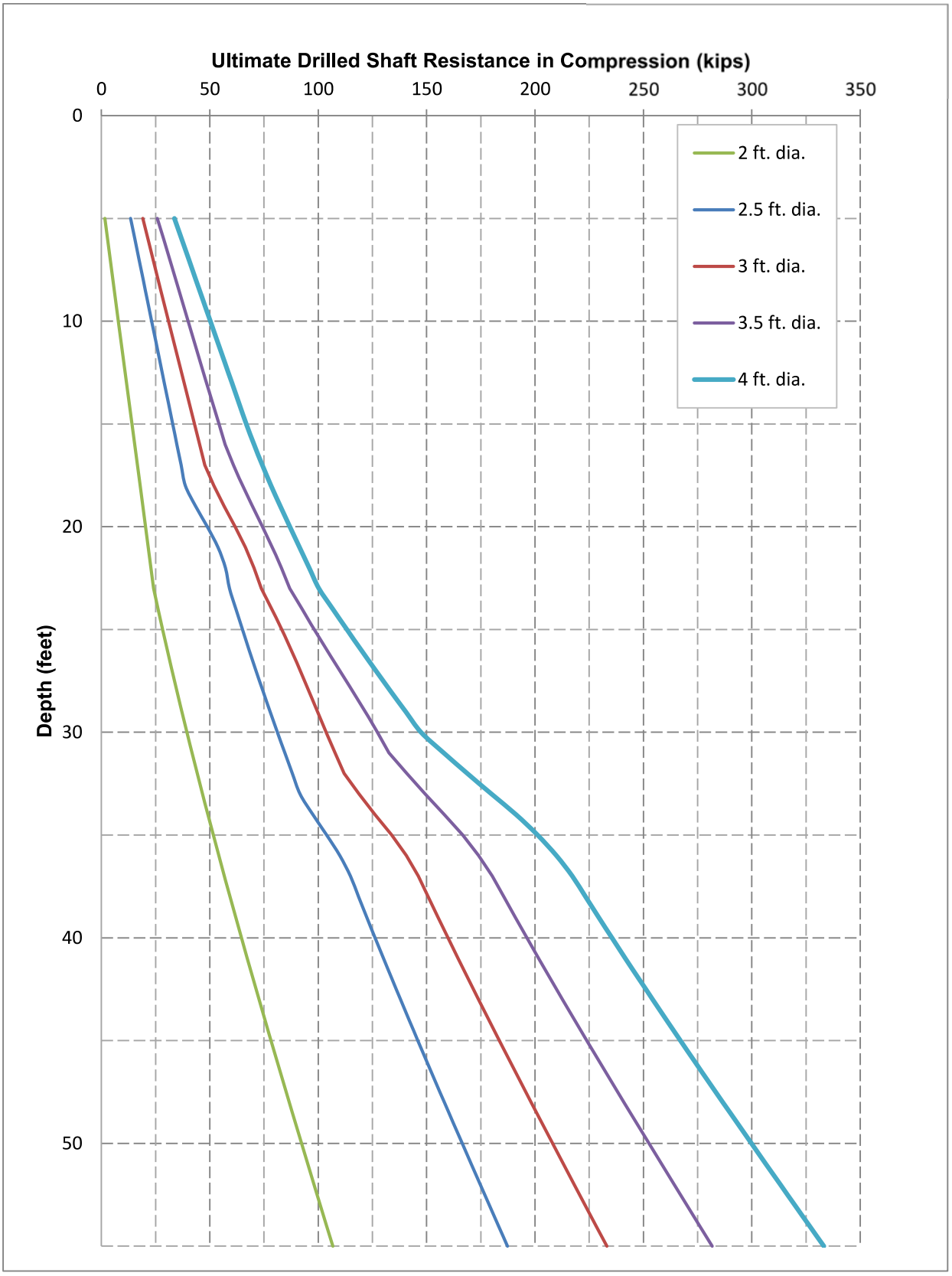
DEEP FOUNDATIONS

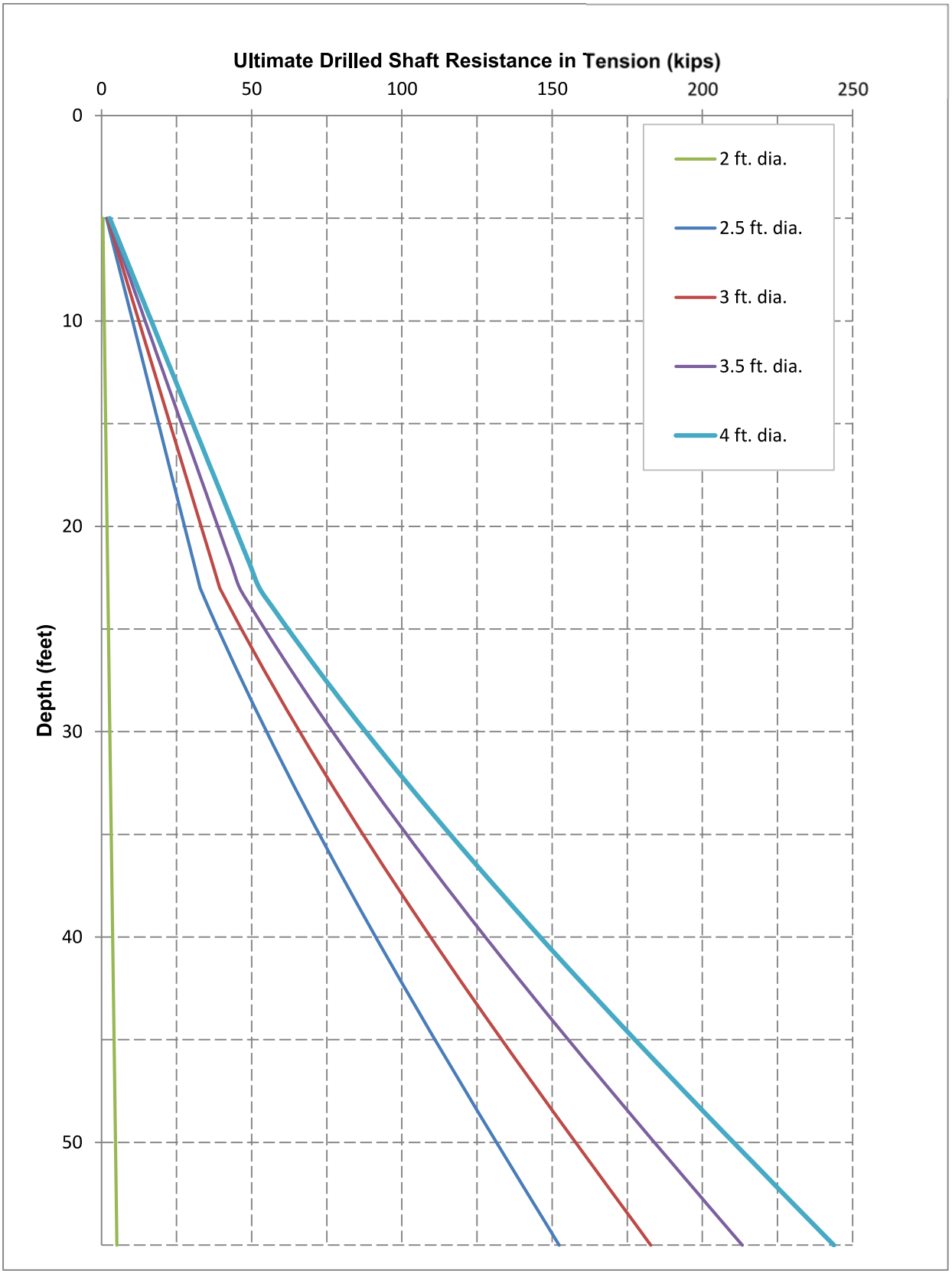
Drilled Shaft Foundations

The proposed building can be supported on a deep foundation system consisting of drilled shafts as an alternative to shallow foundations and Rammed Aggregate Piers. Drilled shafts are particularly efficient in resisting uplift and horizontal forces. The drilled shafts should be used to support the column loads and grade beams which in-turn support the off-grade slab. The following sections provide guideline design information and construction recommendations for deep foundations.

Axial Capacities

We have calculated compression and uplift capacities for various shaft diameters and installation depths for static load conditions using contributions from skin friction and end bearing. The following graphs provide our recommendations for ultimate capacities of individual drilled shafts. A factor of safety of 3 should be used to preclude the necessity of a pile load test. A factor of safety of 2 can be used for compression capacities if a pile load test is performed. Shafts should be installed to a depth of at least 20 feet below the existing or final grades, whichever is lower.


Ultimate Drilled Shaft Resistance in Compression (kips)
0
50
100
150
200
250
300
350
Depth (feet)
0
10
20
30
40
50
2 ft. dia.
2.5 ft. dia.
3 ft. dia.
3.5 ft. dia.
4 ft. dia.


Ultimate Drilled Shaft Resistance in Tension (kips)
0
50
100
150
200
250
Depth (feet)
0
10
20
30
40
50
2 ft. dia.
2.5 ft. dia.
3 ft. dia.
3.5 ft. dia.
4 ft. dia.

These capacities consider failure at the shaft/soil interface, and bearing failure only. Shafts should be spaced no closer than 3 shaft diameters (center to center). For shaft groups, the final design should be checked to evaluate the need for group efficiency reductions. The allowable load can be increased by 30% for highly transient loads such as maximum wind loads. Provisions for structural design of the foundation units have not been made. Structural design of the foundations should be performed by a licensed structural engineer.

Lateral Capacity

We have not performed lateral capacity analyses. If lateral loads exceed 10 kips/shaft, a detailed analysis of lateral load capacity should be performed after the actual loading conditions have been determined and after the foundation size has been selected.

Shaft Load Test

Capacity estimates as provided in the table above are based upon our field testing and estimates of limiting skin friction. Significant variation in shaft capacities is common as a result in variability in shaft installation processes. A field load test should be performed to verify the predicted axial capacities. The load test should consist of the installation of the predominant shaft size planned for construction with the planned installation methods. The test shaft should be loaded to a minimum of 200% of its design capacity. We should oversee the load testing program and reevaluate our capacity predictions based upon the test results. Observation of shaft installation is necessary to confirm actual shaft capacities, and, therefore, required shaft lengths.

Settlement

Shafts installed to a depth of at least 20 feet below existing or final grades as recommended should experience nominal settlement. Movement of less than one (1) inch is expected for the allowable shaft load. These movements are associated with the loading from the structure and would be in addition to any fill-induced settlements, where applicable.

However, if more than two feet of fill will be placed at this site to achieve final grade, fill induced settlements may create downdrag effects on the piles and will reduce the allowable capacity of the pile. Our office should be notified if fill in excess of two feet is planned so that we can evaluate the effect on the pile capacity, and other potential settlement related development issues.

Drilled Shaft Construction

The subsurface conditions predominantly consisted of medium stiff to stiff, lean to fat clays underlain by medium dense silty sands. The clay soils should be relatively easy to drill through using conventional auger drilling equipment. The shaft contractor should have temporary steel casing available to maintain stability of the upper portions of the excavation. More difficult drilling conditions can be expected in the silt layers.

Prediction of excavation cave-in and the need for casing or mud slurry methods is not exact and depends on many factors including but not limited to: soil strength, sand/silt content, excavation and drilling methods, planned diameter and depth of the excavation, water table at time of construction, amount of time shaft excavation will be open, etc. The subsurface information suggests that open excavation drilling may be possible for short term shaft excavations in clay within the upper 25 to 30 feet. However, no exact determinations or depth of excavation caving are possible. For example, if a planned shaft is to be advanced and terminated entirely in a clay formation, then casing/mud may not be necessary; however, sand pockets and seams that may have not been detected during drilling may be encountered which may require temporary casing and/or the slurry method to be used. The need for casing/mud slurry is best evaluated at the time of actual construction. The occurrence of sand and sand layering and related ground water will cause difficulties with shaft excavation stability.

The concrete for the drilled shafts should be a flowable mix that can achieve the required compressive strength with a slump of 7 to 9 inches. The concrete should be placed immediately after excavation of the shaft. If the mud slurry method is used, the discharge should be placed at the base of the excavation prior to pumping the concrete, and the discharge should be continuously raised during the excavation, with at least five feet of concrete head should be maintained over the discharge.

Proper construction techniques and quality control are important for the integrity of the deep foundation system. These construction efforts should be monitored and documented by the geotechnical engineer's representative.

Other Considerations

The locations, depths, and loads on the new shallow foundations need to consider the impact they will have on any adjacent existing foundations or below grade elements. The new shallow foundations should be located outside the influence zone of the adjacent foundations typically defined by a line extending downward at 45 degrees from the outside edge of the adjacent foundation and out a horizontal distance equal to the width of the foundation.

FLOOR SLABS

Design Parameters

ITEM	DESCRIPTION
Floor slab support [1, 2]	Upper 9-inches of subgrade should be compacted to 98% of the material's standard Proctor maximum dry density (ASTM D 698) as outlined **Site Preparation**
Modulus of subgrade reaction	100 pounds per square inch per inch (psi/in) for point loading conditions
Aggregate base course/capillary break [3]	6 inches of free draining granular material

1. Where floor slabs are tied to perimeter walls or turn-down slabs to meet structural or other construction objectives, the structural engineer should account for potential differential settlement through use of sufficient control joints, appropriate reinforcing or other means.
2. Floor subgrades should be maintained in a relatively moist condition until floor slabs are constructed. If the subgrade should become desiccated prior to construction of floor slabs, the affected material should be removed or the materials scarified, moistened, and recompacted. Upon completion of grading operations in the building areas, care should be taken to maintain the recommended subgrade moisture content and density prior to construction of the building floor slabs.
3. The floor slab design should include a capillary break, comprised of free-draining, compacted, granular material, at least 6 inches thick and can be considered as part of the low volume change zone. Free-draining granular material should have less than 5 percent fines (material passing the #200 sieve). Other design considerations such as cold temperatures and condensation development could warrant more extensive design provisions.

Where appropriate, saw-cut control joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations refer to the ACI Design Manual.

Floor Slab Construction Considerations

On most project sites, the site grading is generally accomplished early in the construction phase. However as construction proceeds, the subgrade may be disturbed due to utility excavations, construction traffic, desiccation, rainfall, etc. As a result, the floor slab subgrade may not be suitable for placement of base rock and concrete, and corrective action will be required.

Terracon should review the condition of the floor slab subgrades immediately prior to placement of the granular leveling course and construction of the slabs. Particular attention should be paid to high traffic areas that were rutted and disturbed earlier and to areas containing backfilled trenches. Areas where unsuitable conditions are located should be repaired by removing and replacing the affected material with properly compacted fill.

The use of a vapor retarder should be considered beneath concrete slabs on grade that will be covered with wood, tile, carpet or other moisture sensitive or impervious coverings, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer and slab contractor should refer to ACI 302 and ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder.

GENERAL COMMENTS

Our work is conducted with the understanding of the project as noted in **Project Understanding**. Verification of any stated assumptions and revision of our understanding to reflect actual conditions is important to our work, and the design team should collaborate with Terracon to confirm this understanding.

The design team should collaborate with Terracon to prepare the final design plans and specifications. This facilitates the incorporation of our opinions related to implementation of our geotechnical recommendations.

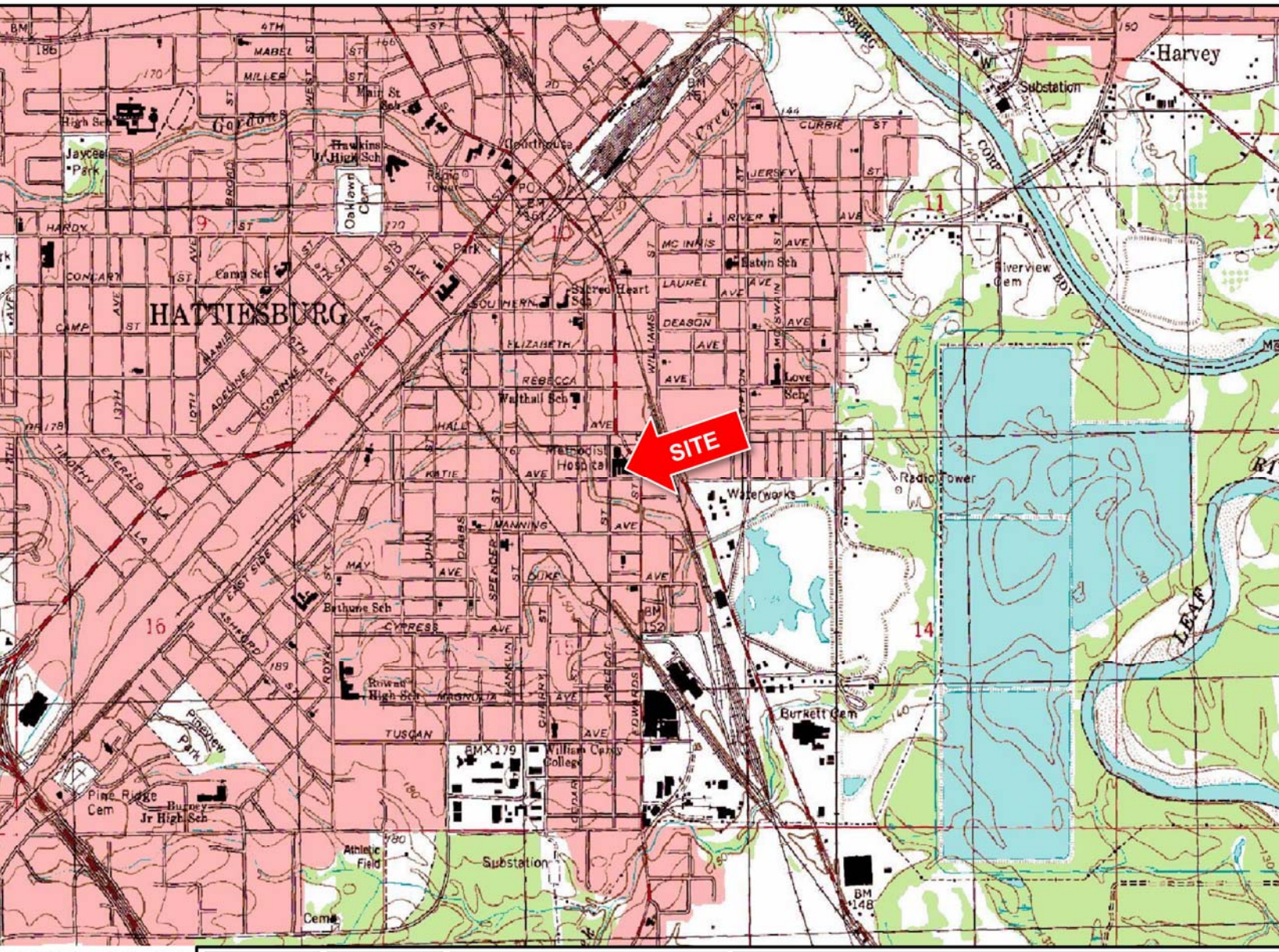
Our analysis and opinions are based upon our understanding of the geotechnical conditions in the area, the data obtained from the site exploration performed and from our understanding of the project. Variations will occur between exploration point locations, across the site, or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. So, Terracon should be retained to provide observation and testing services during grading, excavation, foundation construction and other earth-related construction phases of the project. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our scope of services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence are intended for the exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for that specific purposes to obtain the specific level of detail necessary for costing. Site safety, and other cost estimating including, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

APPENDIX A
EXPLORATION AND LABORATORY RESULTS



HIC MAP IMAGE COURTESY OF
S. GEOLOGICAL SURVEY
GLES INCLUDE: HATTIESBURG,
1996) and CARTERVILLE, MS
(1/1/1985).

OR GENERAL LOCATION ONLY,
TENDED FOR CONSTRUCTION
PURPOSES

Project Manager:	NKL
Drawn by:	NKL
Checked by:	.IWW
Approved by:	JWW

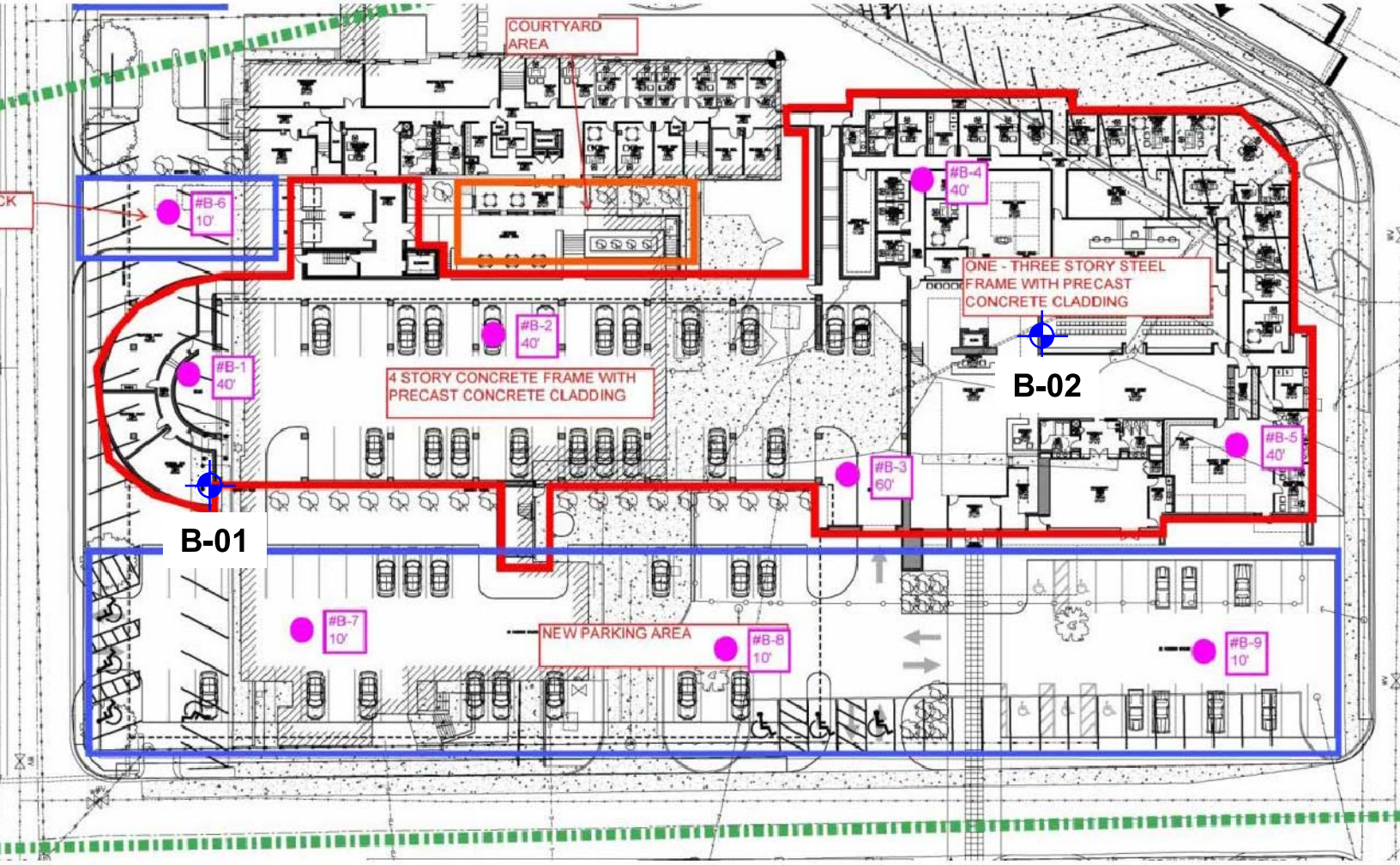
Project No.	EB165058
Scale:	1"=2,000'
File Name:	Exhibit A-1.EB165058
Date:	May 2016

Terracon
859 S Pear Orchard Rd
Ridgeland, MS 39157-5105

SITE LOCATION PLAN

Public Service Complex Police and Court Building

Northeast of Intersection of Katie Avenue and Edwards Street
Hattiesburg, Mississippi



LEGEND

Approximate Exploration Location

FOR GENERAL LOCATION
IS NOT INTENDED FOR
RUCTION PURPOSES

Project Manager: NKL	Project No. EB165058
Drawn by: NKL	Scale: NTS
Checked by: JWW	File Name: Exhibit A-2.EB165058
Approved by: JWW	Date: June 2016

Terracon
859 Pear Orchard Road Ridgeland, Mississippi 39157
PHONE (601) 956 4467 FAX (601) 956 9533

BORING EXPLORATION PLAN

Public Service Complex Police and Court Building

Northeast of Intersection of Katie Avenue and Edwards Street
Hattiesburg, Mississippi

BORING LOG NO. B-01

PROJECT: Public Service Complex Police and Court Building

CLIENT: Albert & Associates Architects, P.A.
Hattiesburg, Mississippi

SITE: Katie Avenue and Edwards Street
Hattiesburg, Mississippi

LOCATION See Exhibit A-2

Latitude: 31.316147° Longitude: -89.286394°

DEPTH	GRAPHIC LOG		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI	PERCENT FINES
0.2		**ASPHALT**				--				9			
1.0		**CLAYEY SAND (SC)**, red, medium dense											
		LEAN CLAY (CL), brown and gray, medium stiff				0.75 (HP)	UC	0.41	14.8	25	95		
4.0		**FAT CLAY (CH)**, gray and brown and red, stiff	5			1.75 (HP)				24		54-14-40	
6.0		**LEAN CLAY WITH SAND (CL)**, gray, very stiff				3.25 (HP)				19			
						3.00 (HP)				19			
			10										
		- medium stiff below 11'				1.00 (HP)	UC	0.99	6	20	109		
			15			1.25 (HP)				21			
			20			2-4-5 N=9				21			
23.0		**SILTY SAND (SM)**, gray, medium dense	25			3-6-6 N=12				23			21
			30			3-7-9 N=16				23			
			35			4-7-10 N=17				26			
38.0		**POORLY GRADED SAND WITH SILT (SP-SM)**, gray, medium dense	40			3-8-9 N=17				22			8
			45			4-7-11 N=18				22			
			50			3-8-11 N=19				30			

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Solid-Flight Auger: 0' - 16'
Rotary Wash: 16' - 60'

Abandonment Method:
Borings backfilled with cement-bentonite grout upon completion.

See Appendix B for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed during augering

Terracon
859 S Pear Orchard Rd
Ridgeland, MS

Boring Started: 5/24/2016 Boring Completed: 5/24/2016

Drill Rig: Tractor Driller: C. Warren

Project No.: EB165058 Exhibit: A-3

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL SLOGS.EB165058.GPJ TERRACON2015.GDT 6/3/16

BORING LOG NO. B-01

PROJECT: Public Service Complex Police and Court Building

CLIENT: Albert & Associates Architects, P.A.
Hattiesburg, Mississippi

SITE: Katie Avenue and Edwards Street
Hattiesburg, Mississippi

LOCATION See Exhibit A-2

Latitude: 31.316147° Longitude: -89.286394°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI	PERCENT FINES
	POORLY GRADED SAND WITH SILT (SP-SM), gray, medium dense *(continued)*											
		55			4-8-12 N=20				19			
	60.0	60			3-7-13 N=20				17			
	Boring Terminated at 60 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Solid-Flight Auger: 0' - 16'
Rotary Wash: 16' - 60'

Abandonment Method:
Borings backfilled with cement-bentonite grout upon completion.

See Appendix B for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed during augering

Terracon
859 S Pear Orchard Rd
Ridgeland, MS

Boring Started: 5/24/2016 Boring Completed: 5/24/2016

Drill Rig: Tractor Driller: C. Warren

Project No.: EB165058 Exhibit: A-3

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL SLOGS.EB165058.GPJ TERRACON2015.GDT 6/3/16

BORING LOG NO. B-02

PROJECT: Public Service Complex Police and Court Building

CLIENT: Albert & Associates Architects, P.A.
Hattiesburg, Mississippi

SITE: Katie Avenue and Edwards Street
Hattiesburg, Mississippi

LOCATION See Exhibit A-2

Latitude: 31.316277° Longitude: -89.285511°

DEPTH	GRAPHIC LOG		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI	PERCENT FINES
		CLAYEY SAND (SC), trace gravel, red, medium dense				--				7			
2.0		**FAT CLAY (CH)**, brown and gray, stiff				3.00 (HP)				20			
			5			3.25 (HP)				28			
						2.50 (HP)	UC	1.96	13.8	20	109		
8.0		**SANDY LEAN CLAY (CL)**, gray, very stiff				3.00 (HP)				15			
			10										
		- medium stiff below 11'				1-2-3 N=5				20		34-17-17	
14.0		**SILTY SAND (SM)**, gray and brown, medium dense	15			3-9-9 N=18				7			
			20			3-7-10 N=17				22			
			25			4-9-14 N=23				25			41
			30			5-12-14 N=26				20			
		- with gravel from 31' - 35'	35			3-6-9 N=15				18			
38.0		**LEAN CLAY WITH SAND (CL)**, dark gray, medium stiff	40			2-3-3 N=6				38			
		- stiff below 43'	45			1.50 (HP)				35			
			50			3-6-8 N=14				31			

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Solid-Flight Auger: 0' - 16'
Rotary Wash: 16' - 60'

Abandonment Method:
Borings backfilled with cement-bentonite grout upon completion.

See Appendix B for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed during augering

Terracon
859 S Pear Orchard Rd
Ridgeland, MS

Boring Started: 5/23/2016 Boring Completed: 5/23/2016

Drill Rig: Tractor Driller: C. Warren

Project No.: EB165058 Exhibit: A-4

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL SLOGS.EB165058.GPJ TERRACON2015.GDT 6/3/16

BORING LOG NO. B-02

PROJECT: Public Service Complex Police and Court Building

CLIENT: Albert & Associates Architects, P.A.
Hattiesburg, Mississippi

SITE: Katie Avenue and Edwards Street
Hattiesburg, Mississippi

LOCATION See Exhibit A-2

Latitude: 31.316277° Longitude: -89.285511°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI	PERCENT FINES
	53.0 **LEAN CLAY WITH SAND (CL)**, dark gray, medium stiff *(continued)*											
	POORLY GRADED SAND WITH SILT (SP-SM), gray, medium dense	55			5-11-14 N=25				21			11
	60.0											
	Boring Terminated at 60 Feet	60			6-10-12 N=22				20			

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Solid-Flight Auger: 0' - 16'
Rotary Wash: 16' - 60'

Abandonment Method:
Borings backfilled with cement-bentonite grout upon completion.

See Appendix B for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed during augering

Terracon
859 S Pear Orchard Rd
Ridgeland, MS

Boring Started: 5/23/2016 Boring Completed: 5/23/2016

Drill Rig: Tractor Driller: C. Warren

Project No.: EB165058 Exhibit: A-4

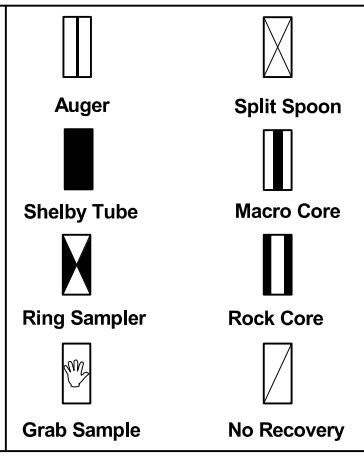
THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL SLOGS.EB165058.GPJ TERRACON2015.GDT 6/3/16

APPENDIX B
SUPPORTING DOCUMENTS

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

SAMPLING



WATER LEVEL



Water Initially Encountered

Water Level After a Specified Period of Time

Water Level After a Specified Period of Time

Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.

FIELD TESTS

(HP)	Hand Penetrometer
(T)	Torvane
(b/f)	Standard Penetration Test (blows per foot)
(PID)	Photo-Ionization Detector
(OVA)	Organic Vapor Analyzer

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance Includes gravels, sands and silts.			CONSISTENCY OF FINE-GRAINED SOILS (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance			
Descriptive Term (Density)	**Standard Penetration or N-Value Blows/Ft.**	**Ring Sampler Blows/Ft.**	**Descriptive Term (Consistency)**	**Unconfined Compressive Strength, Qu, tsf**	**Standard Penetration or N-Value Blows/Ft.**	**Ring Sampler Blows/Ft.**
Very Loose	0 - 3	0 - 6	Very Soft	less than 0.25	0 - 1	< 3
Loose	4 - 9	7 - 18	Soft	0.25 to 0.50	2 - 4	3 - 4
Medium Dense	10 - 29	19 - 58	Medium-Stiff	0.50 to 1.00	4 - 8	5 - 9
Dense	30 - 50	59 - 98	Stiff	1.00 to 2.00	8 - 15	10 - 18
Very Dense	> 50	≥ 99	Very Stiff	2.00 to 4.00	15 - 30	19 - 42
			Hard	> 4.00	> 30	> 42

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 15
With	15 - 29
Modifier	> 30

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300 mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm
Silt or Clay	Passing #200 sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 5
With	5 - 12
Modifier	> 12

PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1 - 10
Medium	11 - 30
High	> 30

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					Soil Classification	
					Group Symbol	Group Name [B]
Coarse Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$ [E]		GW	Well-graded gravel [F]
			$Cu < 4$ and/or $1 > Cc > 3$ [E]		GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH		GM	Silty gravel [F,G,H]
			Fines classify as CL or CH		GC	Clayey gravel [F,G,H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$ [E]		SW	Well-graded sand [I]
			$Cu < 6$ and/or $1 > Cc > 3$ [E]		SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH		SM	Silty sand [G,H,I]
			Fines classify as CL or CH		SC	Clayey sand [G,H,I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots on or above "A" line [J]		CL	Lean clay [K,L,M]
			PI < 4 or plots below "A" line [J]		ML	Silt [K,L,M]
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay [K,L,M,N]
			Liquid limit - not dried			Organic silt [K,L,M,O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line		CH	Fat clay [K,L,M]
			PI plots below "A" line		MH	Elastic Silt [K,L,M]
		Organic:	Liquid limit - oven dried	< 0.75	OH	Organic clay [K,L,M,P]
			Liquid limit - not dried			Organic silt [K,L,M,Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

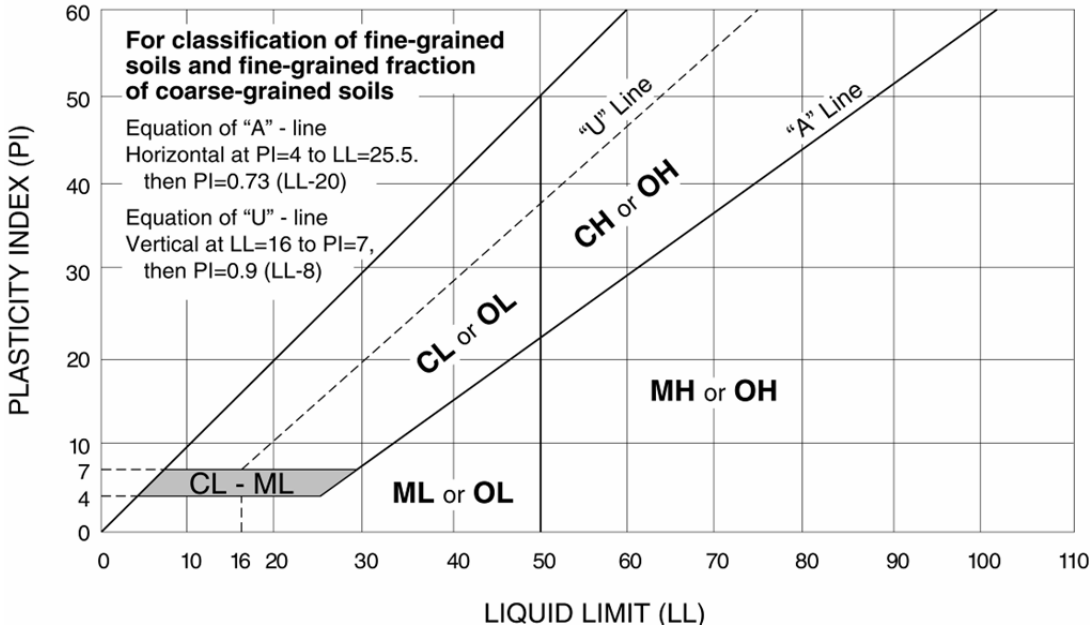
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.



Terracon

SECTION 02 41 00
BUILDING AND STRUCTURE DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Building demolition excluding removal of hazardous materials and toxic substances.

B. Selective demolition of built site elements.

C. Selective demolition of building elements for alteration purposes.

D. Abandonment and removal of existing utilities and utility structures.

1.02 RELATED REQUIREMENTS

A. Section 01 10 00 - Summary: Limitations on General Contractor's use of site and premises.

B. Section 01 10 00 - Summary: Description of items to be salvaged or removed for re-use by General Contractor.

C. Section 01 50 00 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

D. Section 01 60 00 - Product Requirements: Handling and storage of items removed for salvage and relocation.

E. Section 01 70 00 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.

F. Section 02 82 00 - Hazardous Materials Remediation: Other hazardous material remediation.

1.03 REFERENCE STANDARDS

A. 29 CFR 1926 - U.S. Occupational Safety and Health Standards; current edition.

B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2013.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Site Plan: Showing:
   1. Vegetation to be protected.
   2. Areas for temporary construction and field offices.
   3. Areas for temporary and permanent placement of removed materials.

C. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
   1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences.
   2. Identify demolition firm and submit qualifications.
   3. Include a summary of safety procedures.

D. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

1.05 QUALITY ASSURANCE

A. Demolition Firm Qualifications: Company specializing in the type of work required.

PART 2 PRODUCTS

2.01 MATERIALS

A. Fill Material: See Section 31 23 18 Earthwork For Structures.

PART 3 EXECUTION

3.01 SCOPE

A. Remove the entire buildings designated to be demolished in demolition site plan.

B. Remove paving and curbs as required to accomplish new work.

C. Remove all other paving and curbs within construction limits indicated on drawings.

D. Within area of new construction, completely remove all existing (found) foundation walls and footings to the extent that they must be removed not to compromise new structural foundations shown for new construction. All foundation elements planned (or decided) to remain are to be documented and reported the structural engineer for approval first. The structural engineer has the final approval of any existing foundation components to remain with in the new construction area.

E. Outside area of new construction, remove foundation walls and footings to a minimum of 2 feet below finished grade.

F. Remove concrete slabs on grade within site boundaries.

G. Remove underground tanks that contain or once contained petroleum products; fill and bury other types of tanks unless location of underground tanks conflict with planned foundations for the new construction.

H. Remove manholes and manhole covers, curb inlets and catch basins as directed in Civil Drawings.

I. Remove fences and gates.

J. Remove creosote-treated wood utility poles.

K. Remove other items indicated, for salvage, relocation, and recycling.

L. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill as specified in sections 31 23 00 and 31 23 18..

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
   1. Obtain required permits.
   2. Use of explosives is not permitted.
   3. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
   4. Provide, erect, and maintain temporary barriers and security devices.
   5. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
   6. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
   7. Do not close or obstruct roadways or sidewalks without permit.
   8. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
   9. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.

B. Do not begin removal until receipt of notification to proceed from Southern Mississippi Investment Company, Inc. and the City of Hattiesburg.

C. Do not begin removal until built elements to be salvaged or relocated have been removed.

D. Do not begin removal until vegetation to be relocated has been removed and specified measures have been taken to protect vegetation to remain.

E. Protect existing structures and other elements that are not to be removed.
   1. Provide bracing and shoring.
   2. Prevent movement or settlement of adjacent structures.
   3. Stop work immediately if adjacent structures appear to be in danger.

F. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

G. If hazardous materials are discovered during removal operations, stop work and notify Albert & McCleskey Associates Architects and Southern Mississippi Investment Company, Inc.; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury. A Hazardous Materials survey has been conducted for this property. This work must me done and all hazardous materials remediated before any work to be done in this section.

H. Perform demolition in a manner that maximizes salvage and recycling of materials.
   1. Dismantle existing construction and separate materials.
   2. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.

I. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.

J. Underground Storage Tanks: Remove and dispose of as specified in Section 02 65 00.

3.03 EXISTING UTILITIES

A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Southern Mississippi Investment Company, Inc. and the City of Hattiesburg.

E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Southern Mississippi Investment Company, Inc. and the City of Hattiesburg.

F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.

G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

H. Prepare building demolition areas by disconnecting and capping utilities outside the demolition zone; identify and mark utilities to be subsequently reconnected, in same manner as other utilities to remain.

3.04 SELECTIVE DEMOLITION FOR ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as shown.
   2. Report discrepancies to Albert & McCleskey Associates Architects before disturbing existing installation.
   3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.

B. Remove existing work as indicated and as required to accomplish new work.
   1. Remove items indicated on drawings.

C. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.

1. Verify that abandoned services serve only abandoned facilities before removal.
2. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.

D. Protect existing work to remain.
1. Prevent movement of structure; provide shoring and bracing if necessary.
2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
3. Repair adjacent construction and finishes damaged during removal work.
4. Patch as specified for patching new work.

3.05 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash from site.

B. Leave site in clean condition, ready for subsequent work.

C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

SECTION 02 41 19

DEBRIS AND SALVAGE REMOVAL

PART ONE – GENERAL

1.01 SCOPE

A. This Section covers all operations in connection with clearing and demolition. Perform all stripping and demolition and other work necessary for the completion of the work specified herein and as shown on the drawings.

B. The Contractor shall familiarize himself with the existing site conditions in the best manner possible to verify the amount of clearing and demolition that will be performed.

1.02 MATERIALS

A. The Contractor shall remove all debris from the building. Debris shall be considered obviously destroyed building parts and contents. The building shall be swept clean at completion of debris removal.

B. Salvage shall be defined as necessary building parts to be reused or to be retained for the purpose of restoration study by the Architect. The Contractor shall remove the building contents and salvage and place them in an area designated by the Owner and Architect for review for storage. All debris, including the salvage not selected for storage, is to be removed from the site by the Contractor. The Architect will be on the site to supervise the removal of the debris and the protection of the salvage.

1.03 PROTECTION OF EXISTING WORK

A. Provide barriers, fences, coverings, bumpers, weatherproofing, and other protection that will minimize damage to existing work.

1.04 DEMOLITION

A. Demolition shall consist of the removal and disposal of all existing construction required to be removed as per the drawings, including all debris and all rubbish from the designated areas.

B. Demolition of existing and ascertain possible hazards. Remove walls and partitions indicated, without damaging the structural system of the existing building. Work structures by parts, shore against collapse. Chute and load debris directly into trucks when possible. Remove debris as it is produced and do not allow it to accumulate on the site. Constantly restrain dust and water from infiltrating areas not requiring demolition.

1.05 DISCONNECTING MECHANICAL, ELECTRICAL AND PLUMBING

A. Each subcontractor shall disconnect and properly cap utility connections from all items designated for demolition or removal. They shall be responsible for the removal of Work that normally is installed under their jurisdiction, unless notified by the General Contractor in advance.

B. All existing mechanical, electrical and plumbing systems are to be removed in preparation for new systems. See notes on drawings also.

1.06 PROTECTED AND SECURED BUILDING

A. All buildings are to be secure. The fence is to remain to secure the site.

END OF SECTION

SECTION 031000: CONCRETE FORMING AND ACCESSORIES

PART 1 GENERAL

1.1 RELATED SECTIONS

A. Division 01 Sections

B. Section 032000 - Concrete Reinforcing.

C. Section 033000 - Cast-in-Place Concrete.

1.2 REFERENCES

ACI 117 – Standard Specifications for Tolerances for Concrete Construction and Materials.

ACI 301 – Standard Specifications for Structural Concrete.

ACI 318 – Building Code Requirements for Structural Concrete.

ACI 347 – Guide to Formwork for Concrete.

ASTM D1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

ASTM D6817 – Standard Specification for Rigid Cellular Polystyrene Geofoam.

ASTM E96 – Standard Test Methods for Water Vapor Transmission of Materials.

ASTM E154 – Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.

ASTM E1643 – Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.

ASTM E1745 – Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.

ASTM E1993 – Standard Specification for Bituminous Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.

ASTM F1249 – Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor.

1.3 DEFINITIONS

A. Architectural Concrete: All concrete members exposed to public view are classified as Architectural Concrete and shall comply with the Architectural Concrete provisions in this specification and ACI 301.

1.4 SUBMITTALS

A. Submit locations of construction joints in framed construction for approval.

B. Submit manufacturer's data for:

1. Vapor Retarder
2. Expansion/Isolation Joint Filler.
3. Waterstops.

1.5 DESIGN OF FORMWORK

A. Design of formwork, shoring, and reshoring and its removal is the Contractor's responsibility.

B. Design of formwork, shoring, and reshoring shall conform to ACI 117, ACI 301, ACI 318, and ACI 347.

C. Design formwork in a manner such that existing or new construction is not overloaded.

PART 2 PRODUCTS

2.1 FORM MATERIALS

A. Form Material: Wood, plywood, metal, fiberglass or a combination of these, with sufficient strength to prevent distortion.

B. Form Definitions
1. Standard Forms: No form-facing material required. Standard forms are acceptable everywhere except for Architectural Concrete elements.
2. Architectural Concrete Forms: Form-facing material shall be plywood, tempered concrete-form-grade hardboard, metal (unrusted) or plastic that will produce a smooth, uniform texture on the concrete. Do not use form-facing material with raised grain, torn edges, worn edges, patches, dents, or other defects that will impair the texture of the exposed concrete surfaces. Intent is that when the forms are removed, the exposed concrete surfaces will be free from all blemishes. Architectural concrete forms are required for all concrete elements indicated as Architectural Concrete.

2.2 FORMWORK ACCESSORIES

A. Formwork Accessories: Commercially manufactured products, including ties and hangers. Do not use nonfabricated wire form ties.

2.3 FORM RELEASE AGENT

A. Form release agent shall not bond with, stain, nor adversely affect concrete surfaces.

2.4 VAPOR RETARDER

A. Vapor Retarder
1. Polyethylene sheet, not less than 10 mils thick, complying with ASTM E1745, Class A, B, and C.
2. Maximum Permeance: ASTM E96: 0.04 perms (US).
3. Seam Tape: High Density Polyethylene Tape with pressure sensitive adhesive; minimum width of 4 inches.
4. Pipe Boots: Construct pipe boots from vapor barrier material and seam tape in accordance with manufacturer's instructions.

B. Vapor Retarder for areas to receive terrazzo in the police and court lobbies: Polyethylene sheet, not less than 15 mils thick, complying with ASTM E1745, Class A, B, and C

2.5 EXPANSION / ISOLATION JOINT FILLER

A. Expansion / Isolation Joint Filler: ASTM D1751, asphalt impregnated premolded fiberboard, 3/8-inch thick by full thickness of slab or joint, unless indicated otherwise in the Structural Drawings.

2.6 CONSTRUCTION JOINTS

A. Slabs On Grade: Steel plate dowel (1/4” thick) such as manufactured by PNA Construction Technologies, Inc., Greenstreak Group, Inc., or approved equal.
   1. Plate Thickness: 1/4-inch thick for slabs up to 6 inches in thickness; 3/8-inch for slabs over 6 inches and up to 8 inches in thickness; 3/4-inch thick for slabs over 8 inches in thickness and up to 12 inches in thickness.

2.7 WATERSTOPS

A. Waterstops at construction joints and contraction joints indicated in the Structural Drawings shall be sized to suit the joints.

B. Waterstops: Flat, dumbbell type or centerbulb type, Polyvinyl Chloride (PVC) waterstop extruded from elastomeric plastic material, of which the basic resin is prime, virgin polyvinyl chloride.

2.8 DOVETAIL ANCHORS

A. Dovetail Anchors: 24 gage galvanized steel dovetail anchoring slots with filler strips and 16 gage galvanized dovetail anchors, unless otherwise noted in Structural Drawings.

2.9 GEOFOAM

A. Geofoam: Foam-controlled EPS Geofoam, Type EPS22, complying with ASTM D6817.

PART 3 EXECUTION

3.1 GENERAL

A. Erect formwork in accordance with ACI 301 and ACI 347.

B. Finished work shall comply with tolerances of ACI 117.

C. Provide 3/4-inch chamfer at all formed corners.

3.2 FOUNDATION ELEMENTS

A. Form foundation elements if soil or other conditions are such that earth trench forms are unsuitable.

B. Sides of pile/pier caps, perimeter grade beams, foundation walls, and turned-down slabs shall be formed.

C. Maintain minimum coverage of reinforcing steel as indicated in Structural Drawings.

3.3 VAPOR RETARDER

A. Where indicated on Structural Drawings, place vapor retarder over granular subbase and behind expansion / isolation joints at walls. Place electrical conduits and ducts in granular subbase.

B. Install vapor retarder in accordance with manufacturer's instructions and ASTM E1643.
   1. Lap vapor retarder six inches minimum at splices and seal with seam tape.
   2. Lap vapor retarder over footings and seal to walls.
   3. Seal all pipe penetrations with pipe boot.
   4. No penetration of vapor retarder is permitted except for reinforcing steel and permanent utilities.
   5. Do not puncture vapor retarder; repair damaged areas by cutting patches of vapor retarder, overlapping damaged area 6 inches and taping all four sides.

3.4 FORM PREPARATION

A. Seal form joints to prevent leakage.

B. Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed.

C. Before reinforcement is placed, coat contact surfaces of form with form release agent in accordance with manufacturer's recommendations. Do not allow excess form release agent to accumulate in forms or come in contact with concrete surfaces against which fresh concrete will be placed.

3.5 INSERTS AND EMBEDMENT ITEMS

A. Install and secure in position required inserts, embeds, hangers, sleeves, anchors, and nailers.

B. Locate anchor bolts/rods in position in accordance with approved setting drawings and secure to prevent displacement during concrete placement.

3.6 PROVISIONS FOR OTHER TRADES

A. Install openings in concrete formwork to accommodate work of other trades. Determine size and location of openings and recesses from trades requiring such items. Obtain approval from Structural Engineer for openings not shown in Structural Drawings.

B. Accurately place and securely support items built into forms.

3.7 CONSTRUCTION JOINTS

A. Slabs On Grade: Install steel plate dowels in accordance with manufacturer's recommendations. Place plate dowels at mid-depth of slab (+/-1/4-inch), unless noted otherwise in the Structural Drawings.

B. Framed Construction:
   1. Install construction joints in accordance with ACI 318.
   2. Obtain Architect/Structural Engineer's prior approval for use and location of joints.
   3. Provide 1½-inch deep key-type construction joints at end of each placement for framed slabs, beams, walls, and footings. Bevel forms for easy removal.
   4. Remove loose particles and latency from surface prior to placing the next lift. Chip the surface to a depth sufficient to expose sound concrete.

3.8 WATERSTOPS

A. Install PVC waterstops in accordance with manufacturer's recommendations.

3.9 DOVETAILS

A. Install continuous vertical dovetail anchoring slots with filler strips at intersections of concrete and masonry walls unless indicated otherwise on Drawings.

3.10 FORMWORK REMOVAL

A. Remove formwork carefully in such manner and at such time as to ensure complete safety of structure. Do not remove formwork, shoring, or reshoring until members have acquired sufficient strength to support their weight and the load thereon safely.

B. For conventionally reinforced framed slabs, formwork shall remain in place for a minimum of 5 days after concrete placement.

C. For Architectural Concrete elements, remove forms as early as permissible and in such a manner as to not damage exposed surfaces.

3.11 FINISHES OF FORMED SURFACES

A. Standard Form Finish: Patch tie holes and defects. Chip or rub off fins exceeding ¼ inch in height. Leave surface with the texture imparted by the forms.

B. Architectural Concrete Finish: Patch tie holes and defects. Remove all fins completely. Produce finish on newly hardened concrete no later than the day following formwork removal. Wet the surface and rub it with carborundum or other abrasive until uniform color and texture are produced. Use no cement grout other than cement paste drawn from the concrete itself by the rubbing process.

3.12 GEOFOAM

A. Protect and install Geofoam in accordance with manufacturer’s recommendations.

B. Provide positive mechanical means to prevent displacement during concrete placement.

END OF SECTION

SECTION 032000: CONCRETE REINFORCING

PART 1 GENERAL

1.1 RELATED SECTIONS

A. Division 1 Sections

B. Section 031000 – Concrete Forming and Accessories.

C. Section 033000 – Cast-in-Place Concrete.

1.2 REFERENCES

ACI 117 – Standard Specifications for Tolerances for Concrete Construction and Materials.

ACI 301 – Standard Specifications for Structural Concrete.

ACI 315 – Details and Detailing of Concrete Reinforcement.

ACI 318 – Building Code Requirements for Structural Concrete.

ASTM A1064 – Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete Reinforcement.

ASTM A615 – Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

ASTM A706 – Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.

ASTM A1044 – Standard Specification for Steel Stud Assemblies for Shear Reinforcement of Concrete.

AWS D1.4 – Structural Weld Code - Reinforcing Steel.

AWS D12.1 – Recommended Practices for Welding Reinforcing Steel Metal Inserts, and Connections in Reinforced Concrete Construction.

CRSI – Manual of Standard Practice.

1.3 SUBMITTALS

A. Refer to Structural Quality Assurance Plan in the Structural Drawings for additional submittal requirements.

B. Shop Drawings:
1. Notify Structural Engineer prior to detailing reinforcing steel shop drawings.
2. Indicate size, spacing, location and quantities of reinforcing steel and wire fabric, bending and cutting schedules, splice lengths, stirrup spacing, supporting and spacing devices. Detail reinforcing steel in accordance with ACI 315 and CRSI Standards.

3. Written description of reinforcement without adequate sections, elevations, and details is not acceptable.
4. Reproduction of Structural Drawings for shop drawings is not permitted. Electronic drawing files will not be provided to the Contractor.

C. Submit manufacturer's data for tension and compression splicers.

1.4 QUALITY ASSURANCE

A. Refer to the Structural Quality Assurance Plan in the Structural Drawings.

1.5 STORAGE AND PROTECTING

A. Store reinforcing steel above ground so that it remains clean. Maintain steel surfaces free from materials and coatings that might impair bond.

PART 2 PRODUCTS

2.1 MATERIALS

A. Deformed Reinforcing Steel: ASTM A615, refer to Structural Drawings for grade (Grade 60 minimum).

B. Welded Steel Wire Reinforcement: ASTM A1064.

2.2 ACCESSORY MATERIALS

A. Annealed Steel Tie Wire: 16½ gage minimum.

B. Bar Supports: Plastic-tipped steel Class I bar supports conforming to CRSI Specifications. Concrete brick may be used to support reinforcement to obtain proper clearance from earth.

2.3 SPLICERS

A. Tension Splicers: Capable of developing 125% of the reinforcing steel ASTM specified minimum yield strength.

B. Compression Splicers: Mechanical type such that the compression stress is transmitted by end bearing held in concentric contact.

2.4 HEADED STUD ASSEMBLIES FOR SHEAR REINFORCEMENT

A. Headed Stud Assemblies: Studs and base rail shall conform to ASTM A1044.

2.5 DOWEL ADHESIVE

A. Dowel Adhesive: Simpson AT-XP (IAPMO-UES ER-263), Simpson SET-XP (ICC-ES ESR-2508), Powers PE1000+ Epoxy Adhesive (ICC-ES ESR-2583), Powers AC100+ Gold Adhesive (ICC-ES ESR-2582), Hilti HIT-HY 200 SAFE Set Fast Cure Adhesive (ICC-ES ESR-3187), Hilti HIT-RE 500-SD Epoxy Adhesive (ICC-ES ESR-2322) or approved equal.

PART 3 EXECUTION

3.1 FABRICATION

A. Fabricate reinforcing steel in accordance with ACI 318 and CRSI standards.

B. Bend bars cold. Do not heat or flame cut bars. No field bending of bars partially embedded in concrete is permitted, unless specifically approved Structural Engineer and checked by Testing and Inspection Agency for cracks.

C. Weld only as indicated. Perform welding in accordance with AWS D1.4 and AWS D12.1.

D. Tag reinforcing steel for easy identification.

3.2 INSTALLATION

A. Before placing concrete, clean reinforcement of foreign particles and coatings.

B. Place, support, and secure reinforcement against displacement in accordance with ACI 318 and CRSI standards. Do not deviate from alignment or measurement.

C. Place concrete beam reinforcement support parallel to main reinforcement.

D. Locate welded wire reinforcement in the top third of slabs. Overlap mesh one lap plus two inches at side and end joints.

E. Furnish and install dowels or mechanical splices at intersections of walls, columns and piers to permit continuous reinforcement or development lengths at such intersections.

F. Maintain cover and tolerances in accordance with ACI and CRSI Specifications, unless indicated otherwise on Structural Drawings.

3.3 SPLICES

A. Do not splice reinforcement except as indicated on Structural Drawings.

B. Tension couplers may be used and installed in accordance with manufacturer's recommendations.

3.4 HEADED STUD ASSEMBLIES

A. Place headed stud assemblies as indicated in the Structural Drawings.

3.5 DOWELS IN EXISTING CONCRETE

A. Install dowels and dowel adhesive in accordance with manufacturer’s recommendations.

B. Minimum embedment length into the existing concrete shall be 12 bar diameters, unless noted otherwise.

END OF SECTION

SECTION 033000: CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 RELATED SECTIONS

A. Division 1 Sections

B. Section 031000 – Concrete Forming and Accessories.

C. Section 032000 – Concrete Reinforcing.

1.2 REFERENCES

ACI 117 – Standard Specifications for Tolerances for Concrete Construction and Materials.

ACI 214 – Recommended Practice for Evaluation of Strength Test Results of Concrete.

ACI 301 – Specifications for Structural Concrete.

ACI 302.1 – Guide for Concrete Floor and Slab Construction.

ACI 304 – Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.

ACI 305 – Hot Weather Concreting.

ACI 306 – Cold Weather Concreting.

ACI 308 – Guide to Concrete Curing.

ACI 309 – Recommended Practice for Consolidation of Concrete.

ACI 318 – Building Code Requirements for Reinforced Concrete.

ASTM C31 – Standard Practice for Making and Curing Concrete Test Specimens in the Field.

ASTM C33 – Standard Specification for Concrete Aggregates.

ASTM C39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

ASTM C94 – Standard Specification for Ready-Mixed Concrete.

ASTM C138 – Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.

ASTM C143 – Standard Test Method for Slump of Hydraulic-Cement Concrete.

ASTM C150 – Standard Specification for Portland Cement.

ASTM C172 – Standard Practice for Sampling Freshly Mixed Concrete.

ASTM C173 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.

ASTM C230 – Standard Specification for Flow Table for Use in Tests of Hydraulic Cement.

ASTM C260 – Standard Specification for Air-Entraining Admixtures for Concrete.

ASTM C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

ASTM C494 – Standard Specification for Chemical Admixtures for Concrete.

ASTM C618 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

ASTM E1155 – Standard Test Method for Determining F_F Floor Flatness and F_L Floor Levelness Numbers.

1.3 SUBMITTALS

A. Refer to Structural Quality Assurance Plan in the Structural Drawings for additional submittal requirements.

B. Submit three copies of the concrete mix designs. Include the following:
1. Documentation of mix design proportions complying with ACI 318, Chapter 5.
2. Type and quantities of materials including admixtures
3. Slump
4. Air content
5. Water/cement ratio
6. Fresh unit weight
7. Aggregates sieve analysis
8. Design compressive strength
9. Location of placement in structure
10. Method of placement
11. Method of curing
12. Seven-day and 28-day compressive strengths

1.4 QUALITY ASSURANCE

A. The ready-mixed concrete plant shall be certified for conformance with the requirements of the National Ready Mix Concrete Association.

B. Refer to the Structural Quality Assurance Plan in the Structural Drawings.

PART 2 PRODUCTS

2.1 CONCRETE MIX DESIGN

A. Establish concrete mix design proportions in accordance with ACI 318, Chapter 5.

B. Concrete Strength: See Structural Notes in Structural Drawings.

C. Slump

1. Design concrete with a slump between four and ten inches.
2. If a slump greater than five inches is desired, use a mid-range or high-range water reducer.

D. Water/Cementitious Materials Ratio (w/cm): See Structural Notes in Structural Drawings.

E. Entrained Air Content: See Structural Notes in Structural Drawings.

F. Fresh Unit Weight
1. Normal weight concrete: Fresh unit weight of 137 to 148 pcf.

2.2 MATERIALS

A. Materials designated by specific manufacturer's trade names are approved, subject to compliance with the quality and performance indicated by the manufacturer. Instructions and recommendations, published by the manufacturer of such materials are included in and are a part of these Specifications.

2.3 CEMENT

A. Cement: Type I Portland cement complying with ASTM C150, unless noted otherwise. Use one brand only.

2.4 AGGREGATE

A. Fine Aggregate: Fine aggregate complying with ASTM C33.

B. Coarse Aggregate: Gravel or crushed stone complying with ASTM C33 for normal weight concrete. Size coarse aggregate in accordance with ACI 318.

2.5 WATER

A. Water: Potable water free of deleterious substances complying with ACI 318.

2.6 AIR ENTRAINING AGENT

A. Air Entraining Agent: Air entraining agent complying with ASTM C260.

2.7 WATER REDUCER

A. Water Reducer: Water reducing agent complying with ASTM C494.

2.8 MID-RANGE/HIGH-RANGE WATER REDUCER

A. Mid-range/High-range Water Reducer: Mid-range and high-range water reducers (plasticizers) complying with ASTM C494.

2.9 CHLORIDE

A. Chlorides: Chlorides of any form shall not be used in concrete.

2.10 CURING COMPOUND

A. Curing Compound: A water-based, “odorless,” acrylic curing compound with a minimum solid content of 20 percent may be used at the Contractor's option complying with ASTM C309.

2.11 FLY ASH

A. Fly Ash: Class F fly ash with a loss on ignition of less than five percent or Class C fly ash with a loss on ignition of less than one percent complying with ASTM C618.

2.12 ACCELERATORS

A. Accelerators: Non-chloride accelerators complying with ASTM C494.

2.13 RETARDERS

A. Retarders: Retarders complying with ASTM C494.

PART 3 EXECUTION

3.1 GENERAL

A. Prepare place of deposit, mix, convey, and place in accordance with ACI 301 and ACI 304.

B. Wet forms before placing concrete.

C. Deposit concrete as near as practical to final position.

D. Do no flowing of concrete with vibrators.

E. Place slabs in accordance with ACI 302.

F. Place and finish concrete members to comply with tolerances in ACI 117.

G. Do not use aluminum equipment in placing and finishing concrete.

3.2 SLABS-ON-GRADE

A. Place concrete for slabs-on-grade on properly prepared granular subbase with vapor barrier.

B. Place thickened slabs for partitions integral with floor slabs.

3.3 MID-RANGE / HIGH-RANGE WATER REDUCERS

A. Mid-range or high-range water reducers are to be added at dosage recommended by the manufacturer. The slump of the concrete shall be one to four inches at the time the water reducers are added. Do not permit fresh concrete containing superplasticizers to come in contact with fresh concrete not containing superplasticizers.

3.4 ADDITION OF WATER AT JOB SITE

A. Water may be added at the jobsite if neither the maximum permissible water/cement ratio nor the maximum slump is exceeded. All concrete delivery trucks will have actual batch weight tickets available that clearly indicate the quantity of water that may be added at the jobsite that will not exceed the maximum water/cement ratio.

3.5 TIME LIMIT

A. Deposit concrete within one and one-half hours after batching.

3.6 VIBRATION

A. Consolidate concrete in accordance with ACI 301 and ACI 309.

3.7 CURING

A. Begin curing procedures immediately following the commencement of the finishing operation.

B. Cure concrete in accordance with ACI 308. Keep the concrete surface moist.

C. If an acrylic curing compound is used, apply in accordance with manufacturer's recommendations to surfaces of concrete not protected for five days by formwork. Do not use curing compound in areas to receive material that does not adhere to concrete cured with a curing compound unless the curing compound is water-soluble.

3.8 WEATHER PROVISIONS

A. Perform cold weather concreting in accordance with ACI 306.

B. Perform hot weather concreting in accordance with ACI 305.

C. Protect concrete from drying and excessive temperature for the first seven days.

D. Protect fresh concrete from wind.

3.9 CONTRACTION JOINTS

A. Obtain Architect/Structural Engineer's approval for location of contraction joints. Do not use contraction joints in framed floors or composite slabs, unless noted in Structural Drawings.

B. Provide contraction joints in slabs-on-grade to form a regular grid with a maximum spacing as noted in the Structural Drawings. The long dimension of the grid shall not exceed 1.5 times the short dimension of the grid. Contraction joints may be saw cut if cut within 24 hours after placement of concrete. Saw cuts shall be a depth equal to one-fourth the slab thickness by one-eighth inch wide. Alternately, contraction joints may be provided by preformed plastic strip inserts.

C. Provide contraction joints in concrete walls at approximately 30'-0" centers, or as noted in the Structural Drawings; coordinate location with Architect. Contraction joints shall be formed as a V-groove on both faces of the wall, 3/4-inch minimum depth.

3.10 CUTTING CONCRETE

A. Obtain Architect/Structural Engineer's written approval prior to cutting concrete for installation of other work.

3.11 PATCHWORK AND REPAIRS

A. Notify Architect/Structural Engineer of any defective areas in concrete to be patched or repaired. Repair and patch defective areas with non-shrink grout. Cut out defective areas over 2 inches in diameter to solid concrete but not less than a depth of one inch. Make edges of cuts perpendicular to the concrete surface.

3.12 CONCRETE FINISHES

A. Finish Concrete in accordance with ACI 301.

B. All slabs, including roof slabs, shall be troweled finish, unless noted otherwise.

C. Finish slabs to the following flatness and levelness tolerances:
   1. F_F35/F_L25 minimum overall for composite of all measured values and F_F24/F_L15 minimum for any individual floor section.
   2. Slabs to receive wood flooring: F_F45/F_L30 minimum overall for composite of all measured values and F_F30/F_L20 minimum for any individual floor section.
   3. Architect/Structural Engineer will identify which sections of slabs are to be tested for flatness and levelness.
      a. F_L values are applicable only if testing is performed within 72 hours of concrete placement, before tensioning of tendons, and before removal of formwork.
      b. F_F values are applicable to all types of slab construction and are not subject to any time constraints.

END OF SECTION

SECTION 03 30 53

INCIDENTAL CONCRETE

PART 1 – GENERAL

PART 1.1 The following specifications shall apply to any and all items of incidental work with Portland Cement with or without reinforcement, including such items as concrete piers to support cast iron pipe above ground, erosion control bulkheads or structures, cradles and encasement, blocking and the like.

All concrete used in the construction of this project shall comply with the requirements herein specified for its particular class and kind.

PART 2 – MATERIALS:

PART 2.1 All materials used in this work shall consist of Portland Cement, Sand, Gravel, and Clean Water.

A. The cement used shall be domestic manufacture, either "Standard" of "high Early Strength" Portland Cement, which shall meet all the requirements of the current A.S.T.M. Specifications for the type used at the time it is incorporated in the work.

B. The fine aggregate shall consist of clean, sharp sand, well graded from coarse to fine, consisting of hard, durable particles, free from coarse to fine, consisting of hard, durable particles, free from silt, salt or organic matter. It shall meet all the requirements of the A.S.T.M. Specifications C33, Paragraph 1, 2 and 3, and A.S.T.M. C-40.

C. The coarse aggregate used shall consist of clean washed gravel, free from particles of wood or lumps of clay. Not more than 10% shall pass the No. 4 sieve, and it shall conform with the requirements of A.S.T.M. Specifications C33, Paragraph 5 to 8 inclusive.

D. The water used for mixing concrete shall be clear, free from oil, salt, strong acid, alkali organic matter, and shall be approved by the Engineer.

E. Reinforcing steel shall conform tot he requirements of the "Standard Specifications for Billet-Steel Concrete Reinforcing Bars" of intermediate grade (Serial Designation: A 15-39) or the Standard Specifications for Rail-Steel Concrete Reinforcement Bars (Serial Designation; A-16-35) of the American Society for Testing Materials.

PART 3 – CONSTRUCTION

PART 3.1 All concrete materials shall be as handled and stored that they will not become damaged after delivery at the site. The cement shall be thoroughly protected from the weather, and the sand and gravel, shall be so stored that they will not become intermixed, and so as to prevent the admixture with either of any foreign materials. Reinforcing steel shall be so stored that it will not come in contact with the ground, shall be protected from the weather, and shall be clean and free from rust when incorporated in the work.

PART 3.2 Concrete materials shall be mixed in the proportions and in a manner that will produce concrete of the class and strength specified to its use.

PART 3.3 Unless indicated otherwise, all concrete shall be Class A which shall have a crushing strength of not less than 3,000 pounds per square inch at 28 days, as determined by the Standard Methods for testing concrete materials.

PART 3.4 Class B concrete, which shall have a crushing strength of not less than 2,500 pounds per square inch at 28 days, and shall be used for erosion control bulkheads and blocking pipelines at bends to prevent blowing off under pressure.

PART 3.5 Class C concrete which shall have a crushing strength of not less than 2,000 pounds per square inch at 28 days, shall be used for cradles and encasement and may be used for backfill below grade.

PART 3.6 After concrete has been properly mixed, it shall be deposited in the forms in reasonably uniform layers and in such manner as to prevent segregation of the aggregates. It shall be thoroughly spaded or puddled while being placed to insure maximum density and prevent honey-combing.

PART 3.7 No concrete shall be deposited when the air temperature is less than 40 degrees F. No material shall be deposited on a frozen sub-grade, nor shall any frozen moisture or material be incorporated into the mixture.

PART 3.8 No concrete shall be placed in water, nor shall water be permitted to rise on it or to run over it within a period of 24 hours after it has been placed.

PART 3.9 Unsatisfactory concrete, resulting from failure to observe the above requirements or otherwise, shall be removed and replaced as directed by the Engineer.

END OF SECTION

SECTION 034100: PRECAST STRUCTURAL CONCRETE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Section includes the design, manufacture, and erection of structural precast members (including precast, prestressed concrete members).

1.2 RELATED SECTIONS

A. Division 1 Sections.

1.3 REFERENCES

ACI 301 – Specifications for Structural Concrete Buildings.

ACI 318 – Building Code Requirements for Reinforced Concrete.

ASTM C33 – Standard Specification for Concrete Aggregates.

PCI MNL 116 – Manual for Quality Control for Plants and Production of Structural Concrete Products.

PCI MNL 120 – PCI Design Handbook – Precast and Prestressed Concrete.

PCI MNL 135 – Tolerance Manual for Precast and Prestress Concrete Construction.

1.4 DESIGN REQUIREMENTS

A. Structural precast members shall be designed by an engineer licensed in the project state.

B. Structural precast members shall be designed for the loads indicated in the Structural Notes in accordance with ACI 318, Chapter 16 and design recommendations of PCI MNL 120.

C. Design modifications may be made only as necessary to meet field conditions, to ensure proper fitting of the work, and as acceptable to the Architect/Structural Engineer. Maintain the general design concept shown without increasing or decreasing sizes of members or altering profiles and alignment shown.

D. Refer to Architectural Documents for fire rating requirements, if any.

1.5 SUBMITTALS

A. Refer to Structural Quality Assurance Plan in the Structural Drawings for additional submittal requirements.

B. Submit manufacturer’s and erector’s qualifications demonstrating compliance with this specification with the bid.

C. Shop drawings:
1. Shall include the following:
    a. Amount and location of prestressing strands and reinforcement.

b. Location of openings and built-in work.
c. Bearing requirements.
d. Design loads.
e. Design camber.
f. Miscellaneous details.

2. Submit to Architect/Structural Engineer for review.
3. Reproduction of Structural Drawings for shop drawings is not permitted. Electronic drawing files will not be provided to the Contractor.

D. Maintain tensioning records, concrete records, and calibration records for jacking equipment at the project site, available for review by the Architect/Structural Engineer.

1.6 QUALITY ASSURANCE

A. Refer to the Structural Quality Assurance Plan in the Structural Drawings

1.7 QUALIFICATION OF MANUFACTURER

A. Manufacturer shall have a minimum of five years of successful experience in the manufacturing of precast concrete units of quality and scope required on this project.

B. Manufacturing plant shall be certified by the Prestressed Concrete Institute Plant Certification Program.

1.8 QUALIFICATION OF ERECTOR

A. Erector shall have a minimum of five years of successful experience in erection of precast concrete units of quality and scope required on this project.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver precast concrete units to the project site in such quantities and at such times as will ensure the continuity of the installation. Store units at the project site to ensure against cracking, distortion, staining, or other physical damage. Lift and support units with suitable lifting devices only at the lifting or supporting points shown on the shop drawings.

PART 2 PRODUCTS

2.1 PRECAST PRESTRESSED UNITS

A. Furnish precast prestressed units in accordance with PCI MNL 116.

B. Design units according to ACI 318 for load and span conditions indicated.

2.2 MANUFACTURING TOLERANCES

A. Comply with camber and dimensional tolerances of the PCI MNL 135.

B. Machine cast units on long production lines in smooth rigid forms.

2.3 GROUT

A. Non-shrink grout consisting of a premixed, packaged ferrous aggregate shrinkage-resistant grout complying with Corps of Engineers CRD-C588, Type M, and only enough water for a flowable mixture without segregation or bleeding.

2.4 ACCESSORIES

A. Provide all bearing strips, clips, hangers, and other accessories required for installation of precast units and for support of subsequent construction or finishes.

PART 3 EXECUTION

3.1 PREPARATION

A. Installer must examine all parts of the supporting structure and the conditions under which the precast concrete work is to be erected. Notify the Contractor in writing of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the installation until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

B. Verify dimensions of supporting structures at the project site and adjust final shop drawings to reflect actual field dimensions.

C. Do not erect units until supporting members are completely in place.

3.2 INSTALLATION

A. Install precast concrete framing structural members plumb, level, and in alignment within the specified limits of erection tolerances. Provide temporary supports and bracing as required to maintain position, stability and alignment as members are being permanently connected.

B. Install flexible bearing pads where indicated as precast units are being erected. Set pads on level, uniform bearing surfaces and maintain in correct position until precast units are placed.

C. Do not install precast units until concrete has attained its design ultimate compressive strength.

D. Install precast units without exceeding the following tolerance limits:
   1. Variations from plumb: 1/4" in any 20' run or story height; 1/2" total in any 40' or longer run.
   2. Variations from Level or Elevation: 1/4" in any 20' run; 1/2" in any 40' run; total plus or minus 1/2" at any location.
   3. Variation from Theoretical Position in Plan: Plus or minus 1/4" maximum at any location.
   4. Offsets in Alignment of Adjacent Members at Any joint: 1/16" in any 10' run; 1/4" maximum.

E. Grout open spaces at connections and joints, after precast concrete units have been placed and permanently connected.

F. Provide forms or other method for retaining grout in place until hard enough to support itself. Pack spaces with grout by tamping or ramming until voids are completely filled.

G. Perform cutting and fitting of precast slab units as required for the passage of other projecting or adjacent work. Provide straight and clean cuts without breaking or spalling edges.

H. Do not cut any reinforcing steel members unless otherwise acceptable to the precast unit manufacturer and the Architect/Structural Engineer.

I. Reinforce edges of cut openings where required to maintain the structural integrity of the precast units.

J. Lifting devices shall be removed after units are in place.

3.3 CUTTING OPENINGS

A. Openings may be located and field drilled or cut after the units are in place. Obtain written approval from the manufacturer before drilling or cutting.

END OF SECTION

SECTION 036200: NON-SHRINK GROUTING

PART 1 GENERAL

1.1 RELATED SECTIONS

A. Division 1 Sections

1.2 REFERENCES

CRD-C621 – Specification for Non Shrink Grout Packaged Dry, Hydraulic-Cement Grout.

ASTM C109 – Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens).

ASTM C1107 – Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).

1.3 QUALITY ASSURANCE

A. Refer to the Structural Quality Assurance Plan in the Structural Drawings.

1.4 SUBMITTALS

A. Refer to Structural Quality Assurance Plan in the Structural Drawings for additional submittal requirements.

PART 2 PRODUCTS

2.1 GROUT

A. Grout: Flowable, non-shrink, non-metallic in accordance with CRD-C-621 and ASTM C1107.

B. Compressive Strength: 5,000 psi minimum at 28 days.

2.2 WATER

A. Water: Clean, potable water.

PART 3 EXECUTION

3.1 HANDLING

A. Store and protect from moisture and contamination.

3.2 PREPARATION

A. Remove foreign materials including mud and dirt from areas to be grouted.

B. Use forms to contain grout. Forms shall be a minimum 1½ inch larger on all sides than the item grouted.

3.3 MIXING

A. Mix grout to its fluid, self-leveling consistency in accordance with manufacturer’s recommendations. Mix grout in a paddle-type mortar mixer; do not mix by hand.

B. Do not retemper grout. Do not exceed manufacturer’s maximum limit on water content or use at a consistency that produces free bleeding.

3.4 PLACEMENT

A. Consolidate to provide grout uniformity. Do not vibrate grout.

3.5 PROTECTION

A. Protect grout and areas to be grouted from excessive heat and cold in accordance with manufacturer's Specifications. Protect grout from excessive drying shrinkage resulting from wind or direct sunlight. Protect areas grouted from excessive vibrations.

END OF SECTION

SECTION 04 20 00
UNIT MASONRY ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete Block (non-loadbearing only; see Section 04 22 00 for loadbearing CMU typical.
B. Clay Facing Brick.
C. Mortar and Grout.
D. Reinforcement and Anchorage.
E. Flashings.
F. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 04 22 00 - Concrete Unit Masonry Units.
B. Section 07 21 00 - THERMAL INSULATION: Insulation for cavity spaces.
C. Section 07 62 00 - Sheet Metal Flashing and Trim: Through-wall masonry flashings.
D. Section 07 90 05 - Joint Sealers: Backing rod and sealant at control and expansion joints.

1.03 REFERENCE STANDARDS

A. ACI 530/530.1/ERTA - Building Code Requirements and Specification for Masonry Structures and Related Commentaries; 2011.
B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
C. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement; 2015.
D. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2009a (Reapproved 2014).
E. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2015.
F. ASTM C67 - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile; 2014.
G. ASTM C91/C91M - Standard Specification for Masonry Cement; 2012.
H. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units; 2011.
I. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2011.
J. ASTM C150/C150M - Standard Specification for Portland Cement; 2015.
K. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2006 (Reapproved 2011).
L. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made From Clay or Shale); 2014.
M. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2014a.
N. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2011.
O. ASTM C476 - Standard Specification for Grout for Masonry; 2010.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all relevant installers.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for masonry units, fabricated wire reinforcement, and mortar.

C. Samples: Submit four samples of facing brick units to illustrate color, texture, and extremes of color range.

D. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

E. Test Reports: Concrete masonry manufacturer's test reports for units with integral water repellent admixture.

F. Maintenance Materials: Furnish the following for Southern Mississippi Investment Company, Inc.'s use in maintenance of project.

1.06 QUALITY ASSURANCE

A. Comply with provisions of ACI 530/530.1/ERTA, except where exceeded by requirements of the contract documents.

1.07 MOCK-UP

A. Construct a masonry wall as a mock-up panel sized 8 feet long by 6 feet high; include mortar, accessories, structural backup, and flashings (with lap joint, corner, and end dam) in mock-up.

B. Locate where directed.

C. Mock-up to be part of the joint mock-up between various trades to accurately represent the wall construction; see general notes on Sheet T1.0.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

A. Concrete Block: Comply with referenced standards and as follows:
   1. Size: Standard units with nominal face dimensions of 16 x 8 inches and nominal depths as indicated on the drawings for specific locations.
   2. Special Shapes: Provide non-standard blocks configured for corners and other detailed conditions.
   3. Non-Loadbearing Units: ASTM C129.
      a. Hollow block, as indicated.
      b. lightweight.

2.02 BRICK UNITS

A. Manufacturers:
   1. ??????.

B. Facing Brick: ASTM C216, Type FBS, Grade SW.
   1. Color and texture to match Albert & McCleskey Associates Architects's sample; various bricks may be required to meet requirements of the project.
   2. Nominal size: As indicated on drawings.
   3. Special shapes: Molded units as required by conditions indicated, unless standard units can be sawn to produce equivalent effect.
   4. Compressive strength: 2500 psi, measured in accordance with ASTM C67.

2.03 MORTAR AND GROUT MATERIALS

A. Masonry Cement: ASTM C91/C91M, Type N.
   1. Colored Mortar: Premixed cement as required to match Albert & McCleskey Associates Architects's color sample.

B. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.
   1. Not more than 0.60 percent alkali.
   2. Hydrated Lime: ASTM C207, Type S.
   3. Mortar Aggregate: ASTM C144.
   4. Grout Aggregate: ASTM C404.

C. Water: Clean and potable.

2.04 REINFORCEMENT AND ANCHORAGE

A. Manufacturers of Joint Reinforcement and Anchors:
   1. Dur-O-Wal: www.dur-o-wal.com.
   2. Substitutions; See Section 01 63 00 - Substitutions and Product Options.

B. Reinforcing Steel: ASTM A615/A615M, Grade 40 (40,000 psi), deformed billet bars; galvanized.

C. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.

D. Single Wythe Joint Reinforcement: Truss or ladder type; ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M, Class 3; 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage on each exposure.

E. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B.
   1. Anchor plates: Not less than 0.075 inch thick, designed for fastening to structural backup through sheathing by two fasteners; provide design with legs that penetrate sheathing and insulation to provide positive anchorage.
   2. Wire ties: Manufacturer's standard shape, 0.1875 inch thick.
   3. Vertical adjustment: Not less than 2 inches.

2.05 FLASHINGS

A. Copper/Polymer Fabric Flashing: 5 oz/sq ft copper sheet laminated between two sheets of polymer or fiberglass fabric.
   1. Manufacturers:
      a. Advanced Building Products, Inc.; Copper Sealtite 2000: www.advancedbuildingproducts.com.
      b. York Manufacturing, Inc; Multi-Flash 500 Series: www.yorkmfg.com.
      c. Substitutions: See Section 01 60 00 - Product Requirements.

2.06 ACCESSORIES

A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.
   1. Manufacturers:
      a. Dur-O-Wal: www.dur-o-wal.com.
      b. Substitutions; See Section 01 63 00 - Substitutions and Product Options.

B. Joint Filler: Closed cell polyvinyl chloride; oversized 50 percent to joint width; self expanding; as required wide x by maximum lengths available.
   1. Manufacturers:
      a. Dur-O-Wal: www.dur-o-wal.com.
      b. Substitutions; See Section 01 63 00 - Substitutions and Product Options.

C. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.
   1. Mortar Diverter: Semi-rigid mesh designed for installation at flashing locations.
      a. Manufacturers:
         1) Mortar Net USA, Ltd: www.mortarnet.com.

2) Substitutions; See Section 01 63 00 - Substitutions and Product Options.

D. Weeps:
1. Type: Polyester mesh.
a. Manufacturers:
1) Mortar Net Solutions; Weep Vent: www.mortarnet.com.

E. Cavity Vents:
1. Type: Polyester mesh.
a. Manufacturers:
1) Mortar Net Solutions; Cell Vent: www.mortarnet.com.

F. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.07 MORTAR AND GROUT MIXES

A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
1. Masonry below grade and in contact with earth: Type S.
2. Exterior, non-loadbearing masonry: Type N.
3. Interior, non-loadbearing masonry: Type O.

B. Colored Mortar: Proportion selected pigments and other ingredients to match Albert & McCleskey Associates Architects's sample, without exceeding manufacturer's recommended pigment-to-cement ratio.

C. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

D. Mixing: Use mechanical batch mixer and comply with referenced standards.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 PREPARATION

A. Direct and coordinate placement of metal anchors supplied for installation under other sections.

B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.03 COLD AND HOT WEATHER REQUIREMENTS

A. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.

B. Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work.

3.04 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Concrete Masonry Units (any and all specified herein):
1. Bond: Running.
2. Coursing: One unit and one mortar joint to equal 8 inches.
3. Mortar Joints: Concave.

D. Brick Units:
1. Bond: Running.

2. Coursing: Three units and three mortar joints to equal 8 inches.
3. Mortar Joints: Concave.

3.05 PLACING AND BONDING

A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

B. Lay hollow masonry units with face shell bedding on head and bed joints.

C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

D. Remove excess mortar and mortar smears as work progresses.

E. Interlock intersections and external corners, except for units laid in stack bond.

F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

H. Cut mortar joints flush where wall tile is scheduled or resilient base is scheduled.

I. Isolate masonry partitions from vertical structural framing members with a control joint as indicated.

J. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

3.06 WEEPS/CAVITY VENTS

A. Install weeps in veneer and cavity walls at 24 inches on center horizontally above through-wall flashing, above shelf angles and lintels, and at bottom of walls.

B. Install cavity vents in veneer and cavity walls at 24 inches on center horizontally below shelf angles and lintels and near top of walls.

3.07 CAVITY MORTAR CONTROL

A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.

B. Install cavity mortar diverter at base of cavity and at other flashing locations as recommended by manufacturer to prevent mortar droppings from blocking weep/cavity vents.

3.08 REINFORCEMENT AND ANCHORAGE - GENERAL

A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches on center.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

C. Place continuous joint reinforcement in first and second joint below top of walls.

D. Lap joint reinforcement ends minimum 6 inches.

3.09 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

A. Install horizontal joint reinforcement 16 inches on center.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

C. Place continuous joint reinforcement in first and second joint below top of walls.

D. Lap joint reinforcement ends minimum 6 inches.

E. Masonry Back-Up: Embed anchors to bond veneer at maximum 16 inches on center vertically and 36 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.

F. Stud Back-Up: Secure veneer anchors to stud framed back-up and embed into masonry veneer at maximum 16 inches on center vertically and 24 inches on center horizontally. Place

additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.

3.10 MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
   1. Extend flashings full width at such interruptions and at least 6 inches into adjacent masonry or turn up at least 8 inches to form watertight pan at non-masonry construction.
   2. Remove or cover protrusions or sharp edges that could puncture flashings.
   3. Seal lapped ends and penetrations of flashing before covering with mortar.

B. Extend metal flashings through exterior face of masonry and turn down to form drip. Install joint sealer below drip edge to prevent moisture migration under flashing. Use this detail where drawings show exposed metal flashings.

C. Extend metal flashings to within 1/4 inch of exterior face of masonry. Use this detail where drawings show metal flashings not intended to be seen after installation.

D. Extend laminated flashings to within 1/4 inch of exterior face of masonry. Use this detail where drawings show flexible flashings not inteded to be seen after installation.

E. Lap end joints of flashings at least 4 inches and seal watertight with mastic or elastic sealant.

3.11 CONTROL AND EXPANSION JOINTS

A. Locations: Where shown in the Drawings; If not shown, locate within the maximum spacing at logical points near corners, openings, weak points, intersections, columns and joints in the building structure. All proposed control joint locations shall be submitted to the Architect for review and approval.
   1. Maximum Spacing: 50'-0" (straight runs).
   2. Spacing Near Corners: Locate a control joint within one-half the maximum spacing in both directions (less than 25'-0" from the corner).

B. Do not continue horizontal joint reinforcement through control or expansion joints.

C. When Drawings do not detail control joints: Form control joint with a sheet building paper bond breaker fitted to one side of the hollow contour end of the block unit. Fill the resultant core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.

D. Install preformed control joint device in continuous lengths when required by Drawings. Seal butt and corner joints in accordance with manufacturer's instructions.

E. Size control joint in accordance with Section 07 90 05 for sealant performance.

F. Form expansion joint as detailed when the project requires expansion joints; see Drawings.

3.12 BUILT-IN WORK

A. As work progresses, install built-in metal door frames, fabricated metal frames, and window frames and other items to be built into the work and furnished under other sections.

B. Install built-in items plumb, level, and true to line.

C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.
   1. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.

D. Do not build into masonry construction organic materials that are subject to deterioration.

3.13 TOLERANCES

A. Maximum Variation from Alignment of Columns: 1/4 inch.

B. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.

C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

D. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

F. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch.

G. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

3.14 CUTTING AND FITTING

A. Cut and fit for chases, pipes, conduit, and sleeves. Coordinate with other sections of work to provide correct size, shape, and location.

B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.15 CLEANING

A. Remove excess mortar and mortar droppings.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

D. Use non-metallic tools in cleaning operations.

3.16 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

SECTION 042200: CONCRETE UNIT MASONRY

PART 1 GENERAL

1.1 RELATED SECTIONS

A. Division 1 Sections

B. Section 032000 – Concrete Reinforcing.

C. Section 033000 – Cast-in-Place Concrete.

1.2 REFERENCES

ACI 530.1-05/ASCE 6-05/TMS 602-05 – Specification for Masonry Structures.

ASTM A82 – Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

ASTM A153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

ASTM A496 – Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.

ASTM C90 – Standard Specification for Loadbearing Concrete Masonry Units.

ASTM C109 – Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. Cube Specimens).

ASTM C140 – Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.

ASTM C144 – Standard Specification for Aggregate for Masonry Mortar.

ASTM C270 – Standard Specification for Mortar for Unit Masonry.

ASTM C404 – Standard Specification for Aggregates for Masonry Grout.

ASTM C476 – Standard Specification for Grout for Masonry.

ASTM C1019 – Standard Test Method for Sampling and Testing Grout.

ASTM C1314 – Standard Test Method for Compressive Strength of Masonry Prisms.

ASTM D2000 - Standard Classification System for Rubber Products in Automotive Applications.

ASTM D2287 – Standard Specification for Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds.

1.3 SUBMITTALS

A. Refer to Structural Quality Assurance Plan in Structural Drawings for additional submittal requirements.

B. Submit coarse grout mix design.

C. Shop Drawings: Submit for masonry reinforcement complying with Section 032000.

D. Submit procedures for construction of masonry walls to be filled with coarse grout. Procedures should include low lift grouting as applicable to Project.

1.4 QUALITY ASSURANCE

A. Masonry construction and materials shall conform to all the requirements of ACI 530.1/ASCE 6/TMS 602, except as modified by the requirements of the Construction Documents.

B. Refer to the Structural Quality Assurance Plan in the Structural Drawings.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store materials in a dry condition to protect from elements and prevent contamination, deterioration, or damage due to moisture, temperature changes, contaminants, corrosion, and other causes.

PART 2 PRODUCTS

2.1 CONCRETE MASONRY

A. Compressive Strength, f'm: See Structural Notes in the Structural Drawings.

2.2 CONCRETE MASONRY UNITS

A. Concrete masonry units: Comply with ASTM C90.

B. Weight: Lightweight.

C. Net Area Compressive Strength: As listed in Table 2 of ACI 530.1/ASCE 6/TMS 602 required for the specified f'm.

D. Face Dimensions: 16" long x 8" high nominal, unless indicated otherwise.

E. Special shapes: Where indicated on the Drawings.

F. Fire Rating: Where indicated in the Architectural Drawings, provide concrete masonry units that comply with the specified fire ratings.

2.3 MORTAR

A. Mortar: Type M or Type S in accordance with ASTM C270. Refer to Structural Drawings for locations.

B. Do not use admixtures that contain chlorides.

2.4 COARSE GROUT

A. Coarse Grout: In accordance with ASTM C476.

B. Compressive Strength: See Structural Notes in the Structural Drawings.

C. Slump: 8 and 10 inches.

D. Do not use admixtures that contain chlorides.

2.5 WATER

A. Water: Clean potable water free of deleterious substances.

2.6 REINFORCEMENT

A. Horizontal and Vertical Reinforcing Bars: Comply with Section 032000.

2.7 HORIZONTAL JOINT REINFORCEMENT

A. Horizontal Joint Reinforcement: Manufactured with longitudinal, parallel, deformed side wires in accordance with ASTM A496 and of the size specified in the Structural Drawings. Cross wires shall be No. 9 gage, plain, in accordance with ASTM A82, unless noted otherwise in Structural Drawings.

B. Provide as a minimum, one side wire for each face shell of hollow masonry units. Provide additional side wires or eye sections for adjustable wall ties as specified for multiwythe wall construction.

C. Provide truss type joint reinforcement, except ladder type reinforcement shall be used for walls with vertical reinforcement.

D. Finish: Hot-dipped galvanized in accordance with ASTM A153, Class B-2.

E. Provide prefabricated corner and tee section accessories.

2.8 CONTRACTION JOINT MATERIAL

A. Contraction joint material:
1. Rubber shear keys complying with ASTM D2000, M2AA-805 and with a minimum durometer hardness of 80, or
2. PVC shear keys complying with ASTM D2287, Type PVC 654-4 and with a minimum durometer hardness of 85.

PART 3 EXECUTION

3.1 PREPARATION

A. Cold weather masonry construction shall comply with ACI 530.1, Section 1.8, Paragraph C when either of the following conditions exist:
1. The ambient air temperature falls below 40 degrees Fahrenheit, or
2. The temperature of masonry units is below 40 degrees Fahrenheit.

B. Hot weather masonry construction shall comply with ACI 530.1, Section 1.8, Paragraph D when either of the following conditions exist:
1. The ambient air temperature exceeds 100 degrees Fahrenheit, or
2. The ambient air temperature exceeds 90 degrees Fahrenheit with a wind velocity greater than 8 mph.

3.2 CMU PLACEMENT

A. Use dry masonry units. No frozen or wet units shall be used.

B. Discard cracked, chipped, and spalled masonry units.

C. Lay hollow units as follows:
1. With full mortar coverage on horizontal and vertical face shells.
2. Bed webs in mortar in starting course on footings and in all courses of piers, columns, pilasters, and in walls where adjacent to cells or cavities to be filled with grout.
3. For starting course on footings where cells are not to be grouted, spread out full mortar bed including area under cells.
4. Maintain joint widths indicated, except for minor variations to maintain joint alignment. If not indicated, lay walls with 3/8 inch joints.
5. Buttering corners of joints, deep or excess furrowing of mortar joints is not permitted.

D. Lay units in running bond, unless noted otherwise in the Structural Drawings.

E. Fully bond external corners of concrete masonry.

F. Where non-loadbearing masonry partitions extend to underside of floor, roof deck or structural system, stop masonry short 3/8 inch to ½ inch to allow for live load deflection. Fill gap with soft joint filler.

3.3 GROUT PLACEMENT

A. Execute placement of grout in accordance with ACI 530.1, Section 3.5.

B. Place coarse grout in maximum four-foot lifts, unless specifically approved in writing by the Architect/Structural Engineer.

C. Do not fill reinforced cells with mortar.

3.4 MOVEMENT JOINTS

A. Place expansion joints at locations indicated in the Structural Drawings.
1. Do not run any horizontal reinforcing through expansion joints.

B. Place contraction joints at locations indicated in the Structural Drawings.
1. Install contraction joint material.
2. Do not run horizontal reinforcement through contraction joints, except reinforcement in bond beams at floor and roof levels shall be continuous across contraction joints.

3.5 REINFORCEMENT

A. Place reinforcing bars as indicated in the Structural Drawings and in accordance with ACI 530.1, Section 3.4.

3.6 HORIZONTAL JOINT REINFORCEMENT

A. Place horizontal joint reinforcement in the horizontal mortar beds at spacings noted in the Structural Drawings and noted below.

B. For masonry below grade, space horizontal joint reinforcing at 8 inches vertically.

C. Place horizontal joint reinforcement above lintels and below sills at openings. Extend two feet beyond opening.

D. Joint reinforcement shall be continuous. Lap joint reinforcement a minimum of 6 inches.

3.7 ERECTION BRACING

A. Design, provide, and install temporary erection bracing during construction as required to stabilize erected masonry until complete structural system is constructed.

3.8 CLEANING AND POINTING

A. Dry brush masonry surfaces before mortar has set hard to remove mortar crumbs and accumulation.

B. Clean masonry with commercial brick cleaner approved by brick manufacturer. Protect other work from cleaning materials.

C. Cut out defective mortar and repoint.

3.9 PROTECTION OF FINISHED WORK

A. During erection cover top of wall, projections, and sills with strong waterproof membrane at end of each day's work.
   1. Extend and secure cover a minimum of 24 in. down both sides.

B. Do not apply uniform floor or roof loading for at least 12 hours after placing masonry columns or walls.

C. Do not apply concentrated loads for at least 3 days after building masonry columns or walls.

END OF SECTION

SECTION 04 72 00
CAST STONE MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Architectural cast stone.

B. Units required are indicated on the drawings as "cast stone".

C. Units required are:
   1. Exterior wall units, including coping.
   2. Other items indicated on the drawings.

1.02 RELATED REQUIREMENTS

A. Section 04 20 00 - UNIT MASONRY ASSEMBLIES: Installation of cast stone in conjunction with masonry.

B. Section 07 90 05 - Joint Sealers: Materials and execution methods for sealing soft joints in cast stone work.

1.03 REFERENCE STANDARDS

A. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2011.

B. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement; 2015.

C. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement; 2009.

D. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement; 2014.

E. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2015.

F. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2013.

G. ASTM C150/C150M - Standard Specification for Portland Cement; 2015.

H. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2014a.

I. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2013.

J. ASTM C1364 - Standard Specification for Architectural Cast Stone; 2010b.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Manufacturer's Qualification Data: Documentation showing compliance with specified requirements.

C. Product Data: Test results of cast stone components made previously by the manufacturer.

D. Shop Drawings: Include elevations, dimensions, layouts, profiles, cross sections, reinforcement, exposed faces, arrangement of joints, anchoring methods, anchors, and piece numbers.

E. Mortar Color Selection Samples.

F. Verification Samples: Pieces of actual cast stone components not less than 6 inches square, illustrating range of color and texture to be anticipated in components furnished for the project.

G. Verification Samples: Pieces of actual cast stone components not less than 12 inches square, illustrating range of color and texture to be anticipated in components furnished for the project.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: A current producer member of the Cast Stone Institute with a minimum of 5 years of experience in producing cast stone of the types required for project and:

B. Mock-Up: Provide full size cast stone components for installation in mock-up of exterior wall.
   1. Approved mock-up will become standard for appearance and workmanship.
   2. Mock-up may remain as part of the completed work.
   3. Remove mock-up not incorporated into the work and dispose of debris.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver cast stone components secured to shipping pallets and protected from damage and discoloration. Protect corners from damage.

B. Number each piece individually to match shop drawings and schedule.

C. Store cast stone components and installation materials in accordance with manufacturer's instructions.

D. Store cast stone components on pallets with nonstaining, waterproof covers. Ventilate under covers to prevent condensation. Prevent contact with dirt.

E. Protect cast stone components during handling and installation to prevent chipping, cracking, or other damage.

F. Store mortar materials where contamination can be avoided.

G. Schedule and coordinate production and delivery of cast stone components with unit masonry work to optimize on-site inventory and to avoid delaying the work.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Architectural Cast Stone:
   1. Any current producer member of the Cast Stone Institute.

2.02 ARCHITECTURAL CAST STONE

A. Cast Stone: Architectural concrete product manufactured to simulate appearance of natural limestone, complying with ASTM C1364.
   1. Compressive Strength: As specified in ASTM C1364; calculate strength of pieces to be field cut at 80 percent of uncut piece.
   2. Freeze-Thaw Resistance: Demonstrated by field experience.
   3. Surface Texture: Fine grained texture, with no bugholes, air voids, or other surface blemishes visible from distance of 20 feet.
   4. Color: Match sample on file at Albert & McCleskey Associates Architects 's office.
   5. Remove cement film from exposed surfaces before packaging for shipment.

B. Shapes: Provide shapes indicated on drawings.
   1. Variation from Any Dimension, Including Bow, Camber, and Twist: Maximum of plus/minus 1/8 inch or length divided by 360, whichever is greater, but not more than 1/4 inch.
   2. Unless otherwise indicated on drawings, provide:
      a. Wash or slope of 1:12 on exterior horizontal surfaces.
      b. Drips on projecting components, wherever possible.
      c. Raised fillets at back of sills and at ends to be built in.

C. Reinforcement: Provide reinforcement as required to withstand handling and structural stresses; comply with ACI 318.
   1. Pieces More than 12 inches Wide: Provide full length two-way reinforcement of cross-sectional area not less than 0.25 percent of unit cross-sectional area.

2.03 MATERIALS

A. Portland Cement: ASTM C150.
   1. For Units: Type I, white or gray as required to match Albert & McCleskey Associates Architects 's sample.
   2. For Mortar: Type I or II, except Type III may be used in cold weather.

B. Coarse Aggregate: ASTM C33/C33M, except for gradation; granite, quartz, or limestone.

C. Fine Aggregate: ASTM C33/C33M, except for gradation; natural or manufactured sands.

D. Admixtures: ASTM C494/C494M.

E. Water: Potable.

F. Reinforcing Bars: ASTM A615/A615M deformed bars, galvanized.
   1. Galvanized in accordance with ASTM A767/A767M, Class I.

G. Steel Welded Wire Reinforcement: ASTM A1064/A1064M, galvanized or ASTM A884/A884M, epoxy coated.

H. Embedded Anchors, Dowels, and Inserts: Type 304 stainless steel, of type and size as required for conditions.

I. Mortar: Portland cement-lime, as specified in Section 04 05 11; do not use masonry cement.

J. Sealant: As specified in Section 07 90 05.

K. Cleaner: General-purpose cleaner designed for removing mortar and grout stains, efflorescence, and other construction stains from new masonry surfaces without discoloring or damaging masonry surfaces; approved for intended use by cast stone manufacturer and by cleaner manufacturer for use on cast stone and adjacent masonry materials.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine construction to receive cast stone components. Notify Albert & McCleskey Associates Architects if construction is not acceptable.

B. Do not begin installation until unacceptable conditions have been corrected.

3.02 INSTALLATION

A. Install cast stone components in conjunction with masonry, complying with requirements of Section 04 20 00.

B. Mechanically anchor cast stone units indicated; set remainder in mortar.

C. Setting:
   1. Drench cast stone components with clear, running water immediately before installation.
   2. Set units in a full bed of mortar unless otherwise indicated.
   3. Fill vertical joints with mortar.
   4. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.

D. Joints: Make all joints 3/8 inch, except as otherwise detailed.
   1. Rake mortar joints 3/4 inch for pointing.
   2. Remove excess mortar from face of stone before pointing joints.
   3. Point joints with mortar in layers 3/8 inch thick and tool to a slight concave profile.
   4. Leave the following joints open for sealant:
      a. Head joints in top courses, including copings, parapets, cornices, sills, and steps.
      b. Joints in projecting units.
      c. Joints between rigidly anchored units, including soffits, panels, and column covers.
      d. Joints below lugged sills and stair treads.
      e. Joints below ledge and relieving angles.
      f. Joints labeled "expansion joint".

E. Sealant Joints: Install sealants as specified in Section 07 90 05.

F. Installation Tolerances:
   1. Variation from Plumb: Not more than 1/8 inch in 10 feet or 1/4 inch in 20 feet or more.
   2. Variation from Level: Not more than 1/8 inch in 10 feet or 1/4 inch in 20 feet, or 3/8 inch maximum.

3. Variation in Joint Width: Not more than 1/8 inch in 36 inches or 1/4 of nominal joint width, whichever is less.
4. Variation in Plane Between Adjacent Surfaces (Lipping): Not more than 1/16 inch difference between planes of adjacent units or adjacent surfaces indicated to be flush with units.

G. Repairs: Repair chips and other surface damage noticeable when viewed in direct daylight at 20 feet.
1. Repair with matching touchup material provided by the manufacturer and in accordance with manufacturer's instructions.
2. Repair methods and results subject to Albert & McCleskey Associates Architects 's approval.

3.03 CLEANING

A. Keep cast stone components clean as work progresses.

3.04 PROTECTION

A. Protect completed work from damage.

B. Clean, repair, or restore damaged or mortar-splashed work to condition of new work.

END OF SECTION

SECTION 051200: STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.1 RELATED SECTIONS

A. Division 1 Sections

B. Section 052100 – Steel Joist Framing.

C. Section 053100 – Steel Decking.

1.2 REFERENCES

AISC – Steel Construction Manual, 14th Edition.

AISC 303 – Code of Standard Practice for Steel Buildings and Bridges.

AISC 341-10 – Seismic Provisions for Structural Steel Buildings dated June 22, 2010.

AISC 360-10 – Specification for Structural Steel Buildings.

AISC – Specification for Structural Joints Using ASTM A325 or A490 Bolts prepared by the Research Council on Structural Connections.

AWS D1.1 – Structural Welding Code.

AWS A5.1 – Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding.

AWS A5.5 – Specification for Low-Alloy Steel Electrodes for Shielded Metal Arc Welding.

AWS A5.17 – Specification for Carbon Steel Electrodes and Fluxes for Submerged Arc Welding.

AWS A5.20 – Carbon Steel Electrodes for Flux Cored Arc Welding.

SSPC – Steel Structures Painting Manual.

ASTM A6 – Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.

ASTM A36 – Standard Specification for Carbon Structural Steel.

ASTM A53 – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A108 – Standard Specification for steel Bar, Carbon and Alloy, Cold-Finished.

ASTM A123 – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

ASTM A153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

ASTM A307 – Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength.

ASTM A325 – Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 KSI Minimum Tensile Strength.

ASTM A490 – Standard Specification for Structural Bolts, Alloy Steel, Heat-Treated, 150 KSI Minimum Tensile Strength.

ASTM A500 – Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

ASTM A501 – Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.

ASTM A563 – Standard Specification for Carbons and Alloy Steel Nuts

ASTM A572 – Standard Specification for High-Strength Low-Alloy Columbium Vanadium Structural Steel.

ASTM A673 – Standard Specification for Sampling Procedure for Impact Testing of Structural Steel

ASTM A780 – Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

ASTM A992 – Standard Specification for Structural Steel Shapes.

ASTM A1085 – Standard Specification for Cold-Formed Welded Carbon Steel Hollow Structural Sections (HSS)

ASTM B695 – Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel

ASTM F436 – Standard Specification for Hardened Steel Washers.

ASTM F844 – Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use.

ASTM F1554 – Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-Ksi Yield Strength.

ASTM F1852 – Standard Specification for “Twist Off” Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.

ASTM F2280 – Standard Specification for “Twist Off” Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 150 ksi Minimum Tensile Strength.

1.3 SUBMITTALS

A. Refer to Structural Quality Assurance Plan in the Structural Drawings for additional submittal requirements.

B. Shop Drawings:
   1. Contact Structural Engineer’s Construction Administrator prior to detailing structural steel shop drawings.
   2. Shop drawings shall be submitted on a 24” x 36” sheet minimum.

3. Shop drawings shall clearly indicate the profiles, sizes, ASTM Grade, spacing and locations of structural steel members, including connections, attachments, anchorages, framed openings, sizes and types of fasteners, method of tightening fasteners, cambers, and the number, type and spacing of the stud shear connectors and headed studs.
4. Beam sizes shall be shown on the erection drawings (plans).
5. Submit shop drawings for review.
6. Reproduction of Structural Drawings for shop drawings is not permitted. Electronic drawing files will not be provided to the Contractor.

C. Maintain at construction office written welding procedures for each type of welded joint used in accordance with AWS D1.1.

D. Submit certification that the fabricator meets the required qualifications and ultrasonic testing reports for complete penetration welds. If fabricator has an independent testing agency inspect fabrication as required by these specifications, submit the name and qualifications of the independent testing agency.

E. Upon request, submit the erection sequence and procedures to be used by the steel erector.

1.4 QUALITY ASSURANCE

A. Refer to the Structural Quality Assurance Plan in the Structural Drawings.

1.5 FABRICATOR'S QUALIFICATIONS

A. Steel fabricator shall meet the requirements in the Structural Quality Assurance Plan in the Structural Drawings.

1.6 STORAGE

A. Store materials off ground to permit easy access for inspection and identification. Store steel members and packaged items in a manner that provides protection against contact with deleterious materials.

PART 2 PRODUCTS

2.1 ANCHOR RODS

A. Anchor Rods: Headed rod or a threaded rod with a heavy hexagonal nut and plate washer welded to the bottom of the threaded rod conforming to ASTM F1554.

B. Nuts and Washers: Two hexagonal nuts and two plate washers conforming to ASTM A36 for each anchor rod assembly.

2.2 ROLLED STEEL SHAPES, PLATES, AND BARS

A. Rolled Steel Shapes, Plates, and Bars: ASTM A36; ASTM A572, Grade 50; or ASTM A992 as indicated by the Structural Drawings. ASTM A572, Grade 50 may be substituted for ASTM A992.

2.3 SQUARE, RECTANGULAR AND ROUND STEEL HOLLOW STRUCTURAL SECTIONS (HSS)

A. Hollow structural sections: ASTM A1085, 50 ksi minimum yield strength.

2.4 PIPE STEEL STRUCTURAL SECTIONS

A. Pipe Structural Sections: ASTM A53, Gr. B, 35 ksi minimum yield strength.

2.5 NON-HIGH-STRENGTH FASTENERS

A. Non-High-Strength Bolts: ASTM A307, Grade A, 60 ksi minimum, where noted on the Structural Drawings.

B. Hardened Steel Washers: ASTM F436.

2.6 HIGH-STRENGTH FASTENERS

A. High-Strength Bolts: ASTM A325 or ASTM A490 as noted on the Structural Drawings. 3/4-inch minimum diameter.

B. Hardened steel washers shall conform to ASTM F436.

C. Spline-Type Tension Control Bolts: ASTM spline-type tension control bolts with plain hardened washers and suitable nuts are an acceptable alternate design bolt assembly.

D. Do not use load indicating washers.

2.7 HEADED STUDS

A. Headed Studs: ASTM A108, comply with AWS D1.1. Provide studs with the diameter shown on the Structural Drawings.

2.8 EXPANSION ANCHORS

A. Expansion Anchors: See Structural Notes.

2.9 ADHESIVE ANCHORS

A. Adhesive Anchors: See Structural Notes.

2.10 SCREW ANCHORS

A. Screw Anchors: See Structural Notes.

2.11 WELD ELECTRODES

A. Weld Electrodes: AWS A5.1, A5.5, A5.I7, or A5.20 E-70 series low hydrogen electrodes.

B. Properly store electrodes to maintain flux quality.

2.12 PAINT

A. Oxide Primer: AISC Specifications, Code of Standard Practice, and SSPC Steel Structure Painting Manual, unless indicated otherwise.

B. Paint Primer: Free of lead and chromate and comply with State and Federal volatile organic compound (VOC) requirements.

C. Paint Primer: Compatible with finish coating.

2.13 GALVANIZE

A. Galvanized Coating: ASTM A123.

B. Galvanize Bolts, Nuts, and Washers: ASTM A153 when used to connect steel members that are specified to be galvanized.

C. Expansion Anchors, Adhesive Anchors, or Screw Anchors: Where specified to be galvanized, anchors shall be mechanically galvanized in accordance with ASTM B695, Class 65, Type I.

PART 3 EXECUTION

3.1 GENERAL

A. Fabricate and erect structural steel in accordance with AISC Specifications and Code of Standard Practice.

B. Notify Architect/Structural Engineer and Structural Testing/Inspection Agency at least 48 hours prior to structural steel fabrication and erection.

3.2 ANCHOR ROD SETTING

A. Provide templates for setting anchor rods. Position anchor rods by using templates with two nuts to secure in place prior to placement of concrete.

B. Do not erect steel where anchor rod nuts will not have full threads.

3.3 CONNECTIONS

A. Provide a minimum of two fasteners at each bolted connection.

B. Ensure fasteners are lubricated prior to installation.

C. Provide high-strength bolted connections in accordance with AISC Specifications for Structural Joints using ASTM A325 or A490 Bolts.

D. Provide connections for expansion and contraction where steel beams connect to concrete walls or concrete columns and at expansion joints. Secure nuts on bolts against loosening. (Dent threads with a chisel.)

3.4 FASTENER INSTALLATION

A. Bolts shall be installed in holes of the connection and brought to snug tight condition. Tighten connection progressing systematically from the most rigid part to the free edges of the connection to minimize relaxation of the bolts.

B. High-strength bolts installed shall have a hardened washer under the element turned in tightening.

C. Installation and tightening of bolts shall conform to the AISC Specifications for Structural Joints.

3.5 HEADED STUDS

A. Headed studs shall be installed in accordance with AWS D1.1 with the resulting in-place length after burn-off as shown on the Structural Drawings.

B. Do not locate headed studs closer than 1-1/4 inches from the edge of embedded steel member to the centerline of the stud.

C. Remove ceramic arc shields after welding studs.

3.6 EXPANSION ANCHOR INSTALLATION

A. Install in accordance with manufacturer's recommendation and the ICC ESR report for the particular anchor used.

B. Minimum Embedment: See Structural Notes on Drawings.

3.7 ADHESIVE ANCHOR INSTALLATION

A. Install in accordance with manufacturer's recommendation and the ICC ESR or IAPMO-UES report for the particular anchor used.

B. Minimum Embedment: See Structural Notes on Drawings.

3.8 SCREW ANCHOR INSTALLATION

A. Install in accordance with manufacturer's recommendation and the ICC ESR report for the particular anchor used.

B. Minimum Embedment: See Structural Notes on Drawings.

3.9 WELDING

A. Comply with AWS D1.1. Use prequalified weld procedures.

B. Provide end returns where fillet welds terminate at ends or sides. Returns shall be continuous for a distance of not less than two times the nominal size of the weld.

C. Complete penetration joints shall be backgouged to sound metal before the second side is welded or have 1/4-inch root opening with 3/16 x 1 inch backing bar. Access holes are required. Filling access holes is not required.

D. Remove all slag and weld splatter from deposited weld metal.

3.10 SPLICING

A. Splice members only where indicated unless authorized in writing by Structural Engineer.

B. Provide shim plates at bottom flange splice at continuous beam splices with different depths.

3.11 CUTTING

A. Do not use flame cutting to correct errors unless authorized in writing.

B. Re-entrant corners shall have a minimum radius of one inch and be free of notches. Notches and gouges resulting from flame cutting shall be finished to a smooth appearance.

3.12 MILL SCALE

A. Remove loose mill scale.

3.13 BOLT HOLES

A. Cut, drill, or punch holes perpendicular to metal surfaces. Do not enlarge holes by burning. Drill or punch holes in bearing plates. Remove burrs.

3.14 PAINTING

A. Paint steel that is not encased in concrete, plaster, or sprayed fireproofing. Do not shop paint in areas to be field welded, contact surfaces of slip critical connections, or areas to receive special finishes.

B. Field paint as required steel that has been welded or that is unpainted after connections have been tightened.

3.15 GALVANIZING

A. Galvanize shelf angles that support the exterior building veneer, for example brick shelf angles.

B. Galvanize environmentally exposed steel, for example mechanical equipment supports.

C. Touch-up welds and abrasions in galvanized members in accordance with ASTM A780.

END OF SECTION

SECTION 052100: STEEL JOIST FRAMING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Section includes the design, manufacture, and erection of steel joists shown in the Structural Drawings.

1.2 RELATED SECTIONS

A. Division 1 Sections

B. Section 051200 – Structural Steel Framing.

C. Section 053100 – Steel Decking.

1.3 REFERENCES

ASTM A307 – Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

AWS D1.1 – Structural Welding Code.

OSHA – Safety and Health Regulations for Construction, Steel Erection, Open Web Steel Joists, Part 1926.757.

SJI – Standard Specifications for Open Web Steel Joists, K-Series.

SJI – Standard Specifications for Open Web Steel Joists, H-Series.

SJI – Standard Specifications for Longspan Steel Joists, LH-Series, and Deep Longspan Steel Joists, DLH-Series.

SJI – Standard Specifications for Joist Girders.

SSPC – Paint 15 Steel Joist Shop Primer.

VULCRAFT – Specifications for Vulcraft Super Longspan Steel Joists, SLH-Series.

1.4 DESIGN REQUIREMENTS

A. Steel joists and bridging shall be designed by a Structural Engineer licensed in the project state in accordance with the Steel Joist Institute (SJI) Standard Specifications.

B. Refer to Structural Drawings for special design requirements, if any.

1.5 SUBMITTALS

A. Refer to Structural Quality Assurance Plan in the Structural Drawings for additional submittal requirements.

B. Shop Drawings:
1. Shall include the following:

a. Plan of joist layout showing mark, number, type, location, bracing, and spacing of joists.
b. Connection and seat details.
c. Bridging requirements.

2. Shall be signed and sealed by an Engineer licensed in the Project state.

C. Upon request, submit the erection sequence and procedures to be used by the steel erector.

1.6 QUALITY ASSURANCE

A. Refer to the Structural Quality Assurance Plan in the Structural Drawings.

1.7 QUALIFICATIONS

A. Manufacturer shall be a member of the Steel Joist Institute.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store and handle joists as recommended in SJI Standard Specifications.

PART 2 PRODUCTS

2.1 ROLLED STEEL PLATES, SHAPES, AND BARS

A. Steel: Steel in accordance with SJI Standard Specifications.

2.2 UNFINISHED BOLTS, WASHERS, AND NUTS

A. Unfinished Bolts: ASTM A307, Grade A, 60 ksi minimum tensile strength. Provide compatible hexagonal nuts and plain washers.

2.3 WELD ELECTRODES

A. Weld Electrodes: E-70 series low hydrogen electrodes conforming to AWS A5.1 or A5.5, A5.17 or A5.20.

B. Provide proper storage for electrodes to maintain flux quality.

2.4 PAINT

A. Primer shall conform to Steel Structures Painting Council Specification SSPC – Paint 15.

PART 3 EXECUTION

3.1 MANUFACTURE AND ERECTION

A. Manufacture and erect joists in accordance with SJI Standard Specifications and OSHA Steel Erection Standards.

B. Members shall have parallel top and bottom chords unless otherwise indicated.

C. Provide for connections of kickers and hangers to members.

D. Provide bottom chord extensions at columns and as indicated by the Construction Drawings. Weld bottom chords to members after dead loads have been applied.

E. Provide ceiling extensions in areas having ceilings attached directly to joist bottom chord (not suspended ceilings). Extend ends to within 1/2 inch of the finished wall surface unless otherwise indicated.

F. Camber joists according to recommendations in the SJI Standard Specifications, unless noted otherwise on Structural Drawings. Negative camber and bent joists are unacceptable.

G. Do not erect joists until supporting work is secured.

H. Provide bridging complying with SJI Standard Specifications. Provide for connections where bridging terminates.

3.2 CONCENTRATED LOADS ON JOISTS

A. Do no place concentrated loads on the joists that are not shown in the Structural Drawings without receiving written consent from the steel joist manufacturer. Reinforcement required for concentrated loads applied to either the top or bottom chord shall be designed by joist manufacturer.

3.3 HEADER UNITS

A. Provide header units to support openings in floor or roof system not framed with steel shapes.

3.4 SHOP PAINTING

A. Remove loose scale, heavy rust, and other foreign materials from joists and accessories before application of shop paint.

B. Apply one shop coat of steel joist primer paint to joists and accessories, by spray, dipping, or other method to provide a continuous dry paint film thickness of not less than 1.50 mil.

3.5 BEARING

A. Extend ends of steel joists not less than 4 inches over masonry and concrete supports. Extend ends of joists not less than 2½ inches over steel supports. Positive attachment to support shall be made by welding or bolting. In such cases where a shorter end bearing length must be used, such condition must be designed.

B. Fabricate sloped bearing seats where indicated on Drawings or where slope of joist exceeds ¼ inch per foot.

3.6 WELDING

A. Perform welding in accordance with AWS D1.1 "Structural Welding Code". Use AWS Certified Welders.

B. Weld ends of joists resting on steel supports with the minimum weld specified by the SJI standard specifications, unless otherwise indicated in the Structural Drawings.

C. Remove all slag and weld splatter from deposited weld material.

3.7 BRIDGING INSTALLATION

A. Permanently fasten bridging before the application of loads. Secure to steel beams or CMU walls where possible; otherwise terminate bridging with X-bracing to joists top chord.

B. In areas where joists will be exposed to view, align bridging in straight rows to create uniform appearance.

3.8 PROTECTION

A. Provide means for adequate distribution of concentrated loads so that carrying capacity of joists is not exceeded during construction.

B. Provide temporary bridging, bracing, connections, and anchors to ensure lateral stability during construction.

C. Joists damaged during construction shall be replaced or repaired with procedures submitted by the joist manufacturer.

3.9 CUTTING

A. Do not field cut or apply heat to joists unless authorized in writing.

3.10 REPAIRS OR MODIFICATIONS

A. If a steel joist is damaged or its bearing condition must be modified, Contractor shall have the joist supplier provide a sketch showing the required repairs or modifications.

END OF SECTION

SECTION 053100: STEEL DECKING

PART 1 GENERAL

1.1 RELATED SECTIONS

A. Division 1 Sections

B. Section 051200 – Structural Steel Framing.

C. Section 052100 – Steel Joist Framing.

1.2 REFERENCES

AISI – Specifications for the Design of Cold-Formed Steel Structural Members.

AWS D1.1 – Structural Welding Code.

AWS A5.5 – Specifications For Low Alloy Steel Covered Arc-Welding.

SDI 31 – Design Manual for Composite Decks, Form Decks, and Roof Decks

SDI RDCH1 – Roof Deck Construction Handbook

SDI DDMO3 – Diaphragm Design Manual, Third Edition

ASTM A653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

ASTM A1008 – Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.

1.3 SUBMITTALS

A. Notify the Structural Engineer prior to detailing shop drawings.

B. Submit detailed shop drawings showing layout and types of deck panels, weld sizes, weld patterns and conditions requiring closure panels, supplementary framing, sump pans, cant strips, cut openings, special jointing or other accessories.

C. Submit manufacturer’s information including section properties, deck gage, material yield strength, etc. for each type of steel deck required. The submittal shall demonstrate that the deck complies with the minimum section and material properties indicated in the structural notes and this Specification.

D. Submit supporting documentation and manufacturer’s information for deck that does not comply with the minimum section and material properties specified. Deck shall be designed for the design criteria outlined herein and the submittal shall be stamped and signed by an Engineer licensed in the project state.

E. Upon request, submit mill certification that the steel supplied meets these Specifications.

F. Upon request, submit written welding procedures.

G. Submit manufacturer's certification of compliance with supplementary framing, sump pans, cant strips, curb openings, special jointing and other accessories.

1.4 QUALITY ASSURANCE

A. Refer to the Structural Quality Assurance Plan in the Structural Drawings.

B. Welders shall be certified by AWS for the welding process involved.

C. Fire Rated Assemblies: For steel decking that is a part of a specified fire rated assembly, identify steel deck bundles with labels bearing the U.L. mark.

1.5 STORAGE

A. Store materials off ground to permit easy access for inspection and identification. Store steel members and packaged items in a manner that provides protection against contact with deleterious materials.

PART 2 PRODUCTS

2.1 GENERAL

A. Provide steel deck sheets of three spans minimum wherever possible.

2.2 DECK ATTACHMENT

A. Use E-60 series electrodes conforming to AWS A5.5.

B. Provide weld washers for material thinner than 22 gage.

2.3 ROOF DECK

A. Roof Deck: Steel sheets, minimum yield strength of 33,000 pounds per square inch, ASTM A653, Grade 33 or higher, deck types and gages as indicated on Drawings.

B. Finish: Galvanized, G60 coating.

C. End and Side Laps: 2-inch flush, nested unless otherwise indicated or specified.

PART 3 EXECUTION

3.1 GENERAL

A. Installer must examine the areas and conditions under which metal decking is to be installed and notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

B. Steel deck shall be installed in accordance with the approved shop drawings, requirements of the Steel Deck Institute, the manufacturer’s recommendations, and any applicable regulatory, safety guidelines.

3.2 PLACEMENT

A. Place steel deck units on supporting steel framework and adjust to final position before permanently fastening. Install deck units and accessories in accordance with manufacturer's recommendations and the Drawings, and as specified herein.

3.3 CUTTING

A. Cut holes in deck indicated by the Drawings. Other holes required shall be supplied by those requiring them. Obtain written authorization for additional holes and cutting not indicated on erection drawings.

3.4 WELDING

A. Perform welding in accordance with AWS Structural Welding Code.

B. Install weld washers for deck thinner than 22 gage.

3.5 CONCENTRATED LOADS

A. Concentrated loads suspended from the steel deck shall not exceed 50 pounds. No more than one suspended load shall be located in the sheet width in any span.

3.6 DECK SUPPORTS

A. Fasten deck to steel framework at ends and at each intermediate support by welding according to manufacturer's specifications unless indicated otherwise on structural drawings or otherwise specified herein. Do not weld deck in place until all bolted and welded connections for the structural frame are complete. A minimum of one floor over the area to be decked is to be bolted and welded prior to welding deck in place.

3.7 ROOF DECK

A. Place roof deck in straight alignment. Lap ends of sheets two inches.

B. Attach side laps of roof deck with screws spaced at a maximum of 24 inches on center for spans greater than 4 feet unless shown otherwise on the Drawings.

C. Weld roof deck in place by welding with 5/8-inch puddle welds spaced 12 inches on center at each support, unless shown otherwise by the Drawings.

END OF SECTION

SECTION 054000: COLD-FORMED STEEL FRAMING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Section includes the furnishing and installation of cold-formed structural steel studs, joists and accessories as shown in the Structural Drawings and specified herein.

1.2 REFERENCES

AISI S100-07 – North American Specification for the Design of Cold-Form Steel Structural Members.

AISI S200-07 – North American Standard for Cold-formed Steel Framing – General Provisions.

ANSI Z49.1 – Safety in Welding, Cutting, and Allied Processes.

ASTM A780-01, Standard Practice for Repair of Dam-aged and Uncoated Areas of Hot-Dip Galvanized Coat-ings.

ASTM A653 – Standard Specification for Sheet Steel, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

ASTM A924 – Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

ASTM C955, Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gyp-sum Panel Products and Metal Plaster Bases.

ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members.

ASTM C1513-13 - Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections

ASTM C1007 -, Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Assemblies.

AWS D1.3 – Structural Welding Code – Sheet Steel

ANSI Z49.1 - Safety in Welding and Cutting

1.3 SUBMITTALS

A. Submit manufacturer's product information and installation instructions for each type of cold-formed structural steel framing member and accessory. Clearly describe quality. Performance and finish for framing members. Submit certificate of material showing that materials meet or exceed the specified ASTM Standards.

B. Submit fabrication and erection shop drawings for approval by the Architect/Structural Engineer prior to commencement of fabrication. These drawings should include the following:

1. Include placing drawings for framing members showing size and gage designations, number, type, location and spacing. Indicate supplemental strapping, bracing, splices, bridging, accessories, and details required for proper installation.
2. Connection details showing screw types and locations, weld lengths or other fastener requirements.

1.4 QUALITY ASSURANCE

A. Refer to the Structural Quality Assurance Plan in the Structural Drawings.

B. Manufacturer shall have a minimum of three years documented experience in the manufacturing of products required by the Contract Documents. The manufacturer shall be certified by the Steel Stud Manufacturers Association (SSMA).

C. Installer shall have a minimum of three years documented experience.

D. Compute structural properties of studs and joists in accordance with AISI "Specification for Design of Cold-Formed Steel Structural Members."

E. Where framing units and accessories are attached by self-drilling fasteners, expansion anchors and/or powder actuated fasteners such devices shall be approved by Factory Mutual, the Steel Deck Institute, the International Conference of Building Officials or other governing authorities for the specific application noted.

F. Welding shall be in accordance with the AWS 1.3.

G. Where framing units are components of assemblies indicated for a fire-resistance rating, including those required for compliance with governing regulations, provide units which have been approved by governing authorities having jurisdiction.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver to project site in manufacturer's unopened containers or bundles, fully identified with name, brand, type and grade.

B. Protect framing units and accessories from rusting and damage. Store off ground in dry ventilated space or protect with suitable waterproof coverings.

1.6 COORDINATION

A. Cold-formed structural steel framing shall be coordinated with other trades to ensure proper spacing and location of studs for application of other materials.

PART 2 PRODUCTS

2.1 MATERIALS

A. With each type of steel framing required, provide manufacturer's standard steel runners (tracks), blocking, lintels, clip angles, shoes, reinforcements, fasteners, and accessories as recommended by manufacturer for applications indicated, as needed to provide a complete steel framing system.

B. Studs, joists and accessories shall be of the type, size and gage as shown on the Drawings.

C. Studs and accessories which are 97 mil, 68 mil, or 54 mil shall meet the requirements of ASTM A1003 with a minimum yield of 50,000 psi. Studs and accessories which are 43 mil or 33 mil shall meet the requirements of ASTM A1003 with a minimum yield of 33,000 psi.

D. Studs and accessories shall have a G60 galvanized coating meeting the requirements of ASTM653.

E. Substitution: Products of other manufacturers may be acceptable. Submit manufacturer literature for approval.

2.2 ACCESSORIES

A. Bridging: 1-1/2-inch deep by 16 gage minimum.

B. Strap Bracing: Minimum of 1-1/2-inch wide by 18 gage unless noted otherwise.

C. Tracks: Deep leg type, unpunched, same gage, size, and finish as studs with minimum 18 gage thickness.

D. Compensation Tracks/ Slip Tracks: Deep leg type with a flange width of 2-1/2 inch. Track shall be same nominal depth as stud/track with allowance for slip of standard deep leg track. Minimum 14 gage.

E. Plates, Gussets, Clip Angles: Minimum 14 gage. Clip angles shall be a minimum of 2 inches x 2 inches.

F. Self-drilling, Self-tapping Screws: Hot-dip galvanized conforming to ASTM C1513-13 and minimum values set forth in table below:

Minimum Design Values For Self Tapping Screws (Pounds)

Material	#6		#8		#10	
Gage	Shear	Tension	Shear	Tension	Shear	Tension
20	133	53	140	68	141	69
18	188	83	248	94	263	98
16	NA	NA	236	142	261	151
14	NA	NA	NA	NA	286	205

Notes: Values based on thinnest material in the attachment. Values may be increased 33% for wind or seismic loading. NA indicates screw size is inappropriate for material thickness.

G. Anchorage Devices:

1. Powder Actuated Fasteners shall be manufactured from AISI 1062 or AISI 1065 steel austempered to a minimum core hardness of 50-54Rc and possess the following properties:

   Tensile strength = 270,000 psi
   Shear strength = 162,000 psi
   All fasteners shall meet the requirements of ASTM B-633-13.
   Fasteners shall be a minimum 9/64-inch diameter.
   Fasteners shall be zinc plated.

Minimum Design Values for Powder Driven Fasteners in Concrete (Pounds)

Shank Dia	Penetration	Loading Type	3,000 psi Concrete	4,000 psi Concrete
0.145"	1-1/8"	Shear	225	265
0.145"	1-1/8"	Tension	115	145
0.177"	1-7/16"	Shear	285	330
0.177"	1-7/16"	Tension	205	275
0.205"	1-1/4"	Shear	445	500
0.205"	1-1/4"	Tension	280	345

Notes: Values are for semi-lightweight or normal weight concrete. Minimum fastener spacing of 4 inches and minimum edge distance of 3 inches. See product literature for values in structural steel.

H. Welding: AWS D1.3-8 Structural Welding Code-Sheet Metal (field welding of material shall not be permitted for 20 gage material or thinner).

I. Acoustical Sealant: USG, or approved equal.

2.3 FABRICATION

A. Framing components may***OR, shall*** be prefabricated into panels prior to erection. Fabricate panels plumb, square, true to line and braced against racking with joints welded. Members shall be held positively in place until properly fastened. Perform lifting of prefabricated panels in a manner to prevent damage or distortion.

B. Attach similar components by welding, or with self-drilling screw fasteners, as standard with manufacturer. Screws shall be of sufficient size to ensure the strength of the connection. All welds shall be painted with a zinc-rich paint.

C. Wire tying of framing components is not permitted.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install metal framing systems in accordance with manufacturer's printed or written instructions and recommendations, unless otherwise indicated.

B. Install continuous tracks sized to match studs. Align tracks accurately to layout at base and top of studs. Secure tracks as recommended by stud manufacturer for type of construction involved, except do not exceed 24" o.c. spacing for screws or powder-driven fasteners, or 16" o.c. for other types of attachment. Provide fasteners at corners and ends of tracks.

C. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.

D. Splices in axial loaded studs shall not be permitted. Axial loaded bearing studs shall be installed in a manner which will assure that stud ends are positioned against the inside track web prior to stud and track attachment.

E. Complete, uniform and level bearing support shall be provided for the bottom track at each bearing stud location. If not provided, install full size shims below bottom track at stud locations as needed, or set bottom track in high-strength grout.

F. Secure studs to top and bottom runner tracks by either welding or screw fastening at both inside and outside flanges.

G. Where stud system abuts structural columns or walls, including masonry walls, anchor ends of stiffeners to supporting structure.

H. Where studs abut back to back, they shall be secured together by screws or welding at the point of attachment to horizontal steel members.

I. Frame both sides of expansion and control joints, with separate studs; do not bridge the joint with components of stud system.

J. Install supplementary framing, blocking and bracing in steel framing system wherever walls or partitions are indicated to support fixtures, equipment, services, casework, heavy trim and furnishings, and similar work requiring attachment to the wall or partition. Where type of supplementary support is not otherwise indicated, comply with stud manufacturer's recommendations and industry standards in each case, considering weight or loading resulting from item supported.

K. Frame wall openings larger than 2'-0" square with double stud at each jamb of frame except where more than two are either shown or indicated in manufacturer's instructions or on the Drawings. Install runner tracks to jamb studs with stud shoes or by welding, and space jack studs same as full-height studs of wall. Secure stud system wall opening frame in manner indicated. Include headers as indicated on Drawings.

L. Corners: Construct using a minimum of three studs.

M. Headers for wall openings shall be built-up sections using steel stud and track sections as shown on the Structural Drawings. Stud and track members shall be unpunched sections (solid web). Each stud and track section of the header shall be a single piece (no splices permitted). No holes, horizontal or vertical, shall be permitted in headers unless specifically approved by the Structural Engineer.

N. Between Studs: Install framing for attachment of electrical boxes, mechanical and for other items to be anchored to walls.

O. At Butting Walls: Place studs not more than 2 inches from walls.

P. Diagonal bracing shall be installed at locations indicated on Drawings for frame stability and to resist lateral loads. Bracing shall be securely anchored for uplift and horizontal shear. Additional stud(s) shall be positioned to resist the vertical component as indicated on Drawings.

Q. Bridging for studs shall be installed in accordance with manufacturer's recommendations. Resistance to bending and rotation about the minor axis shall be provided by gypsum board or gypsum sheathing per AISI Specification, Section 5.1 on both flanges or shall be provided by mechanical bracing spaced 48 inches maximum, as indicated on the Drawings.

R. Joist bridging shall be provided in accordance with manufacturer's recommendations but not to exceed 8'-0" as indicated on the Drawings.

S. Floor and roof joists shall be located to align directly over bearing studs, or a continuous distribution member shall be provided over the top track. Provide web reinforcement stiffener at reaction points or points of concentrated loads as indicated on Drawings.

T. Floor and roof joists shall be supplied with a solid web. Field-cut unreinforced holes, maximum 2 1/2" diameter or 2 1/2" x 4" oval shape may be cut at the centerline of joist web. Holes shall be a minimum 18" o.c. and located a minimum 20" from the edge of a joist support.

U. Touch-up shop-applied protective coatings damaged during handling and installation. Use compatible primer for prime coated surface; use galvanizing repair paint for galvanized surfaces.

3.2 WELDING RECOMMENDATION

A. A wire feed type welder is recommended for fastest and most uniform welding in the shop. Good welds are also obtained with a 3/32" or 1/8" AWS type 6013 or 7014 rod with a welding heat of 60-110 amperes depending on the gage of material and the fit of the parts.

3.3 FIELD CUTTING

A. Field cutting of small quantities shall be with a 3 H.P. worm drive saw equipped with a reinforced abrasive cut-off blade, a band saw or a power hack saw.

END OF SECTION

SECTION 054100: COLD-FORMED EXTERIOR STEEL STUD FRAMING

PART 1 GENERAL

1.1 RELATED SECTIONS

A. Division 1 Sections

1.2 REFERENCES

ASTM A653/A653M -, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron-Alloy-Coated (Galvannealed) by the Hot-Dip Process.

AWS D1.3 - Structural Welding Code: Sheet Steel.

AISI - Specification for the Design of Cold-Formed Steel Structural Members.

1.3 SUBMITTALS

A. Submit manufacturer's product information clearly describing quality, performance and finish for steel studs.

B. Submit design criteria prepared by the manufacturer/supplier for approval by the Architect/Structural Engineer. Design criteria shall include, but not be limited to the following:

1. Deflection of steel studs shall not exceed L/600.
2. Wind speed as indicated in Structural Notes.

C. Submit shop drawings prepared by manufacturer/supplier for approval by the Architect/Structural Engineer. These drawings should include the following:

1. Plans, cross-sections, or elevations as necessary to adequately depict component locations.
2. Connection details showing screw types and locations, weld lengths or other fastener requirements.

1.4 QUALITY ASSURANCE

A. Manufacturer shall have a minimum of three years documented experience in the manufacturing of products required by the Contract Documents. The manufacturer shall be certified by the Steel Stud Manufacturers Association (SSMA).

B. Installer shall have a minimum of three years documented experience.

C. Design framing system under the direct supervision of a professional structural engineer licensed in the state where the Project is located.

D. Coordinate the placement of components within the stud framing system.

1.5 MOCKUP

A. Provide a minimum of one mockup of exterior wall framing sufficient in size to illustrate various construction conditions and as directed by the Architect. Construct mock-up to include, but not be limited to, the following components:

1. Stud framing, including runners, bridging, outlet box framing and other farming accessories. Include interior and exterior corner conditions, and intersections with interior rated stud walls.
2. Typical window frame, door frame and expansion joint.
3. Insulation, sheathing and vapor retarder. Install sheathing with veneer anchors to receive subsequent veneer mock-up.

B. The approved sample will serve as the standard of quality, as well as for coordination with related components.

C. Leave approved mock-up ready to received exterior insulation and finish system mock-up.

D. Do not place mock-up to remain as a part of the Work.

PART 2 PRODUCTS

2.1 MATERIALS

A. Studs and accessories which are 97 mil, 68 mil, or 54 mil shall meet the requirements of ASTM A1003 with a minimum yield of 50,000 psi. Studs and accessories which are 43 mil or 33 mil shall meet the requirements of ASTM A1003 with a minimum yield of 33,000 psi.

B. Studs and accessories shall have a G60 galvanized coating meeting the requirements of ASTM A653.

C. Stud Size
1. 6-inch, Cee Studs (SJ or CSJ) with minimum 1-5/8-inch round flange and a minimum 1/2-inch return lip with unpunched web. Stud thickness shall be determined by engineering analysis outlined above. Minimum 43 mil studs shall be provided.

D. Substitution: Products of other manufacturers may be acceptable. Submit manufacturer literature for approval.

2.2 ACCESSORIES

A. Bridging: 1-1/2-inch deep by 54 mil minimum.

B. Strap Bracing: Minimum of 1-1/2-inch wide by 43 mil unless noted otherwise.

C. Tracks: Deep leg type, unpunched, same gage, size, and finish as studs with minimum 43 mil thickness.

D. Compensation Tracks/ Slip Tracks: Deep leg type with a flange width of 2-1/2 inch. Track shall be same nominal depth as stud/track with allowance for slip of standard deep leg track. Minimum 68 mil.

E. Plates, Gussets, Clip Angles: Minimum 68 mil. Clip angles shall be a minimum of 2 inches x 2 inches.

F. Self-drilling, Self-tapping Screws: Hot-dip galvanized conforming ASTM C1513-13.

G. Anchorage Devices:

1. Powder Actuated Fasteners shall be manufactured from AISI 1062 or AISI 1065 steel austempered to a minimum core hardness of 50-54Rc and possess the following properties:
   Tensile strength = 270,000 psi
   Shear strength = 162,000 psi
   All fasteners shall meet the requirements of ASTM B-633-78.
   Fasteners shall be a minimum 9/64-inch diameter.
   Fasteners shall be zinc plated.

Minimum Design Values for Powder Driven Fasteners in Concrete (Pounds)

Shank Dia	Penetration	Loading Type	3,000 psi Concrete	4,000 psi Concrete
0.145"	1-1/8"	Shear	225	265
0.145"	1-1/8"	Tension	115	145
0.177"	1-7/16"	Shear	285	330
0.177"	1-7/16"	Tension	205	275
0.205"	1-1/4"	Shear	445	500
0.205"	1-1/4"	Tension	280	345

Notes: Values are for semi-lightweight or normal weight concrete. Minimum fastener spacing of 4 inches and minimum edge distance of 3 inches. See product literature for values in structural steel.

2. Expansion anchors shall be stud type, and shall be zinc plated in accordance with ASTM B633, Type III Fe/Zn 5. Expansion anchors shall be a minimum of 3/8-inch diameter with 2-1/2-inch embedment into concrete unless noted otherwise in the Drawings.

H. Welding: AWS D1.3-8 Structural Welding Code-Sheet Metal (field welding of material shall not be permitted for 20 gage material or thinner).

I. Acoustical Sealant: USG, or approved equal.

PART 3 EXECUTION

3.1 ERECTION

A. General:

1. Framing components shall be cut squarely for attachment to perpendicular members or, as required, for angular fit against abutting members.
2. Erect framing plumb, level, and square.
3. Studs shall be plumbed, aligned, and securely attached to the flanges or web of both the upper and lower tracks.
4. Fastening of components shall be with self-drilling screws or welds. Wire tying of components shall not be permitted. Touch-up field welds and scratched or damaged finish to studs with zinc rich paint.
5. Splices in framing components shall not be permitted other than in runner tracks.
6. Runner tracks shall be securely anchored to the supporting structure.

B. Studs Spacings: As indicated in the Drawings. Where not indicated on the drawings place studs at 16 inches on-center in interior zones and 12 inches on-center at end zones. End zones are defined as areas of discontinuity at building corners and shall be taken as 10 feet from any corner.

C. Stud Tracks: Before installing stud tracks for exterior walls, apply two 1/2- inch round beads of acoustical sealant longitudinally under stud tracks to seal runner to floor.

1. Anchor stud tracks to floor with power-driven fasteners staggered at a minimum of 16 inches on-center.
2. Attach flange of stud to track with #8 screw through each flange.

D. Door Openings: Install double studs each side of door openings.

1. Install double studs horizontally between door jambs at top of doors.
2. On top of headers, install runners to receive bottom ends of studs over door openings.

E. Window Openings: Install double studs each side of window openings.

1. Install double studs horizontally between window jambs to form sills and headers.
2. Install double studs horizontally between window jambs to form sills and headers.
3. On top of headers and bottom of sills, install runners to receive short studs.
4. Attach wood blocking to stud framing with 1/2-inch diameter galvanized bolts 12 inches on-center. Coordinate attachment of window system to blocking/stud framing prior to erection of metal stud framing.
5. For windows over 8 feet wide attach studs/ track to structural steel reinforcement with self-drilling screws.

F. Corners: Construct using a minimum of three studs.

G. Between Studs: Install framing for attachment of electrical boxes, mechanical and for other items to be anchored to walls.

H. At Butting Walls: Place studs not more than 2 inches from walls.

I. Insulation: In all doubled jamb studs and doubled headers not accessible to insulation contractors, insulation equal to that specified elsewhere shall be provided.

END OF SECTION

SECTION 054400: COLD-FORMED STEEL TRUSSES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Section includes all work and supplementary items required to complete the proper design, fabrication and erection of the cold-formed steel trusses as shown in the Construction Documents and specified herein, including headers, outriggers, supplemental rafters and incidental framing for a complete assembly within the extent shown in the Construction Documents.

B. Cold-formed steel trusses include planar structural units consisting of welded, screwed or bolted connected members which are fabricated, cut and assembled prior to delivery.

1.2 RELATED SECTIONS

A. Division 1 Sections.

B. Section 051200 – Structural Steel Framing.

C. Section 053100 – Steel Decking.

1.3 REFERENCES

AISI S100-07 – North American Specification for the Design of Cold-Form Steel Structural Members.

AISI S200-07 – North American Standard for Cold-formed Steel Framing – General Provisions.

AISI S214-07 – North American Standard for Cold-formed Steel Framing – Truss Design, with Supplement 2, dated 2008.

ANSI Z49.1 – Safety in Welding, Cutting, and Allied Processes.

ASTM A653 – Standard Specification for Sheet Steel, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

AWS D1.3 – Structural Welding Code – Sheet Steel.

CFSBCSI – Guide to Good Practice for Handling, Installing, Restraining & Bracing of Cold-Formed Steel Trusses.

1.4 DESIGN REQUIREMENTS

A. Design of the following is the sole responsibility of the Contractor:
1. Cold-formed steel trusses.
2. Header truss units at openings or change of framing.
3. Temporary and permanent restraint/bracing for all cold-formed elements.
4. Roof deck structural support at eave edge, valley, hip, and ridge transition planes.

B. Cold-formed steel trusses shall be designed by a Structural Engineer licensed in the Project state for the loads shown in the Structural Drawings. Live load deflection shall not exceed 1/360 of the span, unless noted otherwise on the Structural Drawings.

C. Cold-formed steel design, fabrication and erection shall conform to AISI S100 and AISI S200, except as modified by AISI S214.

D. For trusses spanning 60 feet or greater, temporary installation restraint/bracing and permanent individual truss member restraint/bracing shall be designed by the cold-formed steel truss Engineer for the specific project conditions.

1.5 SUBMITTALS

A. Refer to Structural Quality Assurance Plan in the Structural Drawings for additional submittal requirements.

B. Shop Drawings:
1. Shall include truss design drawings that show for each truss, as a minimum, the following:
   a. Slope or depth, span and spacing.
   b. Location of all joints and support locations.
   c. Number of plies if greater than one.
   d. Required bearing widths.
   e. Design loads as applicable, including:
      1) Top chord dead and live load.
      2) Bottom chord dead and live load.
      3) Additional loads and locations.
      4) Environmental design criteria and loads (wind, rain, snow, seismic, etc.)
      5) Other lateral loads, including drag strut loads.
   f. Maximum reaction force and direction, including maximum uplift reaction forces where applicable.
   g. Location of all truss member connections.
   h. Gusset plate locations, sizes, and material specifications.
   i. Fastening type, size, quantities, and locations.
   j. Shape and material specification for each truss member;
   k. Maximum axial tension and compression forces in the truss members.
   l. Truss-to-truss connections and truss field assembly requirements.
   m. Calculated span-to-deflection ratio and maximum vertical and horizontal deflection for live and total load as applicable.
   n. Required permanent individual truss member restraint location and the method and details of restraint/bracing.
   o. Design and details for individual truss member reinforcement.
2. Shall include truss placement drawings that identifies the proposed location for each individually designated truss and references the corresponding truss design drawing.
3. Shall include instructions for erection.
4. Shall be sealed by an Engineer licensed in the Project state.

C. Submit erector’s qualifications.

1.6 QUALITY ASSURANCE

A. Refer to the Structural Quality Assurance Plan in the Structural Drawings.

1.7 FABRICATOR'S QUALIFICATIONS

A. Truss fabricator shall meet the requirements in the Structural Quality Assurance Plan in the Structural Drawings.

B. Trusses shall be designed, fabricated, and erected by a firm which has a minimum of five years of successfully designing, fabricating and erecting trussed assemblies similar to scope required .

1.8 ERECTOR'S QUALIFICATIONS

A. Erector shall have a minimum of 5 years experience in the erection of trusses similar in complexity to this Project as evidenced by 10 completed projects.

1.9 DELIVERY, STORAGE AND HANDLING

A. Deliver, handle and store trusses with care and in accordance with manufacturer's instructions and CFSBCSI recommendations to avoid damage from bending, overturning or other cause for which trusses are not designed to resist or endure.

PART 2 PRODUCTS

2.1 TRUSS COMPONENTS

A. Truss components shall be manufactured from steel that conforms to the requirements of ASTM A653, Grade A (33 ksi min. yield) for 18 gage and lighter and ASTM A653, Grade D (50 ksi min. yield) for 16 gage and heavier. Galvanize with a zinc coating complying with G60 minimum.
1. Top chord of cold-formed trusses shall be a minimum of 16 gage to receive roof deck attachments.

2.2 FASTENERS

A. Framing components shall be shop fabricated and joined to one another by means of manufacturer recommended self-drilling, self-tapping screws with corrosion-resistant plated finish or welding complying with AWS D1.3. Welding in the field to cold-formed elements is strictly prohibited unless written permission is received from the truss Engineer.

PART 3 EXECUTION

3.1 PREPARATION

A. Contractor shall prepare the structure to ensure proper and adequate structural support for the materials specified.

3.2 EXAMINATION

A. Truss Erector shall visually examine and verify that receiving surfaces of the substructure have no apparent defects or errors which would result in substandard workmanship.

B. Report any unsatisfactory conditions to the Architect.

3.3 FABRICATION

A. Cold-formed steel trusses shall be constructed at the fabricator's shop. Job-site assembly is not permitted.

B. Truss components shall be straight and true prior to fabrication. Flattening or straightening of components, when necessary, shall be accomplished in a manner so as to not damage the component.

C. Truss components shall be cut neatly to fit snugly against adjacent members.

D. No splices will be allowed in trusses except as shown in the approved shop drawings.

E. Provide all clips, angles, henways and other miscellaneous pieces necessary to attach cold-formed steel trusses to the substructure or to attach other components within this section to one another.

F. Completed trusses shall be free from twists, bends, or open joints with all members straight and true to line.

G. If the truss components have been welded to one another then all welds must be thoroughly cleaned and wire brushed and primed and painted with a high zinc content paint capable of providing an equal or greater degree of protection than the original G-60 galvanized coating.

3.4 ERECTION

A. Trusses shall be erected by approved methods using equipment of adequate capacity to safely perform the work. Lifting of trusses shall be done so as to not cause local distortion in any member.

B. Trusses shall be erected true and plumb and properly bridged and braced in accordance with the approved shop drawings.

C. Contractor is responsible for checking the dimensions and assuring the fit of all members and trusses before erection begins.

D. Work shall be erected plumb and level and to dimensions and spacings indicated on the drawings.

E. Components shall be of the size and spacing shown on the approved shop drawings.

F. Provide web stiffeners and reinforcement at reaction points where required by analysis or to suit details.

G. Anchor trusses securely at all bearing points to comply with methods and details indicated.

H. Install permanent bracing and related components to enable trusses to maintain design spacing, withstand live and dead loads, and comply with other indicated requirements.

I. Do not cut, modify, damage, or remove truss components.

END OF SECTION

SECTION 05 50 00
METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop and site fabricated steel items.

B. All misc. items shown in the drawings but not included in the structural drawings.

C. Steel Pipe Railings.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.

B. Section 04 20 00 - UNIT MASONRY ASSEMBLIES: Placement of metal fabrications in masonry.

C. Section 09 91 13 - Exterior Painting: Paint finish.

D. Section 09 91 23 - INTERIOR PAINTING: Paint finish.

1.03 REFERENCE STANDARDS

A. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements; 2008.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

E. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2013.

G. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2014.

H. ASTM A325M - Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength (Metric); 2014.

I. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2014.

J. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

K. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2014.

L. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.

M. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.

N. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).

O. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

1.04 SUBMITTALS

A. See Section 01 33 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

C. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M. All exterior lintels are to be galvanized.

B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.

C. Plates: ASTM A283.

D. Pipe: ASTM A53/A53M, Grade B Schedule 40, hot-dip galvanized finish.

E. Slotted Channel Framing: ASTM A653/A653M, Grade 33.

F. Slotted Channel Fittings: ASTM A1011/A1011M.

G. Fasteners: As shown in drawings.

H. Bolts, Nuts, and Washers: ASTM A325 (ASTM A325M), Type 1, galvanized to ASTM A153/A153M where connecting galvanized components.

I. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

J. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

K. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Continuously seal joined members by continuous welds.

D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 FABRICATED ITEMS

A. Ladders: Steel; in compliance with ANSI A14.3; with mounting brackets and attachments; prime paint finish. Sizes of steel are shown in drawings.

B. Guard Rails: As detailed; galvanized finish and painted.

C. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; galvanized finish and painted.

D. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of metal decking; galvanized finish.

E. Lintels: As detailed; galvanized finish and painted.

F. Sill Angles for Tempered Glass Railing Assemblies: ASTM A 36/A 36M steel angles with anchoring devices and sizes as indicated in shop drawings for railing assembly, drilled and tapped for fastener types, sizes, and spacing indicated, galvanized finish and painted.

G. Door Frames for Overhead Door Openings and Wall Openings: Channel sections; galvanized finish and painted.

H. Attachment anchors for exterior window openings as shown in the drawings; galvanized and painted; where shown.

2.04 FINISHES - STEEL

A. Prime paint steel items.
   1. Exceptions: Galvanize items to be embedded in concrete or masonry and items specified for exterior painted finish.
   2. Exceptions: Do not prime surfaces in direct contact with concrete or masonry, where field welding is required, and items to be covered with sprayed fireproofing.

B. All exterior exposed steel surfaces must be galvanized and painted as required by 09 91 13.

C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

D. Prime Painting: Prime all steel as required by Section 09 91 23.

E. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements. Provide minimum 1.7 oz/sq ft galvanized coating.

F. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

2.05 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Field weld components as indicated on drawings.

D. Perform field welding in accordance with AWS D1.1/D1.1M.

E. Obtain approval prior to site cutting or making adjustments not scheduled.

F. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

SECTION 05 52 13
HANDRAILS AND RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall mounted handrails.

B. Stair railings and guardrails.

C. Free-standing railings at steps.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Placement of anchors in concrete.

B. Section 04 20 00 - UNIT MASONRY ASSEMBLIES: Placement of anchors in masonry.

C. Section 09 21 16 - Gypsum Board Assemblies: Placement of backing plates in stud wall construction.

D. Section 09 91 13 - Exterior Painting: Paint finish.

E. Section 09 91 23 - INTERIOR PAINTING: Paint finish.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

D. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings; 2013.

E. ASTM E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings; 2000 (Reapproved 2006).

F. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).

1.04 SUBMITTALS

A. See Section 01340 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

PART 2 PRODUCTS

2.01 RAILINGS - GENERAL REQUIREMENTS

A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of ASTM E985 and applicable local code.

B. Distributed Loads: Design railing assembly, wall rails, and attachments to resist distributed force of 75 pounds per linear foot applied to the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E 935.

C. Concentrated Loads: Design railing assembly, wall rails, and attachments to resist a concentrated force of 200 pounds applied at any point on the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E 935.

D. Allow for expansion and contraction of members and building movement without damage to connections or members.

E. Dimensions: See drawings for configurations and heights.
   1. Top Rails and Wall Rails: 1-1/2 inches diameter, round.

F. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
   1. For anchorage to concrete, provide inserts to be cast into concrete, for welding anchors.
   2. For anchorage to masonry, provide brackets to be embedded in masonry, for bolting anchors.
   3. For anchorage to stud walls, provide backing plates, for bolting anchors.

G. Provide welding fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

2.02 STEEL PIPE HANDRAILS AND GUARDRAILS

A. Steel Pipe: ASTM A 53/A 53M, Grade B Schedule 40, galvanized finish.

B. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.

C. Exposed Fasteners: No exposed bolts or screws.

D. Straight Splice Connectors: Steel welding collars.

E. Galvanizing: In accordance with requirements of ASTM A123/A123M.

F. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.03 FABRICATION

A. Accurately form components to suit specific project conditions and for proper connection to building structure.

B. Fit and shop assemble components in largest practical sizes for delivery to site.

C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.

D. Welded Joints:

E. Exterior Components: Continuously seal joined pieces by continuous welds. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.

F. Interior Components: Continuously seal joined pieces by intermittent welds and plastic filler.

G. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply items required to be cast into concrete or embedded in masonry with setting templates, for installation as work of other sections.

C. Apply one coat of bituminous paint to concealed aluminum surfaces that will be in contact with cementitious or dissimilar materials.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.

C. Install railings in compliance with ADA Standards for accessible design at applicable locations.

D. Anchor railings securely to structure.

E. Field weld anchors as indicated on drawings. Touch-up welds with primer. Grind welds smooth.

F. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per floor level, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

SECTION 05 55 00

METAL STAIR NOSINGS

1 GENERAL

1.1 SECTION INCLUDES

A. Extruded aluminum stair nosings.

1.2 RELATED SECTIONS

A. Section 04 20 00 - Unit Masonry

B. Section 03 30 00 - Cast-In-Place Concrete

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. ASTM B 221-93 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.

1.4 SUBMITTALS

A. Submit the following in accordance with Section 01300:

1. Product Data: Manufacturers product specifications, installation and maintenance instructions.

2. Samples for Selection Purposes: Actual sections of stair nosing material in a convenient but representative size.

3. Samples for Verification Purposes: Not less than 6 inch (152 mm) long material in selected colors and finishes for each type of stair nosing specified.

1.5 QUALITY ASSURANCE

A. Single Source Responsibility: Obtain stair nosings from one source and from a single manufacturer.

1.6 SEQUENCING AND SCHEDULING

A. Coordinate with concrete work so that cast-in-place nosings are available for placing integrally with stairs.

1.7 WARRANTY

A. Stair nosings shall be fabricated free of defects in materials and workmanship in accordance with the General Conditions, and the manufacturer shall offer a one-year extended warranty against defects in materials and workmanship.

2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Arden Architectural Specialties, Inc., 151 Fifth Avenue NW, Suite J, St. Paul, Minnesota 55112, (800) 521-1826 or (651) 631-1607, FAX (651) 631-0251.

B. Other manufacturers seeking approval of their products must comply with requirements of the Instructions to Bidders prior to bidding.

2.2 STAIR NOSING TYPE

A. Extruded aluminum two-part stair nosings, Model: N-TB30.

2.3 MATERIALS

A. Extruded aluminum nosings, ASTM B221, alloy 6063-T5 with cement filler with not less than 65% virgin gain aluminum oxide or silicon abrasive grit. Cement filler must contain an acrylic polymer liquid bonding admixture to improve adhesion, tensile, compressive, and flexural strengths and minimize moisture absorption.

1. Type: Extruded aluminum two-part stair nosings

2. Primary Color: as selected from manufacturer’s standards

3. Highlight Color: as selected from manufacturer’s standards

4. Fastening Type: Continuous extruded anchor

2.4 FABRICATION

A. Shop fabricate stair nosings to greatest extent possible in sizes shown. Where not otherwise shown, provide single unit for each grate installation, but do not exceed manufacturers maximum size recommendation.

3 EXECUTION

3.1 EXAMINATION

A. Examine the substrates and conditions under which the work is to be performed, and notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install stair nosings in accordance with manufacturers instructions, at locations shown.

3.3 PROTECTION

A. Upon completion of installation, maintain temporary filler of plywood or fiberboard in nosing channels until construction traffic has ended. Install grit top channels when Project is near time of Substantial Completion.

END OF SECTION

SECTION 06 10 00
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-structural dimension lumber framing.

B. Wall and roof sheathing.

C. Roof-mounted curbs.

D. Roofing nailers.

E. Preservative treated wood materials.

F. Fire retardant treated wood materials.

G. Miscellaneous framing and sheathing.

H. Communications and electrical room mounting boards.

I. Concealed wood blocking, nailers, and supports.

J. Miscellaneous wood nailers, furring, and grounds.

1.02 REFERENCE STANDARDS

A. AFPA (WFCM) - Wood Frame Construction Manual for One- and Two-Family Dwellings; American Forest and Paper Association; 2012.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

D. AWPA U1 - Use Category System: User Specification for Treated Wood; 2012.

E. PS 1 - Structural Plywood; 2009.

F. PS 20 - American Softwood Lumber Standard; 2010.

G. SPIB (GR) - Grading Rules; 2014.

1.03 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
   2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

B. Lumber fabricated from old growth timber is not permitted.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Grading Agency: Southern Pine Inspection Bureau, Inc. (SPIB).

B. Sizes: Nominal sizes as indicated on drawings, S4S.

C. Moisture Content: S-dry or MC19.

D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
   1. Lumber: S4S, No. 2 or Standard Grade.
   2. Boards: Standard or No. 3.

2.03 EXPOSED DIMENSION LUMBER

A. Grading Agency: Southern Pine Inspection Bureau, Inc. (SPIB).

B. Sizes: Nominal sizes as indicated on drawings.

C. Surfacing: S4S.

D. Moisture Content: S-dry or MC19.

2.04 CONSTRUCTION PANELS

A. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

B. Other Applications:
   1. Plywood Concealed From View But Located Within Exterior Enclosure: PS 1, C-C Plugged or better, Exterior grade.
   2. Plywood Exposed to View But Not Exposed to Weather: PS 1, A-D, or better.
   3. Other Locations: PS 1, C-D Plugged or better.

2.05 ACCESSORIES

A. Fasteners and Anchors:
   1. Metal and Finish: Hot-dipped galvanized steel per ASTM A 153/A 153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.

2.06 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
   1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
   2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

B. Fire Retardant Treatment:
   1. Interior Type A: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread rating of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
      a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
      b. Treat rough carpentry items as indicated .
      c. Do not use treated wood in applications exposed to weather or where the wood may become wet.

C. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative to 0.25 lb/cu ft retention.
   1. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
      a. Treat lumber exposed to weather.
   2. Treat lumber in contact with roofing, flashing, or waterproofing.
   3. Treat lumber in contact with masonry or concrete.

PART 3 EXECUTION

3.01 PREPARATION

A. Coordinate installation of rough carpentry members specified in other sections.

3.02 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.03 FRAMING INSTALLATION

A. Set structural members level, plumb, and true to line. Discard pieces with defects that would lower required strength or result in unacceptable appearance of exposed members.

B. Make provisions for temporary construction loads, and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.

C. Install structural members full length without splices unless otherwise specifically detailed.

D. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by applicable codes and AFPA Wood Frame Construction Manual.

E. Construct double joist headers at floor and ceiling openings and under wall stud partitions that are parallel to floor joists; use metal joist hangers unless otherwise detailed.

F. Frame wall openings with two or more studs at each jamb; support headers on cripple studs.

3.04 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.

C. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

D. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

E. Provide the following specific non-structural framing and blocking:
   1. Cabinets and shelf supports.
   2. Wall brackets.
   3. Handrails.
   4. Grab bars.
   5. Towel and bath accessories.
   6. Wall-mounted door stops.
   7. Chalkboards and marker boards.
   8. Wall paneling and trim.
   9. Joints of rigid wall coverings that occur between studs.

3.05 ROOF-RELATED CARPENTRY

A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

B. Provide wood curb at all roof openings except where prefabricated curbs are specified and where specifically indicated otherwise. Form corners by alternating lapping side members.

3.06 INSTALLATION OF CONSTRUCTION PANELS

A. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.
   1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
   2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
   3. Install adjacent boards without gaps.
   4. Size and Location: As indicated on drawings.

3.07 TOLERANCES

A. Framing Members: 1/4 inch from true position, maximum.

B. Variation from Plane (Other than Floors): 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

END OF SECTION

SECTION 06 20 00

FINISH CARPENTRY

PART ONE - GENERAL

1.01 SCOPE

A. Work Included: Provide all finish carpentry indicated on the Drawings as required for a complete and proper installation including but not limited to the following:
   1. Porch and stair balustrades
   2. Window shutters
   3. Install all Finish Hardware.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 09 91 23 – Interior Painting

1.03 QUALIFICATIONS

A. Millwork shall be fabricated by a qualified subcontractor or trade personnel that has been a member in good standing with the Architectural Woodwork Institute for a minimum of (1) year. Provide at least three (3) projects of comparable size and type of work, within the last five years, identifying the following for each project:
   1. Name and location of project
   2. Name and current phone number of client contact
   3. Scope of total project
   4. Scope of specific involvement and responsibility

Evidence of this experience shall be submitted to the Architect by the successful bidder within seven days of bidding.

B. Finish carpentry shall be performed by a qualified subcontractor or trade personnel. At least three (3) projects of comparable size and type of work, within the last five years, identifying the following for each project:
   1. Name and location of project
   2. Name and current phone number of client contact
   3. Scope of total project
   4. Scope of specific involvement and responsibility

Evidence of this experience shall be submitted to the Architect by the successful bidder within seven days of bidding.

C. Qualifications of personnel: Provide workers and supervisors that are thoroughly familiar with the specified requirements and have not less than five (5) years experience in comparable historic preservation projects. Use only skilled workers to ensure installation in strict accordance with the approved design and the approved recommendations of the materials manufacturers.

D. Submit to Architect resumes of key personnel who will be specifically assigned to this project. Resumes must contain Full Name, current employer, education, employment history for the last ten years, and list of completed projects.

1.04 SUBMITTALS

A. A sample of each material and hardware unit to be utilized.

1.05 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

1.06 JOB CONDITIONS

A. Coordination: Fit carpentry work to other work; scribe and cope as required for accurate fit.

PART TWO – PRODUCTS

2.01 MATERIALS

A. Fasteners: Provide fasteners properly selected for the material to be fastened and the substrate to which the material will be fixed, designed to develop proper and adequate strength commensurate with the use.

B. Wood to be mahogany, premium heart pine, or Spanish cedar.

PART THREE - EXECUTION

3.01 INSPECTION

A. Examine the areas and conditions under which work of this Section will be performed. Notify the Contractor of any condition which is detrimental to the proper and timely completion of the work. Do not proceed until all unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install all work plumb, level, true, and straight with no distortions. Shim as required using concealed shims. Install to a tolerance of 1/8" in 8'-0" to plumb and level and with 1/16" maximum offset in flush adjoining surfaces.

3.03 ADJUSTMENT, CLEANING, FINISHING AND PROTECTION

A. Repair damaged and defective work wherever possible to eliminate defects functionally and visually; where not possible to repair properly, replace work. Adjust joinery for uniform appearance.

B. Clean hardware, lubricate where applicable and make final adjustments for proper operation.

C. Wood Finishing: With fine sandpaper, working in the direction of the grain of the wood, remove all rough edges resulting from trimming and leave in condition to receive final finish.

D. Complete the finishing work specified as work of this Section, to whatever extent not completed at shop or prior to installation of work in a manner equal in all respects to shop finish.

END OF SECTION

SECTION 06 41 00
ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Specially fabricated cabinet units.

B. Cabinet hardware for items not shown in drawings.

C. Preparation for installing utilities.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Support framing, grounds, and concealed blocking.

B. Section 12 36 00 - Countertops.

C. Section 09 91 23 - INTERIOR PAINTING: Site finishing of cabinet exterior and interior.

1.03 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.

B. GSA CID A-A-1936 - Adhesive, Contact, Neoprene Rubber; Federal Specifications and Standards; Revision A, 1996.

C. PS 1 - Structural Plywood; 2009.

1.04 SUBMITTALS

A. See Section 01 33 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate materials, component profiles and elevations, assembly methods, joint details, fastening methods, accessory listings, hardware location and schedule of finishes.

C. Product Data: Provide data for hardware accessories.

D. Samples: Submit actual sample items of proposed pulls and hinges, demonstrating hardware design, quality, and finish.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect units from moisture damage.

1.07 FIELD CONDITIONS

A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.01 CABINETS

A. Quality Grade: Unless otherwise indicated provide products of quality specified by AWI//AWMAC/WI (AWS) for Premium Grade.

B. Cabinet Component Construction::
   1. Adjustable Shelf Loading: 50 lbs. per sq. ft..
   2. Cabinet Style: As indicated for each location.
   3. Cabinet Doors and Drawer Fronts: As indicated.
   4. Drawer Side Construction: Multiple-dovetailed.
   5. Drawer Construction Technique: Dovetail joints.

2.02 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

B. Hardwood Edgebanding: Use solid hardwood edgebanding matching species, color, grain, and grade for exposed portions of cabinetry.

2.03 LUMBER MATERIALS

A. For Painted Millwork or Laminate Finish, Softwood Lumber: NIST PS 20; Graded in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated,, Grade III/Economy; average moisture content of 4-9 percent; species and grade as follows:
   1. Cabinet Frame: Solid Stock Wood: Species Ponderosa, White Pine, or Furr, Grade "A" at exposed; "B" at semi-exposed, "C" at concealed.
   2. Exposed Stiles and Rails: Solid Stock Wood: Species Ponderosa, White Pine, or Furr, Grade.
   3. Internal Construction: Solid Stock Wood: Species Ponderosa, White Pine, or Furr, Grade .

B. For Stained Millwork, Hardwood Lumber: NHLA; graded in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated,, Grade III/Economy; average moisture content of 4-9 percent; species and grade as follows:
   1. Cabinet Frame: Solid Stock Wood: Species Cherry, Grade A.
   2. Exposed Stiles and Rails: Solid Stock Wood: Species Cherry, Grade A.
   3. Internal Construction: Solid Stock Wood: Species See Panel Materials below.

2.04 PANEL MATERIALS

A. For Plastic Laminated Finish Millwork: PS 1; Graded in accordance with AWI, core materials of veneer; species and cut as follows:
   1. Door and Drawer Fronts: Species 3/4" Plywood, Grade "B".
   2. Drawer Construction: Species 3/4" Plywood, Grade "B".
   3. Gables and Backs: Species 1/2" and 1/4" (as shown in drawings) Plywood, Grade "B".
   4. Shelving: Species 3/4" Plywood, Grade "B"

B. For Stained Millwork, Hardwood Plywood: HPVA HP-1; graded in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, core materials of veneer (wood plies), type of glue recommended for application; face veneer and cuts as follows:
   1. Exposed Surfaces: Grade AA, Cherry rotary cut, slip-matched.
   2. Door and Drawer Fronts: Species Cherry, Grade "A".
   3. Drawer Construction: Species 3/4" Custom Birch Veneer Plywood, Grade "A".
   4. Gables and Backs: Species 1/2" Custom Birch Veneer Plywood, Grade "A".
   5. Shelving: Species 3/4" Custom Birch Veneer Plywood, Grade "A".
   6. Use as backing for plastic laminate for shelving and backs unless otherwise indicated.

C. Plywood: NIST PS 1, Interior rated adhesives, core of wood plies from listed species unless otherwise indicated, thickness as indicated or as required by application.
   1. Use as backing for plastic laminate in shelving and backs in drawings.

D. Hardwood Edgebanding: Use solid hardwood edgebanding matching species, color, grain, and grade for exposed portions of cabinetry that are stained.

2.05 LAMINATE MATERIALS

A. Plastic Laminate Manufacturers:
   1. Formica Corporation: www.formica.com.
   2. Wilsonart, LLC: www.wilsonart.com.

B. Provide specific types as scheduled.

C. Plastic Laminate: In accordance with AWI Quality Standards Illustrated, 0.039 inch Post Forming quality; color, as selected from manufacturer's standard selection pattern, and matte surface texture as selected.

D. Laminate Backing Sheet: 0.020 inch Backing Sheet grade, undecorated plastic laminate.

2.06 ACCESSORIES

A. Adhesive: GSA CID A-A-1936 contact adhesive.

B. Glass: Type A as specified in Section 08 80 00.

C. Fasteners: Size and type to suit application.

D. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.

E. Concealed Joint Fasteners: Threaded steel.

F. Grommets: Standard plastic grommets for cut-outs, in color to match adjacent surface.

2.07 HARDWARE

A. Use list of hardware below only if NOT listed or shown in the drawings.

B. Adjustable Shelf Supports: Standard side-mounted system using recessed metal shelf standards or multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch spacing adjustments.

C. Adjustable Shelf Supports: Standard back-mounted system using surface mounted metal shelf standards and coordinated cantilevered shelf brackets, satin chrome finish, for nominal 1 inch spacing adjustments.

D. Shelf Brackets: Knape & Vogt # 161LL and 24".

E. Drawer and Door Pulls: Hafele # 131.24.601 knob, Bella Italiana, brass, nickel matt, M4, diameter 25mm; #117.97.663 bar pull, steel, nickel brushed, 8-32, center to center 160mm..

F. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with satin finish. Hafele # 235.12.221

G. Catches: Magnetic. Hafele # 246.36.300 black double magnetic catch; Hafele #246.29.301 black magnetic catch

H. Drawer Slides: Knape & Vogt #1300

I. Hinges: Concealed (fully mortised) self-closing type, steel with satin finish.

J. Cam Locks: Chrome plated finish; 235.12.221 manufactured by Hafele.

2.08 SHOP TREATMENT OF WOOD MATERIALS

A. Shop brush apply wood materials requiring UL fire rating to concealed wood blocking.

B. Provide UL approved identification on fire retardant treated material.

C. Deliver fire retardant treated materials cut to required sizes. Minimize field cutting.

2.09 SITE FINISHING MATERIALS

A. Finishing: Site finished as specified in Section 09 91 23.

2.10 FABRICATION

A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.

B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.

D. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.

1. Cap exposed plastic laminate finish edges with material of same finish and pattern.

E. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

2.11 FACTORY FINISHING

A. Sand work smooth and set exposed nails and screws.

B. For opaque finishes, apply wood filler in exposed nail and screw indentations and sand smooth.

C. On items to receive transparent finishes, use wood filler matching or blending with surrounding surfaces and of types recommended for applied finishes.

D. Seal, stain and varnish exposed to view surfaces. Brush apply only.

E. Seal stain and varnish internal exposed to view and semi-concealed surfaces. Brush apply only.

F. Seal internal surfaces of cabinets with one coat of shellac. Brush apply only.

G. Prime paint surfaces in contact with cementitious materials.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify location and sizes of utility rough-in associated with work of this section.

3.02 INSTALLATION

A. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.

B. Use fixture attachments in concealed locations for wall mounted components.

C. Use concealed joint fasteners to align and secure adjoining cabinet units.

D. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.

E. Secure cabinets to floor using appropriate angles and anchorages.

F. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

3.03 ADJUSTING

A. Adjust installed work.

B. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING

A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION

SECTION 07 13 26

SELF-ADHERING SHEET WATERPROOFING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. All of the Contract Documents, including General and Supplementary Conditions and Division 1 General Requirements, apply to the work of this section.

1.02 SUMMARY

A. The work of this section includes, but is not limited to, the following:

1. Rubberized asphalt sheet membrane waterproofing system
2. Prefabricated drainage composite
3. Protection board

B. Related Sections: Other specification sections which directly relate to the work of this section include, but are not limited to, the following:

1. Section 03 30 00 – Cast-In-Place Concrete
2. Section 04 22 00 – Unit Masonry
4. Section 07 60 00 – Flashing and Sheet Metal
5. Section 07 92 05 – Joint Sealants

1.03 REFERENCE STANDARDS

A. The following standards and publications are applicable to the extent referenced in the text.

B. American Society for Testing and Materials (ASTM)

C 836 Standard Specification for High Solids, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course

D 412 Standard Test Methods for Rubber Properties in Tension

D 570 Standard Test Method for Water Absorption of Plastics

D 882 Standard Test Methods for Tensile Properties of Thin Plastic Sheeting

D 903 Standard Test Method for Peel or Stripping Strength of Adhesive Bonds

D 1876 Standard Test Method for Peel Release of Adhesives (T-Peel)

D 1970 Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection

D 3767 Standard Practice for Rubber - Measurements of Dimensions

D 5385 Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes

E 96 Standard Test Methods for Water Vapor Transmission of Materials

E 154 Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's product data, installation instructions, use limitations and recommendations. Include certification of data indicating VOC (Volatile Organic Compound) content of all components of waterproofing system.

B. Samples: Submit representative samples of the following for approval:

1. Sheet membrane
2. Protection board
3. Prefabricated drainage composite

1.05 QUALITY ASSURANCE

A. Manufacturer: Sheet membrane waterproofing system shall be manufactured and marketed by a firm with a minimum of 20 years experience in the production and sales of self-adhesive sheet membrane waterproofing. Manufacturers proposed for use but not named in these specifications shall submit evidence of ability to meet all requirements specified, and include a list of projects of similar design and complexity completed within the past 5 years.

B. Installer: A firm which has at least 3 years experience in work of the type required by this section.

C. Materials: For each type of material required for the work of this section, provide primary materials which are the products of one manufacturer.

D. Pre-Installation Conference: A pre-installation conference shall be held prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Agenda for meeting shall include review of special details and flashing.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver materials and products in labeled packages. Store and handle in strict compliance with manufacturer's instructions, recommendations and material safety data sheets. Protect from damage from sunlight, weather, excessive temperatures and construction operations. Remove damaged material from the site and dispose of in accordance with applicable regulations.

1. Do not double-stack pallets of membrane on the job site. Provide cover on top and all sides, allowing for adequate ventilation.
2. Protect mastic and adhesive from moisture and potential sources of ignition.
3. Store drainage composite or protection board flat and off the ground. Provide cover on top and all sides.
4. Protect surface conditioner from freezing.

B. Sequence deliveries to avoid delays, but minimize on-site storage.

1.07 PROJECT CONDITIONS

A. Perform work only when existing and forecasted weather conditions are within the limits established by the manufacturer of the materials and products used.

B. Proceed with installation only when substrate construction and preparation work is complete and in condition to receive sheet membrane waterproofing.

1.08 WARRANTY

A. Sheet Membrane Waterproofing: Provide written 5 year material warranty issued by the membrane manufacturer upon completion of the work.

PART 2 PRODUCTS

2.01 MATERIALS

A. Sheet Membrane Waterproofing System: Bituthene® System 4000 Membrane by Grace Construction Products; a self-adhesive, cold-applied composite sheet consisting of a thickness of 1.4 mm (0.056 in.) of rubberized asphalt and 0.1 mm (0.004 in.) of cross-laminated, high density polyethylene film specially formulated for use with water-based surface conditioner. Provide rubberized asphalt membrane covered with a release sheet which is removed during installation. No special adhesive or heat shall be required to form laps.

B. Sheet Membrane Waterproofing

PHYSICAL PROPERTIES FOR BITUTHENE SYSTEM 4000 MEMBRANE:

Property	Test Method	Typical Value
Color		Dark gray-black
Thickness	ASTM D 3767 Method A	1.5 mm (0.060 in.) nominal
Flexibility, 180° bend over 25 mm (1 in.) mandrel at -43°C (-45°F)	ASTM D 1970	Unaffected
Tensile Strength, Membrane Die C	ASTM D 412 Modified[1]	2240 kPa (325 lbs/in.^{2}) minimum
Tensile Strength, Film	ASTM D 882 Modified[1]	34.5 MPa (5,000 lbs/in.^{2}) minimum
Elongation, Ultimate Failure of Rubberized Asphalt	ASTM D 412 Modified[1]	300% minimum
Crack Cycling at -32°C (-25°F), 100 Cycles	ASTM C 836	Unaffected
Lap Adhesion at Minimum Application Temperature	ASTM D 1876 Modified[2]	880 N/m (5 lbs/in.)
Peel Strength	ASTM D 903 Modified[3]	1576 N/m (9 lbs/in.)
Puncture Resistance, Membrane	ASTM E 154	222 N (50 lbs) minimum
Resistance to Hydrostatic Head	ASTM D 5385	70 m (231 ft) of water
Permeance	ASTM E 96, Section 12 – Water Method	2.9 ng/m^{2}sPa (0.05 perms) maximum
Water Absorption	ASTM D 570	0.1% maximum

Footnotes:
1. *The test is run at a rate of 50 mm (2 in.) per minute.*
2. *The test is conducted 15 minutes after the lap is formed and run at a rate of 50 mm (2 in.) per minute at -4°C (25°F).*
3. *The 180° peel strength is run at a rate of 300 mm (12 in.) per minute.*

C. Prefabricated Drainage Composite: (Hydroduct® 220) Drainage Composite by Grace Construction Products. Drainage Composite shall be designed to promote positive drainage while serving as a protection course.

D. Protection Board:

1. Expanded Polystyrene Protection Board: 25 mm (1 in.) thick for vertical applications with the following characteristics. Adhere to waterproofing membrane with Bituthene Protection Board Adhesive.

   Normal Density: 16 kg/m^3 (1.0 lb/ft^3)

   Thermal Conductivity, K factor: 0.24 at 5°C (40°F), 0.26 at 24°C (75°F)

   Thermal Resistance, R-Value: 4 per 25 mm (1 in.) of thickness.

2. Asphalt Hardboard: A premolded semi-rigid protection board consisting of bitumen, mineral core and reinforcement. Provide 3 mm (0.125 in.) thick hardboard on horizontal surfaces not receiving steel reinforced slab. Where steel reinforcing bars are to be used, apply two layers of 3 mm (0.125 in.) thick hardboard or one layer of 6 mm (0.25 in.) thick hardboard.

E. Waterstop: Adcor™ ES hydrophilic non-bentonite waterstop by Grace Construction Products for non-moving concrete construction joints.

F. Miscellaneous Materials: Surface conditioner, mastic, liquid membrane, tape and accessories specified or acceptable to manufacturer of sheet membrane waterproofing.

PART 3 EXECUTION

3.01 EXAMINATION

A. The installer shall examine conditions of substrates and other conditions under which this work is to be performed and notify the contractor, in writing, of circumstances detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected.

3.02 PREPARATION OF SUBSTRATES

A. Refer to manufacturer's literature for requirements for preparation of substrates. Surfaces shall be structurally sound and free of voids, spalled areas, loose aggregate and sharp protrusions. Remove contaminants such as grease, oil and wax from exposed surfaces. Remove dust, dirt, loose stone and debris. Use repair materials and methods which are acceptable to manufacturer of sheet membrane waterproofing.

B. Cast-In-Place Concrete Substrates:

1. Do not proceed with installation until concrete has properly cured and dried (minimum 7 days for normal structural concrete and minimum 14 days for lightweight structural concrete).

2. Fill form tie rod holes with concrete and finish flush with surrounding surface.
3. Repair bugholes over 13 mm (0.5 in.) in length and 6 mm (0.25 in.) deep and finish flush with surrounding surface.
4. Remove scaling to sound, unaffected concrete and repair exposed area.
5. Grind irregular construction joints to suitable flush surface.

C. Masonry Substrates: Apply waterproofing over concrete block and brick with smooth trowel-cut mortar joints or parge coat.

D. Wood Substrates: Apply waterproofing membrane over securely fastened sound surface. All joints and fasteners shall be flush to create a smooth surface.

E. Related Materials: Treat joints and install flashing as recommended by waterproofing manufacturer.

3.03 INSTALLATION

A. Refer to manufacturer's literature for recommendations on installation, including but not limited to, the following:

1. Apply surface conditioner at rate recommended by manufacturer. Recoat areas not waterproofed if contaminated by dust. Mask and protect adjoining exposed finish surfaces to protect those surfaces from excessive application of surface conditioner.
2. Delay application of membrane until surface conditioner is completely dry. Dry time will vary with weather conditions.
3. Seal daily terminations with troweled bead of mastic.
4. Apply protection board and related materials in accordance with manufacturer's recommendations.

3.04 CLEANING AND PROTECTION

A. Remove any masking materials after installation. Clean any stains on materials which would be exposed in the completed work.

B. Protect completed membrane waterproofing from subsequent construction activities as recommended by manufacturer.

END OF SECTION

SECTION 07 19 00
WATER REPELLENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water repellents applied to exterior masonry and concrete surfaces.

1.02 REFERENCE STANDARDS

A. ASTM C140/C140M - Standard Test Methods of Sampling and Testing Concrete Masonry Units and Related Units; 2014.

B. ASTM D5095 - Standard Test Method for Determination of the Nonvolatile Content in Silanes, Siloxanes, and Silane-Siloxane Blends Used in Masonry Water Repellent Treatments; 1991 (Reapproved 2013).

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a meeting at least one week prior to starting work; require attendance of affected installers; invite Albert & McCleskey Associates Architects and Southern Mississippi Investment Company, Inc..

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description.

C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention; cautionary procedures required during application.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Manufacturer's Field Reports: Report whether manufacturer's "best practices" are being followed; if not, state corrective recommendations. Email report to Albert & McCleskey Associates Architects the same day as inspection occurs; mail report on manufacturer's letterhead to Albert & McCleskey Associates Architects within 2 days after inspection.

F. Maintenance Materials: Furnish the following for Southern Mississippi Investment Company, Inc.'s use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Southern Mississippi Investment Company, Inc. reserves the right to provide continuous independent inspection of surface preparation and application of water repellent.

1.06 MOCK-UP

A. Prepare a representative surface 36 by 36 inch in size using specified materials and preparation and application methods on surfaces identical to those to be coated; approved mock-up constitutes standard for workmanship.

B. Locate where directed.

1.07 FIELD CONDITIONS

A. Protect liquid materials from freezing.

B. Do not apply water repellent when ambient temperature is lower than 50 degrees F or higher than 100 degrees F.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Silane/Siloxane Water Repellents:

1. PROSOCO, Inc; Product Siloxine PD: www.prosoco.com.
2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

A. Water Repellent: Non-glossy, colorless, penetrating, water-vapor-permeable, non-yellowing sealer, that dries invisibly leaving appearance of substrate unchanged.
   1. Applications: Vertical surfaces and non-traffic horizontal surfaces.
   2. Number of Coats: Two.
   3. VOC Content: Less than 600 g/L, when tested in accordance with ASTM D3690 or D 5095.
   4. Moisture Absorption When Applied to Masonry: 5 percent, maximum, when tested in accordance with ASTM C140/C140M using masonry sample completely coated with water repellent.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify joint sealants are installed and cured.

C. Verify surfaces to be coated are dry, clean, and free of efflorescence, oil, or other matter detrimental to application of water repellent.

3.02 PREPARATION

A. Protection of Adjacent Work:
   1. Protect adjacent landscaping, property, and vehicles from drips and overspray.
   2. Protect adjacent surfaces not intended to receive water repellent.

B. Prepare surfaces to be coated as recommended by water repellent manufacturer for best results.

3.03 APPLICATION

A. Apply water repellent in accordance with manufacturer's instructions, using procedures and application methods recommended as producing the best results.

B. Apply two coats, minimum.

C. Remove water repellent from unintended surfaces immediately by a method instructed by water repellent manufacturer.

END OF SECTION

SECTION 07 21 00
THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Board insulation with integral vapor barrier and air barrier at exterior wall behind Masonry and Precast Architectural Concrete wall finish and under elevated floor deck. Installation shall meet requirements as an air barrier and class 1 vapor retarder. All joints shall be fully and completely sealed.

B. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

1.02 REFERENCE STANDARDS

A. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2012.

B. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2014.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

D. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C; 2012.

E. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components; 2012.

F. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

C. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.04 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. Insulation Behind Masonry Walls and behind Precast Architectural Concrete: Polyisocyanurate Insulation board.

B. Insulation on Underside of Above Grade Concrete Deck: Polyisocyanurate Insulation with air barrier.

2.02 FOAM BOARD INSULATION MATERIALS

A. Polyisocyanurate Board Insulation: Rigid cellular foam, complying with ASTM C 1289; Type I, aluminum foil both faces; Class 1, non-reinforced foam core.
   1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
   2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
   3. Compressive Strength: 16 psi
   4. Board Size: 48 x 96 inch.

5. Board Thickness: 2.5 inch or as shown on drawings.
6. Thermal Resistance: R-value of 7.6 min.
7. Manufacturers:
   a. Johns Manville; AP Foil-Faced: www.jm.com.
8. Substitutions: See Section 01 63 00.

2.03 BATT INSULATION MATERIALS

A. Where batt insulation is indicated, either glass fiber or mineral fiber batt insulation may be used, at General Contractor's option.

B. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
   1. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
   2. Thermal Resistance: R-value of 13.
   3. Thickness: 6 inch.
   4. Facing: Unfaced.
   5. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/25, when tested in accordance with ASTM E 84.
   6. Manufacturers:
      a. CertainTeed Corporation: www.certainteed.com.
      b. Johns Manville: www.jm.com.
      c. Owens Corning Corp: www.owenscorning.com.
   7. Substitutions: See Section 01630 - Substitutions and Product Options.

C. Mineral Fiber Batt Insulation: Flexible or semi-rigid preformed batt or blanket, complying with ASTM C665; friction fit; unfaced flame spread index of 0 (zero) when tested in accordance with ASTM E84.
   1. Smoke Developed Index: 0 (zero), when tested in accordance with ASTM E84.

2.04 ACCESSORIES

A. Tape: Bright aluminum self-adhering type, mesh reinforced, 2 inch wide.

B. Insulation Fasteners: Impaling clip of unfinished steel with washer retainer and clips, to be adhered to surface to receive insulation, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place.

C. Adhesive: Type recommended by insulation manufacturer for application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 BOARD INSTALLATION AT EXTERIOR CMU WALLS

A. Install Rigid Insulation as per drawings and manufacturer's installation guidelines.

3.03 BOARD INSTALLATION AT UNDERSIDE OF FLOOR DECK

A. Adhere a 6 inch wide strip of polyethylene sheet over expansion joints with double beads of adhesive each side of joint.
   1. Tape seal joints between sheets.
   2. Extend sheet full height of joint.

B. Apply adhesive to back of boards:
   1. Three continuous beads per board length.
   2. Full bed 1/8 inch thick.

C. Install boards horizontally on floor deck.
   1. Place boards to maximize adhesive contact.
   2. Install in running bond pattern.
   3. Butt edges and ends tightly to adjacent boards and to protrusions.

D. Extend boards over expansion joints, unbonded to wall on one side of joint.

E. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

F. Tape insulation board joints.

3.04 BOARD INSTALLATION AT CAVITY WALLS

A. Installation of insulation board shall meet all requirements as and Air Barrier and Class 1 vapor retarder.

B. Install boards to fit snugly between wall ties.
   1. Place membrane surface against adhesive.
   2. Place membrane surface facing out, and tape seal board joints.

C. Install boards horizontally on walls.
   1. Place boards to maximize adhesive contact.
   2. Install in running bond pattern.
   3. Butt edges and ends tightly to adjacent boards and to protrusions.
   4. Place impale fastener locking discs.

D. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

E. Place 6 inch wide polyethylene sheet at perimeter of wall openings, from adhesive vapor retarder bed to window and door frames. Tape seal in place to ensure continuity of vapor retarder and air seal.

3.05 BATT INSTALLATION

A. Install insulation and vapor retarder in accordance with manufacturer's instructions.

B. Install in exterior wall gap spaces without gaps or voids. Do not compress insulation.

C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

E. Retain insulation batts in place with spindle fasteners at 12 inches on center.

F. Coordinate work of this section with construction of continuous air barrier as specified in Section 07 27 13 Self-Adhering Sheet Membrane Air Barriers.

3.06 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

SECTION 07 21 23
LOOSE FILL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Granular insulation in open cells of concrete masonry unit walls not filled with concrete or grout as required by structural drawings.

B. All insulation must be asbestos free.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. ASTM C516 - Standard Specification for Vermiculite Loose Fill Thermal Insulation; 2008 (Reapproved 2013).

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

1.04 SYSTEM DESCRIPTION

A. Materials of This Section: Provide continuity of thermal barrier at building enclosure elements.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

C. Certificates: Certify that products of this section meet or exceed specified requirements.

PART 2 PRODUCTS

2.01 MATERIALS

A. Granular Insulation: ASTM C516, vermiculite type, water repellent, fire resistant; flame spread/smoke developed index of 0/0, when tested in accordance with ASTM E84.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation are dry and ready to receive insulation.

B. Verify spaces are free of mortar to allow free flow of insulation.

3.02 PREPARATION

A. Verify holes and openings have been sealed to prevent escape of insulation.

3.03 INSTALLATION

A. Install insulation in accordance with manufacturer's instructions.

B. Place after masonry wall has sufficiently dried and attained optimum moisture content. Place prior to covering cores with bond beams or lintels.

C. Place as wall is erected. Completely fill spaces.

D. Place in lifts. Do not exceed 6 feet pouring height.

3.04 PROTECTION

A. Place temporary signs in rooms that face insulated walls, warning workers to use caution to prevent loss of insulation if cutting into walls.

END OF SECTION

SECTION 07 25 00
WEATHER BARRIERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air Barriers: Materials that form a system to stop passage of air through exterior walls, joints between exterior walls and roof, and joints around frames of openings in exterior walls.

1.02 RELATED REQUIREMENTS

A. Section 07 21 00 - THERMAL INSULATION: Vapor retarder installed in conjunction with batt insulation.

B. Section 07 90 05 - Joint Sealers: Sealant materials and installation techniques.

C. Section 09 21 16 - Gypsum Board Assemblies: Water-resistive barrier under exterior cladding.

1.03 DEFINITIONS

A. Weather Barrier: Assemblies that form either water-resistive barriers, air barriers, or vapor retarders.

B. Air Barrier: Air tight barrier made of material that is relatively air impermeable but water vapor permeable, both to the degree specified, with sealed seams and with sealed joints to adjacent surfaces. Note: For the purposes of this specification, vapor impermeable air barriers are classified as vapor retarders.

1.04 REFERENCE STANDARDS

A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2006a (Reapproved 2013).

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

C. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials; 2013.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on material characteristics.

C. Manufacturer's Installation Instructions: Indicate preparation.

1.06 MOCK-UP

A. Install air barrier, vapor retarder, and water-resistive barrier materials in mock-up specified in Section 01 33 00.

B. Install air barrier materials in a six foot square mock-up in place for approval be Architect.

1.07 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the materials manufacturers before, during and after installation.

PART 2 PRODUCTS

2.01 WEATHER BARRIER ASSEMBLIES

A. Air Barrier:
   1. On outside surface of inside wythe of exterior masonry cavity walls use air barrier coating.
   2. On outside surface of sheathing of exterior walls use air barrier coating.

2.02 AIR BARRIER MATERIALS (WATER VAPOR PERMEABLE AND WATER-RESISTIVE)

A. Air Barrier, Fluid Applied: Vapor permeable, elastomeric waterproofing.

B. Air Barrier Coating:
   1. Material: Water-based acrylic or polymer-modified bitumen, with VOC content of zero.

2. Acceptable Substrates: Stated by manufacturer as suitable for installation on visibly damp surfaces and concrete that has hardened but is not fully cured ("green" concrete) without requiring a primer.
3. Adhesion to Paper and Glass Mat Faced Sheathing: Sufficient to ensure failure due to delamination of sheathing.
4. Air Permeance: 0.004 cubic feet per minute per square foot, maximum, when tested in accordance with ASTM E2178.
5. Water Vapor Permeance: 5 perms, minimum, when tested in accordance with ASTM E96/E96M, Procedure B.
6. Ultraviolet and Weathering Resistance: Approved in writing by manufacturer for minimum of 6 months weather exposure.
7. Elongation: 300 percent, minimum, when tested in accordance with ASTM D412.
8. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.
9. Products:
   a. Grace Construction Products; Perm-A-Barrier VP: www.na.graceconstruction.com.

2.03 ACCESSORIES

A. Sealants, Tapes, and Accessories for Sealing Weather Barrier and Sealing Weather Barrier to Adjacent Substrates: As specified or as recommended by weather barrier manufacturer.

B. Thinners and Cleaners: As recommended by material manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and conditions are ready to accept the work of this section.

3.02 PREPARATION

A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

3.03 INSTALLATION

A. Install materials in accordance with manufacturer's instructions.

B. Air Barriers: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.

C. Coatings:
   1. Prepare substrate in manner recommended by coating manufacturer; treat joints in substrate and between dissimilar materials as recommended by manufacturer.
   2. Use flashing to seal to adjacent construction and to bridge joints.

D. Openings and Penetrations in Exterior Weather Barriers:
   1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches onto weather barrier and at least 6 inches up jambs; mechanically fasten stretched edges.
   2. At openings to be filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with at least 4 inches wide; do not seal sill flange.
   3. At openings to be filled with non-flanged frames, seal weather barrier to all sides of opening framing, using flashing at least 9 inches wide, covering entire depth of framing.
   4. At head of openings, install flashing under weather barrier extending at least 2 inches beyond face of jambs; seal weather barrier to flashing.
   5. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
   6. Service and Other Penetrations: Form flashing around penetrating item and seal to weather barrier surface.

3.04 FIELD QUALITY CONTROL

A. Do not cover installed weather barriers until required inspections have been completed.

B. Obtain approval of installation procedures by the weather barrier manufacturer based on a mock-up installed in place, prior to proceeding with remainder of installation.

C. Take digital photographs of each portion of the installation prior to covering up.

3.05 PROTECTION

A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION

SECTION 07 27 13

SELF-ADHERED SHEET MEMBRANE AIR BARRIERS, VAPOR IMPERMEABLE

PART 1 — GENERAL

1.01 RELATED DOCUMENTS

A. All of the Contract Documents, including General and Supplementary Conditions and Division 1 General Requirements, apply to the work of this section.

1.02 SUMMARY

A. The work of this section includes, but is not limited to, the following:

1. Materials and installation methods for fluid applied air and vapor barrier membrane system located in the non-accessible part of the wall.
2. Materials and installation methods to bridge and seal air leakage pathways in roof and foundation junctions, window and door openings, control and expansion joints, masonry ties, piping and other penetrations through the wall assembly.

B. Related Sections: Other specification sections that directly relate to the works of this section include, but are not limited to, the following:

1. Section 03 30 00 – Cast-In-Place Concrete
2. Section 04 22 00 – Unit Masonry
3. Section 07 13 26 – Self-Adhering Sheet Waterproofing
4. Section 07 62 00 – Sheet Metal Flashing and Trim
5. Section 07 92 05 – Joint Sealants

1.03 PERFORMANCE REQUIREMENTS

A. Provide an air and vapor barrier system to perform as a continuous barrier to air infiltration/exfiltration and water vapor transmission and to act as a liquid water drainage plane flashed to discharge any incidental condensation or water penetration.

B. ASHRAE 90.1 2010.

1.04 REFERENCES

A. The following standards and publications are applicable to the extent referenced in the text. The most recent version of these standards is implied unless otherwise stated.

B. American Society for Testing and Materials (ASTM)

1. E96 Test Methods for Water Vapor Transmission of Materials
2. D570 Test Method for Water Absorption of Plastics
3. E154 Test Method for Water Vapor Retarders used in contact with Earth Under Concrete Slabs, on Walls or as Ground Cover

4. D1004 Test Method for Initial Tear Resistance of Plastic Film and Sheeting
5. D1938 Test Method for Tear Propagation Resistance of Plastic Film and Thin Sheeting by a Single-Tear Method
6. D1876 Test Method for Peel Resistance of Adhesives
7. D1970 Standard Specifications for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
8. D412 Test Methods for Vulcanized Rubber & Thermoplastic Rubbers and Thermoplastic Elastomers – Tension
9. E2178 Standard Test Method for Air Permeance of Building Materials
10. E2357 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies

1.05 SUBMITTALS

A. Product Data: Submit manufacturer's product data, installation instructions, use limitations and substrate preparation recommendations.

B. Shop drawings showing locations and extent of air and vapor barrier system including details for terminations flashings, penetrations, window and door openings and treatment of substrate joints and cracks.

C. Written documentation demonstrating installers qualifications under the "Quality Assurance" article including reference projects of a similar scope.

D. Samples: Submit representative samples of the following for approval:
   1. Self-Adhered Air Barrier Membrane
   2. Self-Adhered Transition Membrane
   3. Self-Adhered Through Wall Flashing

E. Warranty: Submit a sample warranty identifying the terms and conditions stated in Section 1.09.

1.06 QUALITY ASSURANCE

A. Manufacturer: Air and vapor barrier systems shall be manufactured and marketed by a firm with a minimum of 20 years experience in the production and sales of waterproofing and air barrier products. Manufacturers proposed for use, but not named in these specifications shall submit evidence of ability to meet all requirements specified, and include a list of projects of similar design and complexity completed within the past five years.

B. Installer: The installer shall demonstrate qualifications to perform the work of this Section by submitting the following:
   1. List of at least three (3) projects contracted within the past five (5) years of similar scope and complexity to this project carried out by the firm and site supervisor.
   2. Installer must show evidence of adequate equipment and trained field personnel to successfully complete the project in a timely manner.

C. Materials: Self-adhered air and vapor barrier material shall be 40 mil (.004 in) comprising 36 mil (.0036 in.) rubberized asphalt integrally bonded to 4 mil (.0004 in.) cross-laminated polyethylene

film. For each type of material required for the work of this section, provide primary materials that are the products of one manufacturer.

D. Pre-Installation Conference: A pre-installation conference shall be held prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Agenda for meeting shall include but not be limited to the following:
   1. Review of submittals.
   2. Review of surface preparation, minimum curing period and installation procedures.
   3. Review of special details and flashings.
   4. Sequence of construction, responsibilities and schedule for subsequent operations.
   5. Review of mock-up requirements.
   6. Review of inspection, testing, protection and repair procedures.

E. Mock-up:
   1. Prior to installation of the air and vapor barrier system a field-constructed mock-up shall be provided under the provisions of Section [01340 – Shop Drawings, Product Data, Samples and Mock-ups] to verify details and tie-ins and to demonstrate the required quality of materials and installation.
   2. Construct a typical exterior wall section, 8 feet long and 8 feet wide, incorporating back-up wall, cladding, window and doorframe and sill, insulation, flashing and any other critical junction (roof, foundation, etc).
   3. Allow 24 hours for inspection and testing of mock-up before proceeding with air and vapor barrier work.
   4. Mock-up may remain as part of the work.

F. Inspection and Testing: Cooperate and coordinate with the Owner's inspection and testing agency. Do not cover any installed air and vapor barrier membrane until it has been inspected, tested and approved.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver materials and products in labeled packages. Store and handle in strict compliance with manufacturer's instructions, recommendations and material safety data sheets. Protect from damage from sunlight, weather, excessive temperatures and construction operations. Remove damaged material from the site and dispose of in accordance with applicable regulations.

B. Do not double-stack pallets of fluid applied membrane components on the job site. Provide cover on top and all sides, allowing for adequate ventilation.

C. Protect fluid-applied membrane components from freezing and extreme heat.

D. Sequence deliveries to avoid delays, but minimize on-site storage.

1.08 PROJECT CONDITIONS

A. Perform work only when existing and forecasted weather conditions are within the limits established by the manufacturer of the materials used. Proceed with installation only when the substrate construction and preparation work is complete and in condition to receive the air and vapor barrier membrane.

1.09 WARRANTY

A. Submit manufacturer's warranty that air and vapor barrier and accessories are free of defects at time of delivery and are manufactured to meet manufacturer's published physical properties and material specifications.

B. Warranty Period: Five years from date of completion of the air and vapor barrier membrane installation.

PART 2 PRODUCTS

2.01 GENERAL

For each type of material required for the work of this section, provide primary materials that are the products of one manufacturer.

2.02 SELF-ADHERED AIR BARRIER MEMBRANE

A. Description: Min. 1 mm (.040 in) thick membrane comprised of 0.9 mm (0.036 in) of self-adhesive rubberized asphalt integrally bonded to 0.1 mm (.004 in) of cross-laminated, high-density polyethylene film. Membrane shall be interleaved with disposable silicone-coated release paper until installed.

B. Performance Requirements:

Property	Test Method	Typical Value
Thickness	ASTM D 3767 Method A	1.0 mm (0.040 in.) nominal
Air Permeance at 75Pa (0.3 in. water) Differential Pressure	ASTM E 2178	<0.001 L/(s.m^2) (<0.0002 cfm/ft^2)
Assembly Air Permeance at 75Pa (0.3 in. water) Differential Pressure	ASTM E 2357	<0.004 L/s*m^2 (<0.0008 cfm/ft^2)
Water Vapor Permeance	ASTM E 96, Method B	Less than 2.9 ng/Pa.s.m^2 (0.05 Perms)
Water Absorption: -	ASTM D 570	Max. 0.1% by weight
Puncture Resistance	ASTM E 154	178 N (40 lbs.)
Tear Resistance	Initiation - ASTM D 1004 Propagation - ASTM D1938	Min. 58 N (7.0 lbs.) M.D. Min. 40 N (4.0 lbs.) M.D.
Lap Adhesion at –4°C (25°F)	ASTM D 1876	880 N/m (5.0 lbs./in.) of width
Low Temperature Flexibility	ASTM D 1970	Unaffected to –43°C (-45°F)
Tensile Strength	ASTM D 412, Die C Modified	Min. 2.7 MPa (400 psi)
Elongation, Ultimate Failure of Rubberized Asphalt	ASTM D 412 - Die C	Min. 200%

C. Materials:

Perm-A-Barrier® Wall Membrane from Grace Construction Products, 62 Whittemore Avenue, Cambridge, MA.

D. Substitutions permitted.

2.03 TRANSITION MEMBRANE

A. Description: Min. 1 mm (.040 in) thick membrane comprised of 0.9 mm (0.036 in) of self-adhesive rubberized asphalt integrally bonded to 0.1 mm (.004 in) of cross-laminated, high-density polyethylene film. Membrane shall be interleaved with disposable silicone-coated release paper until installed.

B. Performance Requirements:

1. Water Vapor Transmission: ASTM E 96, Method B: 2.9 ng/m2sPa (0.05 perms) max.
2. Air Permeance at 75Pa (0.3 in. water) pressure difference: 0.0006 L/(s.m^2) (0.00012 cfm/ft^2) max.
3. Puncture Resistance: ASTM E 154: 178 N (40 lbs.) min.
4. Lap Adhesion at –4°C (25°F), ASTM D 1876: 880 N/m (5.0 lbs./in.) of width min.
5. Low Temperature Flexibility, ASTM D 1970: Unaffected to –43°C (-45°F).
6. Tensile Strength, ASTM D 412, Die C Modified: min. 2.7 MPa (400 psi)
7. Elongation, Ultimate Failure of Rubberized Asphalt, ASTM D 412 Die C: min. 200%

C. Materials:

Perm-A-Barrier Detail Membrane manufactured by Grace Construction Products.

D. Substitutions permitted.

2.04 TRANSITION ALUMINUM MEMBRANE

A. Description: 0.9 mm (35 mils) of self-adhesive rubberized asphalt integrally bonded to 0.1 mm (5 mil) of aluminum film to provide a min. 1.0 mm (40 mil) thick membrane. Membrane shall be interleaved with disposable silicone-coated release paper until installed.

B. Performance Requirements:

1. Water Absorption, ASTM D570: max 0.1% by weight
2. Puncture Resistance, ASTM E154: 355N (80 lbs) min.
3. Lap Adhesion at -4ºC (25ºF), ASTM D1876 Modified: 880 N/m (5.0 lbs./in.) of width
4. Low Temperature Flexibility, ASTM D1970 Modified: Unaffected to -26ºC (-15ºF)
5. Tensile Strength, ASTM D412, Die C Modified: min. 4.1 MPa (600 Psi)
6. Elongation, Ultimate Failure of Rubberized Asphalt: ASTM D412, Die C Modified: min. 200%

C. Acceptable Materials:

Perm-A-Barrier Aluminum Flashing manufactured by Grace Construction Products.

D. Substitutions permitted.

2.05 FLEXIBLE MEMBRANE THROUGH-WALL FLASHING

A. Description: Min. 1 mm (.040 in) thick membrane comprised of 0.8 mm (0.032 in) of self-adhesive rubberized asphalt integrally bonded to 0.2 mm (.008 in) of cross-laminated, high-density polyethylene film. Membrane shall be interleaved with disposable silicone-coated release paper until installed.

B. Performance Requirements:

1. Water Vapor Transmission, ASTM E 96, Method B: 2.9 ng/m2sPa (0.05 perms) max.
2. Water Absorption, ASTM D 570: max. 0.1% by weight
3. Puncture Resistance, ASTM E 154: 356 N (80 lbs.) min.
4. Tear Resistance
    a. Initiation ASTM D 1004: min. 58 N (13.0 lbs.) M.D.
    b. Propagation ASTM D 1938: min. 40 N (9.0 lbs.) M.D.
5. Lap Adhesion at -4ºC (25ºF), ASTM D 1876: 880 N/m (5.0 lbs./in.) of width
6. Low Temperature Flexibility, ASTM D 1970: Unaffected to -43ºC (-45ºF)
7. Tensile Strength, ASTM D 412, Die C Modified: min. 5.5 MPa (800 psi)
8. Elongation, Ultimate Failure of Rubberized Asphalt, ASTM D412, Die C: min. 200%

C. Materials:

Perm-A-Barrier Wall Flashing manufactured by Grace Construction Products.

D. Substitutions permitted.

2.06 AIR & VAPOR BARRIER ACCESSORIES

A. Primer: Water-based primer which imparts an aggressive, high tack finish on the treated substrate

1. Flash Point: No flash to boiling point
2. Solvent Type: Water
3. VOC Content: Not to exceed 10 g/l
4. Application Temperature: -4°C (25°F) and above
5. Freezing point (as packaged): -7°C (21°F)

Product: Perm-A-Barrier WB Primer manufactured by Grace Construction Products; Substitutions permitted.

B. Sealant: Two-part, elastomeric, trowel grade material designed for use with self-adhered membranes and tapes. 10 g/l max. VOC Content.

Product: Bituthene® Liquid Membrane manufactured by Grace Construction Products; Substitutions permitted.

C. Optional Primers (Substitutions permitted):

1. Description : Water-based primer which imparts an aggressive, high tack finish on the treated substrate. 1 g/l max. VOC Content.

   Product : Perm-A-Barrier Primer Plus manufactured by Grace Construction Products
2. Description: High tack water based primer. 10 g/l max. VOC content.

   Product: Perm-A-Barrier Liquid Part B manufactured by Grace Construction Products.
3. Description: High tack low VOC solvent based primer. <200 g/l max. VOC content.

   Product: Bituthene Primer B2 LVC manufactured by Grace Construction Products.
4. Description: High tack solvent based primer. 440 g/l max. VOC content.

   Product: Bituthene Primer B2 manufactured by Grace Construction Products.

PART 3 EXECUTION

3.01 EXAMINATION

A. The installer shall examine conditions of substrates and other conditions under which this work is to be performed and notify the contractor, in writing, of circumstances detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected.

3.02 PREPARATION

A. Refer to manufacturer's literature for requirements for preparation of substrates. Surfaces shall be sound and free of voids, spalled areas, loose aggregate and sharp protrusions. Remove contaminants such as grease, oil and wax from exposed surfaces. Remove dust, dirt, loose stone and debris. Use repair materials and methods that are acceptable to manufacturer of the fluid-applied waterproofing.

B. Exterior sheathing panels: Ensure that the boards are sufficiently stabilized with corners and edges fastened with appropriate screws in accordance with exterior sheathing manufactures written instructions.

C. Masonry Substrates: Apply air and vapor barrier over concrete block and brick with smooth and flush mortar joints. Fill all voids and holes, particularly in the mortar joints, with a lean mortar mix, non-shrinking grout or parge coat.

D. Related Materials: Treat construction joints and install flashing as recommended by air barrier manufacturer.

3.03 INSTALLATION

A. Refer to manufacturer's literature for recommendations on installation

B. Apply air barrier membrane to achieve a continuous air barrier according to air barrier manufacturer's written instructions.

C. Application of Self-Adhered Air Barrier Membrane

   1. Install air & vapor barrier to dry surfaces at air and surface temperatures of –4°C (25°F) and above in accordance with manufacturer's recommendations, at locations indicated on Construction Documents.
   2. Prime substrate to receive air barrier membrane as required per manufacturers written instructions.

3. Precut pieces of air & vapor barrier into easily handled lengths.
4. Remove silicone-coated release paper and position membrane carefully before placing length horizontally against the surface.
5. Begin installation at the base of the wall placing top edge of membrane immediately below any masonry reinforcement or ties protruding from substrate.
6. When properly positioned, place against surface by pressing firmly into place. Roll membrane with extension-handled countertop roller immediately after placement.
7. Overlap horizontally adjacent pieces 50 mm (2 in.) and roll seams.
8. Subsequent sheets of membrane applied above shall be positioned immediately below masonry reinforcement or ties. Bottom edge shall be slit to fit around reinforcing wires or ties, and membrane shall overlap the membrane sheet below by 50 mm (2 in.). Roll firmly into place.
9. Seal around masonry reinforcing or ties and all penetrations with termination mastic.
10. Continue the membrane into all openings in the wall, such as doors, windows, etc., and terminate at points that will prevent visibility from interior.
11. Coordinate the installation of air & vapor barrier with roof installer to ensure continuity of membrane with rooftop air & vapor membrane.
12. At end of each working day seal top edge of air & vapor barrier to substrate with termination mastic.
13. Do not allow the rubberized asphalt surface of the air & vapor barrier membrane to come in contact with polysulfide sealants, creosote, uncured coal tar products or EPDM.
14. Do not expose air & vapor barrier membrane to sunlight for more than thirty days prior to enclosure.
15. Inspect installation prior to enclosing and repair punctures, damaged areas and inadequately lapped seams with a patch of the membrane sized to extend 150 mm (6 in.) in all directions from the perimeter of the affected area.

D. Application of Transition Membrane
1. Prime substrate to receive transition membrane as required per manufacturers written instructions.
2. Apply transition membrane with a minimum overlap of 75mm (3 in.) onto each surface at all beams, columns and joints as indicated in detail drawings.
3. Tie in to window and door frames, spandrel panels, roof and floor intersections and changes in substrate.
4. Use pre-cut, easily handled lengths for each location.
5. Remove silicone-coated release paper and position membrane flashing carefully before placing it against the surface.
6. When properly positioned, place against surface by pressing firmly into place by hand roller.
7. Overlap adjacent pieces 50 mm (2 in.) and roll all seams with a hand roller.

8. Seal top edge of flashing with termination mastic.
9. When transition flashing is pre-installed prior to application of Fluid Applied Membrane, apply transition flashing as above. Spray or trowel a continuous uniform film of Fluid Membrane at min. 60 mils (1.5 mm or .060 in.) dry film thickness using multiple, overlapping passes, with a minimum overlap of 75 mm (3 in.) onto transition flashing. For sill condition, spray or trowel Fluid Membrane onto pre-installed sill flashing and onto horizontal section of sill.

E. Application of Flexible Membrane Wall Flashing

1. Prime substrate to receive wall flashing as required per manufacturers written instructions.
2. Precut pieces of flashing to easily handled lengths for each location.
3. Remove silicone-coated release paper and position flashing carefully before placing it against the surface.
4. When properly positioned, place against surface by pressing firmly into place by hand roller. Fully adhere flashing to substrate to prevent water from migrating under flashing.
5. Overlap adjacent pieces 50 mm (2 in.) and roll all seams with a hand roller.
6. Trim bottom edge 13 mm (1/2 in.) back from exposed face of the wall. Flashing shall not be permanently exposed to sunlight.
7. At heads, sills and all flashing terminations, turn up ends a minimum of 50 mm (2 in.) and make careful folds to form an end dam, with the seams sealed.
8. Seal top edge of flashing with termination mastic.
9. Do not allow the rubberized asphalt surface of the flashing membrane to come in contact with poly-sulfide sealants, creosote, uncured coal tar products or EPDM.

3.04 PROTECTION AND CLEANING

A. Remove any masking materials after installation. Clean any stains on materials that would be exposed in the completed work using procedures as recommended by manufacturer.

B. Perm-A-Barrier Wall Membrane is not suitable for permanent exposure and should be protected from the effects of sunlight.

C. Schedule work to ensure that the Perm-A-Barrier Wall Membrane system is covered as soon as possible after installation. Protect Perm-A-Barrier Wall Membrane system from damage during subsequent operations. If the Perm-A-Barrier Wall Membrane system cannot be covered within 30 days after installation, apply temporary UV protection such as dark plastic sheet or tarpaulins.

END OF SECTION

SECTION 07 52 16

SBS-MODIFIED BITUMEN MEMBRANE ROOFING

PART 1 GENERAL

1.01 SUMMARY

A. Work shall include, but is not limited to, the following:
1. Preparation of existing concrete, new concrete & steel roof deck, and all flashing substrates.
2. SBS-modified bitumen vapor retarder (air barrier).
3. Insulation
4. Cover-board
5. SBS-modified bitumen base ply heat-welded & mechanically fastened.
6. SBS-modified bitumen cap sheet heat-welded.
7. SBS-modified bitumen membrane flashings.
8. Liquid-applied, reinforced flashings.
9. Sheet metal flashings and sheet metal roof edge system.
10. All related materials and labor required to complete specified roofing necessary to receive specified manufacturer's warranty.

B. System Summaries:
1. System #1- Concrete Deck
   a. New or Existing Concrete Deck
   b. Elastocol 500 Primer
   c. Elastophene SP 3.0 Vapor Barrier heat welded
   d. Sopra-ISO adhered with Duotack
   e. 1/8" Sopraboard adhered with Duotack
   f. Sopralene Flam 180 heat welded
   g. Sopralene Flam 180 FR GR heat welded
2. System #2- Steel Deck
   a. New or Existing Steel Deck
   b. Sopravap'r self-adhered directly to steel deck
   c. Sopra-ISO loose laid
   d. 1/8" Sopraboard pre secured
   e. Soprafix Base 612 mechanically attached
   f. Sopralene Flam 180 FR GR heat welded

1.02 RELATED SECTIONS

A. Division 01 00 00 General Requirements

1.03 DEFINITIONS

A. ASTM D 1079-Definitions of Term Relating to Roofing, Waterproofing and Bituminous Materials.

B. The National Roofing Contractors Association (NRCA) Roofing and Waterproofing Manual, Fifth Edition Glossary.

1.04 PRE-INSTALLATION MEETINGS

A. Convene prior to commencing work at a time and location to be determined by the Owner/Owners Representative.

1.05 REFERENCES

A. AMERICAN SOCIETY OF CIVIL ENGINEERS - Reference Document ASCE 7, Minimum Design Loads for Buildings and Other Structures.

B. AMERICAN STANDARD OF TESTING METHODS (ASTM):

1. ASTM C 836 - Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course.
2. ASTM C 920 - Standard Specification for Elastomeric Joint Sealants
3. ASTM C 1177/C 1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
4. ASTM C 1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Insulation Board.
5. ASTM D 41 - Standard Specification for Asphalt Primer Used in Roofing, Damp proofing, and Waterproofing.
6. ASTM D 1970 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
7. ASTM D 3019 - Standard Specification for Lap Cement Used with Asphalt Roll Roofing, Non-Fibered, Asbestos-Fibered, and Non-Asbestos-Fibered.
8. ASTM D 3746 - Standard Test Method for Impact Resistance of Bituminous Roofing System.
9. ASTM D 4586 - Standard Specification for Asphalt Roof Cement, Asbestos-Free.
10. ASTM D 5147 - Standard Test Methods for Sampling and Testing Modified Bituminous Sheet Material.
11. ASTM D 5849 - Standard Test Method for Evaluating Resistance of Modified Bituminous Roofing Membrane to Cyclic Fatigue (Joint Displacement)
12. ASTM D 6164 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements.
13. ASTM D 6298 - Standard Specification for Fiberglass Reinforced Styrene-Butadiene-Styrene (SBS) Modified Bituminous Sheets with a Factory Applied Metal Surface.

14. ASTM E 108 - Standard Test Methods for Fire Tests of Roof Coverings.
15. ASTM E 1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.

C. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)::
1. ANSI/SPRI/FM 4435/ES-1 Wind Design Standard for Edge System Used with Low Slope Roofing System.
2. ANSI/SPRI FX-1, Standard Field Test Procedure for Determining the Withdrawal Resistance of Roofing Fasteners.
3. ANSI/SPRI IA-1, Standard Field Test Procedure for Determining the Mechanical Uplift Resistance of Insulation Adhesives over Various Substrates.
4. ANSI/FM 4474- American National Standard for Evaluating the Simulated Wind Resistance of Roof Assemblies Using Static Positive and/or Negative Differential Pressures.

D. FACTORY MUTUAL (FM):
1. FM 4450 - Approval Standard - Class I Insulated Steel Roof Decks.
2. FM 4470 - Approval Standard - Class I Roof Covers.

E. INTERNATIONAL CODES COUNCIL (ICC):
1. 2012 International Building Code (IBC).

F. NATIONAL ROOFING CONTRACTORS ASSOCIATION (NRCA).

G. SHEET METAL AND AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION INC. (SMACNA) Architectural Sheet Metal Manual.

H. UNDERWRITERS LABORATORY (UL):
1. UL 790 Standard Test Methods for Fire Tests of Roof Coverings.
2. UL 1256 – Fire Test of Roof Deck Constructions.

1.06 ACTION SUBMITTALS

A. ISO 9001 Certificate: Manufacturer shall be an ISO 9001 registered company.

B. Product Data Sheets: Submit manufacturer’s product data sheets, installation instructions and/or general requirements for each component.

C. Material Safety Data Sheets: Submit manufacturer’s Material Safety Data Sheets (MDS) for each component.

D. Sample/Specimen Warranty from the manufacturer and contractor.

E. Shop Drawings: Provide roof plan and applicable roof system detail drawings.

1.07 INFORMATIONAL SUBMITTALS

A. Contractor Certification: Submit written certification from roofing system manufacturer certifying that the applicator is authorized by the manufacturer to install the specified materials and system.

1.08 CLOSEOUT SUBMITTALS

A. Warranty: Provide manufacturer's and contractor's warranties upon substantial completion of the roofing system.

1.09 QUALITY ASSURANCE

A. MANUFACTURER QUALIFICATIONS:
   1. PRODUCT QUALITY ASSURANCE PROGRAM: Manufacturer shall be an ISO 9001 registered company.
   2. Manufacture shall have 20 years of experience manufacturing SBS-modified bitumen roofing materials.
   3. Trained Technical Field Representatives, employed by the manufacturer, independent of sales.
   4. Provide reports in a timely manner of all site visit reports.
   5. Provide specified warranty upon satisfactory project completion.

B. CONTRACTOR QUALIFICATIONS:
   1. Contractor shall be authorized by the manufacturer to install specified materials prior to the bidding period through satisfactory project completion.
   2. Applicators shall have completed projects of similar scope using same materials as specified herein.
   3. Contractor shall provide full time, on-site superintendent or foreman experienced with the specified roof system through satisfactory project completion.
   4. Applicators shall be skilled in the application methods for all materials.
   5. Contractor shall maintain a daily record, on-site, documenting material installation and related project conditions.
   6. Contractor shall maintain a copy of all submittal documents, on-site, available at all times for reference.

1.10 DELIVERY, STORAGE AND HANDLING

A. Refer to each product data sheet or other published literature for specific requirements.

B. Deliver materials and store them in their unopened, original packaging, bearing the manufacturer's name, related standards, and any other specification or reference accepted as standard.

C. Protect and store materials in a dry, well-vented, and weatherproof location. Only materials to be used the same day shall be removed from this location. During cold weather, store materials in a heated location, removed only as needed for immediate use.

D. When materials are to be stored outdoors, store away from standing water, stacked on raised pallets or dunnage, at least 4 in or more above ground level. Carefully cover storage with "breathable" tarpaulins to protect materials from precipitation and to prevent exposure to condensation.

E. Carefully store roof membrane materials delivered in rolls on-end with selvage edges up. Store and protect roll storage to prevent damage.

F. Properly dispose of all product wrappers, pallets, cardboard tubes, scrap, waste, and debris. All damaged materials shall be removed from job site and replaced with new, suitable materials.

1.11 SITE CONDITIONS

A. SAFETY:

1. The contractor shall be responsible for complying with all project-related safety and environmental requirements.
2. Heat-welding shall include heating the specified membrane ply using propane roof torches or electric hot-air welding equipment. The contractor shall determine when and where conditions are appropriate to utilize heat-welding equipment. When conditions are determined by the contractor to be unsafe to proceed, equivalent SBS-modified bitumen materials and methods shall be utilized to accommodate requirements and conditions.
3. Refer to NRCA CERTA recommendations, local codes and building owner's requirements for hot work operations.
4. The contractor shall review project conditions and determine when and where conditions are appropriate to utilize the specified liquid-applied, or semi-solid roofing materials. When conditions are determined by the contractor to be unsafe or undesirable to proceed, measures shall be taken to prevent or eliminate the unsafe or undesirable exposures and conditions, or equivalent approved materials and methods shall be utilized to accommodate requirements and conditions.
5. The contractor shall review project conditions and determine when and where conditions are appropriate to utilize the specified hot asphalt-applied materials. When conditions are determined by the contractor to be unsafe or undesirable to proceed, measures shall be taken to prevent or eliminate the unsafe or undesirable exposures and conditions, or equivalent approved materials and methods shall be utilized to accommodate requirements and conditions. .
6. The contractor shall refer to product Material Safety Data Sheets (MDS) for health, safety, and environment related hazards, and take all necessary measures and precautions to comply with exposure requirements.

B. ENVIRONMENTAL CONDITIONS:

1. Monitor substrate temperature and material temperature, as well as all environmental conditions such as ambient temperature, moisture, sun, cloud cover, wind, humidity, and shade. Ensure conditions are satisfactory to begin work and ensure conditions remain satisfactory during the installation of specified materials. Materials and methods shall be adjusted as necessary to accommodate varying project conditions. Materials shall not be installed when conditions are unacceptable to achieve the specified results.
2. Precipitation and dew point: Monitor weather to ensure the project environment is dry before, and will remain dry, during the application of roofing materials.

Ensure all roofing materials and substrates remain above the dew point temperature as required to prevent condensation and maintain dry conditions.

3. Mopping asphalt application: Primer, where used, shall be fully dry before applying hot asphalt. Take all necessary measures and monitor all conditions, to ensure the specified asphalt temperature is no less than 400°F (204°C) at the point of contact with the specified membrane as it is rolled into the hot asphalt.
4. Cold adhesive application: Primer, where used, shall be fully dry before proceeding. During cold weather, store the specified membrane adhesives, flashing cements and mastics in heated storage areas. Take all necessary measures and monitor application conditions, to ensure the adhesive and cement materials are no less than 70°F (21°C) at the point of contact with the membrane.
5. Self-adhered membrane application: During cold weather, store the specified self-adhered membrane and primer materials in heated storage areas to ensure materials remain no less than 70°F (21°C) during application. Ensure conditions allow primer to remain tacky, but not wet so that primer will transfer to finger when touched. Self-adhered primer should not fully dry and lose tack before applying the self-adhered membrane. Ensure conditions remain satisfactory to achieve membrane adhesion as specified.
6. Heat-Welding Application: Take all necessary precautions and measures to monitor conditions to ensure all environmental conditions are safe to proceed with the use of torches and hot-air welding equipment. Combustibles, flammable liquids and solvent vapors that represent a hazard shall be eliminated and primers shall be fully dry before proceeding with heat-welding operations. Refer to NRCA CERTA recommendations.

1.12 PERFORMANCE REQUIREMENTS

A. WIND UPLIFT RESISTANCE:
   1. Performance testing shall be in accordance with ANSI/FM 4474, FM 4450, FM 4470, UL 580 or UL 1897.
      a. Roof System Design Pressures: Calculated in accordance with ASCE 7, or applicable standard, for the specified roof system attachment requirements:
         i. Field of Roof (Zone 1): - 75 psf.
         ii. Perimeter of Roof (Zone 2): - 135 psf.
         iii. Corners of Roof (Zone 3): - 142 psf.

B. FIRE CLASSIFICATION:
   1. Performance testing shall be in accordance with UL 790, ASTM E108, FM 4450 or FM 4470 to meet the 1/4:12 roof slope requirement.
      a. Meets requirements of UL Class A or FM Class A.
   2. Performance testing shall be in accordance with UL 1256, FM 4450 or FM 4470 to meet the specified requirements for interior flame spread and fuel contribution.
      a. Meets requirements of UL 1256, or FM Class 1.

C. ROOF SLOPE:
1. Finished roof slope for SBS modified bitumen surfaces shall be ¼ inch per foot (2 percent) minimum for roof drainage.

D. IMPACT RESISTANCE:
1. Performance testing for impact resistance shall be in accordance with FM 4450, FM 4470, ASTM D3746 or CGSB 37-GP 56M to meet the specified impact resistance requirements.
   a. Meets requirements for FM-SH (Severe Hail), ASTM D3746, or CGSB 37-GP 56M.

E. CYCLIC FATIGUE:
1. The roof system shall pass ASTM D5849 Standard Test Method for Evaluating Resistance of Modified Bituminous Roofing Membrane to Cyclic Fatigue (Joint Displacement). Passing results shall show no signs of cracking, splitting or tearing over the joint.

   a. Roof system shall pass Test Condition 5, tested at -4°F (-20°C) in accordance with ASTM D5849. (**SOPREMA Sopralene polyester reinforced membranes).**

F. ENERGY CONSERVATION REQUIREMENTS:
1. Polyisocyanurate Insulation "R" Value: Long-term thermal resistance (LTTR) values of the specified foam insulation shall be determined in accordance with CAN/ULC-S770.
2. Polyisocyanurate Insulation "R" Value: Shall be determined in accordance with ASTM C1289-11a.
3. Thermal Resistance 'R' for the specified roof insulation system shall include the continuous insulation (ci) above the roof deck.
   a. Total Thermal Resistance R Value, continuous insulation (ci) above-deck: R(20.7)

G. ROOF EDGE SYSTEM SECUREMENT:
   a. Performance testing in accordance with ANSI/SPRI ES-1.
   b. Performance testing meets requirements for specified roof system design pressures.

1.13 WARRANTY

A. Manufacturer's No Dollar Limit (NDL) Warranty. The manufacturer shall provide the owner with the manufacturer's warranty providing labor and materials to for 20 years from the date the warranty is issued.

B. The contractor shall guarantee the workmanship and shall provide the owner with the contractor's warranty covering workmanship for a period of 2 years from completion date.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. SINGLE SOURCE MANUFACTURER: All SBS modified bitumen membrane and flashing sheets shall be manufactured by a single supplier with 20 years or more manufacturing history in the US.
   1. Comply with the Manufacturer's requirements as necessary to provide the specified warranty.

B. PRODUCT QUALITY ASSURANCE PROGRAM: Manufacturer shall be an ISO 9001 registered company. A 'Quality Compliance Certificate (QCC) for reporting/confirming the tested values of the SBS-Modified Bitumen Membrane Materials will be supplied upon request.

C. ACCEPTABLE MANUFACTURER:
   1. Basis of Design: SOPREMA, located at: 12251 Seaway Rd. Gulfport, MS 39503; Tel:228-731-5659; Website: www.soprema.us.
   2. Acceptable Alternate Manufacturers: Siplast & Firestone. All acceptable manufacturers must meet physical performance of Basis of Design Materials.

2.02 ROOFING SYSTEM

A. ROOFING SYSTEM BASIS OF DESIGN: SOPREMA

2.03 SBS-MODIFIED BITUMEN MEMBRANES

A. VAPOR RETARDER AT CONCRETE DECK
   1. VAPOR RETARDER, HEAT-WELDED:
      a. SOPREMA Elastophene SP 3.0: SBS-modified bitumen membrane with plastic burn-off film on the bottom surface and sanded top surface. Glass fiber reinforcement.
         i. Thickness: 118 mils (3.0 mm)
         ii. Width: 39.4 in (1 m)
         iii. Length: 32.8 ft (10 m)
         iv. Meets or exceeds ASTM D6163, Type I, Grade S.

B. VAPOR RETARDER AT STEEL DECK
   1. VAPOR RETARDER, SELF-ADHERED: (used directly on steel decks)
      a. SOPREMA Sopravap'R: SBS-modified bitumen self-adhered membrane with release film on the bottom surface and a tri-laminate woven polyethylene film top surface reinforcement.
         i. Thickness: 31.5 mils (0.80 mm)
         ii. Width: 45 in (1.14 m)
         iii. Length: 133 ft (40.8 m)
         iv. Meets or exceeds ASTM D2178 "Standard Test Method for Air Permeance of Building Materials."

v. Meets or exceeds ASTM E96 (Procedure B) “Standard Test method for Water Vapor Transmission of Materials.”

vi. Meets or exceeds UL 1256 for direct to steel deck applications in accordance with UL Construction No. 123.

C. FIELD BASE PLY AT STEEL DECK

1. FIELD BASE PLY, MECHANICALLY FASTENED:

a. SOPREMA Soprafix Base 612: SBS-modified bitumen membrane ply with plastic burn-off film on the top and bottom surfaces. Non-woven polyester reinforcement. Mechanically fastened in 4 in (minimum) heat-welded side-laps. Base ply for heat-welded cap sheet applications.

i. Thickness: 118 mils (3.0 mm)

ii. Width: 39.4 in (1 m)

iii. Length: 32.8 ft (10 m)

iv. Meets or exceeds ASTM D6164, Type I, Grade S.

D. FIELD BASE PLY AT CONCRETE DECK

1. FIELD BASE PLY, HEAT-WELDED:

a. SOPREMA Sopralene Flam 180: SBS-modified bitumen membrane with plastic burn-off film on top and bottom surfaces. Non-woven polyester reinforcement.

i. Thickness: 114 mils (2.9 mm)

ii. Width: 39.4 in (1 m)

iii. Length: 32.8 ft (10 m)

iv. Meets or exceeds ASTM D6164, Type I, Grade S.

E. FLASHING BASE PLY AT STEEL & CONCRETE DECK:

1. FLASHING BASE PLY, HEAT-WELDED:

a. SOPREMA Sopralene Flam 180: SBS-modified bitumen membrane with plastic burn-off film on top and bottom surfaces. Non-woven polyester reinforcement.

i. Thickness: 114 mils (2.9 mm)

ii. Width: 39.4 in (1 m)

iii. Length: 32.8 ft (10 m)

iv. Meets or exceeds ASTM D6164, Type I, Grade S.

F. FIELD CAP SHEET AT STEEL & CONCRETE DECK:

1. FIELD CAP SHEET HEAT-WELDED:

a. SOPREMA Sopralene Flam 180 FR GR: SBS-modified bitumen membrane Cap Sheet with a burn-off film bottom surface and mineral granule top surface. Non-woven polyester reinforced. UL Class A for specified roof slope requirements.

i. Thickness: 157 mils (4.0 mm)

ii. Width: 39.4 in (1 m)

iii. Length: 32.8 ft (10 m)

iv. Meets or exceeds ASTM D6164, Type I, Grade G.

v. Granule Surfacing:
a) White mineral granules.

G. FLASHING CAP SHEET AT STEEL & CONCRETE DECK:
1. FLASHING CAP SHEET, HEAT-WELDED:
a. SOPREMA Sopralast 50 TV ALU Sanded: SBS-modified bitumen membrane Cap Sheet with a sanded bottom surface and aluminum foil-clad top surface. Glass fiber reinforced. UL Class A for specified roof slope requirements. All SBS modified bitumen foil-clad membrane and flashing sheets shall be manufactured by the supplier.
i. Thickness: 157 mils (4.0 mm)
ii. Width: 39.4 in (1 m)
iii. Length: 32.8 ft (10 m)
iv. Meets or exceeds ASTM D6298.
v. Aluminum foil-clad surfacing, listed by the Cool Roof Rating Council (CRRC):
a) Solar Reflectance: Initial: 0.87 3-year: 0.72
b) Thermal Emittance: Initial: 0.05 3-year: 0.10
c) Solar Reflectance Index (SRI): Initial: 93
3-year: 64
vi. EPA EnergyStar Certified Roofing Product:
a) Solar Reflectance: Initial: 0.80 3-year: 0.58
b) Thermal Emittance: Initial: 0.05

2.04 THERMAL INSULATION SYSTEM AND SUBSTRATE BOARD

A. PARAPET WALL SUBSTRATE
1. GYPSUM ROOF BOARD
a. National Gypsum Company, DEXcell, DEXcell FA:
i. Gypsum core, glass fiber-faced, roof board:
ii. Thickness: 5/8 in
iii. Dimensions: 4 x 4 foot or 4 x 8 foot boards
iv. Facer: Glass fiber.
v. Meets or exceeds ASTM C1177/C1177M.
b. Georgia Pacific Gypsum LLC, DensDeck, DensDeck Prime: Gypsum core, glass fiber-faced, roof board:
i. Thickness: 5/8 in
ii. Dimensions: 4 x 4 foot or 4 x 8 foot boards
iii. Facer: Glass fiber.
iv. Meets or exceeds ASTM C1177/C1177M.
c. United States Gypsum, Securock: Gypsum core, fiber-reinforced roof board.

i. Thickness: 5/8 in
ii. Dimensions: 4 x 4 foot or 4 x 8 foot boards
iii. Facer: None
iv. Meets or exceeds ASTM C1278.

B. RIGID INSULATION
1. POLYISOCYANURATE INSULATION (SOPREMA Sopra-ISOr):
a. SOPREMA Sopra-ISO: Closed cell polyisocyanurate foam core bonded on each side to a glass fiber-reinforced felt facer.
i. Thickness: 1.5 in minimum board thickness. Total thickness to meet specified insulation system thermal resistance 'R' value
ii. Meets or exceeds ASTM C1289, Type II, Class 1, Grade 2 (20 psi).
b. SOPREMA Sopra-ISO Tapered: Closed cell polyisocyanurate foam core bonded on each side to a glass fiber-reinforced felt facer, tapered to provide slope.
i. Taper: 1/4 in per foot. Insulation, crickets and saddles provided with taper as required for positive roof slope.
ii. Meets or exceeds ASTM C1289, Type II, Class 1, Grade 2 (20 psi).

C. COVER-BOARD
1. ASPHALTIC ROOF BOARD
a. SOPREMA, SOPRABOARD, Resisto Board, Ecology Roof System Corp. ERS Ecology Roof Board, Viridian Systems, LLC., Pika Ply Recovery Board, IKO Industries, Ltd., ProtectoBoard, Henry Company Recover Board: Mineral fortified, asphaltic roof substrate board with glass fiber facers. For use as roof cover-board and for vertical flashing substrate. ASPHALTIC ROOF BOARD shall be manufactured by the membrane supplier.
i. Thickness: 1/8 in
ii. Dimensions: 4 x 8 ft acceptable for mechanical attachment, and insulation adhesive application.
iii. Puncture Resistance: 90 lbf
iv. Moisture Absorption: <1.0%
v. Compressive Strength: 1610 psi

D. INSULATION CANT AND TAPERED STRIP
1. CANT STRIP, RIGID MINERAL WOOL
a. SOPREMA SopraRock Cant Strips, Roxul Cant Strips: High density, mineral wool, bitumen coated cant strips.
i. Length: 4 ft sections.
ii. Cross-section dimensions: 1.5 thick x 4 in face width. 2 in thick x 5 in face width. Size as required for flashing conditions.

iii. Surface: Bitumen coated, sanded.
iv. Meets or exceeds ASTM C726.

2. CANT STRIP, EXPANDED PERLITE
   a. High density, laminated board made of high strength fibers and expanded perlite.
      i. Length: 4 ft sections.
      ii. Cross Section dimensions: 1 in thick x 3 in face, 1 in thick x
      iii. 4 in face, 1.5 in thick x 4 in face, 1.5 in thick x 5 in face. Size as required for flashing conditions.
      iv. Meets or exceeds ASTM C728.
3. TAPERED EDGE STRIP AND BOARDS:
   a. Expanded perlite, blended with binders and fibers.
      i. Dimensions: 6 in x 1/2 in, 12 in x 1/2 in, 1 in or 1-1/2 in, 18 in x 1 in or 1-1/2 in. Size as required.
      ii. Meets or exceeds ASTM C728.

E. INSULATION ADHESIVE
1. POLYURETHANE FOAM INSULATION ADHESIVE
   a. SOPREMA DUOTACK: Two-component, polyurethane foam insulation adhesive, applied in ribbons from cartridges or two-component bulk packaging with pump-driven delivery system.
      i. Ribbon size: 1/2 in to 3/4 in wide.
      ii. Ribbon spacing: As required to meet specified wind uplift resistance performance.
         a) Field of Roof (Zone 1): 12 in on-centers
         b) Perimeter of Roof (Zone 2): 6 in on-centers
         c) Corners of Roof (Zone 3): 4 in on-centers

2.05 ACCESSORIES

A. PRIMERS:
1. SOPREMA Elastocol 500 Primer: Asphalt cut-back primer. Primer for the preparation of roof membrane and flashing substrates for asphalt, heat-welded, hot asphalt and COLPLY and COLPLY MODIFIED ADHESIVE, solvent-based, cold adhesive-applied and cement applications.
   a. Meets or exceeds ASTM D41
   b. VOC content: 350 g/L or less.
   c.

B. GENERAL PURPOSE ROOFING CEMENT AND MASTIC
1. SOPREMA Sopramastic: SBS Mastic. Fiber-reinforced, roofing cement, packaged in 5 gallon pails. General purpose roofing cement for low-slope roofing used for sealing membrane T-joints and membrane edges along terminations, transitions and at roof penetrations.
   a. VOC Content: 190 g/L or less.

b. Meets or exceeds ASTM D4586, Type I, Class II.

2. SOPREMA Sopramastic: SBS Mastic. Fiber-reinforced, roofing cement, packaged in 10.4 oz caulk tubes. General purpose roofing cement for low-slope roofing used for sealing membrane T-joints and membrane edges along terminations, transitions and at roof penetrations.
   a. VOC Content: 190 g/L or less.
   b. Meets or exceeds ASTM D4586, Type I, Class II.

C. GENERAL PURPOSE SEALANT
1. SOPREMA Sopramastic SP1: General purpose, paintable, gun-grade, elastomeric, polyether moisture curing sealant for sealing SBS membrane terminations, Kynar 500 PVDF, horizontal and vertical construction joints.
   a. VOC Content: 20 g/L or less.
   b. Meets or exceeds ASTM C920, Type S, Grade NS, Class 50.
   c. Standard color, custom color.

D. INSULATION FASTENERS AND PLATES
1. SOPREMA #12 DP Fastener and 3 in stress plate: Insulation system fasteners and metal stress plates.
2. SOPREMA #14 MP Fastener and 3 in stress plate: Insulation system fasteners and metal stress plates.

E. MEMBRANE FASTENERS AND PLATES
1. SOPREMA #14 MP Fastener: Membrane base ply fastener.
2. SOPREMA 2 in Seam Plate: Membrane base ply seam plate.
3. SOPREMA 2.4 in Seam Plate: Membrane base ply seam plate.

F. LIQUID-APPLIED REINFORCED FLASHING SYSTEM:
1. SOPREMA Alsan Flashing: Single-component, polyurethane-bitumen resin with polyester reinforcing fleece fabric fully embedded into the resin to form roof system flashings.
   a. VOC Content: 250 g/L.
   b. Alsan Flashing: Liquid resin, Meets or exceeds ASTM C836.
   c. Alsan PolyFleece: Non-woven polyester reinforcement.
   d. Surfacing: Alsan Flashing with mineral granules broadcast into wet Alsan Flashing to match adjacent SBS-modified bitumen cap sheet.

G. MINERAL GRANULES:
1. SOPREMA Granules: No. 11, mineral coated colored granules, color to match cap sheet, supplied by membrane cap sheet manufacturer.
   a. SOPREMA Granules

H. EXPANSION JOINT:
1. SOPREMA Soprajoint: Low-profile, polyester knit-reinforced, SBS-modified bitumen expansion joint membrane. Top surface consists of an aluminum-clad bond-breaker, with plastic burn-off film on the bottom surface for torch or hot air welding.
   a. Thickness: 160 mils (4.0 mm)
   b. Width: 18 in (457 mm)

c. Roll Length: 32.8 ft (10 m)
d. Expansion joint, maximum unsupported span: 2 in (51 mm)
e. Expansion joint, maximum displacement: 5/8 in (16 mm)

I. SHEET METAL FLASHING:
1. Contractor shall furnish all sheet metal flashings, counter flashings, roof edge system, and all other related sheet metal flashings and associated fasteners necessary to flash and counter flash the specified roofing system.
2. Sheet metal flashing materials and fasteners shall be compatible with adjacent materials, to accommodate all project related exposures.
3. Pre-Finished (Mill Finished) Sheet Metal Flashing Material: Aluminum.
4. Roof Edge System: Tested per ANSI/SPRI ES-1 to meet or exceed design pressures at roof edge.

J. SHEET METAL, ROOF EDGE SYSTEM:
1. Roof edge system shall include all components and associated fasteners included by the manufacturer to comply with specified performance requirements. Contractor shall provide all other related fasteners and sealants not provided as part of the roof edge system, and required in the manufacturer's product data sheets.
2. Sopra Metal: Engineered Roof Edge System.
a. Material: Aluminum
b. Gauge/Thickness: 24 gauge
c. Finish: Kynar 500 Color selected from manufacturer's color chart. Mill-Finished Aluminum.
d. Tested per ANSI/SPRI ES-1 to meet or exceed design pressures at roof edge.
e. FM Approved.
3. SOPREMA Reglet and Flashing. Engineered, formed metal counterflashing metal.
a. Material: Aluminum
b. Gauge/Thickness: 24 gauge
c. Finish: Kynar 500 Color selected from manufacturer's color chart. Mill-Finished Aluminum.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examination includes visual observations, qualitative analysis, and quantitative testing measures as necessary to ensure conditions remain satisfactory throughout the project.
B. The contractor shall examine all roofing substrates including, but not limited to: insulation materials, roof decks, walls, curbs, rooftop equipment, fixtures, and wood blocking.

C. The applicator shall not begin installation until conditions have been properly examined and determined to be clean, dry and, otherwise satisfactory to receive specified roofing materials.
D. During the application of specified materials, the applicator shall continue to examine all project conditions to ensure conditions remain satisfactory to complete the specified roofing system.

3.02 PREPARATION

A. Before commencing work each day, the contractor shall prepare all roofing substrates to ensure conditions are satisfactory to proceed with the installation of specified roofing materials. Preparation of substrates includes, but is not limited to, substrate repairs, securement of substrates, eliminating all incompatible materials, and cleaning.
B. Where conditions are found to be unsatisfactory, work shall not begin until conditions are made satisfactory to begin work. Commencing of work shall indicate contractor's acceptance of conditions.

3.03 INSULATION SYSTEM APPLICATION

A. Follow insulation system component product data sheets, published general requirements and, approvals.
B. Install all insulation system components on clean, dry, uniform and, properly prepared substrates.
C. All insulation system boards shall be carefully installed and fitted against adjoining sheets to form tight joints.
D. Insulation system boards that must be cut to fit shall be saw-cut or knife-cut in a straight line, not broken. Chalk lines shall be used to cut insulation components. Uneven or broken edges shall not be accepted. Remove dust and debris that develops during cutting operations.
E. Stagger successive layers of insulation 12 in vertically and laterally to ensure board joints do not coincide with joints from the layers above and below.
F. Crickets, saddles, and tapered edge strips shall be installed before installing Cover-boards.
G. Install tapered insulation, saddles and crickets as required to ensure positive slope for complete roof drainage.
H. Cover-boards shall be installed to fit tight against adjacent boards. When required by the Cover-board manufacturer, a uniform gap shall be provided between Cover-boards using a uniform guide placed between board joints to form a gap between all boards during installation.
I. The finished insulation system surface shall be tight to, and flush with, adjacent substrates to form a satisfactory substrate to install specified roof membrane and flashings.
J. Install specified cants where required for membrane flashing transitions.

3.04 INSULATION FASTENER APPLICATION

A. Fasten (Insulation Base Layer, Insulation, Cover-board) to the deck using specified insulation fasteners and plates.
B. Evenly distribute fasteners as required by the board manufacturer's published requirements.
C. Fasten the insulation to meet the specified wind uplift resistance performance requirements and warranty requirements.
D. Minimum insulation fastening requirement:
    1. Field of Roof (Zone 1): 5 fasteners per 4x8 ft board.
    2. Perimeter of Roof (Zone 2): 5 fasteners per 4x8 ft board.
    3. Corners of Roof (Zone 3): 5 fasteners per 4x8 ft board.
E. For insulation and Cover-boards located partially within the defined perimeter and/or corners, install fastening for the entire board as specified herein.

3.05 INSULATION ADHESIVE APPLICATION

A. Apply the specified two-component insulation adhesive to adhere (Insulation Base Layer, Insulation Layers, Cover-board) to the deck and insulation substrate(s).
B. Follow insulation adhesive product data sheets and published general requirements for installation requirements.
C. Apply insulation adhesive in uniform ribbons, 1/2 in to 3/4 in wide.
D. Immediately install insulation components into insulation adhesive, and apply weight to ensure the materials maintain full contact with all ribbons for complete adhesion. Do not allow insulation adhesive to skin-over before placing the insulation materials into the adhesive.
E. Adhere the insulation system to meet the specified wind uplift resistance performance and specified warranty requirements.
F. Minimum insulation adhesive ribbon spacing:
    1. Field of Roof (Zone 1): 12 in on-centers.
    2. Perimeter of Roof (Zone 2): 6 in on-centers.
    3. Corners of Roof (Zone 3): 4 in on-centers.

3.06 PRIMER APPLICATION

A. Examine all substrates, and conduct adhesion peel tests as necessary, to ensure satisfactory adhesion is achieved.
B. Apply the appropriate specified primer to dry, compatible substrates as required to enhance adhesion of new specified roofing materials.
C. Apply primer using brush, roller, or sprayer at the rate published on the product data sheet.
D. Asphalt Primer: Apply (ELASTOCOL 500) primer to dry compatible masonry, metal, wood and other required substrates before applying asphalt and heat-welded membrane

plies. Primer is optional for solvent based solvent-based SBS adhesives and cements, refer to product data sheets.

E. Project conditions vary throughout the day. Monitor changing conditions, monitor the drying time of primers, and monitor the adhesion of the membrane plies. Adjust primer and membrane application methods as necessary to achieve the desired results.

3.07 HEAT WELDING

A. The Contractor is responsible for project safety. Where conditions are deemed unsafe to use open flames, manufacturer's alternate membrane application methods shall be used to install SBS modified bitumen membrane and flashings. Acceptable alternate installation methods include hot asphalt, cold adhesive-applied, self-adhered membranes and mechanically fastened plies. Hot-air welding equipment may be used in lieu of roof torches to seal membrane side and end laps where heat welding the laps is necessary. Refer to NRCA CERTA, local codes and building owner's requirements for hot work operations.

B. Single or multi-nozzle, hand-held propane roof torches shall be used to install heat-welded membrane and flashing plies. Multi-nozzle carts (dragon wagons) may also be utilized to install membrane plies. Seven (7) nozzle carts are recommended for more uniform heat application in lieu of five (5) nozzle carts.

3.08 SBS MASTIC AND GENERAL PURPOSE ROOFING CEMENT APPLICATION

A. Apply SOPREMA Sopramastic general purpose SBS mastic and roofing cement to seal drain leads, metal flanges, seal along membrane edge at terminations, and where specified and required in detail drawings.

B. Do not use general purpose SBS mastics and roofing cement where flashing cement applications are required. Do not use SBS mastics and roofing cement beneath SBS-modified bitumen membrane and flashing plies.

C. Apply general purpose SBS mastic and elastic roofing cement using caulk gun, or notched trowel at 2.0 – 2.5 gallons per square on each surface. Application rates vary based on substrate porosity and roughness. Tool-in as necessary to seal laps

D. Embed matching granules into wet cement where exposed.

3.09 HEAT-WELDED, FULLY ADHERED MEMBRANE APPLICATION

A. Follow material product data sheets and published general requirements for installation instructions.

B. Ensure environmental conditions are safe and satisfactory, and will remain safe and satisfactory, during the application of the heat-welded membrane and flashings.

C. Ensure all primers are fully dry before beginning heat-welding operations.

D. Unroll membrane onto the roof surface and allow time to relax prior to heat welding.

E. Starting at the low point of the roof, lay out the membrane to ensure the plies are installed perpendicular to the roof slope, shingled to prevent back-water laps.
F. Ensure all roofing and flashing substrates are prepared and acceptable to receive the heat-welded membrane.
G. Cut membrane to working lengths and widths to conform to rooftop conditions, and lay out to always work to a selvage edge.
H. Ensure specified side-laps and end-laps are maintained. End-laps should be staggered 3 ft apart.
I. Direct roof torch on the roll as necessary to prevent overheating and damaging the membrane and substrates.
J. As the membrane is unrolled, apply heat to the underside of the membrane until the plastic burn-off film melts away. Continuously move the torch side-to-side across the underside of the roll to melt the bitumen on the underside of the sheet, while continuously unrolling membrane.
K. While unrolling and heating the sheet, ensure a constant flow hot bitumen approximately ¼ to 1/2 in flows ahead of the roll as it is unrolled, and there is 1/8 to 1/4 in bleed out at all laps.
L. Adjust the application of heat to the underside of the membrane and to substrate as required for varying substrates and environmental conditions.
M. At the 6 in end-laps, melt the plastic burn-off film from the top surface or embed granules and remove surfacing, where present, using a torch or hot-air welder.
N. At end-laps, cut a 45 degree dog-ear away from the selvage edge, or otherwise ensure the membrane is fully heat-welded watertight at all T-joints.
O. Each day, physically inspect all side and end-laps, and ensure the membrane is sealed watertight. Where necessary, use a torch or hot-air welder and a clean trowel to ensure all laps are fully sealed.
P. Inspect the installation each day to ensure the plies are fully adhered. Repair all voids, wrinkles, open laps and all other deficiencies.
Q. Offset cap sheet side and end-laps away from the base ply laps so that cap sheet laps are not located within 18 in of base ply laps.

3.10 MECHANICALLY FASTENED MEMBRANE, BASE PLY APPLICATION (SOPREMA SOPRAFIX)

A. Refer to agency approvals for fastening and other system requirements.
B. Mechanically fastened membrane base ply installation:
   1. Follow product data sheets and published detail requirements for additional installation instructions.
   2. Ensure environmental conditions are satisfactory, and will remain satisfactory, during the application.
   3. Unroll the sheet onto the roof surface and allow time to relax before fastening. The sheet should relax in order to prevent wrinkling once fastened.

4. Starting at the low point of the roof, lay out the membrane to ensure the plies are installed perpendicular to the roof slope, shingled to prevent back-water laps.
5. Remove all wrinkles from the sheet.
6. Ensure all roofing and flashing substrates are prepared and acceptable to receive the mechanically fastened membrane.
7. Ensure the specified side-lap and end-lap widths are maintained. End-laps should be staggered 3 ft. apart.
8. Unroll the first roll onto the roof substrate, re-roll the adjacent roll.
9. Starting at one end of the sheet, install the mechanical fasteners along the center of the side-lap. Ensure spacing between fasteners in the laps meets specified wind uplift resistance requirements.
10. Do not over-drive fasteners. Install fasteners as necessary to firmly set the fastener and seam plate tight against the sheet. Prevent wrinkles from forming in the sheet as the fasteners are installed.
11. At the end of the sheet where it terminates at roof edges, walls and curbs, fasten the end-laps to the deck 12 inches on-centers or less.
12. When the side-lap is fastened, un-roll the adjacent roll over the fasteners. Maintain the required side-lap width.
13. Ensure the full side-lap width, and all 6 inch end-laps, are sealed water-tight.
14. For heat-welded side-laps, apply heat to the underside of the roll at the side-laps while unrolling the membrane. Apply heat until the bitumen melts to ensure fully adhesion. Ensure a continuous weld is produced across the full side-lap width.
15. For hot-air welded side-laps, insert the hot-air welder shoe within the lap, and adjust the hot-air welder as required to produce a continuous weld across the full lap width.
16. While heat-welding the membrane side-laps, ensure approximately 1/8 to ¼ in bleed-out is achieved at laps.
17. Adjust the application of heat to the underside of the membrane and to substrate as required for varying substrates and environmental conditions.
18. For self-adhesive side-laps, remove the release film on the underside of the membrane, while immediately following with a steel roller. Immediately heat-weld all 6 inch end-laps, and fully seal all T-joints.
19. At end-laps, cut a 45 degree dog-ear away from the selvage edge, or otherwise ensure the membrane is fully heat-welded watertight at all end- laps and T-joints.
20. Each day, physically inspect all side and end-laps, and ensure the membrane is sealed watertight. Where necessary, use a torch or hot-air welder and a clean trowel to ensure all laps are fully sealed.
21. Offset cap sheet side and end-laps away from the base ply laps so that cap sheet laps are not located within 18 inches of adjacent ply laps.
22. Install membrane inter-ply and/or cap sheet over completed fastened base ply sheet.
23. Inspect the installation each day to ensure the plies are fully adhered. Repair all un-adhered voids, wrinkles, open laps and all other deficiencies.

3.11 FLASHING APPLICATION, HEAT WELDED

A. Refer to SBS manufacturer's membrane application instructions, flashing detail drawings, and follow product data sheets and other published requirements for installation instructions. Refer to manufacturer's membrane flashing detail drawings.

B. The contractor is responsible for project safety. Refer to NRCA CERTA recommendations and building owner requirements for hot work operations.

C. Where required to seal substrates for fire safety, install specified adhered, self-adhered or fastened backer ply to the substrate. Ensure backer-ply covers and seals all substrates requiring protection from exposure to torch operations.

D. Ensure all flashing substrates that require primer are primed, and the primer is fully dry.

E. Unroll the flashing base ply and flashing cap sheet onto the roof surface to their complete length. Once relaxed, cut the membrane to the required working lengths to accommodate the flashing height, cants and the required over-lap onto the horizontal roof surface.

F. Cut the flashing membrane from the end of the roll in order to always install flashings to the side-lap line or selvage edge line.

G. Lay out the flashing base ply and flashing Cap Sheet to offset all side-laps a minimum of 12 inches so that side-laps are never aligned on top of the ply beneath. Shingle the flashing ply laps to prevent back-water laps.

H. Install non-combustible cant strips at transitions where required.

I. Ensure correct membrane and flashing sequencing to achieve redundant, multi-ply, watertight flashings.

J. ROOF MEMBRANE BASE PLY:
   1. Before installing flashings, install the roof membrane base ply in the horizontal field of the roof, and extend the base ply up to the top of the cant, where present, at roof terminations, transitions and penetrations.

K. FLASHING BASE PLY:
   1. Install the flashing base ply starting at the top leading edge of the vertical flashing substrate, down over the cant and onto the horizontal surface of the roof a minimum of 3 inches beyond the of base of the cant onto the roof. Cut the base ply at corners to form 3 inch side-laps. Install gussets to seal corner transitions.
   2. Install one or more flashing base ply(s) at all roof terminations, transitions and penetrations.

L. ROOF MEMBRANE CAP SHEET:
   1. Install the roof membrane Cap Sheet in the horizontal field of the roof over the flashing base ply up to the roof termination, transition or penetration, and up to the top of cants where present.
   2. Using a chalk line, mark a line on the membrane cap sheet a minimum of 4 inches from the base of the cant onto the roof. Where granules are present, embed the cap sheet granules using a torch and trowel or granule embedder to prepare the surface to receive the flashing cap sheet.

M. FLASHING CAP SHEET:

1. Install the flashing Cap Sheet starting at the top leading edge on the vertical substrate, over the cant and onto the roof surface 4 inches from the base of the cant onto the roof.
2. Install the flashing Cap Sheet to ensure a minimum two (2) ply flashing system is present at all roof terminations, transitions and penetrations.

N. During the membrane and flashing installation, ensure all plies are completely adhered into place, with no bridging, voids or openings. Ensure bitumen or flashing cement bleed-out is present at all flashing side and end-laps.

O. Use a damp sponge float or damp rag to press-in the heat-welded flashing plies during installation.

P. Where sufficient bitumen bleed-out is not present, and for all self-adhered plies, apply specified gun-grade sealant or mastic to seal the membrane termination along all roof terminations, transitions and penetrations. These include gravel stop edge metal, pipe penetrations, along the top edge of curb and wall flashing, and all other flashing terminations where necessary to seal flashings watertight.

Q. Fasten the top leading edge of the flashing 8 in on-centers with appropriate 1 in metal cap nails or other specified fasteners and plates. Seal fastener penetrations watertight using specified sealant or mastic.

R. Manufacturer's liquid-applied, reinforced flashing systems shall be installed where conditions are not favorable to install SBS modified bitumen flashings. Such conditions include irregular shapes penetrating roof surfaces (I-beams), confined areas and low flashing heights. Manufacturer's liquid-applied, reinforced flashing systems are recommended in lieu of pitch pans and lead pipe flashings.

3.12 LIQUID-APPLIED, SINGLE-COMPONENT, BITUMEN-URETHANE FLASHING SYSTEM APPLICATION (SOPREMA ALSAN FLASHING)

A. Refer to manufacturer's details drawings, product data sheets and published general requirements for application rates and specific installation instructions

B. Pre-cut SOPREMA ALSAN POLYFLEECE polyester reinforcing fleece to conform to roof terminations, transitions and penetrations being flashed. Ensure a minimum 2 in overlap of fleece at side and end-laps. Ensure the completed liquid-applied flashing membrane is fully reinforced.

C. Apply the base coat of SOPREMA ALSAN FLASHING liquid-applied flashing resin onto the substrate using a brush or roller, working the material into the surface for complete coverage and full adhesion at 2.0 gallons per square.

D. Immediately apply the SOPREMA ALSAN POLYFLEECE reinforcing into the wet base coat of resin. Using a brush or roller, work the SOPREMA ALSAN POLYFLEECE into the wet resin while applying the second coat of SOPREMA ALSAN FLASHING resin to completely encapsulate the fleece at 2.0 gallons per square, and extend the liquid resin 1 inch beyond the fleece.

E. Allow the liquid membrane to sufficiently cure for 24 to 48 hours then apply the finish coat of SOPREMA ALSAN FLASHING resin at 2.0 gallons per square.

F. Broadcast mineral granules into the wet finish coat as required to match the adjacent cap sheet.
G. For SOPREMA Soprastar cap sheets, allow the SOPREMA ALSAN FLASHING system to completely cure for 48 hours or more, then apply the liquid-applied SOPREMA ALSAN FINISH surfacing to match the adjacent Soprastar cap sheet. Refer to SOPREMA ALSAN FINISH product data sheets and installation instructions.

3.13 SHEET METAL FLASHING APPLICATION

A. Refer to sheet metal flashing detail drawings, and follow product data sheets and published general requirements for installation instructions.
B. Follow the most recent edition of the SMACNA Architectural Sheet Metal Manual for fabrication and installation requirements.

3.14 WALKWAYS

A. At areas outlined on the drawings, and around the perimeter of all rooftop equipment and at all door and stair landings, install walkway protection.
B. Cut walkway from end of rolls. No piece shall be less than 24 in.
C. Provide a 2 in space between sheets for drainage.

3.15 CLEAN-UP

A. Clean-up and properly dispose of waste and debris resulting from these operations each day as required to prevent damages and disruptions to operations.

END OF SECTION

SECTION 07 55 00

MULTI-LAYERED WATERPROOF FLOOR SURFACING

PART 1.00 – GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 WORK INCLUDED

A. Work of this Section includes all labor, materials, equipment, accessories and services necessary to complete the multi-layered troweled waterproof mechanical equipment room floor surfacing and vertical flashing as scheduled on the drawings and/or specified herein.

1.3 RELATED WORK

A. Concrete - Section 03 30 00: A fluid applied film forming curing compound complying with ASTM C309 or ASTM C1315 should be applied to the concrete to facilitate proper curing of the concrete substrate. Other types of curing compounds are generally not acceptable. Concrete should be cured for a minimum of 28 days. On grade floors should have functioning vapor retarder beneath slab.

B. Floor drains - Division 15: Floor drains, clean-outs, etc. should be of the "floor-flange" type as manufactured for use with waterproof floors by most major drain manufacturers.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product Data: Submit manufacturer's technical data, application instructions and general recommendations for the multi-layered troweled waterproof flooring surfacing specified herein.

C. Samples for initial selection purposes in form of manufacturer's color charts showing full range of colors and finishes available.

1. Submit 2-1/2" x 4" samples in color (red or gray) the selection shall be designated by the Architect.

D. Samples for Verification: For each multi-layered troweled waterproof floor surfacing system or color specified, Provide 2 each, 6 inches (150mm) square samples in the selected color and texture, applied to a ridged backing by the installing contractor for this project.

E. Material certificates signed by manufacturer certifying that the multi-layered troweled waterproof flooring surfacing supplied for this complies with requirement specified herein.

F. Maintenance Instructions: Submit manufacturer’s written instructions for recommended maintenance practices.

G. Contractor Certification: Submit a letter from the primary materials manufacturer certifying that the installing contractor has been properly trained in the application of the materials being installed, and is acceptable to the materials manufacturer.

1. Engage an installer who employs only persons trained and qualified for accomplishing preparation and installation of the multi-layered troweled waterproof flooring surfacing systems specified, including any sub-contractors performing work on the project.
2. Engage an installer who is certified in writing by the multi-layered troweled waterproof flooring surfacing manufacturer as a factory trained applicator qualified to apply the specified resinous flooring system.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer or applicator who has specialized in installing waterproof flooring system types similar to that required for this Project. The waterproof flooring system installation contractor shall have a minimum of five year experience for installation in the installation of similar materials and is a current SSPC member with SSPC Society of Protective Coatings QP-8 certification and acceptable to materials manufacturer. NOTE TO SPECIFIER: (See www.sspc.org/membership for certified QP-8 contractor member information).

B. Acceptable Materials Manufacturers: Manufacturer shall certify that they are the primary formulator of the materials used in the completion of the work as specified herein. The materials manufacturer shall have a minimum 10 year experience in producing waterproof flooring system materials. They shall also be a member of the SSPC Society of Protective Coatings and meeting SSPC ISO 9001 Quality Control manufacture requirements.

C. Single-Source Responsibility: Obtain multi-layered troweled waterproof flooring surfacing materials, including primers, resins, hardening agents, binders, aggregate blends and finish or sealing coats from a single manufacturer. Provide secondary materials, including patching and fill materials, joint sealant, accessory items, and repair materials from a source recommended by the manufacturer of the primary materials.

D. Qualified Materials: Request for material approvals for any product other than the specified products must be submitted to the architect two weeks prior to the bid, including complete application specification, physical characteristics, and chemical resistance data. Any request after this date will not be accepted. Failure of performance requires immediate removal and replacement of unapproved substituted material with those originally specified at no cost to the owner, architect, construction manager, or general contractor.

E. Mockups: Apply mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set the standard of quality for materials and installation.

1. Apply all components of the specified multi-layered troweled waterproof floor surfacing system at the specified thickness and finished in the texture and color as selected. Apply a minimum 100 square feet area to simulate the actual installation characteristics. Include areas that demonstrate the finished cove base, joint detailing, terminations or any other special conditions.
2. Simulate finished lighting conditions for Architects review of mockups.
3. Approved mockups may become part of the completed work if undisturbed at the time of substantial completion.

F. Inspection of the Work: A SSPC certified CCI concrete coating QA inspector must provide a project inspection plan, perform any specified inspections and verify that the work performed by the contractor meets all of the project specification requirements.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original packages and containers with unbroken seals and bearing manufacturer's labels containing brand name, date of manufacture, manufacture lot number and

directions for storage and mixing with other components.

B. Store materials to comply with manufacturer's directions to prevent deterioration from moisture, heat, cold, direct sunlight, or other detrimental effects.

1.7 PROJECT CONDITIONS

A. Environmental Conditions: Comply with multi-layered troweled waterproof floor surfacing system manufacturer's directions for maintenance of ambient and substrate temperature, moisture, humidity, ventilation and other conditions required to execute and protect work.

B. Lighting: Permanent lighting will be in place and working before installing multi-layered troweled waterproof floor surfacing system.

C. Moisture Vapor Emission Rates: Perform Calcium Chloride test in conformance to ASTM F1869 or in situ relative humidity test conforming to ASTM F2170 to determine moisture vapor emission rates or in situ relative humidity in substrate prior to application of any component of the flooring system. Do not install flooring over substrate with moisture vapor emission rates in excess of 3 lbs. per 24 hour period over a 1000 square foot area or with a relative humidity in excess of 78%. Notify the Architect and Project Administrator immediately if MVER or rh levels exceed these rates.

PART 2.00 – PRODUCTS

2.1 MATERIALS

A. Multi-layered troweled waterproof mechanical equipment room floor surfacing system shall be Dex-O-Tex M-E Flooring as manufactured by Crossfield Products Corp. in Rancho Dominguez, California and Roselle Park, New Jersey.

B. Multi-layered trowel applied waterproof flooring surfacing system shall be composed of a primer bondcoat, waterproof membrane, traffic surfacing and finish coats, and shall conform to the following standards:

1. Traffic surface binder and all rubber emulsions shall be compounded with an aqueous synthetic rubber liquid containing no hydrocarbon solvents.
2. Aggregate for traffic surface coating shall be suitably graded mineral aggregate passing a #20 mesh sieve and retained on a #80 mesh sieve.
3. Fabric used as reinforcement for waterproof base and floor shall be 7 ½ oz. woven polypropylene fabric.
4. Final Finish dressing shall be a single component, water-phase acrylic latex emulsion material, pigmented and of a consistence suitable for roller application.

2.2 PROPERTIES

A. Colors: As indicated or if not otherwise indicated, as selected by Architect from manufacturer’s standard colors.

B. Physical Properties: Provide a flooring system that meet or exceed the listed minimum physical property requirements when tested according to the referenced standard test method in parentheses.

Waterproofness (Smith Emery Laboratories Test Procedure)
Sample 18” diam. Subjected to 50 lbs per inch water pressure
for 60 mins. Test for amount of water forced through in grams.

Tensile Strength & Elongation (ASTM D1117):
Elongation Dry 29.0%
Breakload Dry ..... 106 lbs. per inch
Elongation Wet 31.0%
Breakload Wet ..... 67 lbs. per inch

Strip Adhesion
(Strip adhesion measured in per linear inch force
required to pull up membrane) ..... 19.2 lbs. per inch

Indentation Characteristics (MIL-D-3134, Para. 4.7.3)
(Steadily Applied Load) (2000 lbs. on 1" steel
ram imposed for 30 minutes) ..... < 5%

Indentation Characteristics (MIL-D-3134, Para. 4.7.3)
(Impacted Load 2 lb. Steel ball dropped
from 8 foot height) ..... No cracking or loosening

Resistance to Elevated Temperature
(MIL-D-3134, Para 4.7.5.1) ..... No flow or slip

Skid Resistance (Coefficient of Friction) ..... Varies depending upon surface texture selected.

PART 3.00 - EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where the multi-layered troweled waterproof flooring surfacing is to be installed and notify the Architect of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected by the Contractor in a manner acceptable to the Architect.

B. Job Site Pre-Installation Survey
1. Perform moisture testing in accordance with ASTM F1869, ASTM F2170 or ASTM E1907. Verify and document result in accordance with the specification. If the MVER exceeds 3 lbs. or the relative humidity (RH) of the substrate is greater than 78%, apply Dex-O-Tex VaporControl Primer 200 as per manufacturer's application specification before proceeding.
2. Inspect Substrate to verify proper preparation before applying any materials.
3. Measure and record ambient temperature and humidity, surface temperature and the temperature of the material being used at the start of work, mid-day and at the commencement of work each day. Do not proceed with the application if the conditions are outside the recommended parameters Inspect materials to be used. Verify material is the proper material and all components and sizes are correct. Inspect all containers and verify a proper factory seal with no signs of damage or leakage. Premix Liquid materials into a smooth homogenous blend before uses.

3.2 PREPARATION

A. Substrate: Perform preparation and cleaning procedures according to waterproof floor surfacing manufacturer's instructions for particular substrate conditions involved, and as specified. Prepare in accordance with SSPC SP 13/NACE No. 6.

B. Concrete Surfaces: Shot-blast, or power grind as required to obtain optimum bond of flooring to concrete. Remove sufficient material to provide a sound surface free of laitance, glaze, efflorescence and any bond-inhibiting curing compounds or form release agents. Remove grease, oil and other penetrating contaminates. Prepare substrate in accordance with SSPC SP 13/ NACE No.6. Repair damaged and deteriorated concrete to acceptable condition. Leave surface free of dust, dirt, laitance, and efflorescence. Perform surface cleanliness test in conformance with ISO 8502.

C. Materials: Mix resin hardener aqueous emulsions and aggregate as required and prepare materials according to flooring system manufacturer's instructions.

3.3 APPLICATION

A. General: Apply each component of multi-layered troweled waterproof flooring surfacing system according to manufacturer's directions to produce a uniform monolithic surface of thickness indicated.

B. Environmental Check Points: Measure and record ambient temperature, relative humidity, dew point, surface temperature, and material temperatures at the beginning of work, mid-day, and at the end of work each day work is performed on the project. Include this information with the joint installer manufactures guarantee as part of the project close out documents.

C. Apply synthetic rubber waterproof membrane solution at all vertical junctures. Embed polypropylene fabric into membrane liquid.

D. Apply synthetic rubber waterproof membrane solution with polypropylene fabric reinforcement to entire area to be coated. Overlap all seams a minimum of 2 inches.

E. Trowel apply elasticized resin emulsion and aggregate composition traffic surfacing over all surfaces previously covered with waterproof membrane at nominal 1/8” finish thickness as specified.. Sand surface to remove trowel marks or small surface imperfections.

F. Roller apply two coats of final finish dressing to a uniform finish.

G. Finished waterproof mechanical equipment room floor surfacing shall be a nominal 3/16 inch thick, uniform in color and texture.

H. Cove Base: Apply cove base mix to wall surfaces at locations shown to form cove base height of 4 inches unless otherwise indicated. Follow manufacturer's printed instructions and details including taping, mixing, troweling, and sanding, of cove base.

3.4 CURING, PROTECTION AND CLEANING

A. Cure multi-layered troweled waterproof flooring surface materials according to manufacturer's directions, taking care to prevent contamination during application stages and before completing curing process. Close application area for a minimum of 24 hours.

END OF SECTION

SECTION 07 62 00
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings, counterflashings, gutters, downspouts, and other items indicated in Schedule.

B. Sealants for joints within sheet metal fabrications.

C. Sheet metal splash pans.

1.02 REFERENCE STANDARDS

A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.

C. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2012).

D. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.03 SUBMITTALS

A. See Section 01 33 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

B. Maintain one copy of each document on site.

C. Fabricator and Installer Qualifications: Company specializing in sheet metal work with 5 years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

A. Pre-Finished Aluminum: ASTM B 209 (ASTM B 209M);.040 inch thick; plain finish shop pre coated with fluoropolymer coating of color as selected.
   1. Fluoropolymer Coating: High Performance Organic Finish, AAMA 2604; multiple coat, thermally cured fluoropolymer finish system; color as scheduled.

B. Stainless Steel: ASTM A666 Type 304, soft temper, 28 gage (0.0156 inch) thick; smooth No. 4 finish.

2.02 ACCESSORIES

A. Fasteners: Stainless steel, with soft neoprene washers.

B. Primer: Zinc chromate type.

C. Protective Backing Paint: Zinc molybdate alkyd.

D. Sealant to be Concealed in Completed Work: Non-curing butyl sealant.

E. Sealant to be Exposed in Completed Work: ASTM C920; elastomeric sealant, 100 percent silicone with minimum movement capability of plus/minus 25 percent and recommended by manufacturer for substrates to be sealed; clear.

F. Sealant: Type specified in Section 07 90 05.

G. Plastic Cement: ASTM D4586, Type I.

2.03 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Form pieces in longest possible lengths.

C. Hem exposed edges on underside 1/2 inch; miter and seam corners.

D. Form material with flat lock seams, except where otherwise indicated. At moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

E. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.

F. Fabricate flashings to allow toe to extend 2 inches over roofing gravel. Return and brake edges.

2.04 GUTTER AND DOWNSPOUT FABRICATION

A. Gutters and Downspouts: Sizes indicated.

B. Accessories: Profiled to suit gutters and downspouts.
   1. Anchorage Devices: In accordance with SMACNA requirements.
   2. Gutter Supports: Brackets.
   3. Downspout Supports: Straps.

C. Splash Pans: Same metal type as downspouts, formed to size indicated on drawings; rolled sides of height shown in drawings for inverted pan placement. Provide rippled pan surface as shown in drawings.

D. Downspout Boots: Cast iron. with rust inhibitor by McKinley 1-800-433-2303 (round type).

E. Seal metal joints.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

3.03 INSTALLATION

A. Conform to drawing details.
   1. : SMACNA Architectural Sheet Metal Manual, specific details as called out in drawings.
   2. _____: SMACNA (ASMM), Detail ____.

B. Secure flashings in place using concealed fasteners. Use exposed fasteners only where permitted.

C. Apply plastic cement compound between metal flashings and felt flashings.

D. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

E. Seal metal joints watertight.

F. Secure gutters and downspouts in place using fasteners.

G. Connect downspouts to downspout boots. Grout connection watertight.

H. Set splash pans as shown on drawings.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for field inspection requirements.

B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

3.05 SCHEDULE

A. Gutters and Downspouts: Aluminum, this section

B. Scuppers: Aluminum, this section

C. Roof Flashings and Coping: Aluminum, included in Section 07 52 16.

D. Cavity Wall Flashing: Stainless Steel, this section

E. Counterflashings at Roofing Terminations (over roofing base flashings):

F. Counterflashings at Curb-Mounted Roof Items, including skylights and roof hatches: Aluminum, this section.

G. Roofing Penetration Flashings, for Pipes, Structural Steel, and Equipment Supports: Aluminum, included in Section 07 52 16.

END OF SECTION

SECTION 07 84 00
FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Firestopping systems.

B. Firestopping of all joints and penetrations in fire resistance rated and smoke resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.02 REFERENCE STANDARDS

A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2015.

B. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops; 2013a.

C. ASTM E1966 - Standard Test Method for Fire Resistive Joint Systems; 2007 (Reapproved 2011).

D. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus; 2015a.

E. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed Between Rated Wall Assemblies and Nonrated Horizontal Assemblies; 2013.

F. ITS (DIR) - Directory of Listed Products; current edition.

G. FM P7825 - Approval Guide; Factory Mutual Research Corporation; current edition.

H. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.

I. UL (FRD) - Fire Resistance Directory; current edition.

1.03 SUBMITTALS

A. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.

B. Product Data: Provide data on product characteristics, performance ratings, and limitations.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Certificate from authority having jurisdiction indicating approval of materials used.

1.04 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
   1. Listing in the current-year classification or certification books of UL, FM, or ITS (Warnock Hersey) will be considered as constituting an acceptable test report.
   2. Submission of actual test reports is required for assemblies for which none of the above substantiation exists.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section and:

1.05 MOCK-UP

A. Install one firestopping assembly representative of each fire rating design required on project.
   1. Where one design may be used for different penetrating items or in different wall constructions, install one assembly for each different combination.
   2. Where firestopping is intended to fill a linear opening, install minimum of 1 linear ft.

B. Obtain approval of authority having jurisdiction before proceeding.

C. If accepted, mock-up will represent minimum standard for the Work.

D. If accepted, mock-up may remain as part of the Work. Remove and replace mock-ups not accepted.

1.06 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation. Maintain minimum temperature before, during, and for 3 days after installation of materials.

B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.01 FIRESTOPPING - GENERAL REQUIREMENTS

A. Manufacturers:
   1. A/D Fire Protection Systems Inc: www.adfire.com.
   2. 3M Fire Protection Products: www.3m.com/firestop.
   3. Hilti, Inc: www.us.hilti.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Firestopping: Any material meeting requirements.

C. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Type required for tested assembly design.

D. Fire Ratings: See Drawings for required systems and ratings.

2.02 FIRESTOPPING ASSEMBLY REQUIREMENTS

A. Perimeter Fire Containment Firestopping: Use any system that has been tested according to ASTM E2307 to have fire resistance F Rating equal to required fire rating of the floor assembly.

B. Head-of-Wall Firestopping at Joints Between Non-Rated Floor and Fire-Rated Wall: Use any system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of floor or wall, whichever is greater.

C. Floor-to-Floor, Wall-to-Wall, and Wall-to-Floor Joints, Except Perimeter, Where Both Are Fire-Rated: Use any system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.

D. Through Penetration Firestopping: Use any system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.

2.03 FIRESTOPPING SYSTEMS

A. Firestopping: Any material meeting requirements.
   1. Fire Ratings: Use any system listed by UL or that has F Rating equal to fire rating of penetrated assembly and minimum T Rating Equal to F Rating and that meets all other specified requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter that could adversely affect bond of firestopping material.

B. Remove incompatible materials that could adversely affect bond.

3.03 INSTALLATION

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

B. Do not cover installed firestopping until inspected by authority having jurisdiction.

C. Install labeling required by code.

3.04 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 07 90 05
JOINT SEALERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sealants and joint backing.

B. Precompressed foam sealers.

1.02 REFERENCE STANDARDS

A. ASTM C834 - Standard Specification for Latex Sealants; 2014.

B. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2012.

C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.

D. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2013.

E. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2005 (Reapproved 2010).

1.03 SUBMITTALS

A. See Section 01 33 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating sealant chemical characteristics.

C. Samples: Submit two samples, 1x1 inch in size illustrating sealant colors for selection.

D. Manufacturer's Installation Instructions: Indicate special procedures.

1.04 QUALITY ASSURANCE

A. Conditions of Other Work: The contractor must examine joint surfaces, backing and anchorage of units forming sealant ragget, and conditions under which sealant work is to be performed, and shall correct all conditions detrimental to proper completion of the work and performance of the sealants. DO NOT proceed wit the sealant work until unsatisfactory conditions have been corrected.

B. Weather Conditions: Do not proceed with the installation of sealants under adverse weather conditions, or when temperatures are below or above manufacturer's reccommended temperature range for installation. Proceed with the work only when the forcasted weather conditions are favorable for proper cure and development of high-early bod strength. Installer shall coordinate time schedule with contractor to avoid delay of the project.

C. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.

D. Applicator Qualifications: Company specializing in performing the work of this section with minimum three years documented experience and approved by manufacturer.

E. Applicator shall designate a single individual as project foreman who shall be on site at all times during installation.

1.05 MOCK-UP

A. Provide mock-up of sealant joints in conjunction with window under provisions of Section 01 33 00.

B. Construct mock-up with specified sealant types and with other components noted.

C. Locate where directed.

D. Mock-up may remain as part of the Work.

E. Conduct field test for adheshion of joint sealants to actual joint substrates using proposed joint preparation methods recommended by manufacturer.
   1. Evaluate and report results of field adhesion testing.

1.06 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.07 COORDINATION

A. Coordinate the work with all sections referencing this section.

1.08 WARRANTY

A. See Section 01 77 00 - Contract Closeout, for additional warranty requirements.

B. Correct defective work within a five year period after Date of Substantial Completion.

C. Warranty: Include coverage for installed sealants and accessories which fail to achieve airtight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Silicone Sealants:
   1. Bostik Inc: www.bostik-us.com.
   2. Dow Corning Corp: www.dowcorning.com.
   3. GE Plastics: www.geplastics.com.
   4. Pecora Corporation: www.pecora.com.
   5. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
   6. Tremco, Inc: www.tremcosealants.com.

B. Polyurethane Sealants:
   1. Bostik Inc: www.bostik-us.com.
   2. Pecora Corporation: www.pecora.com.
   3. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
   4. Tremco, Inc: www.tremcosealants.com.

C. Polysulfide Sealants:
   1. Morton International, Inc.
   2. Pecora Corporation: www.pecora.com.
   3. BASF Construction Chemicals-Building Systems: www.chemrex.com.

D. Acrylic Sealants (ASTM C920):
   1. Tremco Global Sealants: www.tremcosealants.com.
   2. Substitutions: See Section 01 33 00.

E. Butyl Sealants:
   1. Bostik Inc: www.bostik-us.com.
   2. Pecora Corporation: www.pecora.com.
   3. Tremco, Inc: www.tremcosealants.com.

F. Acrylic Emulsion Latex Sealants:
   1. Bostik Inc: www.bostik-us.com.
   2. Pecora Corporation: www.pecora.com.
   3. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
   4. Tremco, Inc: www.tremcosealants.com.

G. Preformed Compressible Foam Sealers:
   1. EMSEAL Joint Systems, Ltd: www.emseal.com.
   2. Sandell Manufacturing Company, Inc: www.sandellmfg.com.
   3. Dayton Superior Corporation: www.daytonsuperior.com.

2.02 SEALANTS

A. General Purpose Exterior Sealant: Polyurethane; ASTM C920, Grade NS, Class 25 minimum; Uses M, G, and A; single component.
   1. Color: color as selected.

2. Applications: Use for:
    a. Control, expansion, and soft joints in masonry.
    b. Joints between concrete and other materials.
    c. Joints between metal frames and other materials.
    d. Other exterior joints for which no other sealant is indicated.

B. Exterior Expansion Joint Sealer: Precompressed foam sealer; urethane with water-repellent;
1. Face color: .
2. Size as required to provide weathertight seal when installed.
3. Provide product recommended by manufacturer for traffic-bearing use.
4. Applications: Use for:
    a. Exterior wall expansion joints.

C. Exterior Metal Lap Joint Sealant: Butyl or polyisobutylene, nondrying, nonskinning, noncuring.
1. Applications: Use for:
    a. Concealed sealant bead in sheet metal work.
    b. Concealed sealant bead in siding overlaps.

D. General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C834, Type OP, Grade NF single component, paintable.
1. Color: Standard colors matching finished surfaces.
2. Applications: Use for:
    a. Interior wall and ceiling control joints.
    b. Joints between door and window frames and wall surfaces.
    c. Other interior joints for which no other type of sealant is indicated.

E. Bathtub/Tile Sealant: White silicone; ASTM C920, Uses I, M and A; single component, mildew resistant.
1. Applications: Use for:
    a. Joints between plumbing fixtures and floor and wall surfaces.
    b. Joints between kitchen and bath countertops and wall surfaces.

F. Acoustical Sealant for Concealed Locations:
1. Applications: Use for concealed locations only:
    a. Sealant bead between top stud runner and structure and between bottom stud track and floor.

G. Concrete Floor Joint Filler: Self-leveling, pourable, semi-rigid sealant intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.
1. Composition: Single or multi-part,100 percent solids by weight.
2. Hardness: 85 after 7 days, when tested in accordance with ASTM D2240 Shore A.
3. Color: To be selected by Albert & McCleskey Associates Architects from manufacturer's standard colors.
4. Joint Width: 1/8 inch.

H. Interior Floor Joint Sealant: Polyurethane, self-leveling; ASTM C920, Grade P, Class 25, Uses T, M and A; single or multi- component.
1. Approved by manufacturer for wide joints up to 1-1/2 inches.
2. Color: Standard colors matching finished surfaces.
3. Applications: Use for:
    a. Expansion joints in floors.

I. Concrete Paving Joint Sealant: Polyurethane, self-leveling; ASTM C920, Class 25, Uses T, I, M and A; single or multi- component.
1. Color: Color as selected.
2. Applications: Use for:
    a. Joints in sidewalks and vehicular paving.

J. Silicone Sealant: ASTM C920, Grade NS, Class 25 minimum; Uses NT, A, G, M, O; single component, neutral curing, non-sagging, non-staining, fungus resistant, non-bleeding.
   1. Color: To be selected by Albert & McCleskey Associates Architects from manufacturer's standard range.
   2. Movement Capability: Plus and minus 25 percent.
   3. Service Temperature Range: -65 to 180 degrees F.
   4. Shore A Hardness Range: 15 to 35.

2.03 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Joint Backing: Round foam rod compatible with sealant; ASTM D 1667, closed cell PVC; oversized 30 to 50 percent larger than joint width.

D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean and prime joints in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Protect elements surrounding the work of this section from damage or disfigurement.

E. Exposed Concrete Floor Joints: Test joint filler in inconspicuous area of floor slab. Verify specified product does not stain or discolor slab.

3.03 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Perform installation in accordance with ASTM C1193.

C. Perform acoustical sealant application work in accordance with ASTM C919.

D. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.

E. Install bond breaker where joint backing is not used.

F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

G. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

H. Tool joints concave.

I. Precompressed Foam Sealant: Do not stretch; avoid joints except at corners, ends, and intersections; install with face 1/8 to 1/4 inch below adjoining surface.

J. Compression Gaskets: Avoid joints except at ends, corners, and intersections; seal all joints with adhesive; install with face 1/8 to 1/4 inch below adjoining surface.

K. Concrete Floor Joint Filler: Install concrete floor joint filler per manufacturer's written instructions. After floor joint filler is fully cured, shave joint filler flush with top of concrete slab.

3.04 CLEANING

A. Clean adjacent soiled surfaces.

3.05 PROTECTION

A. Protect sealants until cured.

END OF SECTION

SECTION 07 95 13

EXPANSION JOINT COVER ASSEMBLIES

PART 1 — GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Division-1 General Requirements, apply to the work of this section.

1.02 WORK INCLUDED

A. Furnish and install complete Balco, Inc. Expansion Joint Cover Systems.
   1. Interior Floor expansion joint covers.
   2. Interior Wall expansion joint covers.
   3. Interior Ceiling expansion joint covers.
   4. Exterior Wall expansion joint covers.
   5. Roof expansion joint covers.

1.03 RELATED WORK

A. Related work which is specified elsewhere.
   1. Cast-In-Place Concrete: Section 03 30 00.
   2. Precast Architectural Concrete: Section 03 45 00.
   3. Unit Masonry Assemblies: Section 04 20 00.
   4. Concrete Unit Masonry: Section 04 22 00.
   5. Structural Steel: Section 05 12 00.
   6. SBS-Modified Bitumen Membrane Roofing.
   7. Lightgauge Metal Framing: Section 09 21 16.
   8. Gypsum Wallboard: Section 09 21 16.

1.04 REFERENCES

A. Publications listed herein are part of this specification to the extent referenced. The criteria established in the specifications shall take precedence over the standards referenced herein. (An example of a reference standard is provided below.)
   1. American Society for Testing and Materials (ASTM):
      a. ASTM B221, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.

1.05 DEFINITIONS

A. Define industry and product terms as necessary.

1.06 QUALITY ASSURANCE

A. Manufacturer: Obtain joint cover assemblies through one source from a single manufacturer.
   1. Manufacturer shall be ISO 9001 Certified.
      a. The Manufacturer shall have documented management and control of the processes that influence the quality of its products.
      b. The Manufacturer shall have documented management and control of the processes that influence the quality of its customer service.
   2. Manufacturer shall have a minimum of ten (10) years of experience in the fabrication of expansion joint cover assemblies.

B. Installer: Firm with not less than three (3) years of successful experience in the installation of systems similar to those required by this project and acceptable to the manufacturer of the system.

1.07 SUBMITTALS

A. Submission must be made within ten (10) working days of the General Contract award to avoid project delay. If not adhered to, the Architect will designate the exact product to be used, and the contractor will have no recourse.
   1. Submit manufacturer's specifications and technical data, including Material Safety Data Sheets, installation instructions, and, as required, catalog cuts and templates to explain construction and to provide for incorporation of the product into the project.
   2. Submit certificates, copies of independent test reports, or research reports showing compliance with fire resistance rating and other specified performance requirements.
   3. Submit shop drawings showing complete fabrication details for all joint covers, including required anchorage to surrounding construction, recesses, blocking, backing and connections between similar and dissimilar joint cover assemblies.
   4. Submit three (3) 6" samples of the specified system.

1.08 DELIVERY, STORAGE AND HANDLING

A. Provide temporary protective cover on [anodized aluminum] [stainless steel] [bronze] finished surfaces.

B. Deliver joint covers to jobsite in new, clean, unopened crates of sufficient size and strength to protect materials during transit.

C. Store components in original containers in a clean, dry location.

1.09 SEQUENCING

A. Submittals shall be completed and approved prior to award of subcontract for system

components.

B. Subcontract for the work of this section shall be planned to allow sufficient time for manufacturer's production and delivery scheduling.

1.10 WARRANTY

A. Submit manufacturer's warranty that materials furnished will perform as specified for a period of not less than one (1) year when installed in accordance with manufacturer's recommendations.

PART 2 — PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Furnish and install as noted in specifications and as indicated on drawings, Expansion Joint Cover Types as manufactured by: Balco, Inc., PO Box 17249, 2626 S. Sheridan, Wichita, KS 67217; phone:
800-767-0082 or (316) 945-9328; fax: (316) 945-0789.

B. Substitutions: Submit proposed substitutions in writing to Architect no less than 10 days before bids are due. Submit samples and product data to demonstrate acceptability of proposed substitute. Acceptance will be by Addendum.

2.02 MATERIALS

A. Expansion joint cover systems:
   1. Floor Systems:
      a. 75FP-2x1 1/2 and 75FVP-2x1 1/2 – color black.
   2. Wall/Ceiling Systems:
      a. 75FWG-2 and 75FWGC-2 – color white in ceilings and TBD in walls.
      b. AV-2 and AVL-2 (in LAT ceilings) – color white.
   3. Exterior Wall System:
      a. FCVS – 2 inch; color TBD.
   4. Roof Systems:
      a. FR-2 and FRE-2

B. Materials used in products:
   1. Aluminum:
      a. ASTM B221, alloy 6063-T5 for extrusions.
      b. ASTM B209, alloy 6061-T6 for plate.
      c. ASTM B209, alloy 5052-H32 for sheet.
   2. Steel: ASTM A36 Plate
   3. Stainless Steel: ASTM A666, type 304.

4. PVC Vinyl: Extruded flexible wall and ceiling joint cover.
5. Silicone:
    a. ASTM D 2000, extruded elastomeric flat seal.
    b. ASTM D 2000, 4GE, 709, M, extruded elastomeric seals
        1). Face Seals
        2). Roof Bellow Seals
        3). UV stabilized
        4). Does not propagate flame
6. Santoprene:
    a. Face Seals to be installed in exterior conditions shall be UV resistant.
    b. Colorable extruded wall and ceiling joint cover system face seals.
    c. Neutral extruded wall and ceiling joint cover system back seals.
    d. Extruded back seals, ASTM C 864 modified Grade 221-73
        1). UV stabilized
        2). Black
7. Abrasive: Two (2) part Epoxy combined with aluminum oxide grit.

C. Water Barrier: Flexible EPDM, Class I, ASTM D4637, 45 mils thick (minimum).

D. Fasteners, accessories and other materials required for complete installation in accordance with the manufacturer's installation instructions.

2.03 FABRICATION

A. Fabricate expansion joint cover assemblies as detailed. Provide centering bars, sealing washers, gaskets, splice covers, and closures as necessary for complete installation.
    1. Fabricate special transitions and corner fittings as required.
    2. Fabricate fire barrier and provide fire-resistant sealant as required for fire-resistant installations.
    3. Miter and weld joint systems as applicable.
    4. Provide necessary and related parts, devices, water barrier (if specified), anchors, form clips and other items required for water-resistant and fire-resistant installation.
    5. Provide corners, tees, transitions, curb risers, etc. assembled with connection mitered and secured to ensure proper fit and alignment as applicable.
    6. Special conditions shall be shop fabricated.
    7. Cover plates shall have a serrated exposed surface.

B. Shop assemble components and package with anchors and fittings. Provide components in single lengths where possible; minimize site splicing.

2.04 FINISHES

A. Aluminum:
   1. Floors, Roofs, and Exterior Walls – Mill finish.
   2. Interior Walls and Ceilings – Prime painted.
   3. In contact with concrete – Prime painted.

B. Steel shall be galvanized in accordance with ASTM A123.

D. Stainless Steel: Matte finish, sanded.

E. Vinyl: Black if on floors, white if on ceilings.

F. Santoprene: Select Color.

G. Silicone: Select Color.

G. Abrasive: Black.

H. Filler Strips: Gray.

PART 3 — EXECUTION

3.01 EXAMINATION

A. Verify that field measurements and blockout dimensions are as shown on shop drawings prior to releasing materials for fabrication by the manufacturer.

B. Installer shall examine conditions under which work is to be performed and shall notify the contractor in writing of unsatisfactory conditions. Installer shall not proceed until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

3.02 INSTALLATION

A. Install expansion joint covers in accordance with the manufacturer's instructions. Align work plumb, level, and flush with adjacent surfaces. Rigidly anchor to substrate. Make allowances for change in joint size due to difference between installation and building operating temperatures.

B. Set centering bars diagonally at 20 inches on center maximum (or 10 inches on center for heavy-duty models). Centering bars shall be fully engaged with the base members.

C. Fire Rated Joint Covers: Install fire rated covers to requirements of applicable fire rated design. Install fire barriers and flame sealant as required.

D. Water Barrier: Provide water barriers at exterior joints and where called for on Drawings. Provide drainage fittings where called for on Drawings.

3.03 ADJUSTING AND PROTECTION

A. Adjust joint cover to freely accommodate joint movement.

B. Protect the installation from damage by work of other Sections. Where required, remove and store cover plates and install temporary protection over joints. Re-install cover plates prior to

Substantial Completion of work.

End of Section

SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated steel frames.

B. Steel frames for wood doors.

C. Fire-rated steel doors and frames.

D. Thermally insulated steel doors.

E. Sound-rated steel doors and frames.

F. Bullet resistant steel doors and frames.

G. Steel glazing frames.

H. Accessories, including glazing.

1.02 RELATED REQUIREMENTS

A. Section 08 71 00 - DOOR HARDWARE.

B. Section 08 80 00 - Glazing: Glass for doors and borrowed lites.

C. Section 09 91 23 - INTERIOR PAINTING: Field painting.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2009.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

D. ASTM C1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus; 2011.

E. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009.

F. ASTM E413 - Classification for Rating Sound Insulation; 2010.

G. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2014.

H. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.

I. DHI A115 Series - Specifications for Steel Doors and Frame Preparation for Hardware; Door and Hardware Institute; 2000 (ANSI/DHI A115 Series).

J. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames; 2007.

K. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.

L. UL (BMD) - Building Materials Directory; Underwriters Laboratories Inc.; current edition.

M. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

N. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

O. UL 752 - Standard for Bullet-Resisting Equipment; Current Edition, Including All Revisions.

P. UL 1784 - Standard for Air Leakage Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 33 00 - Administrative Requirements for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced grade standard.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, head and jamb anchor locations and type, and identifying location of different finishes, if any.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Maintain at the project site a copy of all reference standards dealing with installation.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store in accordance with NAAMM HMMA 840.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion.

PART 2 PRODUCTS

2.01 DOORS AND FRAMES

A. Requirements for All Doors and Frames:
   1. Accessibility: Comply with ICC A117.1 and ADA Standards.
   2. Door Top Closures: Flush with top of faces and edges.
   3. Door Edge Profile: Beveled on both edges.
   4. Door Texture: Smooth faces.
   5. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.
   6. Hardware Preparation: In accordance with BHMA A156.115, with reinforcement welded in place, in addition to other requirements specified in door grade standard.
   7. Galvanizing for Units in Wet Areas: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness
   8. Finish: Factory primed, for field finishing.

B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with all the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.02 STEEL DOORS

A. Exterior Doors:
   1. Core: Polyurethane with 2.0 density.
   2. Edge seams are to be fully welded
   3. 14 ga. flush top and bottom channels.
   4. Reinforced and prepared for 3-point latching.
   5. Thickness: 1-3/4".
   6. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness.
   7. Insulating Value: U-value of.37 or less, when tested in accordance with ASTM C1363.
   8. Weatherstripping: Integral, recessed into door edge or frame.
   9. Finish: Factory primed, and field finished.
   10. Gauge: 14.

B. Interior Doors, Fire-Rated:

1. Grade: ANSI/SDI A250.8 (SDI-100); Level 1 - Standard-Duty, Physical Performance Level C, Model 1 - Full Flush.
2. Fire Rating: As indicated on Door and Frame Schedule, tested in accordance with UL 10C ("positive pressure").
   a. Provide units listed and labeled by UL (Underwriters Laboratories) - UL (BMD).
   b. Attach fire rating label to each fire rated unit.
3. Core: Mineral board.
4. Finish: Factory primed, for field finishing.

C. Interior Doors, Sound-Rated:
1. Grade: ANSI/SDI A250.8 (SDI-100); Level 1 - Standard-Duty, Physical Performance Level C, Model 2 - Seamless.
2. Acoustic Rating of Assembled Door, Frame, and Seals: STC of 35, calculated in accordance with ASTM E413, tested in accordance with ASTM E90.
3. Core: Polyurethane.
4. Finish: Factory primed, for field finishing.
5. Sound Seals: Integral, concealed in door and/or frame.
6. Force to Open and Close and Latch: Not more than 5 lbs.

D. Exterior and Interior Bullet Resistant Doors:
1. Ballistic Resistance: UL 752, Level 3.
2. Core Material: Polystyrene.
3. Hinge Rail and Reinforcement: Non-beveled edge, reinforced with continuous steel channel, 12 gage, 0.093 inch minimum metal thickness, welded at 5 inches on center maximum, and compatible with 4.5 inch full mortise template and continuous geared hinges.

2.03 STEEL FRAMES

A. General:
1. Comply with the requirements of grade specified for corresponding door.
   a. ANSI/SDI A250.8 (SDI-100), Level 1 Door Frames: 16 gage, 0.053 inch, minimum thickness.
   b. Frames for Wood Doors: Comply with frame requirements in accordance with ANSI/SDI A250.8 (SDI-100), Level 1, 18 gage, 0.042 inch, minimum thickness.
   c. Frames for Sound-Rated Wood Doors: Comply with frame requirements in accordance with ANSI/SDI A250.8 (SDI-100), Level 1, 18 gage, 0.042 inch, minimum thickness.
   d. Frames for Bullet Resistant Door: Comply with frame requirements in accordance with ANSI/SDI A250.8 (SDI-100) Level 4, 14 gage, 0.067 inch, minimum thickness.
2. Finish: Factory primed, for field finishing.
3. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.
4. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inches high to fill opening without cutting masonry units.
5. Frames Wider than 48 Inches: Reinforce with steel channel fitted tightly into frame head, flush with top.

B. Exterior Door Frames: Fully welded.
1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness.
2. Finish: Factory primed, for field finishing.
3. Weatherstripping: Separate, see Section 08 71 00.

C. Interior Door Frames, Fire-Rated: Knockdown type.
1. Fire Rating: Same as door, labeled.
2. Finish: Factory primed, for field finishing.

D. Sound-Rated Door Frames: Knockdown type.

E. Interior and Exterior Bullet Resistant Frames: UL 752, same level of ballistic resistance as door; face welded construction, ground smooth, fully prepared and reinforced for hardware installation.

F. Frames for Interior Glazing or Borrowed Lights: Construction and face dimensions to match door frames, and as indicated on drawings.

2.04 ACCESSORY MATERIALS

A. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.

B. Astragals for Double Doors:
   1. Exterior Doors: Steel, Z-shaped.
   2. Fire-Rated Doors: Steel, shape as required to accomplish fire rating.

C. Grout for Frames: Portland cement grout of maximum 4-inch slump for hand troweling; thinner pumpable grout is prohibited.

D. Temporary Frame Spreaders: Provide for all factory- or shop-assembled frames.

2.05 FINISH MATERIALS

A. Bituminous Coating: Asphalt emulsion or other high-build, water-resistant, resilient coating.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

3.02 PREPARATION

A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

B. Coat inside of other frames with bituminous coating to a thickness of 1/16 inch.

3.03 INSTALLATION

A. Install in accordance with the requirements of the specified door grade standard and NAAMM HMMA 840.

B. In addition, install fire rated units in accordance with NFPA 80.

C. Coordinate frame anchor placement with wall construction.

D. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.

E. Coordinate installation of hardware.

F. Coordinate installation of glazing.

G. Coordinate installation of electrical connections to electrical hardware items.

3.04 TOLERANCES

A. Clearances Between Door and Frame: As indicated in ANSI/SDI A250.8 (SDI-100).

B. Maximum Diagonal Distortion: 1/16 in measured with straight edge, corner to corner.

3.05 ADJUSTING

A. Adjust for smooth and balanced door movement.

B. Adjust sound control doors so that seals are fully engaged when door is closed.

C. Test sound control doors for force to close, latch, and unlatch; adjust as necessary in compliance with requirements.

3.06 SCHEDULE - SEE DRAWINGS

END OF SECTION

SECTION 08 14 16
FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flush wood doors; flush and flush glazed configuration; fire rated, non-rated, and acoustical.

1.02 RELATED REQUIREMENTS

A. Section 08 11 13 - HOLLOW METAL DOORS AND FRAMES.

B. Section 08 71 00 - DOOR HARDWARE.

C. Section 08 80 00 - Glazing.

1.03 REFERENCE STANDARDS

A. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009.

B. ASTM E413 - Classification for Rating Sound Insulation; 2010.

C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.

D. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.

E. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2012.

F. UL (BMD) - Building Materials Directory; Underwriters Laboratories Inc.; current edition.

G. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01340 - Administrative Requirements for submittal procedures.

B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.

D. Specimen warranty.

E. Test Reports: Show compliance with specified requirements for the following:
   1. Sound-retardant doors and frames; sealed panel tests are not acceptable.

F. Samples: Submit two samples of door construction, 12x12 inch in size cut from top corner of door.

G. Samples: Submit two samples of door veneer, 12x12 inch in size illustrating wood grain, stain color, and sheen.

H. Manufacturer's Installation Instructions: Indicate special installation instructions.

I. Warranty, executed in Southern Mississippi Investment Company, Inc.'s name.

1.05 QUALITY ASSURANCE

A. Maintain one copy of the specified door quality standard on site for review during installation and finishing.

B. Perform work in accordance with AWI Architectural Woodwork Quality Standards Illustrated, Section 1300, Custom Grade.

C. Finish doors in accordance with AWI Architectural Woodwork Quality Standards Illustrated, Section 1500.

D. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.06 REGULATORY REQUIREMENTS

A. Fire Door and Panel Construction: Conform to NFPA 252.

1. Listed and classified by UL as suitable to for the purpose specified and indicated.

B. Installed Fire Rated Door and Transom Panel Assembly: Conform to NFPA 80 for fire rated class as indicated.

C. Sound Retardant Doors: Provide test reports showing that door and frame assembly meets requirements; sealed panel tests not acceptable.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Package, deliver and store doors in accordance with specified quality standard.

B. Accept doors on site in manufacturer's packaging. Inspect for damage.

C. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.

1.08 PROJECT CONDITIONS

A. Coordinate the work with door opening construction, door frame and door hardware installation.

1.09 WARRANTY

A. See Section 01 77 00 for additional warranty requirements.

B. Interior Doors: Provide manufacturer's warranty for the life of the installation.

C. Provide warranty for the following term:
1. Interior Doors: Life of installation.

D. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wood Veneer Faced Doors:
1. Graham Wood Doors: www.grahamdoors.com.
2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 DOORS AND PANELS

A. All Doors: See drawings for locations and additional requirements.
1. Quality Level: Custom Grade, Standard Duty performance, in accordance with AWI/AWMAC/WI (AWS).
2. Quality Level: Custom Grade, in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, Section 1300.
3. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.

B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
1. Provide solid core doors at all locations.
2. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with NFPA 252 or UL 10B - Negative (Neutral) Pressure; Underwriters Laboratories Inc. (UL) or Intertek/Warnock Hersey (WHI) labeled without any visible seals when door is open.
3. Sound Retardant Doors: Minimum STC of 35, calculated in accordance with ASTM E413, tested in accordance with ASTM E90.
4. Wood veneer facing with factory transparent finish where indicated on drawings.

2.03 DOOR AND PANEL CORES

A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated.

B. Fire Rated Doors: Mineral core type, with fire resistant composite core (FD), plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.

C. Sound Resistant Doors: Equivalent to Type particleboard core (PC) construction with core as required to achieve STC rating specified; plies and faces as indicated.

2.04 DOOR FACINGS

A. Veneer Facing for Transparent Finish: White Maple, veneer grade in accordance with quality standard indicated, plain sliced (flat cut), with book match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.

B. Interior Doors - Veneer: white maple species, veneer grade AA, plain sliced select, with book matched grain, for transparent finish.

C. Facing Adhesive: Type I - waterproof.

2.05 ACCESSORIES

A. Glazing: As specified in Section 08 80 00.

B. Glazing Stops: Wood with metal clips for rated doors, mitered corners; prepared for countersink style tamper proof screws.

C. Astragals for Non-Rated Double Doors: Steel, T shaped, overlapping and recessed at face edge.

D. Astragals for Fire Rated Double Doors: Steel, T shaped, overlapping and recessed at face edge, specifically for double doors.

2.06 DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.

B. Cores Constructed with stiles and rails:

C. Sound Rating For Single Door Leaf and Frame Assembly: Minimum STC of 46, calculated in accordance with ASTM E 413, tested in accordance with ASTM E 1408.

D. Provide solid blocks at lock edge and top of door for closer for hardware reinforcement.
   1. Provide solid blocking for other throughbolted hardware.

E. Vertical Exposed Edge of Stiles - Veneer Faces: Of same species as veneer facing.

F. Fit door edge trim to edge of stiles after applying veneer facing.

G. Bond edge banding to cores.

H. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.

I. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.

J. Provide edge clearances in accordance with the quality standard specified.

K. Provide edge clearances in accordance with AWI Quality Standards Illustrated Section 1700.

2.07 FACTORY FINISHING - WOOD VENEER DOORS

A. Finish work in accordance with AWI/AWMAC/WI (AWS), Section 5 - Finishing for grade specified and as follows:
   1. Transparent:
      a. System - 1, Lacquer, Nitrocellulose.
      b. Stain: As selected by Albert & McCleskey Associates Architects.
      c. Sheen: Flat.

B. Factory finish doors in accordance with approved sample.

C. Seal door top edge with color sealer to match door facing.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standard.
   1. Install fire-rated doors in accordance with NFPA 80 requirements.

B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.

C. Adjust width of non-rated doors by cutting equally on both jamb edges.
   1. Trim fire-rated doors in strict compliance with fire rating limitations.

D. Trim door height by cutting bottom edges to a maximum of 3/4 inch (19 mm).

E. Use machine tools to cut or drill for hardware.

F. Coordinate installation of doors with installation of frames and hardware.

G. Coordinate installation of glazing.

H. Install door louvers plumb and level.

3.03 TOLERANCES

A. Conform to specified quality standard for fit and clearance tolerances.

B. Conform to specified quality standard for telegraphing, warp, and squareness.

C. Maximum Vertical Distortion (Bow): 1/8 inch measured with straight edge or taut string, top to bottom, over an imaginary 36 by 84 inches surface area.

D. Maximum Width Distortion (Cup): 1/8 inch measured with straight edge or taut string, edge to edge, over an imaginary 36 by 84 inches surface area.

3.04 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

3.05 SCHEDULE - SEE DRAWINGS

END OF SECTION

SECTION 08 31 00
ACCESS DOORS AND PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall access door and frame units.

B. Ceiling access door and frame units.

C. Provide two (2) additional fire-rated interior wall access doors and two (2) additional ceiling access doors. These doors are above and beyond the doors shown in the plans.

1.02 RELATED REQUIREMENTS

A. Section 08 71 00 - DOOR HARDWARE: Mortise cylinder and core hardware.

B. Section 09 91 23 - INTERIOR PAINTING: Field paint finish.

1.03 REFERENCE STANDARDS

A. UL (FRD) - Fire Resistance Directory; current edition.

1.04 SUBMITTALS

A. See Section 01340 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.

C. Shop Drawings: Indicate exact position of all access door units.

D. Manufacturer's Installation Instructions: Indicate installation requirements.

E. Project Record Documents: Record actual locations of all access units.

1.05 REGULATORY REQUIREMENTS

A. Conform to IBC 2012 code for fire rated access doors.
   1. Provide access doors of fire rating equivalent to the fire rated assembly in which they are to be installed.

B. Provide products listed and labeled by UL as suitable for the purpose specified and indicated.

C. Provide certificate of compliance from authority having jurisdiction indicating approval of fire rated doors.

1.06 PROJECT CONDITIONS

A. Coordinate the work with other work requiring access doors.

PART 2 PRODUCTS

2.01 ACCESS DOOR AND PANEL APPLICATIONS

A. Walls, Unless Otherwise Indicated:
   1. Material: Steel.
   2. Size: 24 by 24 inch, unless otherwise indicated.
   3. Standard duty, hinged door.
   4. Tool-operated spring or cam lock; no handle.
   5. In All Wall Types: Surface mounted face frame and door surface flush with frame surface.

B. Walls in Wet Areas:
   1. Material: Steel, hot-dipped zinc or zinc-aluminum-alloy coated.
   2. Size: 24 by 24 inch, unless otherwise indicated.
   3. Standard duty, hinged door.
   4. Tool-operated spring or cam lock; no handle.
   5. In All Wall Types: Surface mounted face frame and door surface flush with frame surface.

C. Fire Rated Walls: See drawings for wall fire ratings.
   1. Material: Steel.

2. Size: 24 by 24 inch, unless otherwise indicated.
3. Uninsulated, single thickness door panel.
4. Tool-operated spring or cam lock; no handle.

D. Ceilings, Unless Otherwise Indicated: Same type as for walls.
1. Material: Steel.
2. Size in Other Ceilings: 24 by 24 inch, unless otherwise indicated.

2.02 WALL AND CEILING UNITS

A. Manufacturers:
1. Larsens Manufacturing: www.larsensmfg.com.
a. Products Specified: L-DWC; L-FRAP.
2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Access Doors: Factory fabricated door and frame units, fully assembled units with corner joints welded, filled, and ground flush; square and without rack or warp; coordinate requirements with assemblies that units are to be installed in.
1. Style: Frame concealed by door panel.
a. In Gypsum Board: Use drywall bead type frame.
2. Door Style: Single thickness with rolled or turned in edges.
3. Frames: 16 gage, 0.0598 inch, minimum.
4. Hinges: 175 degree stainless steel piano hinge with removable pin.
5. Latch/Lock: Mortise cylinder and core specified in Section 08 71 00.
6. Finish: Factory Primed for Field Painting; See Section 09 91 23

2.03 ACCESS DOOR UNITS - WALLS AND CEILINGS

2.04 FABRICATION

A. Weld, fill, and grind joints to ensure flush and square unit.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that rough openings are correctly sized and located.

3.02 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Install frames plumb and level in openings. Secure rigidly in place.

C. Position units to provide convenient access to the concealed work requiring access.

END OF SECTION

SECTION 08 33 23

HIGH PERFORMANCE OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. High performance overhead coiling rigid doors.

B. Related Requirements:
   1. Section 05 50 00 "Metal Fabrications" for miscellaneous steel supports.
   2. Division 26 and 28 Sections for electrical connections including conduit and wiring for coiling door operators and access control devices.

1.3 REFERENCES

A. References: Refer to the version year adopted by the Authority Having Jurisdiction.
   1. National Electrical Manufacture's Association (NEMA)
   2. Underwriters Laboratories (UL)

B. National Electrical Manufacture's Association (NEMA)
   1. Type 4 - Enclosures constructed for either indoor or outdoor use to provide a degree of protection to personnel against access to hazardous parts.

C. Underwriters Laboratories (UL).
   1. UL 508 Standard for Industrial Control Panels.

D. Door & Access Systems Manufacturers Association (DASMA)

1.4 DEFINITIONS

A. Activation Device: Device that, when actuated, sends an electrical signal to the door operator to open the door.

B. Safety Device: A device that detects the presence of an object or person within a zone where injury could occur and provides a signal to stop the movement of the door.

C. High Performance Door: A powered door characterized by sliding action that is designed to sustain heavy usage at relatively high speeds.

D. High Speed Door: (subcategory of *high performance doors*) A non-swinging door used primarily to facilitate vehicular access or material transportation, with a minimum opening rate of 32 inches per second and a minimum closing rate of 24 inches per second.

1.5 SUBMITTALS

A. Comply with Division 01 - Submittal Procedures.

B. Product Data: For each type of high performance overhead coiling door and accessory.
1. Include construction details, material descriptions, dimensions of individual sub-assemblies (side frames, header, control panel, motor), profiles for slats, and finishes.
2. Include operating characteristics, electrical characteristics, and furnished accessories.
3. Include description of automatic closing device and testing and resetting instructions.

C. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.
1. Include plans, elevations, sections, and mounting details.
2. Show locations of controls, locking devices, and other accessories.
3. Include diagrams for power, signal, and control wiring.

D. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.

E. Samples for Verification: For each type of exposed finish on the following components, in manufacturer's standard sizes:
1. Submit manufacturer’s paint chip samples of selected colors.

F. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals Including a detailed parts list for high performance overhead coiling doors in quantity as required in Division 01, Closeout Submittals.

1.6 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 10 years of documented experience in manufacturing of doors and equipment of similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Installer Qualifications: Installers, trained by the primary product manufacturer, with a minimum 3 years documented experience installing and maintenance of units similar in material, design,

and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

C. Source Limitations: Obtain each type of door, frame, operator and sensor components specified in this Section from a single source, same manufacturer unless otherwise indicated.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication and indicate on shop drawings.

B. Electrical: Verify actual job site power (voltage, phase and Hertz).

C. Verify environmental condition extremes.

D. Verify door sequence of operations.

1.8 COORDINATION

A. Coordinate sizes and locations of door openings and framing as required for high performance overhead coiling doors.

B. Electrical System Roughing-in: Coordinate layout and installation of high performance overhead coiling doors with connections to building power and access control system as applicable.
   1. Fused disconnect required for each individual door within five feet of respective door (not supplied by door manufacturer).

1.9 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. High Performance Overhead Coiling Doors shall be free of defects in material and workmanship for a period of one (1) year from the date of substantial completion.

C. Special Product Warranty: Manufacturer's warranty in which manufacturer agrees to repair or replace components which fail to perform as follows:
   1. 5-year / 1,000,000 Cycle Limited Warranty on Drive Motor and Gearbox.
   2. 2-year / 300,000 Cycle Limited Warranty on all other Mechanical and Electrical Components.

D. During the warranty period a factory-trained technician shall perform service and affect repairs. A safety inspection shall be performed after each adjustment or repair and a completed inspection form shall be submitted to the Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Manufacturer: ASSA ABLOY Entrance Systems, 975-A Old Norcross Road, Lawrenceville, GA 30046. Toll Free 1-800-ALBANY1. Web- www.albanydoors.us Contact- sales.us.albany@assaabloy.com

B. Substitutions: Requests for substitution and product approval in compliance with the specifications must be submitted in writing and in accordance with the procedures outlined in Division 1, Section, “Substitution Procedures”. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HIGH PERFORMANCE OVERHEAD COILING DOORS

A. Model: Albany RR3000 Rigid high-speed industrial door. (Basis of Design):
1. Glazed overhead coiling door formed with curtain of interlocking aluminum framed clear glazed window slats (openings as shown in drawings).
2. Overhead counterbalance system, motor and gearbox drive system.
3. Door side frames.
4. Control panel, activation devices, and safety sensor devices.

2.3 PERFORMANCE REQUIREMENTS

A. Opening Speed: Door to operate at a variable speed up to 80 inches (2032 mm) per second.

B. Closing Speed: Door to operate at a variable speed up to 24 inches (609.6 mm) per second.

C. Operation Cycles: Drive motor and gearbox capable of operating for not less than 1,000,000 cycles. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

D. Wind Resistance: Up to 21 lbf/sq. ft. (90 mph) (145km/hr).

2.4 DOOR ASSEMBLY

A. Door Curtain Design:
1. Glazed Door Curtain Slats: Low profile, double aluminum framed glazed slats.
   a. Cross section: 4.92 inches (125 mm) × 0.79 inches (20.07 mm).

b. Slat design: Slats shall be designed with an overlap, which prohibits knife or pry-bar entry and prevents water from collecting on rubber weather seal (exterior side).
c. Hingeless slat connection allows the door to function with missing slats.
d. Each individual slat can be removed and replaced.

2. Gasket Seal: Continuous gaskets between slats to be highly durable EPDM rubber weather seal.
3. Lifting Belt: Slats individually attached to braided steel reinforced lifting belt
4. Bottom Bar: Wireless failsafe electric safety edge.

B. Curtain Jamb Guides: 11 gauge steel sections, which includes the lateral structural frame assembly with a bolt on cover, to guide the door panel in its upward and downward movement.
1. Tracks lined with HDPE for smooth panel movement.
2. Galvanized steel guides and frame shall be powder coated finish.

C. Top Roll System: 4.25 inches (108 mm) diameter, steel tube - 11 gauge steel complying with ASTM A513.
1. Drum tube deflection shall not exceed 0.01 inch (0.254 mm) per foot and shall not exceed 0.14 inches (0.3556 mm) over the entire length.
2. Disc drive system for frictionless winding of door curtain.
3. Door slats shall not contact one another when door is rolled up on drum tube.

D. Counterbalance system: Internally mounted counterbalance system shall utilize extension springs along with a belt and pulley mechanism. Torsion spring shall not be located within the top roll barrel.
1. Redundant springs keep the door operating should a primary spring break.
2. Durable machined aluminum pulleys. Each pulley shall contain two permanently sealed and lubricated ball bearings.
3. Provide manufacturer's standard factory 1.18 inch (29.97 mm) nylon belting.

E. Electric Door Operator: Reversible-type motor with controller for motor exposure indicated.
1. Usage Classification: Heavy duty, rated up to 25 cycles per hour and over 500 cycles per day.
2. Motor Exposure: Exterior and Interior use.
3. Side Mounted: Operator is mounted to the header assembly on the left or right side of door and connected to door drive shaft.
4. Electrical Characteristics:
a. Phase: Three phase.
b. Volts: Verify on-site electrical.
c. Hertz: 50/60.
5. Operator: 1.5 horsepower in-line hollow shaft two-stage bevel drive.
6. Emergency Manual Operation: Disengagement lever which puts the door in a spring balanced state and allows door to be manually opened by hand in the event of a power failure.
7. Limit Switch: Equip each motorized door with a proximity switch detecting the bottom slat of the moving door panel interlocked with motor controls and set to set the control’s reference position and automatically stop door at fully opened position.
8. Encoder: Equip each motorized door with a rotary encoder mounted on the drive motor for precise positioning and speed regulation of the door in operation.

9. Timer: Each door to have automatic closing controlled by an adjustable hold open time delay.

2.5 CONTROL PANEL

A. MCC controller housed in a NEMA 4 rated enclosure.

B. Controls must include a Vector Control drive system capable of infinitely variable speed control in both the up and down directions and integrated programmable capability allowing field customization of logic I/O functionality without adding components.

C. Operational parameters must be set from the Graphical User Interface (GUI).

D. Controller comes with factory set parameters and a 64 bit scrollable graphic/text display. Display shows functional information during normal operation and will advise if maintenance is required.

E. Controls must be fully self-diagnostic thru the GUI and provide corrective actions for error conditions.

F. Control interface must display options and guidance in full text displayed language. Language options must be available in English, Spanish, French, German, or Portuguese languages.

G. Door must be provided with electronic encoder. A proximity or rotary switch must be provided to accommodate the top position reference.

2.6 ACTIVATION DEVICES

A. General: Provide activation devices for condition of exposure and for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated. Coordinate activation and safety devices with door operation and door operator mechanisms.

B. Pedestrian Type Activation Devices:
1. Three Push Button Switch: Button for open, button for close, button for stop. Buttons to be located only inside the Sally Port.

C. Vehicular Type Activation Devices:
1. Radio Control Activation: Near proximity portable push button remote control programmable to individual doors or multiple doors in common.
   a. One Button Remote Control. There will be enough control devices to supply the entire police department as needed.

2.7 SAFETY DEVICES

A. General: Provide safety devices for condition of exposure and for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated. Coordinate safety devices with door operation and door operator mechanisms.

B. Door to be provided with Albany Safety Light Curtain System.
   1. Light curtain must be housed inside of the side jamb guide assembly and cover an area to a height of no less than six feet.
   2. Light curtain system must have a minimum of 40 infrared thru-beam optical sensors.
   3. Control panel interface must indicate safety device errors in full text displayed language in the event of an abnormal condition.

C. Door to be provided with failsafe electric safety edge. Door controller must indicate if the safety edge is not operable.
   1. Connections between the safety edge and controller must be fully wireless. No coil cords allowed.

D. Door must be provided with a spring-balanced egress system allowing the door panel to open manually without the use of hand cranks in the event of a power outage. Counter-balance design must allow the door to be opened in event of power failure.

2.8 REMOTE MONITORING SYSTEM

A. Remote Monitoring System connectable to existing secure, password protected IT network with internet connectivity. System to be directly powered and controlled by the MCC Controller, and it can be upgraded remotely when new features are made available. System will notify authorized individuals via phone/text/email of selected key events or errors and also allows access the door history and current status information online.

2.9 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.10 ALUMINUM FINISHES

A. Anodized Finish:
   1. AAMA 611, Clear, AA- M12C22A41, Class I, 0.018 mm.

2.11 STEEL FINISHES

A. Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

B. Galvanized Steel: Nominal 0.028-inch (0.71-mm) thick, hot-dip galvanized steel sheet with G90 (Z275) zinc coating, complying with ASTM A 653/A 653M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Examine locations of electrical connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install high performance overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Install high performance overhead coiling doors, hoods, controls, and operators at the mounting locations indicated for each door.

C. Accessibility: Install high performance overhead coiling doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

3.3 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.
   1. Perform installation and startup checks according to manufacturer's written instructions.
   2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

1. Adjust exterior doors and components to be weather-resistant.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Adjust seals to provide tight fit around entire perimeter.

3.5 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door installation.

B. Clean glass and metal surfaces promptly after installation. Remove excess sealants, compounds, dirt and other substances. Repair damages finish to match original finish.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain high performance overhead coiling doors.

END OF SECTION

SECTION 08 34 59

VAULT DOORS

1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers security vault doors which are designed to conform to the minimum standards for physical security equipment as required by the Information Security Oversight Office Directive governing the safeguarding of national security information. The doors provide protection against unauthorized entry for the periods of time specified in 1.2.1.

1.2 Classification. The vault doors under this specification shall be of the following classes, types, styles and designs, as specified (see 6.2).

1.2.1 Classes.

Class 5-V - Vault door shall be resistant to 20 man-hours surreptitious entry, 30 man-minutes covert entry and 10 man-minutes forced entry.

1.2.2 Type.

Type IIR – Swing determined by plans; without optical device.

1.2.3 Styles.

Style K - Key change combination lock.

1.2.4 Design.

Design S - Single lock.

2. APPLICABLE DOCUMENTS

2.1 Government publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the issue in effect on the date of invitation for bids or request for quotation shall apply.

Federal Specifications:

FF-L-2740 Lock, Combination.
QQ-C-320 Chromium Plating (Electro-deposited).
QQ-P-416 Plating, Cadmium, (Electro-deposited).
TT-C-490 Cleaning Methods and Pretreatment of Ferrous Surfaces for Organic Coatings.

Federal Standards:

Fed. Std. No. 123 - Marking for Domestic Shipment (Civil Agencies).
Fed. Std. No. 595 - Colors.

(Activities outside the Federal Government may obtain copies of Federal Specifications, Standards and Handbooks as outlined under General Information in the Index of Specifications and Standards and at the price indicated in the Index. The index which includes cumulative supplements, as issued, is for sale on a subscription basis by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC, 20402.

(Single copies of this Specification and other Federal Specifications are available from: General Services Administration, Federal Supply Service, Specifications Section (3FP-E), Suite 8100, 470 East L'Enfant Plaza, SW, Washington, DC 20407, Tel - (202)619-8925.)

(Sample panels of the standard colors are obtainable, without charge, from the Business Service Center, Federal Supply Service, General Services Administration, Washington, DC 20407, or from the Business Service Center of the nearest Regional Office.)

Military Standards:

MIL-STD-129 - Marking for Shipment and Storage.

(Copies of Military Specifications and Standards are available from: DODSSP - Customer Service, Standardization Document Order Desk, 700 Robbins Avenue, Bldg. 4D, Philadelphia, PA 19111-5094, Tel 215.697.2179)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless a specific issue is identified, the issue in effect on the date of invitation for bids or request for proposal, shall apply.

American National Standards Institute (ANSI)/American Society for Quality (ASQ): ANSI/ASQ Z1.4 - Sampling Procedures and Tables for Inspection by Attributes

(Application for copies should be addressed to ANSI, 11 West 42nd Street, NY 10036.)

American Society for Testing and Materials (ASTM):

ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.

(Application for copies should be addressed to the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959)

Underwriters Laboratories (UL):

UL 752 - Standard For Safety For Bullet-Resistive Equipment.

UL 768 - Combination Locks: For locking control of safes, chests, vaults, and similar products.

(Application for copies should be addressed to Global Engineering Documents,15 Inverness Way, East Englewood, CO 80112, Telephone: (303)397-7956 (outside the U.S.), (800)854-7179 (U.S. and Canada) ,Fax: (303)397-2740)

National Motor Freight Traffic Association, Inc., Agent:

National Motor Freight Classification.

(Application for copies should be addressed to the American Trucking Association, Inc., Traffic Department, 1616 P Street, NW, Washington DC, 20036.)

Uniform Classification Committee, Agent:

Uniform Freight Classification.

(Application for copies should be addressed to the Uniform Classification Committee, Room 1106, 222 South Riverside Plaza, Chicago, IL 60606.)

3. REQUIREMENTS

3.1 Qualification. The vault doors furnished under this specification shall be products which have been tested and have passed the qualification tests and inspections specified in section 4, and have been listed on or approved for listing on the applicable Qualified Products List (QPL). The Government testing facility for the General Services Administration reserves the right to test the vault door in accordance with standards that are privileged to the Government.

3.1.1 Qualification suspension.

3.1.1.1 Development of entry techniques. The doors qualified under this specification will be continually tested by the Government during the term of qualification to determine whether the surreptitious, covert or forced entry protection afforded by the doors should or can be improved. If at any time, entry techniques are developed within the framework of the specification which affect a door's security integrity, it shall be removed from the QPL.

3.1.1.2 Change in specification requirements. This specification will be reviewed by the Government to determine whether the specification requirements should or can be changed to improve product quality. If, at any time, requirements are changed and such changes affect the qualification status of a qualified door, it shall be removed from the QPL and the manufacturer will be required to modify the product to the extent necessary to comply with specification changes and have the product requalified.

3.2 Materials. Materials used in the door's construction shall be as specified herein. Materials not specified shall be of good commercial quality, suitable in all respects for the purpose intended.

3.2.1 Steel. Steel used in the door shall be of the type, thickness and strength to meet all applicable requirements of this specification. Steel shall be free from rust, scale, pits, buckles and other imperfections that might adversely affect the appearance or the serviceability of the finished product.

3.2.2 Face hardware. The face hardware, excluding combination locks, shall be satin finished anodized aluminum, type 430 corrosion resistant steel or satin finished chromium plating on steel or on die-cast zinc, brass or bronze. The exposed surfaces of all hardware used on a single unit shall be finished to match each other within the limits of the base material and protective coating used. The exposed surfaces of all face hardware shall be free of sharp edges, burrs, pits, nicks or scratches that penetrate the protective plating or anodizing.

3.2.3 Finishing materials.

3.2.3.1 Enamel and lacquer. The final coat for the door shall be either baked enamel, air dried, textured finish, powder coat finish, nitrocellulose lacquer or water reducible coating. The quality of the final coat and its application shall be in accordance with good commercial standards and practices. The color shall be gray, color No. 26134, of Federal Standard No. 595.

3.2.3.2 Chromium plating. Chromium plating shall be in accordance with Class I, Type II of QQ-C-320

3.3.1 Design. The design shall provide for an end product that is practical, durable, and acceptable in general appearance. The doors shall be hinged to swing right or left, as specified (see 6.2).

3.3.2 Assembly. The door frame shall be considered a part of the door for purposes of entry resistance testing and shall afford the same security protection as that of the door. Protection for the extended locking bolts shall be built into the door frame. The overall width of the door frame shall not exceed the width of the clear door opening by more than 410 mm. The door frame for single leaf doors shall be designed to mount in a structural wall opening ranging from 1190 to 1240 mm wide and 2080 to 2110 mm high. The door shall be assembled in such a manner as to preclude the removal or loosening of any of the door's components when the door is closed and locked, except that the hinges shall be removable from the outside. All welding and brazing shall be sound, without porosity and shall accomplish secure and rigid joints in proper alignment. All protruding or depressed welds on the door's exterior surface shall be filled and sanded or ground smooth. The door and frame shall be in perfect alignment and operation of the locking mechanism, including the locking bolts, shall be smooth and positive without binding or jamming of parts. The door shall withstand the test in 4.4.8.1.

3.3.3 Clear door opening. The vault door assembly shall be of one size. When installed, the single leaf door shall have a clear door opening of 1980 mm high and 1015 mm wide. When installed, the double leaf door shall have a clear door opening of 1980 mm high and 2000 mm wide. A forming tolerance of +3 mm shall be permitted. Other door sizes may be approved at the request of the manufacturer based upon documented agency requirements.

3.3.4 Wall thickness. The door assembly shall be adaptable to one of the following wall thicknesses, as specified (see 6.2): 150 mm; 205 mm; 255 mm; or 305 mm. The assembly design shall provide a +15 mm adjustment to allow for variations in the nominal wall thickness (see 6.4).

3.3.5 Door frame. The door frame shall be non-grout type and the frame and door shall be mounted so that there shall be not more than 3 mm clearance between the door and the door frame. The frame shall be designed so that when attached to the wall, the wall clamping bolts will be exposed only on the inside of the vault. The frame shall have leveling and adjusting screws to compensate for building sag which may occur at any time in the future.

3.3.6 Door pull and throw bolt handles. The door pull and throw bolt handles shall be of the material specified in paragraph 3.2.2. They shall be not less than 100 mm in length and of designs consistent with their intended usage. The handles shall be without burrs, nicks, scratches, and sharp edges. A door pull shall be securely and firmly attached to both the door front and the door interior. Throw bolt handles shall be firmly attached to the front of the door.

Door pulls and throw bolt handles shall be attached so they withstand loosening in testing and in operation during the service life of the door. The door pull handle on the front of the door may be integral with the throw bolt handle. Removal of the handle arbor shall be controlled only from the inside of the door. The throw bolt handle shall require not more than 20 Newton-meters torque to engage or disengage the boltwork mechanism, and the initial force required to swing the unlocked door from any position shall not exceed 45 Newtons at the operating handle.

3.3.7 Door stop. A door stop to prevent the door's face hardware from striking wall surfaces shall be furnished with the door. The stop shall be designed to be wall mounted unless otherwise specified (See 6.2). The stop shall be able to withstand hard usage. The stop shall not scratch or scar the door's painted finish when the door is swung open against it.

3.3.8 Door striker. The door shall have a striker on both the front and hinged edges to minimize play or shake in the door when in the locked condition. The fit of the door to the striker on both the front and hinged edges shall be such that there is not more than 1 mm play or shake in the door when the bolts are thrown to the locked position.

3.3.9 Door hinges. The door shall be mounted to the frame by not less than two anti-friction bearing hinges, so designed to allow the door to be opened approximately 180 degrees. The hinges shall be removable from the outside.

3.3.10 Door threshold. The door threshold shall be designed to provide a ramp at the door threshold of approximately 6 mm to permit free swing of the door after its installation. If receptive cups, ports, or grooves are used, they shall be recessed not less than 12 mm below the bolt in its extended position to prevent dirt or other substances from obstructing the locking mechanism.

3.3.11 Back cover plate. Back cover plates of not less than 1.5 mm thickness shall completely enclose the back of the door. The back plates shall be firmly and securely fastened to the door and shall be reinforced or attached by a method to prevent sagging, bulging, or distortion. The back plates shall be easily removed by one person for service purposes by the use of common hand tools and shall weigh less than 20.4 kg (45 lbs). The back shall have an opening covered by an inspection plate. The opening, with the inspection plate removed shall be large enough and positioned so as to allow maintenance of the door's combination lock and cam assembly. 3.4 Lock. The lock shall be in accordance with the following paragraphs:

3.4.1 Combination lock. Class 5V and Class 5B, Design S doors, shall have a Style H or Style K lock, as specified (see 6.2). The lock shall meet the requirements of FF-L-2740. The lock design or installation shall not compromise the integrity of the door.

3.4.2 Lock installation. The lock's dial ring shall be mounted so as to be flush to the surface of the door. The attachment of the dial ring shall be firm and secure without movement or side play. The lock case shall be firmly and securely attached to the door by suitable and effective means so that there is no movement or side play to the lock case. The lock shall not be modified in any manner from the formation supplied by the lock manufacturer, except that the spindle may be cut to proper length.

3.5 Locking mechanism. The engaging bolts shall be of a design, size and material strength to withstand the applicable tests in Section 4. The bolts shall operate easily and smoothly, without binding or jamming. The bolts shall not dent or otherwise deface the door frame in their movement. The attaching linkage shall be channeled, strapped or welded. The locking mechanism shall have a detent to lock the bolts in the open position when the bolts are retracted

and the door swung open. The detent shall be designed so that it cannot be inadvertently tripped, permitting the bolts to be thrown to the engaged position. The locking mechanism shall be designed such that, with the vault door in the open position, the lock can be locked so when the door is pulled shut from the inside, the vault door will immediately lock in the closed position.

3.6 Locking mechanism and lock mounting drawings. Complete, exploded view drawings of the locking mechanism and lock mounting, with individual parts indexed, shall be furnished by the manufacturer upon specific request of the purchaser.

3.7 Resistance to entry techniques.

3.7.1 Surreptitious, covert and forced entry techniques. The vault door shall withstand the applicable tests in 4.4.8 for not less than the periods of time specified hereunder. Class 5-V - Vault door shall be resistant to 20 man-hours surreptitious entry, 30 man-minutes covert entry and 10 man-minutes forced entry.

3.8 Escape device. Each vault door shall have an escape device which shall be permanently installed on the inside face of the door. The device shall permit ready escape for persons locked inside the vault area. Access to the device shall only be from the inside the vault, and its design shall be such that under normal operating conditions it can not be activated from the outside. A decal shall be permanently affixed to the inside face of the door frame outlining, in easily read letters, completely understandable instructions for activating the device to open the door. Neither the design of the device nor its installation shall affect the door's resistance to entry techniques. The escape device shall allow the door to be returned to the fully secure condition following egress from the vault. The escape device shall pass the escape device operational test in paragraph 4.4.8.5.

3.9 Lubrication. Moving parts requiring lubrication shall have a permanent type lubricant applied which is suitable to the varied climatic conditions likely to be encountered during the service of the product.

3.10 Pretreatment and finish.

3.10.1 Pretreatment. All exterior and interior ferrous metal surfaces shall be treated for painting in accordance with any type in TT-C-490. Special attention shall be given to the door's interior to assure all welds are clean and that all slag, spatter, and dirt accumulation is removed.

3.10.2 Finish. The final coat used for the finish shall be as specified in 3.2.3.1 and it shall be applied to all exterior and interior metal surfaces except plated metal. The minimum total finished film thickness of the final coat shall be not less than 0.025 mm. The finish shall level out to produce uniform exposed surfaces without runs, wrinkles, grit, areas of thin or no film, or separation of color. A textured or crinkle finish may be used. Special attention shall be given to insure that all surfaces are adequately protected against rust. The final finish shall withstand the test in 4.4.8.5 without evidence of cracking, flaking, or loss of adhesion of the finish. Two test panels of 0.9 mm thick steel shall be furnished with the sample door for the purpose of the test. One panel shall be prepared to reflect the inner coating and one to reflect the outing coating.

3.10.3 Plating. Bolts, screws, nuts, and similar hardware shall be made to resist rust by electro-galvanizing or by chromium plating as specified in 3.2.3. 3.13 Labels. Each door furnished under this specification shall bear the applicable labels specified hereunder.

3.11 Labels Each door furnished under this specification shall bear the applicable labels specified here under.

3.11.1 Identification label. The label shall be affixed to the inside face of the door frame. The label shall show the door model and serial number, date of manufacture, and Government contract number.

3.11.2 Certification label. A certified label shall be affixed to the inside face of the door bearing the following certification:

A. For the Class 5-V door:

"This is a U.S. Government Class 5-V vault door which has been tested and approved by the Government under Fed. Spec. AA-D-600D. It affords the following security protection:

"20 man-hours against surreptitious entry.
30 man-minutes against covert entry.
10 man-minutes against forced entry.
The protection certified above applies only to the door and not to the vault proper."

3.11.3 Number label. All vault doors shall have a number label securely affixed to the front face. Regardless of the method used, the label attachment shall not degrade the door security. The label shall be mounted on the door frame, above or to the left side of the door. The label shall be nominal 0.5 mm thick, satin finished aluminum and shall be 63-65 mm by 17-20 mm. The label numbering system shall be established by the manufacturer to provide non-repetitive numbers. The label numbers shall be not less than 4.5 mm high and shall be embossed.

3.12 Workmanship. The workmanship shall be of a quality to produce a serviceable and well finished end item, able to withstand hard daily usage. The edges of all exposed parts and sheets shall be protected by folding, beading, flanging or grinding to eliminate burrs, roughness, and sharp edges. The bending of channels and flanges shall be straight and smooth. Welding and brazing shall produce secure and rigid connections. Lock washers, cotters pins, clips, and other retainers or built-in features shall be used to prevent loosening of screws, bolts, and nuts which may cause disengagement of parts and possible lock-out. Moving parts shall operate smoothly without binding or jamming. The door shall be free of any defects or features which may adversely affect its appearance and serviceability or which may cause personal injury.

Table I - Classification of Preparation for Delivery Defects

Examine	Defect
Markings	Omitted; incorrect; illegible; improper size, location, sequence or method of application.
Materials	Any component missing or damaged.
Workmanship	Incomplete closure of box, loose strapping, distortion of container.

3.13 Replacement of parts. Parts subject to replacement, such as the combination lock and face hardware, shall be capable of identical replacement in the field without the use of special tools or specially qualified personnel and shall be possible without affecting the security integrity of the door.

3.14 Spare parts list. A spare parts list of all door parts which may be subject to subsequent replacement shall be furnished with each door delivered under contract. The parts list shall clearly identify the parts by descriptions and part numbers. The list shall be printed on paper or other suitable material and bonded by glue or adhesive to the inside face of the door frame.

4. QUALITY ASSURANCE PROVISIONS

4.1 Inspection responsibility. Except that testing for qualification shall be performed by an agency designated by the General Services Administration, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own or any other inspection facility or service acceptable to the Government. Inspection records of the examinations and tests shall be kept complete and available to the Government, as specified in the contract or order. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure that supplies and services conform to prescribed requirements.

4.2 Component and material inspection. In accordance with 4.1, the supplier is responsible for insuring that components and materials used are manufactured, tested, and inspected in accordance with the requirements of referenced subsidiary specifications and standards to the extent specified, or, if none, in accordance with this specification.

4.3 Inspection of preparation for delivery requirements. An inspection shall be made to determine that the packing and marking comply with the requirements in Section 5 of this specification. Defects shall be in accordance with Table I. The sample unit shall be one shipping container fully prepared for delivery.

4.4 Testing procedures and tests.

4.4.1 Testing agency. Qualification tests on doors submitted for approval for inclusion on the applicable Qualified Products List (QPL) and any re-testing that may be required shall be performed by a testing agency specifically designated by the General Services Administration.

4.4.2 Testing costs. All testing costs entailed in determining the qualification of the supplier's product, including costs of re-testing of a qualified product if subsequently disqualified under 3.1.1, shall be borne by the supplier, and shall be paid prior to the commencement of testing.

4.4.3 Test procedures. The following procedures shall govern the testing of all doors submitted for qualification under this specification.

(a) Samples shall be submitted for qualification only after the supplier has obtained written authorization from the General Services Administration.
(b) A qualification test may be discontinued at the Government's testing facility at any time the product fails to meet any one or more of the requirements set forth in this specification. The manufacturer may be permitted to make modifications on the sample during the testing phase where such modifications, in the judgment of the General Services Administration and the testing facility, are clearly in the interest of the Government.
(c) In case of failure of the sample, consideration will be given to the request of the manufacturer for resubmission for retest only after it has been clearly shown that

changes have been made in the product which the Government considers sufficient to warrant retest.
(d) The manufacturer or his representative will not be permitted to observe the actual tamper resistance tests conducted on his product at the testing facility. However, when samples tested fail to comply with the requirements of this specification, the sample may be examined by the manufacturer or his representative and full details of the failure may be made known to them in a manner which, for reasons of security, will be in the best interest of the Government.

4.4.4 Test samples. Qualification test sample representative of the classes, types and designs of the class the supplier proposes to furnish shall be forwarded at a time and to a place designated by the General Services Administration. During testing, in the event the sample is destroyed or damaged to such an extent that the testing cannot be completed, the Government reserves the right to require the manufacturer to furnish additional samples to complete the testing.

4.4.5 Drawings and material specifications. The manufacturer shall furnish two complete sets of construction and assembly drawings and material specifications with the sample submitted for qualification. When samples have been tested and are approved for inclusion on the applicable QPL, the manufacturer shall furnish three additional complete sets of the assembly and construction drawings and material specifications lists to the General Services Administration for the Government's use in inspection and acceptance of the product after award of contract. All material so furnished by the manufacturer will be held in proprietary confidence.

4.4.5.1 Changes in drawings and material specifications. Once the door has been tested and approved for QPL, no change of any kind shall be made in its construction or in the construction drawings unless prior written authorization to make the change is obtained from the Federal Supply Service, General Services Administration. Upon receipt of a request for a change, the General Services Administration will determine whether additional testing is required for approval.

4.4.6 Qualification testing. Qualification testing shall consist of the following tests and inspections. Failure of the sample to withstand these tests shall provide reason to consider the product as having failed to meet qualification requirements.

(a) Inspections - 4.4.9
(b) Door test - 4.4.8.1
(c) Surreptitious, covert and forced entry test - 4.4.8.2
(d) Finish Test - 4.4.8.4
(e) Escape Device Operational Test – 4.4.8.5

4.4.7 Acceptance after award of contract. The Government reserves the right to inspect and test each door, including all component parts thereof, delivered for acceptance under this specification after award of contract.

4.4.8 Test methods.

4.4.8.1 Door test. The vault door shall be suspended in a test frame and swung open 90 degrees from its closed position. Ninety kilograms shall be loaded on the top edge of the door opposite and furthermost from the hinged side. The door shall be allowed to hang in this position for approximately 24 hours. At the end of this period, the door shall be examined for ease of

operation. The door shall not stick or jam in its frame and the lock and locking mechanism shall operate easily and smoothly.

4.4.8.2 Surreptitious, covert and forced entry test. There shall be sufficient time and opportunity to study the design and construction of the vault door and to develop testing methods prior to the start of testing. There shall be no limit to the number of methods of surreptitious, covert and forced entries attempted. No more than two men shall be used simultaneously during each attempt at entry. The man-minute working time shall cover the period during which an entry test on the cabinet is in progress and shall be exclusive of time required for safety precautions and rest periods.

4.4.8.2.1 Surreptitious, covert and forced entry tools and devices.

4.4.8.2.1.1 Surreptitious entry tools and devices. Tools and devices used in the surreptitious entry tests are unlimited, except that the total weight of the tools used for a single test shall not exceed 70 kilograms. The test tools and devices selected for a particular attempt shall be weighed prior to commencement of the test.

4.4.8.2.1.2 Covert entry tools and devices. The tools and devices used in the covert entry tests shall be limited as specified below. Power tools, electrically or battery powered shall be commercially available equipment, and shall be limited to drills not exceeding 5000 rpm. Pressure rigs may be used, with a lever arm not exceeding 762 mm. Tools may be reasonably modified, i.e., special chucks on drills, ground or shaped chisels or pry bars, etc. Electrical tools shall be able to operate on electricity available in normal office space. Tools and devices shall be capable of being carried in two cases or bags, each case or bag not exceeding 0.042 cubic meters in volume. The total weight of the tools used in a single test shall not exceed 70 kilograms, exclusive of the weight of the case. Devices for the application of heat shall be limited to single tank propane, butane or equivalent devices which fall with the weight and dimension limits specified above. Acetylene, MAPP or equivalent shall not be used. Electric arc or any form of burn bars, oxidizer assisted products or explosives shall not be used. The test tools and devices selected for a particular attempt shall be weighed prior to commencement of the test.

4.4.8.2.1.3 Forced entry tools and devices. The tools and devices used for forced entry tests shall be limited to non-powered tools only. The test tools and devices selected for a particular attempt shall be weighed prior to commencement of the test.

4.4.8.2.2 Surreptitious, covert and forced entry test timing. The time clock shall be started when the test equipment is picked up to approach the sample and shall not be stopped during the test except as specified above. Any change or repair of tools taken from the carrying case during a test shall only be done while the clock is running. The tests must be conducted in a manner that is repeatable. Any surreptitious, covert, or forced entry through the vault door under the above conditions, within the time specified for the door's class, shall provide reason to consider the door as having failed to meet the requirement.

4.4.8.3 Finish test. The two panels, prepared as specified in 3.13.2 shall, at room temperature, be bent around a 6.4 mm rod to an angle of 180 degrees. The panels shall then be examined for compliance with 3.13.2.

4.4.8.4 Escape device operational test. The escape device shall be subjected to 10,000 cycles of operation without addition of lubricants and without replacements of any component. One cycle shall consist of using the escape device to throw the bolts and open the vault door, and

then close and lock the vault door. Any failure of the escape device during test shall be cause for rejection.

4.4.9 Inspection. A visual inspection shall be made of the product to determine compliance with the requirements specified in Section 3.

5. PREPARATION FOR DELIVERY

5.1 Packing.

5.1.1 Level A. Each complete door shall be packed in a crate or in a box . When packed in a crate, the contents shall be waterproof shielded with a shroud. When packed in a box, the contents shall be shrouded and the box shall be modified with addition of reinforcing members and skids. The contents of the crate or box shall be blocked, braced and cushioned to prevent movement during multiple shipments.

5.2 Marking.

5.2.1 Civil agencies. In addition to the marking required in the contract or order, the shipping containers shall be marked in accordance with Fed. Std. No. 123.

5.2.2 Military activities. In addition to markings required by the contract or order, the shipping containers shall be marked in accordance with MIL-STD-129.

6. NOTES

6.1 Intended use. The doors are intended for use in storage vaults and strong-rooms to protect against unauthorized passage of a person or persons through the doorway into the vault proper.

6.2 Ordering data. Purchasers should exercise any desired options offered herein, and procurement documents should specify the following:

(a)Title, symbol and date of this specification.
(b)Class, type, style, and design required.
(c)Thickness and composition of the vault wall.
(d)Door stop requirements if other than wall mount.
(e)Levels of packing and marking required.

6.3 Qualification. With respect to products requiring qualification, awards will be made only for such products as have, prior to the time set for opening of bids, been tested and approved for inclusion on the applicable Federal Qualified Products List, whether or not such products have actually be so listed by that date. The attention of suppliers is called to this requirement, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification so that they may be eligible to be awarded contracts or orders for the products covered by this specification. The activity responsible for the Qualified Products List is the Furniture Commodity Center, Federal Supply Service, General Services Administration, Washington, D.C. 20406, and information pertaining to qualification may be obtained from that activity.

6.4 Composition of vault wall. Examples of materials commonly used in vault construction are reinforced concrete, interlocked hard brick, steel alloy, or a combination of these. In order that

the door manufacturer can insure a proper fit, the purchaser should stipulate in the purchase order (see 6.2) the thickness and the type of material used in the vault wall.

6.5 Definition of terms used in this specification.

6.5.1 Entry. For the purpose of this specification, entry means: (1) opening the door, (2) creating an opening to allow passage through the vault door or wall opening in which the door is mounted.

6.5.2 Surreptitious entry. For the purpose of this specification, surreptitious entry means a method of entry, such as lock manipulation or radiological attack on the combination lock, which

6.5.3 Covert entry. For the purpose of this specification, covert entry is defined as a method of entry which causes physical damage to the door or lock such that the damage can be repaired to the point where it would not be detectable by a user during normal use. However, the damage would be detectable during inspection by a qualified person. If replacement parts, including replacement lock parts, or paint, are necessary to conceal the damage caused by the entry attempt so it cannot be detected during normal use, the entry method shall be considered covert.

6.5.4 Forced entry. For the purpose of this specification, forced entry means a method of entry which would leave evidence of the act and which would be readily discernible in the normal use of the door. Forced entry is considered to be an attack in which the attacker has no concern over leaving evidence that the vault door has been penetrated.

6.5.5 Lock manipulation. For the purpose of this specification, lock manipulation is defined as the opening of the combination lock without alteration of the physical structure, or disarranging of parts. Ordinarily, manipulation would be accomplished by movement of the lock dial.

6.6 Samples. All samples required for test purposes shall be furnished at no expense to the Government and the manufacturer shall pay all transportation charges to and from the point where the tests are performed. All tested samples shall become the property of the Government but may be released to the manufacturer at the option of the Government. Upon request, the manufacturer shall furnish to the Government a door equal in every respect to that of the qualified sample for use of inspection during the term of the contract. The door shall be furnished at no expense to the Government and will be returned to the manufacturer at his request upon expiration of his contract.

6.7 Special techniques. Information relating to special techniques used in the testing of vault doors will be disclosed to qualified suppliers and personnel of the Federal agencies on an official, need-to-know basis.

END OF SECTION

SECTION 08 34 63

DETENTION DOORS AND FRAMES

PART 1 GENERAL

1.1 SECTION INCLUDES

Special Function Door and Frame Components for use in local detention facilities.

1.2 RELATED SECTIONS

03 30 00 Cast-in-place Concrete.
03 62 00 Grouting.
04 20 00 Masonry.
05 50 00 Metal Fabrications.
08 71 53 Detention Door Hardware.
09 91 23 Painting and Coating.

1.3 REFERENCES

ASTM A 568/A 568M Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled.
ASTM A 653/A 653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
ASTM A 924/A 924M Standard Specification for General Requirements for Sheet Steel, Metallic-Coated by the Hot-Dip Process.
ASTM A 1008/A 1008M, Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High Strength Low-Alloy, High Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
ASTM A 1011/A 1011M, Specification for Steel, Sheet, and Strip, Hot-Rolled, Carbon, Structural, High Strength Low-Alloy and High Strength Low-Alloy with Improved Formability
ANSI/SDI A250.10 Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
ANSI/SDI A250.11 Recommended Erection Instructions for Steel Frames.
ANSI/NAAMM HMMA 863 Detention Security Hollow Metal Doors and Frames.
HMMA 820-TN01 Grouting Hollow Metal Frames.
HMMA 840-TN01 Painting Hollow Metal Products.
HMMA 840 Installation and Storage of Hollow Metal Doors and Frames.
HMMA 841 Tolerances and Clearances for Commercial Hollow Metal Doors and Frames.
ANSI/NFPA 252 Standard Methods of Fire Tests of Door Assemblies.
ANSI/UL10B Fire Tests of Door Assemblies.
ANSI/UL10C Standard for Positive Pressure Fire Tests of Door Assemblies.

1.4 DESIGN and PERFORMANCE REQUIREMENTS

Where noted on the door schedule, Hollow Metal Detention Doors and Frames shall have been evaluated, certified, or physically tested to meet static load, impact, and rack/twist performance of ANSI/NAAMM HMMA 863.
Where noted on the door schedule, Hollow Metal Detention Doors and Frames shall have been evaluated, certified, or physically tested to meet fire protection rating specified. If any door or frame product cannot meet these requirements because of design, hardware or any other reason, the Architect shall be so advised in the submittal documents. If hardware, glazing, or other options are unknown at the time of submittal document preparation, the architect shall be advised prior to fabrication.
Hollow Metal Detention doors and frames shall incorporate recycled materials in at least 30% by weight.

1.5 SUBMITTALS

Submit shop drawings showing profiles, product components, anchors, and accessories. Details deemed to be proprietary by the manufacturer may be identified as such.

Submit installation instructions and installation tolerances if other than as specified in ANSI/SDI A250.11 or HMMA 840. Submit jobsite storage and protection requirements if other than as specified herein or in HMMA 861 or HMMA 840-TN01.
Provide certification of compliance with specified performance level.

1.6 QUALITY ASSURANCE
Installer shall have documented experience in installation of Hollow Metal Detention doors and frames, including the specialized hardware required.
Fabricate products to tolerances in compliance with HMMA 863.

1.7 DELIVERY, STORAGE, AND HANDLING
Store and handle products in accordance with HMMA 863, or HMMA 840-TN01 in manufacturer's original, unopened, undamaged containers.
Assure that protection for glazing (if applicable) is intact.
Protect materials, including accessories, in a secure area protected from adverse temperature and humidity conditions.
Store doors and frames upright on wood planking, protected at corners to prevent damage.
Do not store in non-vented plastic or canvas shelters.

1.8 COORDINATION
Coordinate work with other directly affected trades, wall construction, and hardware installation.
Coordinate hardware locations with Sections 08 71 53.
The Hollow Metal Detention door and frame manufacturer shall be provided with the final approved hardware schedule along with current templates for ALL hardware items prior to beginning any manufacturing.
Assure that the Hollow Metal Detention door and frame manufacturer is notified in writing of expected preparation (example: drilling and tapping) for all detention grade hardware.
Coordinate placing of material orders and fabrication schedules with construction progress.
Where glazing occurs, coordinate removable stop side, clearly indicated on shop drawings.

1.9 WARRANTY
Submit written copy of manufacturer's standard warranty documents.

PART 2 PRODUCTS
2.1 MANUFACTURER
Hollow Metal Detention doors and frames shall be manufactured by:
MEGAMET INDUSTRIES, INC.
P.O. BOX 635 (3228 6th. Avenue North) BIRMINGHAM, AL 35201
WEBSITE: www.megametusa.com
PHONE: (205) 322-7700 TOLL FREE: (888) 322-7750
FAX: (205) 322-4600
Substitutions: See Section 01 63 00.

2.2 HOLLOW METAL DETENTION DOORS
Provide "MegaGard" Hollow Metal Detention doors not less than 2" nominal thickness as listed in the door schedule and indicated on the Drawings in accordance with this specification. Opening sizes, configurations and types shall be as indicated on the Drawings and/or door schedule.
Fabricate doors with (12 gage) face thickness.
Cold and hot rolled steel for door faces and reinforcing shall comply with ASTM A568, A1008 or A1011.
Hot-dip galvanized steel, where indicated on the door schedule, shall comply with ASTM A653 or A924.
Coating thickness shall be (Class A60).

Fabricate faces and edges as seamless doors from two sheets of steel with no visible seams on either face or vertical edges; continuously weld door edges, fill and finish smooth.

All doors shall be handed with either square or bevel edges (at manufacturer's option).
Vertical edges shall be reinforced with continuous channels at hinge and lock edges. Channel shall be formed from one member; spliced channels are not permitted.
Internal stiffeners shall be continuous (interrupted only in the areas of hardware, visions, or other such devices) formed steel sections spanning the full interior thickness between door faces. These stiffeners shall be as required by performance and shall be no less than 18 gage minimum thickness. Stiffeners shall be spaced so that the vertical interior webs are no more than 4 in. apart. Stiffeners shall be fastened to both face sheets by welds spaced a maximum of 3 in. on center. Spaces between stiffeners shall be filled with fiberglass or mineral rock wool batt-type material.
Top and bottom of doors shall be closed flush either by inverted steel channels or by the addition of non-removable capping channels
Hardware Preparation: Mortise, reinforce, drill, and tap to receive templated mortise hardware using reinforcement thicknesses in accordance with HMMA 863. Reinforce only for specified surface hardware or hardware mounted to top/bottom channels using reinforcement thicknesses in accordance with HMMA 863. Where detention locks with mounting plates occur, prepare lock pockets in accordance with templates designed for surface mounted (not flush mounted) cover plates.
Where doors are scheduled to include vision panels, fabricate vision framing integrally welded on the prisoner-accessible side of the door and removable angle or zee shaped stop on opposite side with dimensions as required to suit glazing material. Removable stops shall be welded at corners into 4-sided frame. Preparation for glazing detail shall be shown on shop drawings. Removable stops shall be temporarily attached with pan or button head screws of size and spacing to meet impact requirements. Glazier shall remove temporary screws and install glazing with detention grade screws.
Glazing material shall be as required to meet impact requirements and shall be (furnished and installed by door manufacturer).

2.3 HOLLOW METAL DETENTION FRAMES
Provide "MegaGard" Hollow Metal Detention frames as listed in the door schedule and indicated on the Drawings in accordance with this specification. Opening sizes, profiles, anchors, and types shall be as indicated on the Drawings. Jamb or head profiles requiring unequal face frames shall be indicated on shop drawings.
Fabricate frames from (12 gage) material.
Cold and hot rolled steel for frames and reinforcing shall comply with ASTM A568, A1008 or A1011.
Hot-dip galvanized steel for frames shall comply with ASTM A653 or A924. Coating thickness shall be (Class A60).

Fabricate frames with tightly fitting mitered corners and butted stops.
Continuously weld frame faces, rabbets, soffits, and stops at corners internally or externally; fill, and finish smooth. Provide temporary shipping spreader welded to jambs at bottom.
Mortise, reinforce, drill, and tap to receive templated mortise hardware using reinforcement thicknesses in accordance with HMMA 863. Reinforce only for specified surface hardware using reinforcement thicknesses in accordance with HMMA 863. Where detention locks with mounting plates occur, prepare lock pockets in accordance with templates designed for surface mounted (not flush mounted) cover plates.
Provide frames with one welded-in floor anchor per jamb and wall anchors to suit the substrate located in accordance with HMMA 863.

2.4 OPERATING CLEARANCES
Doors shall be undersized from frame opening sizes at head, jamb, and threshold in accordance with HMMA-841.

2.5 HARDWARE LOCATIONS
Unless otherwise specified, hinges and locks shall be located in accordance with HMMA-863.

2.6 HOLLOW METAL DETENTION WINDOW FRAMES (BORROWED LIGHTS)

Where shown or scheduled, provide "MegaGard" detention window frames (borrowed lights) fabricated in accordance with Section 2.3. Profiles, height of stops, and rabbet size may differ based on configurations required to achieve the impact requirements of glazing material specified. Removable stops shall be angle or channel shaped with dimensions as required to suit glazing material. Preparation for glazing detail shall be shown on shop drawings. Removable stops shall be temporarily attached with pan or button head screws of size and spacing to meet impact requirements. Glazier shall remove temporary screws and install glazing with detention grade screws.
Glazing material shall be as required to meet impact requirements and shall be (furnished and installed by door manufacturer).

PART 3 EXECUTION

3.1 EXAMINATION

Before beginning installation contractor shall verify that substrate conditions are acceptable for supporting completed assemblies; adequately protect any areas of frames from grout penetration or for mounting screws where frames are fully grouted. Refer to HMMA 820-TN01.
Select fasteners of adequate type, number, and quality to perform intended functions.

3.2 INSTALLATION

Install frames plumb, straight, and true, rigidly secured in place and properly braced; comply with ANSI/SDI A250.11, and HMMA-841.
Grout fill frames in new masonry in accordance with ANSI/SDI A250.11, and HMMA 820-TN01.
Secure any bolted connections to adjacent construction using bolts suitable for the substrate.
Install accessories, doors, and hardware in accordance with manufacturers' templates and instructions.

3.3 PROTECTION

Protect installed products and finished surfaces from damage during construction.

3.4 FINAL ADJUSTMENTS

After construction work has been completed in the area, clean and adjust hinges, locks, and closers to assure proper operation prior to turn-over to Owner.

END OF SECTION

SECTION 08 43 13

ALUMINUM STOREFRONT AND DOORS

PART 1 - GENERAL

1.1 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 Summary

A. Section Includes: Kawneer Architectural Aluminum Storefront Systems, including perimeter trims, stools, accessories, shims and anchors, and perimeter sealing of storefront units.
   1. Types of Kawneer Aluminum Storefront Systems include:
      a. Trifab™ VG 450/451 Framing System – 1-3/4" x 4-1/2" (44.5 mm x 114.3 mm) nominal dimension; Non-Thermal; Front, Center, Back, Multi-Plane, Structural Silicone or Weatherseal Glazed (Type B); Stick or Punched Opening Fabrication.

B. Related Sections:
   1. 07 25 00 “Air Barriers”
   2. 07 92 05 “Joint Sealants”
   3. 08 44 13 “Glazed Aluminum Curtain Walls”
   4. 08 80 00 “Glazing”

1.3 Definitions

A. Definitions: For fenestration industry standard terminology and definitions refer to American Architectural Manufacturers Association (AAMA) – AAMA Glossary (AAMA AG).

1.4 Performance Requirements

A. Storefront System Performance Requirements:
   1. Wind loads: Provide storefront system; include anchorage, capable of withstanding wind load design pressures as shown in the structural drawings. The design pressures are based on the International Building Code; 2012 Edition.
   2. Air Infiltration: The test specimen shall be tested in accordance with ASTM E 283. Air infiltration rate shall not exceed 0.06 cfm/ft^2 (0.3 l/s · m^2) at a static air pressure differential of 6.24 psf (300 Pa).
   3. Water Resistance: The test specimen shall be tested in accordance with ASTM E 331. There shall be no leakage at a minimum static air pressure differential of 8 psf (383 Pa) as defined in AAMA 501.
   4. Uniform Load: A static air design load of 20 psf (958 Pa) shall be applied in the positive and negative direction in accordance with ASTM E 330. There shall be no deflection in excess of L/175 of the span of any framing member. At a structural test load equal to 1.5 times the specified design load, no glass breakage or permanent set in the framing members in excess of 0.2% of their clear spans shall occur.

1.5 Submittals

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, hardware, finishes, and installation instructions for each type of aluminum-framed storefront system indicated.

B. Shop Drawings: Include plans, elevations, sections, details, hardware, and attachments to other work, operational clearances and installation details.

C. Samples for Initial Selection: For units with factory-applied color finishes including samples of hardware and accessories involving color selection.

D. Samples for Verification: For aluminum-framed storefront system and components required.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for each type of aluminum-framed storefront.

F. Warranty: Special warranty specified in this Section.

G. Fabrication Sample: Of each vertical-to-horizontal intersection of aluminum-framed systems, made from 12" (304.8 mm) lengths of full-size components and showing details of the following:
   1. Joinery, including concealed welds.
   2. Anchorage.
   3. Expansion provisions.
   4. Glazing.
   5. Flashing and drainage.

H. Other Action Submittals:
   1. Entrance Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

1.6 Quality Assurance

A. Installer Qualifications: An installer which has had successful experience with installation of the same or similar units required for the project and other projects of similar size and scope.

B. Manufacturer Qualifications: A manufacturer capable of providing aluminum-framed storefront system that meet or exceed performance requirements indicated and of documenting this performance by inclusion of test reports, and calculations.

C. Source Limitations: Obtain aluminum-framed storefront system through one source from a single manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of aluminum-framed storefront system and are based on the specific system indicated. Refer to Division 01 Section “Product Requirements”. Do not modify size and dimensional requirements.
   1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockup for type(s) of storefront elevation(s) indicated, in location(s) shown on Drawings.

F. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section “Project Management and Coordination”.

G. Structural-Sealant Glazing: Comply with ASTM C 1401, “Guide for Structural Sealant Glazing” for design and installation of structural-sealant-glazed systems.

H. Structural-Sealant Joints: Design reviewed and approved by structural-sealant manufacturer.

1.7 Project Conditions

A. Field Measurements: Verify actual dimensions of aluminum-framed storefront openings by field measurements before fabrication and indicate field measurements on Shop Drawings.

1.8 Warranty

A. Manufacturer’s Warranty: Submit, for Owner’s acceptance, manufacturer’s standard warranty.
   1. Warranty Period: Two (2) years from Date of Substantial Completion of the project provided however that the Limited Warranty shall begin in no event later than six months from date of shipment by manufacturer.

PART 2 - PRODUCTS

2.1 Manufacturers

A. Basis-of-Design Product:
   1. Kawneer Company Inc.

2. Trifab™ VG 450 Framing System (Non-Thermal)
3. System Dimensions: 1-3/4" x 4-1/2" (44.5 mm x 114.3 mm)
4. Glass: Center, Exterior or Interior

B. Substitutions: Refer to Substitutions Section for procedures and submission requirements
1. Post-Contract (Construction Period) Substitutions: Submit written request in order to avoid storefront installation and construction delays.
2. Product Literature and Drawings: Submit product literature and drawings modified to suit specific project requirements and job conditions.
3. Certificates: Submit certificate(s) certifying substitute manufacturer (1) attesting to adherence to specification requirements for storefront system performance criteria, and (2) has been engaged in the design, manufacturer and fabrication of aluminum storefronts for a period of not less than ten (10) years. (Company Name)
4. Test Reports: Submit test reports verifying compliance with each test requirement required by the project.
5. Samples: Provide samples of typical product sections and finish samples in manufacturer's standard sizes.

C. Substitution Acceptance: Acceptance will be in written form, either as an addendum or modification, and documented by a formal change order signed by the Owner and Contractor.

2.2 Materials

A. Aluminum Extrusions: Alloy and temper recommended by aluminum storefront manufacturer for strength, corrosion resistance, and application of required finish and not less than 0.070" (1.8 mm) wall thickness at any location for the main frame and complying with ASTM B 221: 6063-T6 alloy and temper.

B. Fasteners: Aluminum, nonmagnetic stainless steel or other materials to be non-corrosive and compatible with aluminum framing members, trim hardware, anchors, and other components.

C. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.

D. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.

E. Sealant: For sealants required within fabricated storefront system, provide permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.

F. Tolerances: Reference to tolerances for wall thickness and other cross-sectional dimensions of storefront members are nominal and in compliance with AA Aluminum Standards and Data.

2.3 Storefront Framing System

A. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

B. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials. Where exposes shall be stainless steel.

C. Perimeter Anchors: When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action

D. Packing, Shipping, Handling and Unloading: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

E. Storage and Protection: Store materials protected from exposure to harmful weather conditions. Handle storefront material and components to avoid damage. Protect storefront material against damage from elements, construction activities, and other hazards before, during and after storefront installation.

2.4 Glazing Systems

A. Glazing: As specified in Division 08 Section “Glazing”.

B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, extruded EPDM rubber.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

D. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

E. Glazing Sealants: For structural-sealant-glazed systems, as recommended by manufacturer for joint type, and as follows:
   1. Structural Sealant: ASTM C 1184, single-component neutral-curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant and approved by a structural-sealant manufacturer for use in aluminum-framed systems indicated.
      a. Color: Black
   2. Weatherseal Sealant: ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O; single-component neutral-curing formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and aluminum-framed-system manufacturers for this use.
      a. Color: Matching structural sealant.

2.5 Entrance Door Systems

A. Entrance Doors: 350 Series Doors, finish to match system.

B. Door Hardware: Included in Door Hardware Allowance.

2.6 Accessory Materials

A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 07 Section “Joint Sealants”.

B. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30 mil (0.762 mm) thickness per coat.

2.7 Fabrication

A. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
   1. Profiles that are sharp, straight, and free of defects or deformations.
   2. Accurately fit joints; make joints flush, hairline and weatherproof.
   3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
   4. Physical and thermal isolation of glazing from framing members.
   5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
   6. Provisions for field replacement of glazing.
   7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

B. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

C. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.

D. Storefront Framing: Fabricate components for assembly using manufacturer’s standard installation instructions.

E. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.8 Aluminum Finishes

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Factory Finishing:
   1. Kawneer Permanodic™ AA-M10C22A41, AAMA 611, Architectural Class I Clear Anodic Coating (Color #14 Clear).

PART 3 - EXECUTION

3.1 Examination

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weather tight aluminum- framed storefront system installation.
   1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
   2. Wood Frame Walls: Dry, clean, sound, well nailed, free of voids, and without offsets at joints. Ensure that nail heads are driven flush with surfaces in opening and within 3 inches (76 mm) of opening.
   3. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
   4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Installation

A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing aluminum-framed storefront system, accessories, and other components.

B. Install aluminum-framed storefront system level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.

C. Set sill members in bed of sealant or with gaskets, as indicated, for weather tight construction.

D. Install aluminum framed storefront system and components to drain condensation, water penetrating joints, and moisture migrating within aluminum-framed storefront system to the exterior.

E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 Field Quality Control

A. Field Tests: Architect shall select storefront units to be tested as soon as a representative portion of the project has been installed, glazed, perimeter caulked and cured. Conduct tests for air infiltration and water penetration with manufacturer's representative present. Tests not meeting specified performance requirements and units having deficiencies shall be corrected as part of the contract amount.
   1. Testing: Testing shall be performed by a qualified independent testing agency. Refer to Testing Section for payment of testing and testing requirements. Testing Standard per AAMA 503, including reference to ASTM E 783 for Air Infiltration Test and ASTM E 1105 Water Infiltration Test.
      a. Air Infiltration Tests: Conduct tests in accordance with ASTM E 783. Allowable air infiltration shall not exceed 1.5 times the amount indicated in the performance requirements or 0.09 cfm/ft^2, whichever is greater.
      b. Water Infiltration Tests: Conduct tests in accordance with ASTM E 1105. No uncontrolled water leakage is permitted when tested at a static test pressure of two-thirds the specified water penetration pressure but not less than 6.24 psf (300 Pa).

B. Manufacturer's Field Services: Upon Owner’s written request, provide periodic site visit by manufacturer’s field service representative.

3.4 Adjusting, Cleaning, and Protection

A. Clean aluminum surfaces immediately after installing aluminum-framed storefronts. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

B. Clean glass immediately after installation. Comply with glass manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

DISCLAIMER STATEMENT

This guide specification is intended to be used by a qualified construction specifier. The guide specification is not intended to be verbatim as project specification without appropriate modifications for the specific use intended. The guide specification must be used and coordinated with the procedures of each design firm, and the particular requirements of a specific construction project.

END OF SECTION 08 43 13

SECTION 08 44 13

GLAZED ALUMINUM CURTAIN WALLS

PART 1 - GENERAL

1.1 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 Summary

A. Section Includes: Kawneer Architectural Aluminum Curtain Wall Systems, including perimeter trims, stools, accessories, shims and anchors, and perimeter sealing of curtain wall framing.
   1. Types of Kawneer Aluminum Curtain Wall include:
      a. 1600 Wall System™1 Curtain Wall – 2-1/2" (63.5), outside glazed pressure plate format and silicon mullions as shown in drawings.
         1) System depth: 7-1/2" to 10-1/2" framing (depth as required to meet engineered loads required by this section and the provisions required in the structural drawings) for 1" (25.4) insulating glazing.

B. Related Sections:
   1. 07 25 00 “Air Barriers”
   2. 07 92 05 “Joint Sealants”
   3. 08 43 13 “Aluminum-Framed Storefronts and Doors”
   4. 08 80 00 “Glazing”

1.3 Definitions

A. Definitions: For fenestration industry standard terminology and definitions refer to American Architectural Manufactures Association (AAMA) – AAMA Glossary (AAMA AG).

1.4 Performance Requirements

A. General Performance: Comply with performance requirements specified, as determined by testing of glazed aluminum curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
   1. Glazed aluminum curtain walls shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads. Failure also includes the following:
      a. Thermal stresses transferring to building structure.
      b. Glass breakage.
      c. Loosening or weakening of fasteners, attachments, and other components.
      d. Failure of operating units.

B. Delegated Design: Design glazed aluminum curtain walls, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Wind loads: Provide Curtain Wall system; include anchorage, capable of withstanding wind load design pressures as required in the structural drawings. The design pressures are based on the International Building Code; 2012 Edition

D. Air Infiltration: The test specimen shall be tested in accordance with ASTM E 283. Air infiltration rate shall not exceed 0.06 cfm/ft^2 (0.3 l/s · m^2) at a static air pressure differential of 6.24 psf (300 Pa).

E. Water Resistance, (static): The test specimen shall be tested in accordance with ASTM E 331. There shall be no leakage at a static air pressure differential of 12 psf (575 Pa) as defined in AAMA 501.

F. Water Resistance, (dynamic): The test specimen shall be tested in accordance with AAMA 501.1. There shall be no leakage at an air pressure differential of 12 psf (575 Pa) as defined in AAMA 501.

G. Uniform Load: A static air design load of 40 psf (1915 Pa) shall be applied in the positive and negative direction in accordance with ASTM E 330. There shall be no deflection in excess of L/175 of the span of any framing member at design load. At structural test load equal to 1.5 times the specified design load, no glass breakage or permanent set in the framing members in excess of 0.2% of their clear spans shall occur.

H. Seismic: When tested to AAMA 501.4, system must meet design displacement of 0.010 x the story height and ultimate displacement of 1.5 x the design displacement.

I. Thermal Transmittance (U-factor): When tested to AAMA Specification 1503, the thermal transmittance (U-factor) shall not be more than: 0.66 (clear).

J. Condensation Resistance (CRF): When tested to AAMA Specification 1503, the condensation resistance factor shall not be less than 66frame and 60glass (clear)

or

Condensation Index (I): when tested to CSA-A440-00, the Condensation Index shall not be less than 68_{frame} and 54_{glass} (clear).

K. Thermal Transmittance (U-factor): When tested to AAMA Specification 1503, the thermal transmittance (U-factor) shall not be more than: 0.43 (HP glass).

L. Condensation Resistance (CRF): When tested to AAMA Specification 1503, the condensation resistance factor shall not be less than 71frame and 71glass (HP glass).

M. Sound Transmission Loss: When tested to ASTM E90 and ASTM E1425, the Sound Transmission Class (STC) and Outdoor/Indoor Transmission Class (OITC) shall not be less than:
STC 31 or OITC 26 based upon 1" (25.4) insulating glass (1/4", 1/2" AS, 1/4"),
STC 37 or OITC 30 based upon 1" (25.4) laminated glass (1/4" laminated, 1/2" AS, 1/4" laminated).

1.5 Submittals

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For glazed aluminum curtain walls. Include plans, elevations, sections, full-size details, and attachments to other work.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified preconstruction testing agency, for glazed aluminum curtain walls, indicating compliance with performance requirements.

F. Fabrication Sample: Of each vertical-to-horizontal intersection of aluminum-framed curtain wall systems, made from 12" (304.8 mm) lengths of full-size components and showing details of the following:
1. Joinery
2. Glazing

1.6 Quality Assurance

A. Installer Qualifications: Installer who has had successful experience with installation of the same or similar systems required for the project and other projects of similar size and scope.

B. Manufacturer Qualifications: A manufacturer capable of fabricating glazed aluminum curtain walls that meet or exceed performance requirements.

C. Source Limitations: Obtain aluminum curtain wall system through one source from a single manufacturer.

D. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements,

alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.

E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockups for type(s) of curtain wall elevation(s) indicated, in location(s) shown on Drawings.

F. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section “Project Management and Coordination”.

1.7 Project Conditions

A. Field Measurements: Verify actual locations of structural supports for glazed aluminum curtain walls by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 Warranty

A. Manufacturer’s Warranty: Submit, for Owner’s acceptance, manufacturer’s standard warranty.
   1. Warranty Period: Two (2) years from Date of Substantial Completion of the project provided however that the Limited Warranty shall begin in no event later than six months from date of shipment by manufacturer.

PART 2 - PRODUCTS

2.1 Manufacturers

A. Basis-of-Design Product:
   1. Kawneer Company Inc.
      a. 1600 Wall System™1 Curtain Wall – 2-1/2" (63.5), outside glazed pressure plate format or silicone mullions as shown in drawings.
         1) System depth: 7-1/2" to 10-1/2" framing (depth as required to meet engineered loads required by this section and the provisions required in the structural drawings) for 1" (25.4) insulating glazing.

B. Substitutions: Refer to Substitutions Section for procedures and submission requirements.
   1. Post-Contract (Construction Period) Substitutions: Submit written request in order to avoid curtain wall installation and construction delays.
   2. Product Literature and Drawings: Submit product literature and drawings modified to suit specific project requirements and job conditions.
   3. Certificates: Submit certificate(s) certifying substitute manufacturer (1) attesting to adherence to specification requirements for curtain wall system performance criteria, and (2) has been engaged in the design, manufacturer and fabrication of aluminum curtain walls for a period of not less than ten (10) years. (Company Name).
   4. Test Reports: Submit test reports verifying compliance with each test requirement required by the project.
   5. Samples: Provide samples of typical product sections and finish samples in manufacturer's standard sizes.

C. Substitution Acceptance: Acceptance will be in written form, either as an addendum or modification, and documented by a formal change order signed by the Owner and Contractor.

2.2 Materials

A. Aluminum Extrusions: Alloy and temper recommended by glazed aluminum curtain wall manufacturer for strength, corrosion resistance, and application of required finish and not less than 0.070" (1.78) wall thickness at any location for the main frame and complying with ASTM B 221: 6063-T6 alloy and temper.

B. Aluminum sheet alloy: Shall meet the requirements of ASTM B209.

C. Fasteners: Aluminum, nonmagnetic stainless steel or other materials to be non-corrosive and compatible with aluminum window members, trim hardware, anchors, and other components.

D. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.

E. Pressure Plate: Pressure plate shall be aluminum and fastened to the mullion with stainless steel screws.

F. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.

G. Sealant: For sealants required within fabricated curtain wall system, provide permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.

H. Thermal Barrier: Thermal separator shall be extruded of a silicone compatible elastomer that provides a minimum 1/4" (6.3) separation.

I. Tolerances: Reference to tolerances for wall thickness and other cross-sectional dimensions of glazed curtain wall members are nominal and in compliance with AA Aluminum Standards and Data.

2.3 Curtain Wall Framing

A. Framing Members: Manufacturer's standard extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
   1. Glazing System: 4 sided captured.
   2. Glazing Plane: Front.

B. Glass: 1" (25.4) insulating glass option.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

D. Framing Sealants: Shall be suitable for glazed aluminum curtain wall as recommended by sealant manufacturer.

E. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials. Where exposed shall be stainless steel.

F. Perimeter Anchors: When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.

G. Packing, Shipping, Handling and Unloading: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

H. Storage and Protection: Store materials protected from exposure to harmful weather conditions. Handle curtain wall material and components to avoid damage. Protect curtain wall material against damage from elements, construction activities, and other hazards before, during and after installation.

2.4 Glazing

A. Glazing: Comply with Division 08 Section “Glazing”. Following glazing options are available.
   1. 1600 Wall System™1 Curtain Wall.
      a. System depth: 7-1/2" to 10-1/2" framing (depth as required to meet engineered loads required by this section and the provisions required in the structural drawings) for 1" (25.4) insulating glazing.

B. Glazing Gaskets: Gaskets to meet the requirements of ASTM C864.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

D. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

E. Glazing Sealants: As recommended by manufacturer for joint type.

2.5 Operable Units

A. Doors: AA 425 Thermal Entrance Doors at all exterior locations.

B. Door Hardware: By Hardware Allowance.

2.6 Accessory Materials

A. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil (0.762 mm) thickness per coat.

B. Versoleil™ SunShade – Outrigger/Single Blade System: An aluminum sunshade consisting of outriggers, louvers, and fascia at a depth of 36" that are anchored directly to the vertical curtain wall mullions. Outriggers shall be finished to match curtain wall finish. Locate where shown in drawings.

2.7 Fabrication

A. Form or extrude aluminum shapes before finishing.

B. Fabricate components that, when assembled, have the following characteristics:
   1. Profiles that are sharp, straight, and free of defects or deformations.
   2. Accurately fitted joints with ends coped or mitered.
   3. Physical and thermal isolation of glazing from framing members.
   4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
   5. Provisions for field replacement of glazing from exterior.
   6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
   7. Internal guttering system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.
   8. Double barrier design with primary air and vapor barrier at interior side of glazed aluminum curtain wall and secondary seal weeped and vented to exterior.

C. Curtain Wall Framing: Fabricate components for assembly using shear block system following manufacturer's standard installation instructions.

D. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.8 Finishes

A. Shop Finishing:
   1. Kawneer Permanodic™ AA-M10C22A41, AAMA 611, Architectural Class I Clear Anodic Coating (Color #14 Clear).

PART 3 - EXECUTION

3.1 Examination

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Installation

A. General: Install curtain wall systems plumb, level, and true to line, without warp or rack of frames with manufacturer’s prescribed tolerances and installation instructions. Provide support and anchor in place.
   1. Dissimilar Materials: Provide separation of aluminum materials from sources of corrosion or electrolytic action contact points.
   2. Glazing: Glass shall be outside glazed and held in place with extruded aluminum pressure plates anchored to the mullion using stainless steel fasteners spaced no greater than 9" (228.6) on center.
   3. Water Drainage: Each light of glass shall be compartmentalized using joint plugs and silicone sealant to divert water to the horizontal weep locations. Weep holes shall be located in the horizontal pressure plates and covers to divert water to the exterior of the building.

B. Related Products Installation Requirements:
   1. Sealants (Perimeter): Refer to Joint Treatment (Sealants) Section.
   2. Glass: Refer to Glass and Glazing Section.
      a. Reference: ANSI Z97.1, CPSC 16 CFR 1201 and GANA Glazing Manual.

3.3 Field Quality Control

A. Field Tests: Architect shall select curtain wall units to be tested as soon as a representative portion of the project has been installed, glazed, perimeter caulked and cured. Conduct tests for air infiltration and water penetration with manufacturer's representative present. Tests not meeting specified performance requirements and units having deficiencies shall be corrected as part of the contract amount.
   1. Testing: Testing shall be performed per AAMA 503 by a qualified independent testing agency. Refer to Testing Section for payment of testing and testing requirements.
      a. Air Infiltration Tests: Conduct tests in accordance with ASTM E 783. Allowable air infiltration shall not exceed 1.5 times the amount indicated in the performance requirements or 0.09 cfm/ft^2, which ever is greater.
      b. Water Infiltration Tests: Conduct tests in accordance with ASTM E 1105. No uncontrolled water leakage is permitted when tested at a static test pressure of two-thirds the specified water penetration pressure but not less than 8 psf (383 Pa).

B. Manufacturer's Field Services: Upon Owner's written request, provide periodic site visit by manufacturer's field service representative.

3.4 Adjusting, Cleaning and Protection

A. Protection: Protect installed product's finish surfaces from damage during construction. Protect aluminum curtain wall system from damage from grinding and polishing compounds, plaster, lime, acid, cement, or other harmful contaminants.

B. Cleaning: Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions prior to owner's acceptance. Remove construction debris from project site and legally dispose of debris.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

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END OF SECTION

SECTION 08 52 13

ALUMINUM CLAD WINDOWS

Part 1 General

1.1 Section Includes

A. Aluminum Clad and/or Wood Ultimate Double Hung – Next Generation, Single Hung, Transom, Picture window complete with hardware, glazing, certified mulls, weather strip, insect screen, removable grille, grilles-between-the-glass, simulated divided lite, jamb extension, combination storm/screen, and standard or specified anchors, trim, attachments, and accessories

1.2 Related Sections

A. Section 01 33 00 – Submittal Procedures; Shop Drawings, Product Data and Samples

B. Section 01 63 00 – Product Options

C. Section 06 20 00 – Millwork: Wood trim other than furnished by window manufacturer

D. Section 07 92 05 – Joint Sealant: Sill sealant and perimeter caulking

E. Section 09 91 23 – Painting and Coasting: Paint and stain other than factory-applied finish

1.3 References

A. American Society for Testing Materials (ASTM):

1. E283: Standard Test method for Rate of Air Leakage through Exterior Windows, Curtain Walls and Doors

2. E330: Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls and Door by Uniform Static Air Pressure Difference

3. E547: Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors by Cyclic Static Air Pressure Differential

4. E2190: Specification for Sealed Insulated Glass Units

5. C1036: Standard Specification for Flat Glass

6. E2068: Standard Test Method for Determination of Operating Force of Sliding Windows and Doors

7. E 1996: Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors and Storm Shutters Impacted by Windborne Debris in Hurricanes

8. E 1886: Standard Test method for Performance of Exterior Windows, curtain Walls, and Storm Shutters Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials

9. F 2090-10: Standard Specifications for Windows Fall Prevention Devices with Emergency Escape (egress) Release Mechanisms

B. American Architectural Manufacturer's Association/Window and Door Manufacturer's Association (AAMA/WDMA/CSA):

1. AAMA/WDMA/CSA 101/I.S.2/A440-08, Standard/Specification for windows, doors and skylights

2. AAMA/WDMA/CSA 101/I.S.2/A440-11, Standard/Specification for windows, doors and skylights

3. AAMA 450-10, Voluntary Performance Rating Method for Mulled Fenestration Assemblies

C. WDMA I.S.4: Industry Standard for Water Repellant Preservative Treatment for Millwork

D. Window and Door Manufacturer's Association (WDMA): 101/I.S.2 WDMA Hallmark Certification Program

E. Sealed Insulating Glass Manufacturer's Association/Insulating Glass Certification Council (SIGMA/IGCC)

F. American Architectural Manufacturer's Association (AAMA): 2605: Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions and Panels

G. National Fenestration Rating Council (NFRC):

1. 101: Procedure for Determining Fenestration Product thermal Properties

2. 200: Procedure for Determining Solar Heat Gain Coefficients at Normal Incidence

H. Window Covering Manufacturer's Association

1. A100.1: American National Standard for Safety of Corded Window Coverings Products

1.4 System Description

A. Design and Performance Requirements:

Product	Air Test to PSF	Water Tested to psf	Structural Tested to psf	Certification Rating	Design Pressure	Overall Width	Overall Height
Clad Ultimate Double Hung Next Generation (4040)	1.57	7.5	75	LC-PG50	DP50	45.25	87.5
Clad Ultimate Double Hung Next Generation (4044)	1.57	7.5	75	LC-PG50	DP50	45.25	95.5
Clad Ultimate Double Hung Next Generation (4450)	1.57	7.5	75	LC-PG50	DP50	49.25	107.5
Clad Ultimate Double Hung Next Generation (4450-HP)	1.57	9.75	97.5	LC-PG65	DP65	49.25	107.5
Clad Ultimate Double Hung Next Generation (5456)	1.57	6	60	LC-PG35	DP35	59.25	119.5
Clad Ultimate Double Hung Picture Next Generation (6668)	1.57	7.5	75	CW-PG50	DP50	67.25	69.5
Clad Ultimate Double Hung Picture Next Generation (60102)	1.57	7.5	75	CW-PG50	DP50	61.25	103.5
Clad Ultimate Double Hung Picture Next Generation (60102-HP)	1.57	9.75	97.5	CW-PG65	DP65	61.25	103.5
Clad Ultimate Double Hung Transom Next Generation (4020)	1.57	7.5	75	LC-PG50	DP50	45.25	27.6875
Clad Ultimate Double Hung Transom Next Generation (6820)	1.57	7.5	75	LC-PG50	DP50	73.25	27.6875

Clad Ultimate Double Hung Transom Next Generation (6820-HP)	1.57	9.75	97.5	LC-PG65	DP65	73.25	27.6875

A. Design and Performance Requirements: Continued

Clad Ultimate Double Hung Next Generation (4036 - IZ3)	1.57	9.75	97.5	LC-PG65	DP65	45.25	79.5
Clad Ultimate Double Hung Next Generation (4450 - IZ3)	1.57	9.75	97.5	LC-PG65	DP65	49.25	107.5
Clad Ultimate Double Hung Transom Next Generation (6820-IZ3)	1.57	9.75	97.5	LC-PG65	DP65	73.25	27.6875
Clad Ultimate Double Hung Picture Next Generation (60102-IZ3)	1.57	9.75	97.5	CW-PG65	DP65	61.25	102.5

1.5 Submittals

A. Shop Drawings: Submit shop drawings under provision of Section 01 33 00

B. Product Data: Submit catalog data under provision of Section 01 33 00

C. Samples:

1. Submit corner section under provision of section 01 33 00

2. Include glazing system, quality of construction and specified finish

D. Quality Control Submittals: Certificates: submit manufacturer's certification indicating compliance with specified performance and design requirement under provision of section 01 33 00

1.6 Quality Assurance

A. Requirements: consult local code for IBC [International Building Code] year and pertinent revisions for information on:

1. Egress, emergency escape and rescue requirements

2. Basement window requirements

3. Windows fall prevention and/or window opening control device requirements

1.7 Delivery

A. Comply with provisions of Division 1.

B. Deliver in original packaging and protect from weather

1.8 Storage and Handling

A. Prime and seal wood surfaces, including to be concealed by wall construction, if more than thirty (30) days will expire between delivery and installation

B. Store window units in an upright position in a clean and dry storage area above ground to protect from weather under provision of Division 1.

1.9 Warranty

A. Clear insulating glass with stainless steel spacers is warranted against seal failure caused by manufacturing defects and resulting in visible obstruction through the glass for twenty (20) years from the original date of purchase. Glass is warranted against stress cracks caused by manufacturing defects from ten (10) years from the original date of purchase.

B. Standard exterior aluminum cladding finish is warranted against manufacturing defects resulting in chalk, fade and loss of adhesion (peel) per the American Architectural Manufacturer's Association (AAMA) Specification 2605-11 Section 8.4 and 8.9 for twenty (20) years from the original date of purchase.

C. Factory-applied interior finish is warranted to be free from finish defects for a period of five (5) years from the original date of purchase.

D. Hardware and other non-glass components are warranted to be free from manufacturing defects for ten (10) years from the original date of purchase.

Part 2 Products

2.1 Manufactured Units

A. Description: Aluminum Clad Ultimate Double Hung – Next Generation (and related stationary units) as manufactured by Marvin Windows and Doors, Warroad, Minnesota.

2.2 Frame Description

A. Interior: Non Finger-Jointed Pine or finger-jointed core with non finger-jointed Pine veneer; optional non finger-jointed Douglas Fir or finger-jointed core with non finger-jointed Douglas Fir veneer; optional non finger-jointed White Oak or finger-jointed with non finger-jointed Oak veneer; non finger-jointed Cherry or finger-jointed core with Cherry veneer; non finger-jointed Mahogany or finger-jointed core with non finger-jointed Mahogany veneer; non finger-jointed Vertical Grain Douglas Fir or finger-jointed with non finger-jointed Vertical Grain Douglas Fir veneer

1. Kiln-dried to moisture content no greater than 12 percent at the time of fabrication

2. Water repellant, preservative treated in accordance with ANSI/WDMA I.S.4.

B. Frame exterior aluminum clad with 0.050” (1.3mm) thick extruded aluminum

C. Frame thickness: 1 25/32” (45mm) head and jambs

D. Frame depth: Frame depth had an overall 5 21/32” jamb (144mm). 4 9/16” (116mm) jamb depth from the nailing fin plane to the interior face of the frame for new construction.

E. Sill assembly including the sill liner: 2 7/32” (56mm)

2.3 Sash Description

A. Interior: Non Finger-Jointed Pine or finger-jointed core with non finger-jointed Pine veneer; optional non finger-jointed Douglas Fir or finger-jointed core with non finger-jointed Douglas Fir veneer; optional non finger-jointed White Oak or finger-jointed with non finger-jointed Oak veneer; non finger-jointed Cherry or finger-jointed core with Cherry veneer; non finger-jointed Mahogany or finger-jointed core with non finger-jointed Mahogany veneer; non finger-jointed Vertical Grain Douglas Fir or finger-jointed with non finger-jointed Vertical Grain Douglas Fir veneer

1. Kiln-dried to moisture content no greater than 12 percent at the time of fabrication

2. Water repellant preservative treated with accordance with WDMA I.S.4.

B. Sash exterior aluminum clad with 0.050” (1.3mm) thick extruded aluminum

C. Sash thickness: 1 3/4” (44mm)

D. Operable sash tilt to interior for cleaning or removal

E. Sash Options: Unequal Sash

F. Exterior Cope Profile: Putty

G. Interior Sash Sticking

1. Standard: Ogee

2. Optional: Square

2.4 Glazing

A. Select quality complying with ASTM C1036. Insulating glass SIGMA/IGCC certified to performance level CBA when tested in accordance with ASTM E2190.

B. Glazing method: Insulating glass

C. Glazing seal: Silicone bedding on interior and exterior

D. Glass Type: Clear, Low E1 with Argon.

2.5 Certified Mulling

A. Directional mull limits: 1 High (can be 2 or more units wide in an assembly)

1. Max mullion span is 71 ½" (1816mm); max tributary width 45 ¼" (1149mm)

2. CUDH NG to CUDH NG only

3. Certified to Design Pressure 50

B. Directional mull limits: 1 Wide (can be 2 or more units high in an assembly)

1. Max mullion span is 69 ¼" (1759mm); max tributary height 53 19/32" (1361mm)

2. CUDH NG over CUDH NG only

3. Certified to Design Pressure 50

C. Multiple Wide x Multiple High assemblies with 1" LVL

1. Max mullion span is 75 11/16" (1922mm); max tributary width is 45 1/4" (1149mm)

2. LVL must be in vertical mull

3. Certified to Design Pressure 50

D. Multiple Wide x Multiple High assemblies with 3/8" (10mm) MRF

1. Max mullion span is 83 11/16" (2125mm); max tributary width 45 1/4" (1149mm)

2. CUDH NG over CUDH NG only

3. Certified to Design Pressure 65

E. If any units have a lower design pressure the entire assembly will have the lowest design pressure of any unit or mull in the assembly.

2.6 Finish

A. Exterior: Aluminum clad. Fluoropolymer modified acrylic topcoat applied over primer. Meets AAMA 2605 requirements.

4. Custom colors: Color to exactly match approved site sample.

B. Interior Finish options:

1. Prime: Factory-applied enamel primer. Available on Pine product only.

2.7 Hardware

A. Multi-point locking system that provides locking, unlocking, venting, balancing, and tilting of the sash members

B. Lock Actuator Assembly

1. Material

a. Zinc die cast

b. Finish: Oil Rubbed Bronze or Satin Nickel

2. Design Feature and Components

a. To unlock unit, turn the handle 135°

b. When bottom sash is operated first, top sash remains locked

c. To open top sash, unlock bottom sash while leaving it in the closed position; once top sash is open, bottom may be opened

d. Each sash automatically locks independent of the other, therefore, one sash may be open while the other is locked in closed position

e. To tilt the bottom sash for wash mode, the bottom sash must be open; push the button on top of the lock handle and rotate the handle 180°

f. To tilt the top sash for wash mode, the bottom sash must be tilted and/or removed from the frame; lower the top sash to a good working height, retract the tilt latches on the top rail and tilt sash out of the frame

g. Custodial hardware colors: Satin Taupe, White, Bronze

h. Vent Mode: no vent mode

C. Latches

1. Bottom sash latch, top sash latch, top sash tilt latch

2. Latches accommodate locking/un-locking, travel of sash in frame, vent mode, and tilting into wash-mode

3. Color: Beige

D. Balance System (balance system determined by sash weight)

1. Block & tackle balances
2. Spiral balances
3. Hybrid spiral balances

E. Factory-applied Window Opening Control Device (WOCD) is a sash limiter that prevents the window opening more than 4” vertically. It meets ASTM F2090-10 specifications for window fall prevention standards. The system consists of two single action devices that allows for egress (when applied to an egress size window) by bypassing the 4” stop feature.

1. Retrofit requires new sashes
2. 2 WOCD’s applied to each double and single hung window and will be recessed into the stiles of the top sash
3. Default color matches lock handle
4. Strike plate mounted to the bottom sash check rail
5. Strike plate color to match weather strip

F. Sash Limiter

1. Bottom Sash Limiter: Replaces the vent mode feature when selected
    a. Available on all operator configurations, and StormPlus IZ3
    b. Selectable bottom sash locations, 4", 6" or 8" Net Clear Opening (NCO)
    c. Non-tilt hardware is default, and a sash removal tool is required in order to by-pass the Sash limiter for sash removal (tilt wash mode)
    d. Standard application is factory applied. Available for field retrofit applications.
    e. Color: Will align with the Interior Weather Strip Package selection
2. Top Sash Limiter
    a. Available on all operator configurations, with the exception Single Hung configurations. This includes StormPlus IZ3
    b. Standard application is factory applied. Available for field applications
    c. Color: Will align with the Interior Weather Strip Package selection

G. Exterior Sash Lugs – Standard Option

1. Standard Profile: Ogee

2. Available on Top Sash

3. Color: Available in all exterior clad color options

    a. Color shall be the same as top sash clad color

4. Standard application is factory applied. Available for field applications

2.8 Weather Strip

A. Operating units:

1. Jambs and header: Foam-filled bulb

2. Bottom rail and check rail: Hollow bulb

B. Stationary units:

1. Jambs: Foam for picture units; foam-filled bulb for transom unit

2. Header and bottom rail: Hollow bulb

2.9 Jamb Extension

A. Jamb extensions are available for various wall thickness factory-applied up to a 14” (356mm) wide

B. Finish: Match interior frame finish

2.10 Simulated Divided Lites (SDL)

A. 5/8” (16mm) wide, 7/8” (22mm) wide, 1 1/8” (29mm) wide, 1 3/4” (44mm) wide, 1 15/16” (49mm) wide, 2 13/32” (61mm) wide with or w/out internal spacer bar

B. Exterior muntins: 0.050” (1.3mm) thick extruded aluminum

C. Interior muntins: Pine, Mixed Grain Douglas Fir, White Oak, Cherry, Mahogany Vertical Grain Douglas Fir

D. Muntins adhere to glass with closed-cell copolymer acrylic foam tape

E. Exterior sticking: Putty

F. Interior Sticking:

1. Standard: Ogee

2. Optional: Square

G. Patterns: Rectangular, custom lite cut

H. Finish – exterior matches exterior aluminum clad colors, interior matches interior wood species and color

2.11 Grilles-Between-the–Glass (GBG)

A. 11/16” (17mm) white contoured aluminum bar

1. Exterior Colors: Exterior matches exterior aluminum clad colors. The exterior GBG color is designed to best match the Marvin aluminum clad color when used with Low E glass. The use of different types of glazing may alter the exterior GBG color appearance

2. Interior Colors: White is the default color. Optional colors: Bronze, Pebble Gray, Sierra, White

B. Optional flat aluminum spacer bar.

C. Pattern: Custom lite layout

2.12 Accessories and Trim

A. Installation Accessories:

1. Factory-installed vinyl nailing/drip cap

2. Installation brackets: 6 3/8” (162mm), 9 3/8” (283mm), 15 3/8” (390mm)

3. Masonry brackets: 6” (152mm), 10” (254mm)

B. Aluminum Extrusions:

1. Casing Profile: Brick Mould Casing (BMC), Flat Casing, Columbus Casing, Grayson Casing, Kinsley Casing, Ridgeland Casing, Stratton Casing, Thorton Casing, Potter Casing

2. Aluminum clad Extrusion: Frame Expander, Jamb Extender, Mullion Cover, Mullion Expander, Subsill, Subsill End Cap and Lineal Cap

3. Finish: Fluoropolymer modified acrylic topcoat applied over primer. Meets AAMA 2605 requirements

4. Available in all exterior aluminum clad colors

Part 3 Execution

3.1 Examination

A. Verification of Condition: Before installation, verify openings are plumb, square and of proper dimensions as required in Division 1. Report frame defects or unsuitable conditions to the General contractor before proceeding.

B. Acceptance of Condition: Beginning on installation confirms acceptance of existing conditions.

3.2 Installation

A. Comply with Division 1.

B. Assemble and install window/door unit(s) according to manufacturer’s instruction and reviewed shop drawing.

C. Install sealant and related backing materials at perimeter of unit or assembly in accordance with Section 07 92 05 Joint Sealants.

D. Install accessory items as required.

E. Use finish nails to apply wood trim and mouldings.

3.3 Cleaning

A. Remove visible labels and adhesive residue according to manufacturer's instruction.

B. Leave windows and glass in a clean condition. Final cleaning as required in Division 1.

3.4 Protecting Installed Construction

A. Comply with Division 1.

B. Protecting windows from damage by chemicals, solvents, paint or other construction operations that may cause damage.

End of Section

SECTION 08 55 00

BULLET RESISTANT WINDOWS AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Bullet Resistant Transaction Windows.

B. Bullet Resistant Transparencies.

C. Bullet Resistant Ballistic Counters.

D. Bullet Resistant Currency Trays.

1.2 RELATED SECTIONS

A. Section 06 10 00 - Rough Carpentry.

B. Section 08 70 00 - Hardware.

1.3 REFERENCES

A. ASTM A 666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar.

B. ASTM B 209/B 209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

C. NIJ Standard 0108.01 - (National Institute of Justice) Standard for Ballistic Resistant Protective Materials.

D. Underwriters Laboratories: UL 752 - Standard for Bullet Resisting Equipment.

1.4 PERFORMANCE REQUIREMENTS

A. Design, fabricate and install all partition materials specified in this section to meet or exceed the requirements of UL 752.

1.5 SUBMITTALS

A. Submit under provisions of Section 01 30 00.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Shop Drawings: Submit Manufacturer approved shop drawings detailing plan, section and elevation views as necessary to ensure proper field installation procedures. Coordinate locations with those listed in the Contract Drawings.

D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: All primary products specified in this section will be supplied by a single manufacturer with a minimum of ten (10) years experience.

B. Installer Qualifications: All products listed in this section are to be installed by a single installer with a minimum of five (5) years demonstrated experience in installing products of the same type and scope as specified.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of hazardous materials, and materials contaminated by hazardous materials, in accordance with requirements of local authorities having jurisdiction.

1.8 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.9 WARRANTY

A. At project closeout, provide to Owner or Owners Representative an executed copy of the manufacturer's standard limited warranty against manufacturing defect, outlining its terms, conditions, and exclusions from coverage.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Total Security Solutions, which is located at: 170 National Park Dr.; Fowlerville, MI 48836; Tel: 517-223-7807; Fax: 517-223-0805; Email: request info (info@tssbulletproof.com); Web:www.tssbulletproof.com

B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.

2.2 BULLET RESISTANT TRANSACTION MODULES

A. Construction:
1. Model: Interior - Natural Voice Transmission (NVR).
2. Rating: UL 752 Level 3.
3. Frame: Stainless Steel.
4. Counter Construction: Stainless Steel, No. 4 Brushed Finish.
5. Deal Tray: Stainless steel - recessed.

B. Glazing: As specified in Article 2.2 of this section. Meets Underwriters Laboratories Standard 752 for bullet resistance and/or tested by H.P. White Laboratory for specified bullet resistance.

1. Glazing Type: Laminated polycarbonate.

C. Voice Transmission:
1. System Type: Speak Hole and Backer.
2. Voice Port: Fabricated from Same Glazing material, Stainless Steel of same level of protection, Electronic speaker device.
a. Shape: Circle.

2.3 BULLET RESISTANT TRANSPARENCIES

A. Scope: Bullet-resistant barrier system which maintains an open environment. For use in applications where optical quality, clean ability and long term performance are important.

2.4 BALLISTIC COUNTERS

A. Scope: Countertop integrated into a complete bullet-resistant barrier system matching adjacent materials featured. Ballistic counters use layered, reinforced, structural polyester laminate (fiberglass).

B. Counter Surface:
1. Material: Stainless Steel.

2.5 CURRENCY TRAYS

A. Mounting: Recessed.
1. Dimensions: 16 inches by 10 inches by 1-1/2 inches (406mm x 254mm x 38mm).

B. Finish:
1. Finish: Brushed Stainless Steel.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 08 60 00

CURB MOUNT PLASTIC GLAZED UNIT SKYLIGHTS

PART 1-GENERAL

1.1 SUMMARY

A. This section includes the following:
    1. Curb-mounted plastic glazed unit skylights.
        a. DDCCM model circular double dome
B. Related Sections: The following sections contain requirements that relate to this section:
    1. Division Six Section “Rough Carpentry” for wood curbs and nailers.
    2. Division Seven Section “Roof Accessories” for curbs, roof hatches, and smoke vents.
    3. Division Seven Section “Flashing and Sheet Metal” for metal flashing for skylights.
C. Refer to roofing system sections for roofing accessories to be built into the roofing system to accommodate work of this section.

1.2 PERFORMANCE REQUIREMENTS

A. General: Provide unit skylights capable of withstanding loads as defined by the local codes having jurisdiction where units are to be installed without failure.

B. Units shall be tested to compliance with AAMA\WDMA\CSA\101\I.S.2\A440 as required by the International Building Code.

1.3 SUBMITTALS

A. Product Data Sheet: For each type of skylight specified, include details of construction and installation relative to applicable roofing materials.
B. Samples for Selection: Manufacturer’s color charts showing a full range of colors available for each type of skylight glazing and aluminum finish.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide Thermoformed domes fabricated from sheets identical to those tested for the following fire-test-response characteristics, per ASTM test method indicated below, by UL or other testing and inspecting agencies acceptable to authorities having jurisdiction. Identify plastic sheets with appropriate markings of applicable testing and inspecting organization.

    1. Self-Ignition Temperature: 651 deg F (343 deg C) or greater when tested per ASTM D 1929 on plastic sheets in the thickness intended for use.
    2. Smoke density of 75 or less when tested per ASTM D 2843 on plastic sheets in the thickness intended for use.
    3. Relative- Burning Characteristics: As follows, when tested per ASTM D 635:

a. Acrylic: Burning rate of 2.5 inches (64 mm) per minute or less when tested on plastic glazing indicated below with a nominal thickness of 0.060 inch (1.5 mm) or the thickness intended for use.

1.5 WARRANTY

A. General: Warranties specified in this section shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.
B. Skylight Warranty: Provide written warranty signed by manufacturer, agreeing to repair or replace work that exhibits defects in materials or workmanship and guaranteeing weather-tight and leak-free performance. “Defects” is defined as uncontrolled leakage of water and abnormal aging or deterioration.

1. Warranty Period: 2 years from date of Substantial Completion.

C. Plastic Warranty: Provide written warranty signed by manufacturer agreeing to repair or replace work that has or develops defects in the plastic. “Defects” is defined as abnormal aging or deterioration.

1. Warranty Period for Acrylic: 2 years from date of Substantial Completion against yellowing.

D. Finish Warranty: Provide written warranty signed by manufacturer agreeing to repair or replace work with finish defects. “Defects” is defined as peeling, chipping, chalking, fading, abnormal aging or deterioration, and failure to perform as required.

1. Warranty Period for Powder Coat Finish: 5 years from date of Substantial Completion.

PART 2- PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by Wasco Products, Inc., Wells, ME (800-388-0293).
B. Substitutions: Manufactures shall not be considered without prior approval in writing no later than ten (10) calendar days prior to bid. Substitute manufacturers must have been in the custom skylight business for not less than a period of 15 years and must submit to the Architect the following:

1. List of similar projects successfully completed within the last five years.
2. Proof of financial capability.
3. Complete details of proposed skylight.
4. Complete specifications for Architect’s review.

2.2 MATERIALS

A. Curb Frame: Bright white high performance PVC with Bronze cap stock and minimum effective external wall thickness of 0.060 inch (1.5mm). Provide integral condensation gutter system with corners fully welded for waterproof quality.

B. Retainer Frame: Extruded aluminum alloy 6063-T5 (min). ASTM B 221 (ASTM B 221 M) with minimum effective thickness of 0.060 inch (1.5 mm).
    1. Curbs: Minimum 1 ½" wide field built or pre-fabricated curb (By Others)
C. Plastic Sheets: Monolithic, formable, transparent (colorless, tinted or translucent white) sheets with good weather and impact resistant.
    1. Acrylic: ASTM D 4802, thermoformable, acrylic (methacrylate), Category C-2 or CC-2 Type UVA (formulated with ultraviolet absorber), with Finish 1 (smooth or polished), unless otherwise indicated.
D. Thermal Break: Fabricate skylight units with thermal chambered PVC frame.
E. Fasteners: Same metal as metals being fastened, or nonmagnetic stainless steel or other non-corrosive metal as recommended by manufacturer.

2.3 PLASTIC SKYLIGHT UNITS

A. General: Factory-assembled, curb-mounted unit consisting of plastic glazing, gasketing, inner frame designed to mount on separate curb, and self-contained flashing.
    b. Products: Provide Model DDCCM model circular double dome - meeting the requirements of this section.
B. Curb: Minimum 1 ½" wide field built or pre-fabricated (By Others).
C. Condensation Control: Fabricate skylight units with integral internal gutters to collect condensation.
D. Thermal Break: Fabricate skylight units with thermal chambered PVC.
E. Shape and Size: As indicated by model number.
F. Outer Glazing: Dome or pyramid thermoformed:
    a. Acrylic (Clear).
G. Inner Glazing: Dome or pyramid thermoformed:
    a. Acrylic (Clear).

2.4 FALL PROTECTION SAFETY SCREENS

A. Screen: Welded steel wire mesh, 4" x 4" spacing, wire diameter - .188" min. hot dipped galvanized finish on carbon steel or unfinished stainless steel.
B. Frame: Extruded aluminum alloy 6063-T5 (min). ASTM B 221 (ASTM B 221 M) with minimum effective thickness of 0.090 inch (2.2 mm).
    a. Frame includes a pocket for the edges of the screen material, and a downward leg for attachment to any vertical surface of a skylight retainer or frame.
C. Adjustment Bar: Extruded aluminum bar stock, ¼" x 1", alloy 6063-T5 (min). ASTM B 221 (ASTM B 221 M).
    a. Adjustment bar is slotted for width adjustment in the field.
D. Fasteners: Nonmagnetic stainless steel or other non-corrosive metal as recommended by manufacturer.

2.5 FABRICATION

A. Framing Components: As follows:
    1. Factory fit and assemble components.
    1. Fabricate components that, when assembled, will have accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion.
    2. Fabricate components to drain water passing joints and condensation to the exterior.
    3. Fabricate components to accommodate expansion, contraction, and field adjustment, and to provide for minimum clearance and shimming at skylight perimeter.

4. Fabricate components to ensure that glazing is thermally and physically isolated from framing members.
5. Fit and secure PVC frame joints by thermal welding.
6. Fit and secure aluminum retainer joints by heliarc welding.

2.6 ALUMINUM FINISHES

A. General: Comply with NAAMM “Metal Finishes Manual” recommendations for application and designations of finishes.
B. Finish designations prefixed by AA conform to the system for designations of aluminum finishes established by the Aluminum Association.
    1. Powder Coat High-Performance Architectural Coating: comply with AAMA 2604. Color: to be selected from manufacturer's standard color range.

PART 3- EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with installer present, for compliance with requirements for installation tolerances and other conditions affecting skylight performance.
    1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with manufacturer’s written instructions for protecting, handling, and installing skylight components.
B. Coordinate with installation of roof deck and other substrates to receive skylight units.
C. Coordinate with installation of vapor barriers, roof insulation, roofing, and flashing as required to assure that each element of the work performs properly and that combined elements are waterproof and weather tight. Anchor units securely to supporting structural substrates, adequate to withstand lateral and thermal stresses ass well as inward and outward loading pressures.
D. Counter Flashing: Where counter flashing is required as component of the skylight, install to provide an adequate waterproof overlap with roofing or roof flashing (as counter flashing). Seal with thick bead of mastic sealant, except where overlap is indicated to be left open for ventilation.

3.3 CLEANING AND PROTECTION

A. Clean exposed metal and plastic surfaces according to manufacturer’s instructions. Touch up damaged metal coatings.
B. Final cleaning by others.

END OF SECTION

SECTION 08 71 00
DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hardware for wood and hollow metal doors.

B. Hardware for fire-rated doors.

C. Lock cylinders for doors that hardware is specified in other sections.

D. Thresholds.

E. Weatherstripping, seals and door gaskets.

F. NOTE: ALLOWANCE DOES NOT INCLUDE ANY HARDWARE THAT IS SPECIFICALLY CALLED OUT IN DRAWINGS WITH MANUFACTURER PRODUCT MODEL NUMBER, ETC.

G. Gate locks.

1.02 RELATED REQUIREMENTS

A. Section 08 11 13 - HOLLOW METAL DOORS AND FRAMES.

B. Section 08 14 16 - FLUSH WOOD DOORS.

C. Section 08 43 13 - ALUMINUM STOREFRONT & DOORS: Hardware for doors in storefront, including:
   1. Integral weatherstripping.
   2. Installation of lock cylinders provided under this section.

D. Section 28 10 00 - Access Control : Electronic access control devices.

E. Section 28 31 00 - Fire Detection and Alarm: Electrical connection to activate door closers.

1.03 PRICE AND PAYMENT PROCEDURES

A. See Section 01 21 00 - Allowances, for allowances affecting this section.

B. NOTE: ALLOWANCE DOES NOT INCLUDE ANY HARDWARE THAT IS SPECIFICALLY CALLED OUT IN DRAWINGS WITH MANUFACTURER PRODUCT MODEL NUMBER, ETC.

1.04 REFERENCE STANDARDS

A. BHMA A156.2 - American National Standard for Bored and Preassembled Locks & Latches; 2011.

B. BHMA A156.3 - American National Standard for Exit Devices; 2014.

C. BHMA A156.4 - American National Standard for Door Controls - Closers; 2013.

D. BHMA A156.5 - American National Standard for Cylinders and Input Devices for Locks; 2014.

E. BHMA A156.8 - American National Standard for Door Controls - Overhead Stops and Holders; 2010.

F. BHMA A156.13 - American National Standard for Mortise Locks & Latches Series 1000; 2012.

G. BHMA A156.14 - American National Standard for Sliding and Folding Door Hardware; 2013.

H. BHMA A156.15 - American National Standard for Release Devices - Closer Holder, Electromagnetic and Electromechanical; 2011.

I. BHMA A156.18 - American National Standard for Materials and Finishes; 2012.

J. BHMA A156.21 - American National Standard for Thresholds; 2014.

K. BHMA A156.22 - American National Standard for Door Gasketing and Edge Seal Systems, Builders Hardware Manufacturers Association; 2012.

L. BHMA A156.23 - American National Standard for Electromagnetic Locks; 2010.

M. BHMA A156.31 - American National Standard for Electric Strikes and Frame Mounted Actuators; 2013.

N. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames; 2004.

O. DHI WDHS.3 - Recommended Locations for Architectural Hardware for Flush Wood Doors; 1993; also in WDHS-1/WDHS-5 Series, 1996.

P. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.

Q. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

R. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the manufacture, fabrication, and installation of products that door hardware will be installed upon.

B. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.

C. Convey Southern Mississippi Investment Company, Inc.'s keying requirements to manufacturers.

D. Preinstallation Meeting: Convene a preinstallation meeting one week prior to commencing work of this section; require attendance by all affected installers.

E. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.06 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:
   1. Submit manufacturer's parts lists and templates. As soon as installation schedules are returned without exception, furnish required templat information to the various manufacturers for fabrication purposes.
   2. Catalogs and Brochures: Submit cuts of the items proposed for use.
   3. Schedules: Organize in manner directed; do not proceed until directions are received.

C. Hardware Schedule: Detailed listing of each item of hardware to be installed on each door. Use door numbering scheme as included in the Contract Documents. Identify electrically operated items and include power requirements.

D. Keying Schedule: Submit for approval of Southern Mississippi Investment Company, Inc. and the City of Hattiesburg.

E. Samples: Prior to preparation of hardware schedule:
   1. Submit one (1) sample of hinge, latchset, lockset, and closer illustrating style, color, and finish.
   2. Samples will be returned to supplier.

F. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

G. Keys: Deliver with identifying tags to Southern Mississippi Investment Company, Inc. by security shipment direct from hardware supplier.

H. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in Southern Mississippi Investment Company, Inc.'s name and registered with manufacturer.

I. Project Record Documents: Record actual locations of concealed equipment, services, and conduit.

J. Maintenance Materials and Tools: Furnish the following for Southern Mississippi Investment Company, Inc.'s use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Lock Cylinders: One for each master keyed group.

3. Tools: One set of all special wrenches or tools applicable to each different or special hardware component, whether supplied by the hardware component manufacturer or not.

1.07 QUALITY ASSURANCE

A. Standards for Fire-Rated Doors: Maintain one copy of each referenced standard on site, for use by Albert & McCleskey Associates Architects and General Contractor.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

C. Hardware Supplier Qualifications: Company specializing in supplying commercial door hardware with 5 years of experience.

D. Hardware Supplier Personnel: Employ an Architectural Hardware Consultant (AHC) to assist in the work of this section.

1.08 PRE-INSTALLATION MEETING

A. Convene one week prior to commencing work of this section.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Package hardware items individually; label and identify each package with door opening code to match hardware schedule.

1.10 COORDINATION

A. Coordinate the work with other directly affected sections involving manufacture or fabrication of internal reinforcement for door hardware.

B. Furnish templates for door and frame preparation.

C. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

D. Coordinate Southern Mississippi Investment Company, Inc.'s keying requirements during the course of the Work.

1.11 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide five year warranty for door closers.

C. Defects shall included, but not limited to, the following:
   1. Faulty or inadequate design.
   2. Improper fabrication or assembly.

D. Make necessary repairs promptly in the event of a failure during the guarantee period.

1.12 MAINTENANCE PRODUCTS

A. Provide special wrenches and tools applicable to each different or special hardware component.

B. Provide maintenance tools and accessories supplied by hardware component manufacturer.

PART 2 PRODUCTS

2.01 DOOR HARDWARE - GENERAL

A. Provide hardware specified or required to make doors fully functional, compliant with applicable codes, and secure to the extent indicated.

B. Provide items of a single type of the same model by the same manufacturer.

C. Provide products that comply with the following:
   1. Applicable provisions of federal, state, and local codes.
   2. Fire-Rated Doors: NFPA 80.
   3. Hardware on Fire-Rated Doors, Except Hinges: Listed and classified by UL as suitable for the purpose specified and indicated.
   4. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.

D. Function: Lock and latch function numbers and descriptions of manufactures series as listed in hardware schedule.

E. Electrically Operated and/or Controlled Hardware: Provide all power supplies, power transfer hinges, relays, and interfaces required for proper operation; provide wiring between hardware and control components and to building power connection.

F. Finishes: Provide door hardware of the same finish unless otherwise indicated.
   1. Primary Finish: Satin chrome plated over nickel on brass or bronze, 626 (approx US26D).
   2. Secondary Finish: Satin chrome plated over nickel on brass or bronze, 626 (approx US26D).
      a. Use secondary finish in kitchens, bathrooms, and other spaces containing chrome or stainless steel finished appliances, fittings, and equipment; provide primary finish on one side of door and secondary finish on other side if necessary.
   3. Finish Definitions: BHMA A156.18.
   4. Exceptions:
      a. Where base metal is specified to be different, provide finish that is an appearance equivalent according to BHMA A156.18.
      b. Hinges for Fire-Rated Doors: Steel base metal with painted finish.
      c. Door Closer Covers and Arms: Color to be selected by Albert & McCleskey Associates Architects from manufacturer's standard colors.

2.02 LOCKS AND LATCHES

A. Locks: Provide a lock for every door, unless specifically indicated as not requiring locking.
   1. If no hardware set is indicated for a swinging door provide an office lockset.
   2. Trim: Provide lever handle or pull trim on outside of all locks unless specifically stated to have no outside trim.
   3. Lock Cylinders: Provide key access on outside of all locks unless specifically stated to have no locking or no outside trim.

B. Lock Cylinders: Manufacturer’s standard tumbler type, six-pin standard core.
   1. Provide cams and/or tailpieces as required for locking devices required.

C. Keying: Grand master keyed.

D. Latches: Provide a latch for every door that is not required to lock, unless specifically indicated "push/pull" or "not required to latch".

2.03 HINGES

A. Hinges: Provide hinges on every swinging door.
   1. Provide five-knuckle full mortise butt hinges unless otherwise indicated.
   2. Provide ball-bearing hinges at all doors having closers.
   3. Provide hinges in the quantities indicated.
   4. Provide non-removable pins on exterior outswinging doors.
   5. Where electrified hardware is mounted in door leaf, provide power transfer hinges.

2.04 CYLINDRICAL LOCKSETS

A. Locking Functions: As defined in BHMA A156.2, and as follows.
   1. Hardware to perform as required by the intent of the design. Owner and Architect to review the proposed hardware and its intended operation by the Architectural Hardware Consultant before approving the hardware.

2.05 MORTISE LOCKSETS

A. Locking Functions: As defined in BHMA A156.13, and as follows:
   1. Hardware to perform as required by the intent of the design. Owner and Architect to review the proposed hardware and its intended operation by the Architectural Hardware Consultant before approving the hardware.

2.06 AUXILIARY LOCKS (DEADBOLTS)

A. Locking Functions: As defined in BHMA A156.5, and as follows:
   1. Hardware to perform as required by the intent of the design. Owner and Architect to review the proposed hardware and its intended operation by the Architectural Hardware Consultant before approving the hardware.

2.07 FLUSHBOLTS AND COORDINATORS

A. Flushbolts: Lever extension bolts in leading edge of door, one bolt into floor, one bolt into top of frame.
   1. Pairs of Swing Doors: At inactive leaves, provide flush bolts of type as required to comply with code.
   2. Floor Bolts: Provide dustproof strike except at metal thresholds.
   3. Hardware to perform as required by the intent of the design. Owner and Architect to review the proposed hardware and its intended operation by the Architectural Hardware Consultant before approving the hardware.

2.08 MAGNETIC LOCKS

A. Magnetic Locks - Basis of Design: _____.

B. Magnetic Locks: Complying with BHMA A156.23 - Grade 1, and UL 10C listed for fire doors.
   1. Hardware to perform as required by the intent of the design. Owner and Architect to review the proposed hardware and its intended operation by the Architectural Hardware Consultant before approving the hardware.

2.09 ELECTRIC STRIKES

A. Electric Strikes: Complying with BHMA A156.31 and UL listed as a Burglary-Resistant Electric Door Strike; style to suit locks.

2.10 EXIT DEVICES

A. Locking Functions: Functions as defined in BHMA A156.3, and as follows:
   1. Hardware to perform as required by the intent of the design. Owner and Architect to review the proposed hardware and its intended operation by the Architectural Hardware Consultant before approving the hardware.

2.11 CLOSERS

A. Closers: Complying with BHMA A156.4.
   1. Provide surface-mounted, door-mounted closers unless otherwise indicated.
   2. Provide a door closer on every exterior door.
   3. Provide a door closer on every fire- and smoke-rated door. Spring hinges are not an acceptable self-closing device unless specifically so indicated.
   4. On pairs of swinging doors, if an overlapping astragal is present, provide coordinator to ensure the leaves close in proper order.
   5. At corridors, locate door-mounted closer on room side of door.
   6. At outswinging exterior doors, mount closer in inside of door.
   7. Hardware to perform as required by the intent of the design. Owner and Architect to review the proposed hardware and its intended operation by the Architectural Hardware Consultant before approving the hardware.

2.12 STOPS AND HOLDERS

A. Stops: Complying with BHMA A156.8; provide a stop for every swinging door, unless otherwise indicated.
   1. Provide wall stops, unless otherwise indicated.
   2. If wall stops are not practical, due to configuration of room or furnishings, provide overhead stop.
   3. Stop is not required if positive stop feature is specified for door closer; positive stop feature of door closer is not an acceptable substitute for a stop unless specifically so stated.

4. Hardware to perform as required by the intent of the design. Owner and Architect to review the proposed hardware and its intended operation by the Architectural Hardware Consultant before approving the hardware.

B. Magnetic Holder/Releases: Complying with BHMA A156.15; fail safe; doors release to close automatically when electrical current is interrupted; holding force: 25 to 40 pounds-force.

2.13 GASKETING AND THRESHOLDS

A. Gaskets: Complying with BHMA A156.22.
1. On each door in smoke partition, provide smoke gaskets; top, sides, and meeting stile of pairs. If fire/smoke partitions are not indicated on drawings, provide smoke gaskets on each door identified as a "smoke door" and 20-minute rated fire doors.
2. On wood doors with fire rating more than 20-minutes, provide frame-applied intumescent gaskets.
3. On each exterior door, provide weatherstripping gaskets, unless otherwise indicated; top, sides, and meeting stiles of pairs.
   a. Where exterior door is also required to have fire or smoke rating, provide gaskets functioning as both smoke and weather seals.
4. On each exterior door, provide door bottom sweep, unless otherwise indicated.
5. On doors indicated as "sound-rated", "acoustical", or with an STC rating, provide sound-rated gaskets and automatic door bottom; make gaskets completely continuous, do not cut or notch gaskets for installation.

B. Thresholds: Complying with BHMA A156.21.
1. At each exterior door, provide a threshold unless otherwise indicated.

C. Fasteners At Exterior Locations: Non-corroding.

2.14 SLIDING AND BIFOLDING DOOR HARDWARE

A. Sliding and Bifolding Door Hardware: Complying with BHMA A156.14.

B. Pocket Doors: Provide pocket door kit, including header assembly, split studs, hangers, door hanger plates, bumper, guides, floor plate, and end bracket.

2.15 PROTECTION PLATES AND ARCHITECTURAL TRIM

A. Protection Plates:
1. Kickplate: Provide on push side of every door with closer, except aluminum storefront and glass entry doors.
2. Hardware to perform as required by the intent of the design. Owner and Architect to review the proposed hardware and its intended operation by the Architectural Hardware Consultant before approving the hardware.

B. Drip Guard: Provide projecting drip guard over all exterior doors unless they are under a projecting roof or canopy.

2.16 KEY CONTROLS

A. Facility Manager's Key Cabinet: Sheet steel construction, piano hinged door with key lock.
1. Mounting: Wall-mounted.
2. Capacity: Actual quantity of keys, plus 25 percent additional capacity.
3. Horizontal metal hook strips with replaceable labels covered with clear plastic.
4. Size key hooks to hold 6 keys each.
5. Finish: Baked enamel, manufacturer's standard color.
6. Key cabinet lock to building keying system.

2.17 FIRE DEPARTMENT LOCK BOX

A. Fire Department Lock Box: Heavy-duty, surface mounted, solid stainless-steel box with hinged door and interior gasket seal; single drill resistant lock with dust covers and tamper alarm.
1. Capacity: Holds 10 keys.
2. Finish: Manufacturer's standard silver.

3. Manufacturers - Fire Department Lock Box:
   a. Knox Company; Knox-Box Rapid Entry System: www.knoxbox.com.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that doors and frames are ready to receive work; labeled, fire-rated doors and frames are present and properly installed, and dimensions are as indicated on shop drawings.

B. Verify that electric power is available to power operated devices and of the correct characteristics.

3.02 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and applicable codes.

B. Use templates provided by hardware item manufacturer.

C. Install hardware on fire-rated doors and frames in accordance with code and NFPA 80.

D. Mounting heights for hardware from finished floor to center line of hardware item.
   1. For steel doors and frames: Comply with DHI "Recommended Locations for Architectural Hardware for Steel Doors and Frames."
   2. For Wood Doors: Comply with DHI "Recommended Locations for Architectural Hardware for Wood Flush Doors."

E. Set exterior door thresholds with full-width bead of elastomeric sealant on each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel countersunk screws.

3.03 FIELD QUALITY CONTROL

A. Provide an Architectural Hardware Consultant to inspect installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer's instructions and as specified.

3.04 ADJUSTING

A. Adjust work under provisions of Section 01 70 00.

B. Adjust hardware for smooth operation.

3.05 CLEANING

A. Clean adjacent surfaces soiled by hardware installation. Clean finished hardware per manufacturer's instructions after final adjustments has been made. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.

3.06 PROTECTION

A. Protect finished Work under provisions of Section 01 70 00.

B. Do not permit adjacent work to damage hardware or finish.

3.07 SCHEDULE - FOLLOWING THIS SECTION IS THE HARDWARE SCHEDULE.

END OF SECTION

SECTION 08 71 13

AUTOMATIC DOOR OPERATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following types of automatic door operators:
   1. Exterior and interior, automatic door operators, full energy, with visible header mounting.
   2. Automatic door operators shall be configured for doors as follows:
      a. Simultaneous pairs.
      b. Single doors.
      c. One-way traffic.

B. Related Sections:
   1. Division 8 Section “Doors and Frames” for entrances furnished and installed separately in Division 8 Section.
   2. Division 8 Section "Aluminum-Framed Entrances and Storefronts" for entrances furnished and installed separately in Division 8 Section.
   3. Division 8 Section "Door Hardware" for hardware to the extent not specified in this Section.
   4. Division 26 Sections for electrical connections provided separately including conduit and wiring for power to, and control of, automatic door operators.

1.3 REFERENCES

A. General: Standards listed by reference, including revisions by issuing authority, form a part of this specification section to extent indicated. Standards listed are identified by issuing authority, authority abbreviation, designation number, title or other designation established by issuing authority. Standards subsequently referenced herein are referred to by issuing authority abbreviation and standard designation.

B. Underwriters Laboratories (UL):
   1. UL 325 – Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems.
   2. UL 10C – Positive Pressure Fire Tests of Door Assemblies

C. American National Standards Institute (ANSI)/Builders’ Hardware Manufacturers Association (BHMA):
   1. ANSI/BHMA A156.10: Standard for Power Operated Pedestrian Doors.

D. American Society for Testing and Materials (ASTM):
   1. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
   2. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

E. American Association of Automatic Door Manufacturers (AAADM):

F. National Fire Protection Association (NFPA):
   1. NFPA 101 – Life Safety Code.
   2. NFPA 70 – National Electric Code.

G. International Code Council (ICC):
   1. IBC: International Building Code

H. Building Officials and Code Administrators International (BOCA), 1999:

I. International Standards Organization (ISO):
   1. ISO 9001 - Standard for Manufacturing Quality Management Systems

J. National Association of Architectural Metal Manufacturers (NAAMM):
   1. Metal Finishes Manual for Architectural and Metal Products.

K. American Architectural Manufacturers Association (AAMA):
   1. AAMA 607.1 - Clear Anodic Finishes for Architectural Aluminum.
   2. AAMA 611 Voluntary Specification for Anodized Architectural Aluminum.

1.4 DEFINITIONS

A. Activation Device: Device that, when actuated, sends an electrical signal to the door operator to open the door.

B. Safety Device: Device that prevents a door from opening or closing, as appropriate.

1.5 PERFORMANCE REQUIREMENTS

A. General: Provide automatic door operators capable of withstanding loads and thermal movements based on testing manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Operating Range: Minus 30 deg F (Minus 34 deg C) to 130 deg F (54 deg C).

C. Opening-Force Requirements for Egress Doors: In the event power failure to the operator, swinging automatic entrance doors shall open with a manual force, not to exceed 30 lbf (133 N) applied at 1” (25 mm) form the latch edge of the door.

D. Break Away Requirements: Automatic door operators shall breakaway with no more than 30 lbf (133 N) applied at 1” (25 mm) from the latch edge of the door.

1.6 SUBMITTALS

A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 01 submittal procedures.

B. Shop Drawings: Include plans, elevations, sections, details, hardware mounting heights, and attachments to other work. Indicate wiring for electrical supply.

C. Color Samples for selection of factory-applied color finishes.

D. Closeout Submittals: Provide the following with project close-out documents.
   1. Owner’s Manual.
   2. Warranties.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative, with certificate issued by AAADM, who is trained for installation and maintenance of units required for this Project.

B. Manufacturer Qualifications: A qualified manufacturer with a manufacturing facility certified under ISO 9001.

C. Manufacturer shall have in place a national service dispatch center providing 24 hours a day, 7 days a week, emergency call back service.

D. Certifications: Automatic door operators shall be certified by the manufacturer to meet performance design criteria in accordance with the following standards:
1. ANSI/BHMA A156.10.
2. NFPA 101.
3. UL 325 Listed.
4. UL 10C Listed.
5. IBC 2009
6. BOCA

E. Source Limitations: Obtain automatic door operators through one source from a single manufacturer.

F. Product Options: Drawings indicate sizes, profiles, and dimensional requirements of swinging doors equipped with automatic door operators and are based on the specific system indicated. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

G. Power Operated Door Standard: ANSI/BHMA A156.10.

H. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

I. Emergency-Exit Door Requirements: Comply with requirements of authorities having jurisdiction for swinging automatic entrance doors serving as a required means of egress.

1.8 PROJECT CONDITIONS

A. Field Measurements: General Contractor shall verify openings to receive automatic door operators by field measurements before fabrication and indicate measurements on Shop Drawings.

B. Mounting Surfaces: General Contractor shall verify all surfaces to be plumb, straight and secure; substrates to be of proper dimension and material.

C. Other trades: General Contractor Advise of any inadequate conditions or equipment.

1.9 COORDINATION

A. Templates: Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing automatic door operators to comply with indicated requirements.

B. Electrical System Roughing-in: Coordinate layout and installation of automatic door operators with connections to, power supplies, remote activation devices, and electric door latching hardware.

C. System Integration: Integrate automatic door operators with other systems as required for a complete working installation. Where required for proper operation, provide a time delay relay to signal automatic door operator to activate only after electric lock system is released.

1.10 WARRANTY

A. Automatic door operators shall be free of defects in material and workmanship for a period of one (1) year from the date of substantial completion.

B. During the warranty period the Owner shall engage a factory-trained technician to perform service and affect repairs. A safety inspection shall be performed after each adjustment or repair and a completed inspection form shall be submitted to the Owner.

C. During the warranty period all warranty work, including but not limited to emergency service, shall be performed during normal working hours.

PART 2 - PRODUCTS

2.1 AUTOMATIC DOOR OPERATORS

A. Manufacturer: Stanley Access Technologies; Magic-Force™ Series automatic door operator with Sentrex™ door mounted safety system.

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
   1. Headers: 6063-T6.
   2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
   3. Sheet and Plate: ASTM B 209.

2.3 COMPONENTS

A. Header Case: Header case shall not exceed 6” (152 mm) square in section and shall be fabricated from extruded aluminum with structurally integrated end caps, designed to conceal door operators and controls. The operator shall be sealed against dust, dirt, and corrosion within the header case. Access to the operator and electronic control box shall be provided by a full-length removable cover, edge rabbetted to the header to ensure a flush fit. Removable cover shall be secured to prevent unauthorized access.

B. Door Arms: A combination of door arms and linkage shall provide positive control of door through entire swing; units shall permit use of butt hung, center pivot, and offset pivot-hung doors.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials.

D. Signage: Provide signage in accordance with ANSI/BHMA A156.10.

2.4 SWINGING DOOR OPERATORS

A. General: Provide door operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated.

B. Electromechanical Operators: Self-contained unit powered by a minimum 3/16 horsepower, permanent-magnet DC motor; through a high torque reduction gear system.
   1. Operation: Power opening and spring closing.
   2. Operator Type: Full energy.
   3. Handing: Non-handed; no tools required to change handing.
   4. Capacity: Rated for door panels weighing up to 350 lb (159 kg).
   5. Mounting: Visible
   6. Features:
      a. Adjustable opening and closing speeds.
      b. Adjustable opening and closing force.
      c. Adjustable back-check.
      d. Adjustable hold-open time between 0 and 30 seconds.
      e. Reverse on obstruction.
      f. Closed loop speed control with active braking and acceleration.
      g. Variable obstruction recycle time delay.
      h. Optional Switch to open/Switch to close operation.
      i. Optional push to activate operation.
      j. When operators are provided in pairs, adjustable features are independently adjustable for each operator.

C. Field Adjustable Spring Closing Operation: The operator shall close the door by spring energy employing the motor, as a dynamic brake to provide closing speed control. The closing spring shall be a helical compression spring, adjustable for positive closing action. The spring shall be adjustable, without removing the operator from the header, to accommodate a wide range of field conditions.

D. Independent Adjustable Closing and Latching Speed Control: The operator shall employ a rheostat module to allow for independent field adjustment of closing and latching speeds using the motor as a dynamic brake.

E. Field Adjustable Open Stop: The operator shall provide a field adjustable open stop to accommodate opening angles from 80 to 135 degrees without the need for additional components.

F. Consistent Cycle: The operator shall deliver an even, consistent open force across the entire transition from door fully closed to door fully open. Additionally, the range of the force shall be field adjustable to accommodate a wide range of on-site conditions.

G. Quiet Performance: The operator shall be designed to output audible noise ratios less than or equal to 50dba.

H. Manual Use: The operator shall function as a manual door closer in the direction of swing with or without electrical power. The operator shall deliver an even, consistent open force across the entire transition from door fully closed to door fully open.

I. Electrical service to door operators shall be provided under Division 16 Electrical. Minimum service to be 120 VAC, 5 amps.

2.5 ELECTRICAL CONTROLS

A. Electrical Control System: Electrical control system shall include a microprocessor controller and position encoder. The encoder shall monitor revolutions of the operator shaft and send signals to microprocessor controller to define door position. Systems utilizing external magnets and magnetic switches are not acceptable.

B. Performance Data: The microprocessor shall collect and store performance data as follows:
   1. Counter: A non-resettable counter to track operating cycles.
   2. Event Reporting: Unit shall include event and error recording including number of occurrences of events and errors, and cycle count of most recent events and errors.
   3. LED Display: Display presenting the current operating state of the controller.

C. Controller Protection: The microprocessor controller shall incorporate the following features to ensure trouble free operation:
   1. Automatic Reset Upon Power Up.
   2. Main Fuse Protection.
   3. Electronic Surge Protection.
   4. Internal Power Supply Protection.
   5. Resetable sensor supply fuse protection.
   6. Motor Protection, over-current protection.

D. Soft Start/Stop: A “soft-start” “soft-stop” motor driving circuit shall be provided for smooth normal opening and recycling.

E. Obstruction Recycle: Provide system to recycle the swinging panels when an obstruction is encountered during the closing cycle.

F. Programmable Controller: Microprocessor controller shall be programmable and shall be designed for connection to a local configuration tool. Local configuration tool shall be a software driven handheld interface. The following parameters may be adjusted via the configuration tool.
   1. Operating speeds and forces as required to meet ANSI/BHMA A156.10.
   2. Adjustable and variable features as specified in 2.4, B.
   3. Firmware update.
   4. Trouble Shooting
      a. I/O Status.
      b. Electrical component monitoring including parameter summary.
   5. Software for local configuration tool shall be available as a free download from the sliding automatic entrance manufacturer’s internet site. Software shall be compatible with the following operating system platforms: Palm®, Android®, and Windows Mobile®.

G. Emergency Breakout Switch: A cam actuated emergency breakout switch shall be provided to disconnect power to the motor when an in-swinging door is manually pushed in the emergency out direction. The operator will then automatically reset and power will be resumed.

H. Control Switch: Automatic door operators shall be equipped with a three position function switch to control the operation of the door. Control switch shall provide three modes of operation, Automatic, Off, and Hold-Open.

I. Power Switch: Automatic door operators shall be equipped with a two position On/Off switch to control power to the door.

2.6 ACTIVATION AND SAFETY DEVICES

A. Push Plates: Provide 4 ½ inch (114 mm) square push plates with UL recognized SPDT switch. Face plates and mounting studs shall be stainless steel. Face plates shall be engraved with the international symbol for accessibility and “Push To Open”. Push plates shall be wall mounted in single or double gang electrical boxes and hardwired to door operator controls.

B. Presence Detection: Provide door mounted presence detection system designed to sense people in the swing zone prior to activation, and during operation of, swinging automatic entrances. The complete presence detection system shall meet the requirements of ANSI A156.10 and the following requirements:
   1. Door Mounted Presence Detection Sensors: Door mounted presence detection sensors shall be infrared type designed specifically to sense multi-dimensional zones for detection of moving or stationary objects in the swing zone of a swinging door leaf. Sensor housings shall be high impact shock resistant with tinted lenses suitable for door mounting. Door mounted presence detection sensors shall not be affected by ultrasonic, ambient light or radio frequencies, within the vicinity of the swing door.
   2. Presence detection system shall be equal to or better than Stanley Access Technologies Sentrex3 system.
   3. Secondary Activation: Where full energy doors are specified with activation by knowing act devices; including but not limited to push plates and card readers, provide a secondary activation sensor in accordance with ANSI A156.10.

C. Guide Rails: Guide rails shall be provided manufactured from 1/2 inch x 1 1/2 inch (12 mm x 38 mm) T-6063 alloy aluminum. Length and height shall be as required for compliance with ANSI A156.10. Finish shall match finish of automatic door operator headers.

2.7 ALUMINUM FINISHES

A. General: Comply with NAAMM Metal Finishes Manual for Architectural and Metal Products for recommendations for applying and designing finishes. Finish designations prefixed by AA comply with system established by Aluminum Association for designing finishes.

B. Class II, Clear Anodic Finish: AA-M12C22A31 Mechanical Finish: as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.40 mils minimum complying with AAMA 611-98, and the following:
   1. AAMA 607.1
   2. Applicator must be fully compliant with all applicable environmental regulations and permits, including wastewater and heavy metal discharge.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances, header support, and other conditions affecting performance of swinging automatic entrance doors. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Do not install damaged components. Fit joints to produce hairline joints free of burrs and distortion. Rigidly secure non-movement joints.

B. Mounting: Install automatic door operators/headers plumb and true in alignment with established lines and grades. Anchor securely in place.
   1. Install surface-mounted hardware using concealed fasteners to greatest extent possible.
   2. Set headers, arms and linkages level and true to location with anchorage for permanent support.

C. Door Operators: Connect door operators to electrical power distribution system as specified in Division 16 Sections.

3.3 FIELD QUALITY CONTROL

A. Testing Services: Factory Trained Installer shall test and inspect each swinging automatic entrance door to determine compliance of installed systems with applicable ANSI standards.

3.4 ADJUSTING

A. Adjust door operators, controls, and hardware for smooth and safe operation, for tight closure, and complying with requirements in ANSI/BHMA A156.10 by AAADM Certified Technician.

3.5 CLEANING AND PROTECTION

A. Clean surfaces promptly after installation. Remove excess sealant compounds, dirt, and other substances. Repair damaged finish to match original finish.

END OF SECTION 08 71 13

SECTION 08 80 00
GLAZING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Glass.

B. Laminated Glass for Floor installation and attachment components.

C. Glazing compounds and accessories.

D. See Section 08 85 00 for Fire-resistant rated glazing.

1.2 RELATED REQUIREMENTS

A. Section 07 90 05 - Joint Sealers: Sealant and back-up material.

B. Section 08 11 13 - HOLLOW METAL DOORS AND FRAMES: Glazed lites in doors and borrowed lites.

C. Section 08 14 16 - FLUSH WOOD DOORS: Glazed lites in doors.

D. Section 08 43 13 - ALUMINUM STOREFRONT & DOORS: Glazing furnished by storefront manufacturer.

E. Section 08 44 13 - ALUMINUM CURTAIN WALL: Glazing furnished by wall manufacturer.

1.3 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; current edition.

B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.

C. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.

D. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2014.

E. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2013.

F. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2012a.

G. GANA (SM) - GANA Sealant Manual; 2008.

H. GANA (LGRM) - Laminated Glazing Reference Manual; 2009.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.5 PERFORMANCE REQUIREMENTS

A. Provide glass and glazing materials for continuity of building enclosure vapor retarder and air barrier:
   1. In conjunction with vapor retarder and joint sealer materials described in other sections.
   2. To utilize the inner pane of multiple pane sealed units for the continuity of the air barrier and vapor retarder seal.
   3. To maintain a continuous air barrier and vapor retarder throughout the glazed assembly from glass pane to heel bead of glazing sealant.

B. Select type and thickness of exterior glass to withstand dead loads and wind loads acting normal to plane of glass at design pressures calculated in accordance with IBC 2012 code.
   1. Use the procedure specified in ASTM E 1300 to determine glass type and thickness.
   2. Limit glass deflection to 1/200 or flexure limit of glass, whichever is less, with full recovery of glazing materials.
   3. Thicknesses listed are minimum.

C. All Work associated with the Laminated Floor Glass (LFG) is to be designed by a Professional Engineer licensed in the State of Mississippi with at least 5 years documented commercial installations of Laminated Floor Glass assemblies and apply all of the latest codes and regulations regarding all aspects of Laminated Floor Glass in a floor assembly application. This includes but is not limited to manufacturing technology, visual perception hazards (such as tripping), etc. All work associated with the Laminated Floor Glass is to be reviewed by the Laminated Glass supplier with qualifications listed below. Laminated Glass supplier must submit signed letter on company letterhead stating that the design meets all applicable standards to Laminated Glass.

1.6 SUBMITTALS

A. See Section 01 33 00 - Administrative Requirements, for submittal procedures.

B. Product Data on Glass Types: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.

C. Product Data on Glazing Compounds: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.

D. Samples: Submit one samples 12 by 12 inch in size of glass and plastic units, showing coloration and design.

E. Certificates: Certify that products meet or exceed specified requirements.

F. Professional Engineer's documented qualifications listed below.

G. Installer's documented qualifications listed below.

H. Laminated Glass supplier must submit signed letter on company letterhead stating that the design meets all applicable standards to Laminated Glass.

I. Manufacturer's Certificate: Certify that insulated glass meets or exceeds specified requirements.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with GANA Glazing Manual and FGMA Sealant Manual for glazing installation methods.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

C. Laminated Glass Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years documented experience and a minimum of 5 high traffic commercial installations using all products including Laminated Floor Glass.

D. All work associated with the Laminated Floor Glass is to be designed, reviewed and stamped by a Professional Engineer licensed in the State of Mississippi with at least 5 documented commercial installations of Laminated Floor Glass.

E. Laminated Glass Supplier Qualifications: Company specializing in performing the work of this section with minimum 5 years documented experience and a minimum of 5 high traffic commercial installations using all products including Laminated Floor Glass.

F. Laminated Glass Manufacturer's Qualifications: Company specializing in performing the work of this section with minimum 5 years documented experience and a minimum of 5 high traffic commercial installations using all products including Laminated Floor Glass.

1.8 MOCK-UP

A. Provide mock-up of Laminated Glass Floor installation and stair tread including glass.

B. Locate where directed by Architect.

C. Mock-up may remain as part of the Work.

1.9 PRE-INSTALLATION MEETING

A. Convene one week before starting work of this section.

1.10 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 50 degrees F.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.11 WARRANTY

A. See Section 01 77 00, for additional warranty requirements.

B. Sealed Insulating Glass Units: Provide a five (5) year warranty to include coverage for seal failure, interpane dusting or misting, including replacement of failed units.

C. Laminated Glass: Provide a five (5) year warranty to include coverage for delamination, including replacement of failed units.

PART 2 PRODUCTS

2.1 BASIS OF DESIGN - INSULATING GLASS UNITS

A. Type A - Sealed Insulating Glass Units: Vision glazing, with Low-E coating.
   1. Application: Exterior Glass inserts in curtain wall and storefront installations intended to be "clear glass" and is designated in the drawings as such..
   2. Between-lite space filled with air.
   3. Thermal Resistance (U-Value): 0.29, nominal.
   4. Total Solar Heat Gain Coefficient: 0.39, nominal.
   5. Total Visible Light Transmittance: 70 percent, exactly.
   6. Basis of Design: PPG Industries, Inc: www.ppgideascapes.com.
   7. Outboard Lite: Heat-strengthened float glass, 1/4 inch thick, minimum.
      a. Low-E Coating: PPG Solarban 60 on #2 surface.
      b. Tint: Starphire (clear).
   8. Inboard Lite: Heat-strengthened float glass, 1/4 inch thick.
      a. Tint: Starphire (clear).

B. Type C - Sealed Insulated Glass Units: Vision glazing, with Low-E coating.
   1. Same as Type A, except the inboard glass is to be etched white in its entirety so that it is completely translucent and all vision through glass is obscured. Contractor to submit sample for approval of translucent glass.

C. Total Thickness: 1 inch.

D. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of another acceptable manufacturer.
   1. Substitution Procedures: See Section 01 60 00 - Product Requirements.
      a. For any product not identified as "Basis of Design", submit information as specified for substitutions.

2.2 GLAZING UNITS

A. Type D - Single Vision Glazing:
   1. Application: All interior glazing unless otherwise indicated.
   2. Type: Fully tempered float glass.
   3. Tint: Clear.
   4. Thickness: 1/4 inch.

B. Type M - Single Safety Glazing: Non-fire-rated.
   1. Application: Provide this type of glazing in the following locations:
      a. Glazed lites in doors, except fire doors.
      b. Glazed sidelights to doors, except in fire-rated walls and partitions.
      c. Other locations required by applicable federal, state, and local codes and regulations.
      d. Other locations indicated on the drawings.
   2. Type: Laminated safety glass as specified.
   3. Tint: Clear.

4. Thickness: 1/4 inch.

C. Type N - Detention Glazing: Laminated glass/plastic glazing.
1. Application: Locations indicated on the drawings.

D. Type J - Obscure Glazing: Translucent, showing shadows but not forms.
1. Application: Locations indicated on the drawings.
2. Type: Etched float glass, fully tempered.
3. Tint: White.
4. Thickness: 1/4 inch, nominal.

E. Type L - Two-Way (Transparent) Mirror:
1. Application: Locations indicated on the drawings.
2. Thickness: 1/4 inch.
3. Product: Mirropane by Pilkington or equal.

2.3 EXTERIOR GLAZING ASSEMBLIES

A. Performance Criteria: Select type and thickness of glass to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of glass.
1. Design Pressure: Calculated in accordance with applicable codes.
2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
3. Glass thicknesses listed are minimum.

B. Air and Vapor Seals: Provide completed assemblies that maintain continuity of building enclosure vapor retarder and air barrier:
1. In conjunction with vapor retarder and joint sealer materials described in other sections.
2. To maintain a continuous air barrier and vapor retarder throughout the glazed assembly from glass pane to heel bead of glazing sealant.

2.4 GLASS MATERIALS

A. Float Glass Manufacturers:
1. AGC Flat Glass North America, Inc: www.na.agc-flatglass.com.
2. Pilkington North America Inc: www.pilkington.com/na.
3. PPG Industries, Inc: www.ppgideascapes.com.

B. Float Glass: All glazing is to be float glass unless otherwise indicated.
1. Heat-Strengthened and Fully Tempered Types: ASTM C1048, Kind HS and Kind FT.
2. Thicknesses: As indicated; for exterior glazing comply with requirements indicated for wind load design regardless of thickness indicated.

C. Laminated Glass: Float glass laminated in accordance with ASTM C 1172.
1. Laminated Safety Glass: Comply with 16 CFR 1201 test requirements for Category II.
2. Plastic (PVB) Interlayer: 0.090 inch thick, minimum.
3. Two Layers 1/8" glass with .090 PVB interlayer.
4. Total Thickness of Laminated Glass: 1/4".
5. Where fully tempered is specified or required, provide glass that has been tempered by the tong-less horizontal method.
6. Type LG glass is to be "Clear" Low E glass.

D. Laminated Floor Glass: Laminated Floor Glass to meet the specifications herein:
1. Specification written around Dupont's SentryGlas Plus as supplied by Depp Glass or equal.
2. Substitutions permitted that meet or exceed this specification; see Section 01600.
3. Finish: JDZ11272 "Punto" (Mini-dot) or equal.
4. Color: Standard (green).
5. Thickness: As required by engineering required in this Section 08800.
6. Comply with ASTM D-5026: Young's Modulus - 43.5Kpsi.
7. Comply with ASTM D-638: Tear Strength - 604 Ft-lb/in cubed; Tensile Strength - 5.0 Kpsi; Elongation - 400%.
8. Comply with ASTM D-792: Density - 0.0343 lbs/in cubed.
9. Comply with ASTM D-790: Flex. Modulus (73 degrees F) - 50 Kpsi.

10. Comply with ASTM D-648: HDT @ 66psi - 110 degrees.
11. Comply with ASTM D-696: Coeff. Expansion - 0.10-0.15 mils/in.
12. Comply with ASTM D-1003: Haze - <2%.
13. Comply with Dupont Adhesion to Glass, CSS - >3000psi.
14. Comply with ANSI Z26.1: Impact Test, 5PB (2.27Kg) - >30ft.; Boil Test, 2 hr. - No defects; Bake Test, 2 Hr./100 degrees C - No defects.

E. Two-Way Mirror Glass: Mirror quality float glass (Q2) with factory coating.
1. Manufacturers:
a. Pilkington North America Inc; Pilkington Mirropane Two-Way Mirror: www.pilkington.com/na.
b. Substitutions: Refer to Section 01 60 00 - Product Requirements.

2.5 GLAZING COMPOUNDS

A. Manufacturers:
1. Dow Corning Corp: www.dowcorning.com.
2. GE Plastics: www.geplastics.com.
3. Pecora Corporation: www.pecora.com.
4. Substitutions: See Section 01 33 00.

B. Butyl Sealant: Single component; ASTM C920, Grade NS, Class 12-1/2, Uses M and A, Shore A hardness of 10 to 20; black color.

C. Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C920, Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.

2.6 GLAZING ACCESSORIES

A. Manufacturers:
1. Norton Performance Plastics Corp.
2. Pecora Corporation: www.pecora.com.
3. Tremco, Inc: www.tremcosealants.com.
4. Substitutions: Refer to Section 01600 - Product Requirements.

B. Setting Blocks: Neoprene, 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.

C. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch long x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.

D. Glazing Tape: Preformed butyl compound with integral resilient tube spacing device; 10 to 15 Shore A durometer hardness; coiled on release paper, standard size; black color.

E. Glazing Gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; as selected color.

F. Glazing Clips: Manufacturer's standard type.

2.7 SOURCE QUALITY CONTROL

A. Test samples in accordance with ANSI Z97.1.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that openings for glazing are correctly sized and within tolerance.

B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and ready to receive glazing.

3.2 PREPARATION

A. Clean contact surfaces with solvent and wipe dry.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant.

D. Install sealants in accordance with ASTM C1193 and GANA Sealant Manual.

E. Install sealants in accordance with manufacturer's instructions.

3.3 INSTALLATION - EXTERIOR DRY METHOD (TAPE AND GASKET SPLINE GLAZING)

A. Cut glazing tape to length; install on glazing pane. Seal corners by butting tape and sealing junctions with butyl sealant.

B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.

D. Install removable stops without displacing glazing spline. Exert pressure for full continuous contact.

E. Trim protruding tape edge.

3.4 INSTALLATION - EXTERIOR WET/DRY METHOD (PREFORMED TAPE AND SEALANT)

A. Cut glazing tape to length and set against permanent stops, 3/16 inch below sight line. Seal corners by butting tape and dabbing with butyl sealant.

B. Apply heel bead of butyl sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete the continuity of the air and vapor seal.

C. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

D. Rest glazing on setting blocks and push against tape and heel bead of sealant with sufficient pressure to attain full contact at perimeter of pane or glass unit.

E. Install removable stops, with spacer strips inserted between glazing and applied stops 1/4 inch below sight lines.
   1. Place glazing tape on glazing pane of unit with tape flush with sight line.

F. Install removable stops, with spacer strips inserted between glazing and applied stops, 1/4 inch below sight line. Place glazing tape on glazing pane or unit with tape flush with sight line.

G. Fill gap between glazing and stop with sealant to depth equal to bite of frame on glazing, but not more than 3/8 inch below sight line.

H. Apply cap bead of sealant along void between the stop and the glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.5 INSTALLATION - INTERIOR WET METHOD (COMPOUND AND COMPOUND)

A. Install glazing resting on setting blocks. Install applied stop and center pane by use of spacer shims at 24 inch centers, kept 1/4 inch below sight line.

B. Locate and secure glazing pane using glazers' clips.

C. Fill gaps between glazing and stops with glazing compound until flush with sight line. Tool surface to straight line.

3.6 CLEANING

A. Remove glazing materials from finish surfaces.

B. Remove labels after Work is complete.

C. Clean glass and adjacent surfaces.

3.7 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

3.8 SCHEDULE

A. Storefront: Type [A, B, C, D and K], thicknesses required to comply with performance

requirements, exterior dry method.

B. Aluminum Entrance Doors: Type [M], 1/4 inch thick, [exterior wet/dry method].

C. Hollow Steel Frames - Interior: Interior wet method with Type [D and L] compound.

D. Steel Doors:
   1. Interior: Type [M and N], 9mm - 12 mm thick, interior wet method.
   2. Exterior: Type [M], 9/16 inch thick, [exterior wet/dry method].

E. Flush Wood Doors:
   1. Interior: Type [M], 9mm - 12 mm thick, interior wet method.

END OF SECTION

SECTION 08 85 00

FIRE RATED STEEL FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Fire rated glazing and framing systems for installation as door frames, sidelights and windows in interior openings.

B. Related Sections:

05 12 00 – STRUCTURAL STEEL FRAMING
05 50 00 – METAL FABRICATIONS
07 84 00 – FIRESTOPPING
08 11 13 – HOLLOW METAL DOORS AND FRAMES
08 71 00 – DOOR HARDWARE

1. Section 07 84 00 “Firestopping:” Firestops between work of this section and other fire resistive assemblies.

2. Section 08 11 13 “Hollow Metal Doors and Frames.” Hollow Metal doors prepped for the work of this section.

3. Section 08 71 00 “Door Hardware:” Door hardware other than that provided by the work of this section

1.2 REFERENCES

A. American Architectural Manufacturers Association (AAMA)

1. AAMA 501.1-2005: Standard Test Method for Water Penetration of Windows, Curtain Walls, and Doors Using Dynamic Pressure

2. AAMA 501.2-2003: Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems

3. AAMA 501.4-2000 (Revised 2001): Recommended Static Test Method for Evaluating Curtain Wall and Storefront Systems Subjected to Seismic and Wind Induced Interstory Drifts

4. AAMA 501.5-2005: Test Method for Thermal Cycling of Exterior Walls

5. AAMA 506-2000 (Revised 2003): Voluntary Specifications for Hurricane Impact and Cycle Testing of Fenestration Products

6. AAMA 1503-1998: Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections

7. AAMA 2603-2002 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.

8. AAMA 2604-2005 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.

9. AAMA 2605-2005 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

B. American Society for Testing and Materials (ASTM):

1. Fire safety related:

a. ASTM E119: Methods for Fire Tests of Building Construction and Materials.

b. ASTM E2074-00: Standard Test Method for Fire Tests of Door Assemblies, Including Positive Pressure Testing of Side-Hinged and Pivoted Swinging Door Assemblies.

c. ASTM E2010-01: Standard Test Method for Positive Pressure Fire Tests of Window Assemblies.

2. Material related

a. ASTM A 1008/A 1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength, Low Alloy, and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2007.

b. ASTM A 1011/A 1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2006b.

C. American Welding Society (AWS)

1. AWS D1.3 - Structural Welding Code - Sheet Steel;; 2007

D. Builders Hardware Manufacturers Association, Inc

1. BHMA A156 - American National Standards for door hardware; 2006 (ANSI/BHMA A156).

E. National Fire Protection Association (NFPA):

1. NFPA 80: Fire Doors and Windows.

2. NFPA 251: Fire Tests of Building Construction & Materials

3. NFPA 252: Fire Tests of Door Assemblies

4. NFPA 257: Fire Test of Window Assemblies

F. Underwriters Laboratories, Inc. (UL):

1. UL 9: Fire Tests of Door Assemblies

2. UL 10 B: Fire Tests of Door Assemblies

3. UL 10 C: Positive Pressure Fire Tests of Window & Door Assemblies

4. UL 263: Fire tests of Building Construction and Materials

5. UL-752 Ratings of Bullet-Resistant Materials

G. American National Standards Institute (ANSI):

1. ANSI Z97.1: Standard for Safety Glazing Materials Used in Buildings

H. Consumer Product Safety Commission (CPSC):

1. CPSC 16 CFR 120: Safety Standard for Architectural Glazing Materials

I. American Society of Civil Engineers (ASCE)

1. ASCE 7 – Minimum Design Loads for Buildings and Other Structures; 2005

1.3 PERFORMANCE REQUIREMENTS

A. Fire Rating Requirements

1. Duration – Windows Capable of providing a fire rating for 60 & 120 minutes (see drawings).

B. Delegated design: For the performance requirements listed below requiring structural design provide data, calculations and drawings signed and sealed by an engineer licensed in the state [province] where the project is located.

C. Structural Performance

1. Member deflection: Limit deflection of the edge of the glass normal to the plane of the glass to [flexure limit of glass][1/175 of the glass edge length or ¾ inch, which ever is less][of any framing member

2. Accommodate movement between storefront and adjoining systems

1.4 SUBMITTALS

A. Submit in accordance with Section 01630.

B. Product Data: include laboratory test data.

C. Shop Drawings:

1. Include plans, elevations and details of product showing component dimensions; framed opening requirements, dimensions, tolerances, and attachment to structure

2. Provide templates for the location of embeds and anchor locations required any adjoining work

D. Design Data

E. Hardware schedule: list of manufacture supplied hardware and verification of cylinder size complying with Section 08 71 00

F. Samples for Initial Color Selection: For steel frames with factory-applied powder coat color finishes.

1. Triplicate copies of manufacturer's powder coating color charts showing the full range of colors available.

G. Verification Sample of selected finish on steel frame piece.

H. Samples: For following products:

Two 8-inch by 10-inch Samples for glass.

I. Glazing Schedule: Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.

J. Technical Information: Submit latest edition of manufacturer's product data providing product descriptions, technical data and installation instructions. Including blank warranty form.

K. Installer Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

L. Manufacturer's Certificate

M. Field Quality-control reports:

N. Maintenance Data

O. Warranties: Submit manufacturer's warranty and ensure that forms have been completed in the Owner's name and registered with the manufacturer.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications:

B. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association Glazier Certification Program as Level 2 (Senior Glaziers) or Level 3 (Master Glaziers).

C. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for Project and whose work has resulted in construction with a record of successful in-service performance.

D. Source Limitations for Glazing Accessories: Obtain glazing accessories from one source for each product and installation method indicated.

E. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by UL, for fire ratings indicated, based on testing according to NFPA 252, ASTM E119. Assemblies must be factory-welded or come complete with factory-installed mechanical joints and must not require job site fabrication.

F. Fire-Rated Window Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by UL, for fire ratings indicated, based on testing according to NFPA 257, ASTM E119. Assemblies must be factory-welded or come complete with factory-installed mechanical joints and must not require job site fabrication.

G. Certification: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.

1. [Door assemblies shall be tested to the acceptance criteria of ASTM E2074-00, NFPA 252, UL 9, UL 10-C Standard Methods of Fire Tests of Door Assemblies.]

2. [Window assemblies shall be tested to the acceptance criteria of ASTM E2010-01, NFPA 257, UL 10-B, UL 10-C Standard methods for Fire Tests of Window Assemblies.]

3. [Wall assemblies shall be tested to the acceptance criteria of ASTM E119, NFPA 251, UL 263 Standard Test Methods for Fire Tests of Building Construction and Materials.]

4. Underwriters Laboratories (UL) shall conduct fire test.

H. Listings and Labels - Fire Rated Assemblies: Under current follow-up service by an approved independent agency maintaining a current listing or certification. Label assemblies accordance with limits of manufacturer's listing.

I. Window assemblies with ratings of less than 60 minutes may be tested in accordance with ASTM E2010-01, NFPA 257, UBC 7-4, UL 9, CAN4-S106 Standard Test Methods.

1.6 PRE-INSTALLATION MEETING

A. Conduct a pre-installation conference at least one week prior to the work of this section.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle under provisions specified by manufacturer.

1. At delivery inspect all containers for damage.

2. Examine glass and frame units for damage.

3. List all damage to containers on the shipping company's Bill of Lading

4. Report damage to manufacturer immediately.

5. Store glazing materials and frame units in original packing containers

6. Do expose glazing material of frame units to sunlight and weather.

7. Do not store horizontally.

8. Place glass and frames upright, no less than 6 degrees from vertical.

9. Store all materials in dry conditions, off the ground.

10. Protect from construction activities.

11. Fully support Glass units along entire length

12. Glass and frame units must be separated by non abrasive pads such as cloth or cork.

13. Do not stack containers

1.8 PROJECT CONDITIONS

A. Obtain field measurements prior to fabrication of frame units. If field measurements will not be available in a timely manner coordinate planned measurements with the work of other sections.

1. Note whether field or planned dimensions were used in the creation of the shop drawings.

B. Coordinate the work of this section with others effected including but not limited to: other exterior envelope components and door hardware beyond that provided by this section

1.9 WARRANTY

A. Provide the Pilkington Pyrostop™ and Frame supplier's limited five year warranty dated from substantial completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS - FIRE RATED DOOR FRAMES AND WINDOWS

A. Manufacturer Glazing Material: "Pilkington Pyrostop™" fire-rated glazing as manufactured by the Pilkington Group and distributed by Technical Glass Products, 8107 Bracken Place SE, Snoqualmie, WA 98065 (800-426-0279) fax (800-451-9857) e-mail sales@fireglass.com, web site http://www.fireglass.com

B. Frame System: "Fireframes® Heat Barrier Series" fire-rated steel frame system as manufactured and supplied by Technical Glass Products, 8107 Bracken Place SE, Snoqualmie, WA 98065 (800-426-0279) fax (800-451-9857) e-mail sales@fireglass.com web site http://www.fireglass.com

C. Substitutions: See Section 01630.

2.2 MATERIALS - GLASS

A. Fire Rated Glazing: Composed of multiple sheets of Pilkington "Optiwhite" low iron, high-visible-light transmission glass laminated with an intumescent interlayer.

B. Impact Safety Resistance: ANSI Z97.1 and CPSC 16CFR1201 (Cat. I and II).

C. Properties Interior Glazing

Property			
Fire Rating	60 minute	90 minute	120 minute
Manufacturer's designation	60-101	90-102	120-104
Glazing type	single	single	Insulated glass unit
Nominal Thickness	7/8" (23mm)	1-7/16" (37mm)	2-1/8 (54mm)
Weight in lbs/sf	10.85	17.61	21.71
Daylight Transmission	88%	85%	78%
Sound Transmission Coefficient	41dB	45dB	46dB

D. Logo: Each piece of fire-rated glazing shall be labeled with a permanent logo including name of product, manufacture, testing laboratory (UL), fire rating period, safety glazing standards, and date of manufacture.

E. Glazing Accessories: Manufacturer's standard compression gaskets, spacers, setting blocks and other accessories necessary for a complete installation.

2.3 MATERIALS – STEEL FRAMING

A. Steel Framing System 60 min & 120 min:

1. Steel Frame: Profiled steel tubing permanently joined with steel bolts.

2. Insulation: Insulate framing system against effects of fire, smoke, and heat transfer from either side. Insulate profiled steel tubing using a shell construction that incorporates Promatect-H intermediate interlayer. Firmly pack perimeter of framing system to rough opening with mineral wool fire stop insulation or appropriately rated intumescent sealant.

3. Steel Glazing Beads: Extruded steel beads with dimensions recommended by manufacturer to securely hold glazing material in place.

4. Fasteners: Type recommended by manufacturer

5. Glazing Accessories: Set Pyrostop glass using calcium silicate, or setting blocks.

6. Glazing Gaskets, Compounds and tapes: Glaze Pyrostop glass with approved EPDM glazing gaskets and [closed cell PVC tape], or [pure silicone sealant].

2.4 FABRICATION

A. Furnish frame assemblies pre-welded.

1. When necessary, splice frames too large for shop fabrication or shipping or to fit in available building openings.

2. Fit with suitable fasteners.

3. Knock-down door perimeter frames are not permitted

B. Field glaze door and frame assemblies.

C. Factory prepare steel door assemblies field mounting of hardware

D. Fabrication Dimensions: Fabricate fire rated assembly to field dimensions.

E. Obtain reviewed Shop Drawings prior to fabrication.

2.5 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish frames after assembly.

C. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

D. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable. Noticeable variations in the same piece are not acceptable.

2.6 FACTORY FINISHES

A. Color-Coated Finish: Apply manufacturer's standard powder coating finish system complying with AAMA 2603 applied to factory-assembled frames before shipping, complying with manufacturer's written instructions for surface preparation including pretreatment, application, and minimum dry film thickness.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

2.7 ACCESSORY MATERIALS

A. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for **[30-mil] [0.762-mm]** thickness per coat.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and members to which the work of this section attaches or adjoins prior to frame installation.

B. Provide openings plumb, square and within allowable tolerances.

1. The manufacturer recommends 3/8 inch shim space at all walls

C. Notify Architect of any conditions which jeopardize the integrity of the proposed fire wall / door system.

D. Do not proceed until such conditions are corrected.

3.2 INSTALLATION

A. Follow manufacturer's written instructions and reviewed shop drawings.

B. Install fully welded fire [window] [wall] [door] in strict accordance with the approved shop drawings.

C. Set continuous sill members and flashing in full sealant bed to produce a watertight installation

D. Install fire safing / fire stopping at edges of system

E. Install glazing in strict accordance with fire resistant glazing material manufacturer's specifications. Field cutting or tampering is not permissible.

F. Do not install damaged frames or chipped glassing units.

G. Install plumb and true. Limit out of plumb or true to 1/8 inch in 10'-0" in any dimension.

3.3 REPAIR AND TOUCH UP

A. Limited to minor repair of small scratches. Use only manufacturer's recommended products.

1. Such repairs shall match original finish for quality or material and view.

2. Repairs and touch-up not visible from a distance of 5 feet Owner and Architect to approve.

B. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged.

3.4 ADJUSTING

A. Adjust door function and hardware for smooth operation. Coordinate with other hardware suppliers for function and use of any other attached hardware.

3.5 PROTECTION AND CLEANING

A. Protect glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface`. Remove nonpermanent labels, and clean surfaces.

1. Do not clean with astringent cleaners. Use a clean “grit free” cloth and a small amount of mild soap and water or mild detergent.

2. Bullet resistant glazing materials employing PVB layer on exterior surface

3. Protect surface applied film. Do not use any of the following:

   a. Steam jets

   b. Abrasives

   c. Strong acidic or alkaline detergents, or surface-reactive agents

   d. Detergents not recommended in writing by the manufacturer

   e. Do not use any detergent above 77 degrees F

   f. Organic solvents including but not limited to those containing ester, ketones, alcohols, aromatic compounds, glycol ether, or halogenated hydrocarbons.

   g. Metal or hard parts of cleaning equipment must not touch the glass surface

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.

C. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer.

END OF SECTION

SECTION 09 21 16
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.
B. Metal stud wall framing.
C. Metal channel ceiling framing.
D. Acoustic insulation.
E. Gypsum sheathing.
F. Cementitious backing board.
G. Gypsum wallboard.
H. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping: Top-of-wall assemblies at fire rated walls.
B. Section 07 90 05 - Joint Sealers: Acoustic sealant.

1.03 REFERENCE STANDARDS

A. AISI SG02-1 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2001 with 2004 supplement. (replaced SG-971)
B. ANSI A108.11-SystemDeleted - American National Standard for Interior Installation of Cementitious Backer Units; 2010 (Revised).
C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
D. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2015.
E. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2014.
F. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2015.
G. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2013.
H. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2015.
I. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2014.
J. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2013.
K. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2013.
L. ASTM C1280 - Standard Specification for Application of Gypsum Sheathing Board; 2013.
M. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2014.
N. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels; 2015.
O. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels; 2013.
P. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2012.

Q. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009.

R. ASTM E413 - Classification for Rating Sound Insulation; 2010.

S. GA-216 - Application and Finishing of Gypsum Board; 2013.

T. GA-600 - Fire Resistance Design Manual; 2015.

U. UL (FRD) - Fire Resistance Directory; current edition.

1.04 SUBMITTALS

A. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.

B. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

C. Test Reports: For stud framing products that do not comply with ASTM C645 or ASTM C754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.

1.05 QUALITY ASSURANCE

A. Perform in accordance with ASTM C 840. Comply with requirements of GA-600 for fire-rated assemblies.
   1. Maintain one copy of standards at project site.

B. Installer Qualifications: Company specializing in performing gypsum board application and finishing, with minimum 5 years of documented experience.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.
   1. See PART 3 for finishing requirements.

B. Interior Partitions: Provide completed assemblies with the following characteristics:
   1. Acoustic Attenuation: STC of 45-49 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

C. Shaft Walls at HVAC Shafts: Provide completed assemblies with the following characteristics:
   1. Air Pressure Within Shaft: Sustained loads of 5 lbf/sq ft with maximum mid-span deflection of L/240.
   2. Acoustic Attenuation: STC of 35-39 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

D. Shaft Walls at Elevator Shafts: Provide completed assemblies with the following characteristics:
   1. Air Pressure Within Shaft: Intermittent loads of 5 lbf/sq ft with maximum mid-span deflection of L/240.
   2. Acoustic Attenuation: STC of 35-39 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

E. Fire Rated Assemblies: Provide completed assemblies with the following characteristics:
   1. Fire Rated Partitions: UL listed assembly No. U419 & U420 ; 1 & 2 hour rating.
   2. Fire Rated Shaft Walls: UL listed assembly No. U497; 1 hour rating.
   3. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).

2.02 METAL FRAMING MATERIALS

A. Manufacturers - Metal Framing, Connectors, and Accessories:
   1. Clarkwestern Dietrich Building Systems LLC: www.clarkdietrich.com.
   2. Dietrich Metal Framing: www.dietrichindustries.com.
   3. Substitutions: See Section 01 3300 - Substitutions and Product Options

B. Non-Loadbearing Framing System Components: ASTM C 645; galvanized sheet steel, of size and properties necessary to comply with ASTM C 754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf.
   1. Exception: The minimum metal thickness and section properties requirements of ASTM C645 are waived provided steel of 40 ksi minimum yield strength is used, the metal is continuously dimpled, the effective thickness is at least twice the base metal thickness, and maximum stud heights are determined by testing in accordance with ASTM E72 using assemblies specified by ASTM C754.
   2. Studs: "C" shaped with flat or formed webs .
   3. Runners: U shaped, sized to match studs.
   4. Ceiling Channels: C shaped.
   5. Furring: Hat-shaped sections, minimum depth of 7/8 inch and 1-1/2 inches as shown on drawings.

C. Shaft Wall Studs and Accessories: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 and specified performance requirements.

D. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.

E. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.
   1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI SG02-1.
   2. Material: ASTM A653/A653M steel sheet, SS Grade 50/340, with G60/Z180 hot dipped galvanized coating.
   3. Provide components UL-listed for use in UL-listed fire-rated head of partition joint systems indicated on drawings.
   4. Deflection and Firestop Track:
      a. Provide mechanical anchorage devices as described above that accommodate deflection while maintaining the fire-rating of the wall assembly.

2.03 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
   1. Georgia-Pacific Gypsum: www.gpgypsum.com.
   2. National Gypsum Company: www.nationalgypsum.com.
   3. USG Corporation: www.usg.com.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
   2. Glass mat faced gypsum panels as defined in ASTM C1658/C1658M, suitable for paint finish, of the same core type and thickness may be substituted for paper-faced board.
   3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
      a. Mold-resistant board is required whenever board is being installed before the building is enclosed and conditioned.
   4. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
   5. Thickness:
      a. Vertical Surfaces: 5/8 inch.
   6. Mold Resistant Paper Faced Products:
      a. Georgia-Pacific Gypsum; ToughRock Mold-Guard.
      b. Georgia-Pacific Gypsum; ToughRock Fireguard X Mold-Guard.
   7. Glass Mat Faced Products:
      a. Georgia-Pacific Gypsum; DensArmor Plus.
      b. Georgia-Pacific Gypsum; DensArmor Plus Fireguard C.

C. Impact Resistant Wallboard:

1. Application: High-traffic areas indicated.
2. Surface Abrasion: Level 3, minimum, when tested in accordance with ASTM C1629/C1629M.
3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
4. Glass Mat-Faced Type: Gypsum wallboard as defined in ASTM C1658/C1658M.
5. Type: Fire resistance rated Type X, UL or WH listed.
6. Thickness: 5/8 inch.
7. Edges: Tapered.
8. Products:
    a. Georgia-Pacific Gypsum; DensArmor Plus Impact-Resistant.

D. Backing Board For Wet Areas: One of the following products:
1. Application: Surfaces behind tile in wet areas including tub and shower surrounds and shower ceilings.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
3. Glass Mat Faced Board: Coated glass mat water-resistant gypsum backing panel as defined in ASTM C1178/C1178M.
    a. Standard Type: Thickness 1/2 inch.
    b. Products:
        1) Georgia-Pacific Gypsum; DensShield Tile Backer.

E. Backing Board For Non-Wet Areas: Water-resistant gypsum backing board as defined in ASTM C1396/C1396M; sizes to minimum joints in place; ends square cut.
1. Application: Vertical surfaces behind thinset tile, except in wet areas.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
3. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
4. Type: Regular and Type X, in locations indicated.
5. Type X Thickness: 5/8 inch.
6. Regular Board Thickness: 1/2 inch.
7. Edges: Tapered.
8. Products:
    a. Georgia-Pacific Gypsum; ToughRock Mold-Guard Gypsum Board.

F. Ceiling Board: Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Ceilings, unless otherwise indicated.
2. Thickness: 1/2 inch.
3. Edges: Tapered.
4. Products:
    a. Georgia-Pacific Gypsum; ToughRock Span 24 Ceiling Board.

G. Exterior Sheathing Board: Sizes to minimize joints in place; ends square cut.
1. Application: Exterior sheathing, unless otherwise indicated.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
3. Glass Mat Faced Sheathing: Glass mat faced gypsum substrate as defined in ASTM C1177/C1177M.
4. Core Type: Regular.
5. Regular Board Thickness: 1/2 inch.
6. Edges: Square, for vertical application.
7. Glass Mat Faced Products:
    a. Georgia-Pacific Gypsum; DensGlass Sheathing.

H. Shaftwall and Coreboard: Type X; 1 inch thick by 24 inches wide, beveled long edges, ends square cut.
1. Glass Mat Faced Type: Glass mat shaftliner gypsum panel or glass mat coreboard gypsum panel as defined in ASTM C1658/C1658M.

2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
3. Products:
   a. Georgia-Pacific Gypsum; DensGlass Shaftliner (mold-resistant).

2.04 ACCESSORIES

A. Acoustic Insulation: ASTM C 665; preformed glass fiber, friction fit type, unfaced. Locate in all wall locations.

B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.

C. Acoustic Sealant: As specified in Section 07 90 05.

D. Water-Resistive Barrier: As specified in Section 07 25 00.

E. Corner Beads: Galvanized steel.

F. Reveals: (Sizes as shown on drawings) by Fry Reglet or equal.
   1. Drywall Control Joint: DRM-625-75 by Fry Reglet.
   2. F-Reveal: DRMF-625-75.
   3. Reveal: DRM-625-75.
   4. Z-Reveal: DRMZ-625-75

G. Base Moldings: 4 inch high by reveal manufacturer (Fry Reglet or equal).
   1. DRMB-625-400 by Fry Reglet.

H. J-moldings: (Sizes as shown on drawings) by Fry Reglet or equal.

I. Edge Trim: Bead type(s) as detailed.

J. Joint Materials: ASTM C475 and as recommended by gypsum board manufacturer for project conditions.

K. High Build Drywall Surfacer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.

L. Screws for Attachment to Steel Members Less Than 0.033 inch In Thickness, to Wood Members, and to Gypsum Board: ASTM C1002; self-piercing tapping type; cadmium plated for exterior locations.

M. Screws for Attachment to Steel Members From 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws for application of gypsum board to loadbearing steel studs.

N. Screws: ASTM C 1002; self-piercing tapping type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 SHAFT WALL INSTALLATION

A. Shaft Wall Framing: Install in accordance with manufacturer's installation instructions.
   1. Fasten runners to structure with short leg to finished side, using appropriate power-driven fasteners at not more than 24 inches on center.
   2. Install studs at spacing required to meet performance requirements.

B. Shaft Wall Liner: Cut panels to accurate dimension and install sequentially between special friction studs.
   1. On walls over sixteen feet high, screw-attach studs to runners top and bottom.
   2. Seal perimeter of shaft wall and penetrations with acoustical sealant.

3.03 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.

B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
   1. Level ceiling system to a tolerance of 1/1200.

2. Laterally brace entire suspension system.
3. Install bracing as required at exterior locations to resist wind uplift.

C. Studs: Space studs at 16 inches on center.
1. Extend partition framing to structure in all locations.
2. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.

D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

E. Standard Wall Furring: Install at masonry walls scheduled to receive gypsum board, not more than 4 inches from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches on center.
1. Orientation: Horizontal.
2. Spacing: As indicated.

F. Acoustic Furring: Install resilient channels at maximum 24 inches on center. Locate joints over framing members.

G. Furring for Fire Ratings: Install as required for fire resistance ratings indicated and to GA-600 requirements.

H. Blocking: Install blocking for support of plumbing fixtures, toilet partitions, wall cabinets, wood frame openings, toilet accessories, and hardware. Bolt or screw steel channels to studs.

3.04 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
1. Place one bead continuously on substrate before installation of perimeter framing members.
2. Place continuous bead at perimeter of each layer of gypsum board.
3. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.05 BOARD INSTALLATION

A. Comply with ASTM C 840 and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Non-Rated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
1. Exception: Tapered edges to receive joint treatment at right angles to framing.

C. Double-Layer Non-Rated: Use gypsum board for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing. Use glass mat faced gypsum board at exterior walls and at other locations as indicated. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.

D. Fire-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

E. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.

F. Exterior Sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.
1. Paper-Faced Sheathing: Immediately after installation, protect from weather by application of water-resistive barrier.

G. Cementitious Backing Board: Install over steel framing members where indicated, in accordance with ANSI A108.11-SystemDeleted and manufacturer's instructions.

H. Installation on Metal Framing: Use screws for attachment of gypsum board except face layer of non-rated double-layer assemblies, which may be installed by means of adhesive lamination.

3.06 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as follows:
   1. Not more than 30 feet apart on walls and ceilings over 50 feet long. Request Architect's approval for all control joint location before installation.
   2. At exterior soffits, not more than 30 feet apart in both directions.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials and as indicated.

3.07 JOINT TREATMENT

A. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
   2. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.
   3. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
   4. Level 1: Fire rated wall areas above finished ceilings, whether or not accessible in the completed construction.

B. Finish gypsum board in scheduled areas in accordance with levels defined in ASTM C 840 and as scheduled below.
   1. Above Finished Ceilings Concealed From View: Level 1.
   2. Utility Areas and Areas Behind Cabinetry: Level 2.
   3. Walls and Ceilings to Receive Flat or Eggshell Paint Finish: Level 4.
   4. Walls and Ceilings to Receive Semi-Gloss or Gloss Paint Finish: Level 5.

C. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch.
   2. Taping, filling, and sanding is not required at surfaces behind adhesive applied ceramic tile and fixed cabinetry.
   3. Taping, filling and sanding is not required at base layer of double layer applications.

D. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

E. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

3.08 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION

SECTION 09 22 36.23
METAL LATH

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal lath for Portland cement plaster.

B. Furring for metal lath.

C. Metal ceiling framing.

1.02 RELATED REQUIREMENTS

A. Section 09 24 00 - Portland Cement Plastering.

B. Section 09 21 16 - Gypsum Board Assemblies: Water-resistive barrier under exterior plaster and stucco.

1.03 REFERENCE STANDARDS

A. ASTM C841 - Standard Specification for Installation of Interior Lathing and Furring; 2003 (Reapproved 2013).

B. ASTM C847 - Standard Specification for Metal Lath; 2014a.

C. ASTM C1063 - Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster; 2015a.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on furring and lathing components, structural characteristics, material limitations, and finish.

C. Samples:
   1. Submit two samples, 4 by 4 inch in size illustrating lath material and finish.

1.05 QUALITY ASSURANCE

A. Maintain one copy of each installation standard referenced in PART 3 on site throughout the duration of lathing and plastering work.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Lath:
   1. Alabama Metal Industries Corporation: www.amico-lath.com.
   2. Clarkwestern Dietrich Building Systems LLC: www.clarkdietrich.com.
   3. Dietrich Metal Framing: www.dietrichindustries.com.

2.02 FRAMING AND LATH ASSEMBLIES

A. Provide completed assemblies with the following characteristics:
   1. Maximum Deflection of Vertical Assemblies: 1:360 under lateral point load of 100 lbs.
   2. Maximum Deflection of Horizontal Assemblies: 1:240 deflection under dead loads and wind uplift.

2.03 FRAMING MATERIALS

A. Furring Channels: Formed steel, minimum 0.020 inch thick, 3/8 inch deep by 7/8 inch high, splicing permitted; galvanized.

B. Main Ceiling Channels: Formed steel, asphalt coated, minimum 0.05 inch thick, 3/4 inch deep by 1-1/2 inch high, single piece, no splicing; galvanized.

C. Ceiling Hangers: Rolled steel sections, of size and type to suit application, to rigidly support ceiling components in place to deflection limits as indicated; galvanized.

D. Lateral Bracing: Formed steel, minimum 0.060 inch thick, size and length as required; galvanized.

2.04 LATH

A. Diamond Mesh Metal Lath: ASTM C847, galvanized; self-furring.
   1. Weight: To suit application, comply with deflection criteria, and as specified in ASTM C841 or ASTM C1063 for framing spacing.

B. Beads, Screeds, Joint Accessories, and Other Trim: Depth governed by plaster thickness, and maximum possible lengths.
   1. Material: Formed sheet steel with rust inhibitive primer, expanded metal flanges.

2.05 ACCESSORIES

A. Anchorage: Tie wire, nails, and other metal supports, of type and size to suit application; to rigidly secure materials in place, galvanized.

B. Tie Wire: Annealed galvanized steel.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that substrates are ready to receive work and conditions are suitable for application.

C. For exterior plaster and stucco on stud walls, verify that water-resistive barrier has been installed over sheathing substrate completely and correctly.

D. Do not begin until unacceptable conditions have been corrected.

E. If substrate preparation is the responsibility of another installer, notify Albert & Associates Architects of unsatisfactory preparation before proceeding.

3.02 INSTALLATION - GENERAL

A. Install interior lath and furring for gypsum plaster in accordance with ASTM C841.

B. Install lath and furring for Portland cement plaster in accordance with ASTM C1063.

3.03 WALL FURRING INSTALLATION

A. Install furring channels horizontally; secure with fasteners on alternate channel flanges at maximum 24 inches on center.

B. Space furring channels maximum 16 inches on center, and not more than 4 inches away from floor and ceiling lines.

3.04 CEILING AND SOFFIT FRAMING INSTALLATION

A. Install furring after work above ceiling or soffit is complete. Coordinate the location of hangers with other work.

B. Install furring independent of walls, columns, and above-ceiling work.

C. Securely anchor hangers to structural members or embed in structural slab. Space hangers as required to limit deflection to criteria indicated. Use rigid hangers at exterior soffits.

D. Space main carrying channels at maximum 72 inch on center, and not more than 6 inches from wall surfaces. Lap splice securely.

E. Securely fix carrying channels to hangers to prevent turning or twisting and to transmit full load to hangers.

F. Install furring channels perpendicular to carrying channels, not more than 2 inches from perimeter walls, and rigidly secure. Lap splices securely.

G. Reinforce openings in suspension system that interrupt main carrying channels or furring channels with lateral channel bracing. Extend bracing minimum 24 inches past each opening.

H. Laterally brace suspension system.

3.05 CONTROL AND EXPANSION JOINT INSTALLATION

A. Locate joints as indicated on drawings but minimally as to comply with ASTM C1063 and the requirements listed below:
   1. Area of plaster panel not to exceed 144 sq ft for vertical surfaces.
   2. Area of plaster panel not to exceed 100 sq ft for horizontal, curved or angled surfaces.
   3. Spacing between control joints not to exceed 18 ft in each direction.
   4. Area bounded by control joints not to exceed a length-to-width ratio of 2-1/2 to 1.

B. Construct expansion joints of back-to-back casing beads with a backer rod and sealant, set 1/4 inch apart.

3.06 LATH INSTALLATION

A. Apply metal lath taut, with long dimension perpendicular to supports.

B. Lap ends minimum 1 inch. Secure end laps with tie wire where they occur between supports.

C. Lap sides of diamond mesh lath minimum 1-1/2 inches.

D. Attach metal lath to metal supports using tie wire at maximum 6 inches on center.

E. Continuously reinforce internal angles with corner mesh, except where the metal lath returns 3 inches from corner to form the angle reinforcement; fasten at perimeter edges only.

F. Place corner bead at external wall corners; fasten at outer edges of lath only.

G. Place base screeds at termination of plaster areas; secure rigidly in place.

H. Place 4 inch wide strips of metal lath centered over junctions of dissimilar backing materials, and secure rigidly in place.

I. Place lath vertically above each top corner and each side of door frames to 6 inches above ceiling line.

J. Place casing beads at terminations of plaster finish. Butt and align ends. Secure rigidly in place.

K. Place additional strip mesh diagonally at corners of lathed openings. Secure rigidly in place.

3.07 TOLERANCES

A. Maximum Variation from True Lines and Levels: 1/8 inch in 10 feet.

B. Maximum Variation from True Position: 1/8 inch.

END OF SECTION

SECTION 09 24 00
PORTLAND CEMENT PLASTERING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Portland cement plaster for installation over metal lath.

1.02 RELATED REQUIREMENTS

A. Section 09 22 36.23 - Metal Lath: Metal furring and lathing for plaster.

1.03 REFERENCE STANDARDS

A. ASTM C91/C91M - Standard Specification for Masonry Cement; 2012.

B. ASTM C150/C150M - Standard Specification for Portland Cement; 2015.

C. ASTM C206 - Standard Specification for Finishing Hydrated Lime; 2014.

D. ASTM C926 - Standard Specification for Application of Portland Cement-Based Plaster; 2015b.

1.04 SUBMITTALS

A. See Section 01 33 00 - Administrative Requirements, for submittals procedures.

B. Product Data: Provide data on plaster materials, characteristics and limitations of products specified.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

1.06 MOCK-UP

A. Construct mock-up of exterior wall, 4 feet long by 4 feet wide, illustrating surface finish for each condition listed in drawings.

B. Locate where directed.

C. Mock-up may remain as part of the Work.

1.07 FIELD CONDITIONS

A. Maintain minimum ambient temperature of 50 degrees F during installation of plaster and until cured.

PART 2 PRODUCTS

2.01 PORTLAND CEMENT PLASTER ASSEMBLIES

A. Exterior Stucco: Portland cement plaster system, made of finish, brown, and scratch coat and reinforcing mesh.

2.02 PLASTER MATERIALS

A. Portland Cement, Aggregates, and Other Materials: In accordance with ASTM C926.

B. Portland Cement: ASTM C150/C150M, Type I.
   1. For finish coat: White color.

C. Masonry Cement: ASTM C91 Type N.

D. Lime: ASTM C206, Type S.

E. Aggregate: In accordance with ASTM C926.

F. Water: Clean, fresh, potable and free of mineral or organic matter that could adversely affect plaster.

G. Finish Aggregate: Marble, color to be selected later, chip size of 100 percent passing 1/8 inch but retained on 1/16 inch screen.

2.03 METAL LATH AND ACCESSORIES

A. Metal Lath and Accessories: As specified in Section 09 22 36.23.

B. Beads, Screeds, and Joint Accessories: As specified in Section 09 22 36.23.

C. Soffit Vents: Model # PRM-75-V-75 and 1680-V and PCS-75-V-75 by Fry Reglet where shown in drawings.

2.04 PLASTER MIXES

A. Over Solid Bases: Three-coat application, mixed and proportioned in accordance with ASTM C926.

B. Over Metal Lath: Three-coat application, mixed and proportioned in accordance with ASTM C926.

C. Mix only as much plaster as can be used prior to initial set.

D. Mix materials dry, to uniform color and consistency, before adding water.

E. Protect mixtures from freezing, frost, contamination, and excessive evaporation.

F. Do not retemper mixes after initial set has occurred.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify the suitability of existing conditions before starting work.

B. Masonry: Verify joints are cut flush and surface is ready to receive work of this section. Verify no bituminous or water repellent coatings exist on masonry surface.

C. Concrete: Verify surfaces are flat, honeycomb are filled flush, and surfaces are ready to receive work of this section. Verify no bituminous, water repellent, or form release agents exist on concrete surface that are detrimental to plaster bond.

D. Metal Lath and Accessories: Verify lath is flat, secured to substrate, and joint and surface perimeter accessories are in place.

E. Mechanical and Electrical: Verify services within walls have been tested and approved.

3.02 PREPARATION

A. Dampen masonry surfaces to reduce excessive suction.

B. Clean concrete surfaces of foreign matter. Clean surfaces using acid solutions, solvents, or detergents. Wash surfaces with clean water.

C. Roughen smooth concrete surfaces and apply bonding agent in accordance with manufacturer's instructions.

3.03 PLASTERING

A. Apply plaster in accordance with ASTM C 926 and with recommendations by the Portland Cement Plaster (Stucco) Manual - latest edition.

B. Three-Coat Application Over Metal Lath:
   1. Apply first coat to a nominal thickness of 3/8 inch.
   2. Apply second coat to a nominal thickness of 3/8 inch.
   3. Apply finish coat to a nominal thickness of 1/8 inch.

C. Three-Coat Application Over Solid Bases:
   1. Apply first coat to a nominal thickness of 1/4 inch.
   2. Apply second coat to a nominal thickness of 1/4 inch.
   3. Apply finish coat to a nominal thickness of 1/8 inch.

D. In exterior work, scribe contraction joints through entire plaster application as shown on the drawings but in no case shall exceed 10 feet on center each way.

E. Moist cure base coats.

F. Apply second coat immediately following initial set of first coat.

G. After curing, dampen previous coat prior to applying finish coat.

H. Finish Texture: Float to a consistent and smooth finish. All finishes to be approved by Architect before total installation.

I. Avoid excessive working of surface. Delay troweling as long as possible to avoid drawing excess fines to surface.

J. Moist cure finish coat for minimum period of 48 hours.

3.04 TOLERANCES

A. Maximum Variation from True Flatness: 1/8 inch in 10 feet.

END OF SECTION

SECTION 09 25 00

SOUND ABSORBING PLASTER SYSTEM

PART 1 GENERAL

1.1 SUMMARY

A. The BASWAphon Sound Absorbing Plaster System is used to reduce reverberation time, making voice, music and other sound much more intelligible. Its design is based on a fine porous surface that appears to be solid, applied onto a mineral wool panel. High frequency sound energy passes through the pores, into the mineral wool, and is converted into heat energy. Low frequency sound energy vibrates the porous surface diaphragmatically, and is converted into heat energy.

B. The BASWAphon Sound Absorbing Plaster System is a complete manufactured system. Components of the system are as follows: a BASWAphon Pre-Coated panel which is made with made of randomly spun anti-sagging mineral wool fibers which are pre-coated in the factory with recycled glass microspheres; the pre-coated panel is adhered to a stable substrate with BASWAphon plaster based adhesive. The “V” groove seam between the panels, formed by the beveled edges on the glass microsphere pre-coating, is filled with BASWAphon Fill. A base coat of BASWAphon Base and a finish coat of BASWAphon Fine Coat are thereafter applied onto the panels on site, then troweled smooth, to give the appearance of a conventional smooth plaster surface. All components, including vinyl trims described below, are supplied by the manufacturer.

C. The work described in this Section, as shown on Drawings, Finish Schedules or as specified herein, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work in this Section includes all labor, materials, equipment and services necessary to complete the BASWAphon Sound Absorptive System, as shown on the drawings, finish schedules, and / or defined and specified herein.

1.3 RELATED SECTONS

A. Gypsum Board – See Section 09 21 16

1.4 QUALITY ASSURANCE

A. Certified Installers:

1. All Contractors shall be certified to install the BASWAphon Sound Absorbing Plaster System by BASWA acoustic North America, LLC (BASWA acoustic) (440.951.6022).

1.5 SUBMITTALS

A. Shop Drawings / Product Data:

1. Base Drawings, Approved Detail Drawings and Product Literature.

2. Show dimensioned wall elevations or ceiling plans with control joint locations, mounting details, transition details to adjacent work, design, weight, thickness, color and other data necessary to install the work and coordinate work with other affected trades.

B. Samples / Mock-Up:

1. Job Site Mock-Up: Install a 4' x 4' mock-up of the BASWAphon Sound Absorptive Plaster System replicating relative details and conditions. Obtain mock-up acceptance before any additional applications. Accomplish work to equal, or exceed standard established by accepted job site mock-up.

C. Acoustical Performance Data:

1. Certified Acoustical Performance Sound Absorption Test Report data, conducted by a recognized, independent, testing agency, shall be submitted upon request and meet the following minimum requirements. Sound absorption reports shall not be more than 3 years old. Noise Reduction Coefficient (NRC) for the 1 - 9/16" (40mm) system shall be 0.85 per ASTM C 423-09a *Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method for 'Type A' Mounting*. Specific performance of the 1 - 9/16" sound absorptive system shall be as follows:

Frequency, Hz	Absorption Coefficient
100	.06
125	.20
200	.57
250	.71
400	1.02
500	1.02
800	.98
1000	.90
1250	.86
1600	.87
2000	.77
2500	.73
4000	.77
5000	.75

D. Fire Test Data:

1. Certified Reports on Surface Burning Characteristics Determined by ASTM E 84 *Twenty-Five Foot Tunnel Furnace Test Method*, conducted by a recognized, independent, testing agency, shall be submitted upon request and meet the following minimum requirements:

    a. Class A Flame Spread Classification
        1. 25 Flame Spread or less
        2. 10 Smoke Development or less

E. Mold Test Data

1. Certified Reports from an independent, testing agency, shall be submitted upon request and meet the following minimum requirements:

    a. Testing per ASTM 3273

1. 10 / 10 – Week 4 – No Defacement

b. Testing per ASTM G – 21 F, attaining a rating of 0.

F. Light Reflectance Coefficient Test Data:

1. Certified Reports on Light Reflectance Coefficient Performance Determined by ASTM E *1477-98 Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating Sphere Reflectometer*, conducted by a recognized, independent, testing agency, shall be submitted upon request and meet the following minimum requirements:

a. Light Reflectance Value
1. Light Reflectance Value 'L' a minimum of 0.79.

G. VOC Emission Test Data:

1. Test Certificate from an independent testing certificate for California Department of Public Health CDPH / EHLB / Standard Method Version 1.1, 2010

a. School Classroom - Compliant
b. Private Office – Compliant

H. R-Value:

1. R-Value – 6.83 or greater

1.6 REFERENCES

A. ASTM C 423-09a: Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method 'Type A' Mounting.

B. ASTM E 795-05: Standard Practices for Mounting Test Specimens During Sound Absorption Tests.

C. ASTM E 84: Standard Test Method for Surface Burning Characteristics and Building Materials. Class A Fire Rating.

D. ASTM C842, Specification and Standards for Application of Interior Gypsum Plaster.

E. ASTM E 1477-98 Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating Sphere Reflectometer.

F. VOC Test - California Department of Public Health CDPH / EHLB / Standard Method Version 1.1, 2010

G. ASTM 3273, ASTM G – 21 B, and ASTM G – 21 F Mold Resistance and Fungal Resistance Test

1.7 DELIVERY, STORAGE AND HANDLING

A. Ship and deliver in protective packaging to prevent freight damage.

B. Allow materials to become acclimated to Project conditions before installation.

C. Store materials in accordance with manufacturer's recommendations in a fully enclosed space where materials will be protected against damage from moisture, surface contamination and other causes. All wet work must be completed in area of storage.

D. Protect BASWAphon Base and BASWAphon Fine Coat from freezing. Product that has frozen cannot be used and is not warranted.

1.8 PROJECT CONDITIONS

A. Environmental Requirements: Comply with requirements of referenced plaster application standards and recommendations of product manufacturer for environmental conditions before, during and after installation.

B. Temperature Requirements: Where ambient outdoor temperature at the building site is less than 55º F (13º C), a temperature of not less than 55º F and not more than 80º F shall be maintained continuously in the area of the installation for a period of not less than one week prior to the application of BASWAphon Sound Absorbing Plaster System. Temporary heat shall be evenly distributed to prevent concentrated uneven heat or cold on the BASWAphon Sound Absorbing Plaster System or its substrate. Acceptable temperature range shall be maintained until the permanent HVAC system is activated.

C. Ventilation: Ventilate building spaces as required to remove excess moisture to promote drying of the applied materials.

D. Protect contiguous work form soiling, splattering, moisture deterioration and other harmful effects that may be caused by the application of the materials.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials and installation shall be based upon the BASWAphon Sound Absorbing Plaster System's performance, specifications, information, and details as supplied by BASWA acoustic North America, LLC, 21863 Aurora Rd., Cleveland, OH 44146, www.baswaphon.com, (440.951.6022). Other products and installers must meet the design and performance criteria described herein. Substitutions shall only be approved by architect, in writing, prior to bid date.

B. The BASWAphon Sound Absorbing Plaster System shall be provided in a total system thickness (adhesive, Pre-Coated mineral wool panels, Base Coat and Fine Coat) of approximately 1 - 9/16" (40mm).

C. The BASWAphon Sound Absorbing Plaster System shall consist of BASWAphon Pre-Coated mineral wool supporting panels, BASWAphon panel adhesive, BASWAphon Fill, a base coat of BASWAphon Base and a finish coat of BASWAphon Fine Coat.

D. Trim Pieces:

1. All corner beads, reveals, terminations, control joints or other trim pieces shall be white vinyl, manufactured by Trim-Tex or Vinyl Corp. in profiles approved by BASWA acoustic. Trims shall be installed with Trim-Tex 847 Spray Adhesive; no other adhesive is approved.

E. The Base and Fine Coat coats shall be provided in the standard BASWAphon “natural white” color.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas where, and conditions under which, the BASWAphon Sound Absorbing Plaster System is to be installed. Correct any conditions detrimental to the proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected in order to permit the proper installation of the work.

B. Verify that all mechanical and electrical services within the area of application have been roughed in at the appropriate depth relative to the thickness of the system; tested and approved, prior to commencement of application. Review approved details provided by BASWA acoustic for verification.

3.2 ACCEPTABLE SUBSTRATE

A. General:

1. The BASWAphon Sound Absorbing Plaster System must be installed over a “sealed air tight” stable substrate. All penetrations shall be “closed off” to prevent air from passing through the BASWAphon Sound Absorbing Plaster System, thereafter through the substrate and then into the plenum above, or vice versa.

2. All HVAC, electrical, fire sprinkler and other penetrations of the substrate shall be sealed with traditional drywall tape or a self-adhesive fire tape to prevent air movement between the plenum and finished space or vice versa.

3. Adhesive Strength required for bonding to the substrate surface for the application of the BASWAphon Sound Absorbing Plaster System is a minimum of 17 N/psf.

4. Plywood substrates are not acceptable due to the potential of excessive expansion and contraction movement.

5. All substrates for the application shall not vary from plumb, level, or a “smooth consistent curvature” by more than a total of 1/4 inch in 12 feet.

B. Substrate Material:

1. New drywall substrates receiving the full BASWAphon Sound Absorbing Plaster System shall be a Level One finish; taped only.

3.3 INSTALLATION

A. General Information and Requirements:

1. Hand Tools:

a. All application of BASWAphon Pre-Coated mineral wool panels, Fill, Base and Fine Coats must be facilitated by using the proper BASWAphon stainless steel flat or notched hand trowels supplied by BASWA acoustic. The proper notched gauging trowels and smoothing

trowels shall be used at each step noted below in order to control material thickness.

2. BASWAphon Pump (Optional):

    a. The BASWAphon Base and Fine Coats may be applied by using traditional hawk and trowel methods; however, use of the BASWAphon pump, dramatically increases production and greatly reduces product waste. The proper notched gauging trowels and smoothing trowels shall be used at each step noted below in order to control material thickness. BASWAphon pump is supplied by BASWA acoustic.

3. Lighting:

    a. Inherent in all hand troweled product applications, minor acceptable trowel marks or imperfections in the finished surface may occur and become exposed or “exaggerated” under critical lighting. Ensure that the lighting used during the entire installation process replicates the actual finished lighting. All skylights, clearstory windows and other openings which naturally light the area of the installation shall be uncovered during the entire installation in order to represent finished conditions.

4. Drying Times:

    a. Drying times for the BASWAphon panel adhesive, Fill, Base and Fine Coats are typically overnight, however, drying times may be longer due to unusual on-site conditions. Prior to proceeding with any additional work, ensure BASWAphon panel adhesive, Fill, Base or Fine Coat is completely and thoroughly dry.

5. Finished Coat Installation:

    a. Application of the BASWAphon Fine Coat shall be facilitated in one operation at each area of installation; “cold joints” in the Fine Coat are not acceptable.

6. Staging:
    a. Generally, the BASWAphon Sound Absorbing Plaster System is installed using full “tiered scaffolding with outriggers” on wall applications and / or a full “dance floor scaffolding” on ceiling applications in order to achieve an acceptable finish without “cold joints”. Rolling tower scaffolds which can be moved across an installation area may also be acceptable.

7. Access Doors in BASWAphon:

    a. Access Doors used in the BASWAphon Sound Absorbing Plaster System shall be “trimless” and have a 1” recessed door. Access Door shall be model number 5020, sized as required, manufactured by Acudor Products, Inc. (800.722.0501). Install per detail approved by BASWA acoustic.

8. Securing to BASWAphon:

a. Light fixtures, ornamentation, speakers, cover plates or any other items cannot be attached to the BASWAphon Sound Absorbing Plaster System. Ensure items are secured to proper blocking or other attachment system independent of the BASWAphon Sound Absorbing Plaster System per details approved by BASWA acoustic.

B. Installation Procedures:

1. Install BASWAphon Sound Absorbing Plaster System materials in accordance with BASWA acoustic's installation instructions and details. Installation shall start only after all other work in the area of the installation has been completed.

a. Pre-Coated Mineral Wool Panels:

1. A field applied 2mm thick layer of BASWAphon adhesive is applied to the mineral wool back face of the BASWAphon 36mm thick Pre-Coated panel. Panel is pressed firmly onto and fully adhered to the stable substrate. Ensure that panels are set as level and as smooth to each other as practicable. Stagger joints between panels.

b. Trim:

1. Install white vinyl trim pieces. Trims shall be installed with Trim-Tex 847 Spray Adhesive; no other adhesive is approved.

c. Fill:

1. Fill seams between BASWAphon Pre-Coated panels with BASWAphon Fill, and cover all white vinyl trim with BASWAphon Fill. Sand Fill smooth when completely dry.

d. Base (Natural White):

1. Prior to applying the layer of BASWAphon Base, ensure product is thoroughly mixed and all pails for each separate area are batched together in order to provide even consistent coloring. Apply a 2.0 – 3.0mm thick layer and trowel smooth. Sand smooth when completely dry.

e. Fine Coat (Natural White):

1. Prior to applying the finish layer of BASWAphon Fine Coat, ensure product is thoroughly mixed and all pails for each separate area are batched together in order to provide even consistent coloring. Apply a 0.5 – 1.0mm thick layer of BASWAphon Fine Coat and trowel smooth to a quality level consistent with accepted samples or mock-up. Note that BASWAphon is a hand troweled finished product. Inherent in all hand troweled product applications, minor acceptable trowel marks and other imperfections in the finished surface may occur which are only visible at certain times of day or under certain critical lighting conditions. The finish should be critically viewed only under end-use lighting conditions

END OF SECTION

SECTION 09 30 00
TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tile for floor applications.

B. Tile for wall applications.

C. Ceramic accessories.

D. Ceramic trim.

E. Non-ceramic trim.

1.02 RELATED REQUIREMENTS

A. Section 07 90 05 - Joint Sealers.

B. Section 07 95 13 - Expansion Joint Cover Assemblies: Expansion joint components.

C. Section 09 21 16 - Gypsum Board Assemblies: Tile backer board.

1.03 REFERENCE STANDARDS

A. ANSI A108/A118/A136.1 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium); 2013.1.
   1. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar; 2014.
   2. ANSI A108.1b - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).
   3. ANSI A108.1c - Specifications for Contractors Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Bed with Dry-Set or Latex-Portland Cement; 1999 (Reaffirmed 2010).
   4. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive; 2009 (Revised).
   5. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).
   6. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy; 1999 (Reaffirmed 2010).
   7. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout; 1999 (Reaffirmed 2010).
   8. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout; 1999 (Reaffirmed 2010).
   9. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework; 1999 (Reaffirmed 2010).
   10. ANSI A108.11-SystemDeleted - American National Standard for Interior Installation of Cementitious Backer Units; 2010 (Revised).
   11. ANSI A108.12 - American National Standard for Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).
   12. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone; 2005 (Reaffirmed 2010).
   13. ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive; 2013 (Revised).

14. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar; 2012 (Revised).
15. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation; 2010 (Revised).
16. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes For Thin-Set Ceramic Tile And Dimension Stone Installation; 2014.

B. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-set Ceramic Tile and Dimension Stone Installation; 2014.

C. ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar; 2013.1.
   1. ANSI A137.1 - American National Standard Specifications for Ceramic Tile; 2013.1.

D. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2015.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. See Section 01 33 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.

D. Product Data: Provide instructions for using grouts .

E. Samples: Provide sample tiles as requested by Architect for color selection from standard color line.

F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

G. Maintenance Data: Include recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.

H. Maintenance Materials: Furnish the following for Southern Mississippi Investment Company, Inc.'s use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Tile: 20 square feet of each size, color, and surface finish combination.

1.06 QUALITY ASSURANCE

A. Maintain one copy of and ANSI A108/A118/A136.1 and TCNA (HB) on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum 5 years of documented experience.

C. Installer Qualifications: Company specializing in performing tile installation, with minimum of 5 years of documented experience.

1.07 MOCK-UP

A. See Section 01 40 00 - Quality Requirements, for general requirements for mock-up.

B. Construct a dry layout of all tile for Architect's approval before installation.

C. Minimum size of mock-up is indicated on the drawings.

D. Approved mock-up may remain as part of the Work.

1.08 PRE-INSTALLATION MEETING

A. Convene one week before starting work of this section.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.10 FIELD CONDITIONS

A. Maintain ambient and substrate temperature of 50 degrees F during installation of mortar materials.

1.11 EXTRA MATERIALS

A. Provide 20 sq. ft of each size, color, and surface finish of tile specified.

PART 2 PRODUCTS

2.01 TILE

A. Manufacturers: Various manufacturers as specified in the finish schedule.

B. Wall Tile : ANSI A137.1, and as follows:
   1. Moisture Absorption: 3.0 to 7.0 percent.
   2. Size and Shape: Various, as shown in the drawings.
   3. Edges: Various, as shown in the drawings.
   4. Surface Finish: Various, as shown in the drawings.
   5. Colors: as shown in the drawings.
   6. Pattern: Various, as shown in the drawings.
   7. Trim Units: Matching bullnose, cove, base, and curb shapes in sizes coordinated with field tile. Use these shapes only as directed in the drawings.

C. Quarry Tile: ANSI A137.1, and as follows:
   1. Moisture Absorption: 0.5 to 3.0 percent.
   2. Size and Shape: As shown in the drawings.
   3. Thickness: 1/2 inch.
   4. Edges: As shown in the drawings.
   5. Surface Finish: Non-slip.
   6. Colors: To be selected from manufacturer's standard range.
   7. Pattern: As shown in the drawings.
   8. Trim Units: Matching bullnose and cove base shapes in sizes coordinated with field tile.

D. Paver Tile: ANSI A137.1, and as follows:
   1. Manufacturer and product selected in drawings.
   2. Moisture Absorption: 0 to 0.5 percent.
   3. Size and Shape: as shown in drawings.
   4. Face: Various, as selected in the drawings.
   5. Edges: Various as selected in the drawings.
   6. Surface Finish: Various, as selected in the drawings.
   7. Colors: As scheduled in drawings.
   8. Trim Units: Matching various shapes in sizes coordinated with field tile. Trim units, if they exist, are specified or shown in the drawings.

E. Natural Stone Tile:
   1. Composition: As shown in the drawings.
   2. Mesh-Mounted Tiles:
      a. Size and Shape: As shown in the drawings tiles on 12 by 12 inch nominal mesh backing.
      b. Thickness: 1/4 inch.
   3. Face: Smooth.
   4. Surface Finish: Polished.
   5. Edges: Square.
   6. Moisture Absorption: 0 to 0.3 percent, maximum.
   7. Color(s): As shown on the drawings.

2.02 TRIM AND ACCESSORIES

A. Ceramic Accessories: See drawings for selected finish, same color and finish as adjacent field tile; same manufacturer as tile.

B. Ceramic Trim: Matching cove base ceramic shapes in sizes coordinated with field tile.
   1. Applications:
      a. Open Edges: Bullnose. Use only where shown in the drawings.
      b. Inside Corners: Coved. Use only where shown in the drawings.
      c. Floor to Wall Joints: Cove base. Use only where shown in the drawings.
   2. Manufacturers: Same as for tile.

C. Non-Ceramic Trim: Brushed stainless steel, style and dimensions to suit application, for setting using tile mortar or adhesive.
   1. Applications:
      a. Open edges of floor tile. Use "RENO-U" floor trim by Schluter Systems (800) 472-4588 or equal. H=1/2 inch and W=7/8 inch and L=(length as shown in drawings).
      b. Transition between floor finishes of different heights.
      c. Borders and other trim as indicated on drawings.
   2. Manufacturers:
      a. Schluter-Systems: www.schluter.com.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 SETTING MATERIALS

A. Provide setting materials made by the same manufacturer as grout.

B. Latex-Portland Cement Mortar Bond Coat: ANSI A118.4 or ANSI A118.15.
   1. Applications: Use this type of bond coat where indicated and where no other type of bond coat is indicated.
   2. Products:
      a. LATICRETE International, Inc; LATICRETE 254 Platinum: www.laticrete.com.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

C. Epoxy Adhesive and Mortar Bond Coat: ANSI A118.3.
   1. Applications: Kitchens.
   2. Products:
      a. LATICRETE International, Inc; LATICRETE LATAPOXY 300 Adhesive: www.laticrete.com.

2.04 GROUTS

A. Polymer Modified Grout: ANSI A118.7 polymer modified cement grout.
   1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.
   2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.
   3. Color(s): As selected by Albert & McCleskey Associates Architects from manufacturer's full line.
   4. Products:
      a. LATICRETE International, Inc; LATICRETE PERMACOLOR Grout: www.laticrete.com.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

B. Epoxy Grout: ANSI A118.3 chemical resistant and water-cleanable epoxy grout.
   1. Applications: Kitchens.
   2. Color(s): As selected by Albert & McCleskey Associates Architects from manufacturer's full line.
   3. Products:

a. LATICRETE International, Inc; LATICRETE SPECTRALOCK PRO Premium Grout: www.laticrete.com.
b. Substitutions: See Section 01 60 00 - Product Requirements.

2.05 MAINTENANCE MATERIALS

A. Grout Sealer: Liquid-applied, moisture and stain protection for existing or new Portland cement grout.
1. Composition: Water-based colorless silicone.

2.06 ACCESSORY MATERIALS

A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12; not intended as waterproofing.
1. Type: Fluid-applied.
2. Thickness: 20 mils, maximum.
3. Crack Resistance: No failure at 1/16 inch gap, minimum.
4. Products:
a. LATICRETE International, Inc; LATICRETE Blue 92 Anti-Fracture Membrane: www.laticrete.com.
b. Substitutions: See Section 01 60 00 - Product Requirements.

B. Waterproofing Membrane at Showers and Tiled Tubs: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
1. Fluid or Trowel Applied Type:
a. Material: Synthetic rubber.
b. Products:
1) LATICRETE International, Inc; LATICRETE HYDRO BAN: www.laticrete.com.
2) Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.

C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of setting materials to sub-floor surfaces.

D. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by tile manufacturer and setting materials manufacturer.

E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Protect surrounding work from damage.

B. Vacuum clean surfaces and damp clean.

C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

3.03 INSTALLATION - GENERAL

A. Install tile, thresholds, and stair treads and grout in accordance with applicable requirements of ANSI A108.1a thru A108.13, manufacturer's instructions, and TCNA (HB) recommendations.

B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.

C. Place thresholds at exposed tile edges.

D. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.

E. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.

F. Form internal angles square and external angles bullnosed.

G. Install ceramic accessories rigidly in prepared openings.

H. Install non-ceramic trim in accordance with manufacturer's instructions.

I. Sound tile after setting. Replace hollow sounding units.

J. Keep control and expansion joints free of mortar, grout, and adhesive.

K. Keep expansion joints free of adhesive or grout. Apply sealant to joints.

L. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

M. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.

N. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

O. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS

A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout, unless otherwise indicated.

B. Where waterproofing membrane is indicated, install in accordance with TCNA (HB) Method F122, with latex-Portland cement grout.

C. Where epoxy bond coat and grout are indicated, install in accordance with TCNA (HB) Method F131.

3.05 INSTALLATION - SHOWERS AND BATHTUB WALLS

A. At tiled shower receptors install in accordance with TCNA (HB) Method B415, mortar bed floor, and W244, thin-set over cementitious backer unit walls.

B. Grout with standard grout as specified above.

C. Seal joints between tile work and other work with sealant Type Bathtub/Tile Sealant specified in Section 07 90 05.

3.06 INSTALLATION - WALL TILE

A. Over cementitious backer units on studs, install in accordance with TCNA (HB) Method W244, using membrane at toilet rooms, kitchens, and locker rooms.

B. Over interior concrete and masonry install in accordance with TCNA (HB) Method W202, thin-set with dry-set or latex-Portland cement bond coat.

3.07 CLEANING

A. Clean tile and grout surfaces.

3.08 PROTECTION

A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION

SECTION 09 51 00
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Ceiling tiles.

1.2 RELATED REQUIREMENTS

A. Section 07 90 05 - Joint Sealers: Acoustical sealant.

1.3 REFERENCE STANDARDS

A. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2013a.

B. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2014.

1.4 SUBMITTALS

A. Provide ceiling types as indicated on the finish Schedule codes within drawings.

B. See Section 01 33 00 - Administrative Requirements, for submittal procedures.

C. Product Data: Provide data on suspension system components.

D. Samples: Submit two samples 6 by 6 inch in size illustrating material and finish of acoustical units.

E. Samples: Submit two samples each, 6 inches long, of suspension system main runner.

F. Maintenance Materials: Furnish the following for the City of Hattiesburg's, use in maintenance of project.
   1. See Section 01 33 00, for additional provisions.
   2. Extra Acoustical Units: Quantity equal to 5 percent of total installed.

1.5 QUALITY ASSURANCE

A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.6 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

1.7 PROJECT CONDITIONS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Install acoustical units after interior wet work is dry.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acoustic Panels:
   1. Armstrong World Industries, Inc: www.armstrong.com.
   2. USG: www.usg.com.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Suspension Systems:
   1. Same as for acoustical units.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 ACOUSTICAL UNITS

A. Acoustical Units - General: ASTM E1264, Class A.

B. Note: T-Bar Smart Lights are specified to be used in some grid systems; See Electrical Drawings and Specifications for this information. Where the T-Bars are shown in a room, ALL of the grids in that room are to be matching widths to the specified T-Bar width.

C. Acoustical Tile Type LAT-1:
   1. Calla by Armstrong; Square Lay-in; Beveled Tegular; Sizes indicated in drawings.
   2. Mars HiNRC by USG; Square Lay-in; Beveled Tegular; Sizes indicated in drawings.
   3. Suspension System Type: B.

D. Acoustical Tile Type LAT-2:
   1. Ceramaguard by Armstrong; Unperforated; Square Lay-in; Sizes indicated in drawings.
   2. Radar Ceramic by USG; Unperforated; Square Lay-in; Sizes indicated in drawings.
   3. Suspension System Type: A.

E. Acoustical Tile Type LAT-3:
   1. Dune by Armstrong; Angled Tegular; Sizes indicated in drawings.
   2. Olympia Micro by USG; Angled Tegular; Sizes indicated in drawings.
   3. Suspension System Type: A and B.

F. Acoustical Tile Type LAT-4:
   1. Lyra by Armstrong; Square Tegular; Sizes indicated in drawings.
   2. Suspension System Type: C.

G. Acoustical Tile Type LAT-5: Specified in Section 09 54 23.

H. Ceiling Type LAT-6:
   1. Soundscapes Blades.
   2. Color: White
   3. Size: 22" x 94".

I. Perforated Metal Ceiling Type LAT-7: Aluminum flat formed sheet.
   1. Metalworks by Armstrong.
   2. Size: 24 by 24 inches.
   3. Color: White.
   4. Style: Vector.
   5. Perforation Pattern: M2 Microperf.
   6. Percentage Open Area: 25%.

2.3 SUSPENSION SYSTEM(S)

A. Manufacturers:
   1. Armstrong World Industries, Inc: www.armstrong.com.
   2. USG: www.usg.com.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.

C. Note: T-Bar Smart Lights are specified to be used in some grid systems; See Electrical Drawings and Specifications for this information. Where the T-Bars are shown in a room, ALL of the grids in that room are to be matching widths to the specified T-Bar width.

D. Exposed Steel Suspension System Type A: Formed steel (stainless steel for outside use), commercial quality cold rolled; Intermediate-duty.
   1. Profile: Tee; 15/16 inch wide face.
   2. Construction: Double web.
   3. Finish: White painted.
   4. Products:

a. Prelude.
b. Substitutions: See Section 01 60 00 - Product Requirements.

E. Suspension System Type B: Formed steel, commercial quality cold rolled; intermediate-duty.
1. Profile: Tee; 9/16 inch.
2. Construction: Double web.
3. Products:
a. Suprafine.
b. Substitutions: See Section 01 60 00 - Product Requirements.

F. Suspension System Type C: Formed steel, commercial quality cold rolled.
1. Profile: Suprafine; 9/16 inch.
2. Construction: Double web.
3. Product: TechZone by Armstrong.
4. Substitutions: See Section 01 63 00.

2.4 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application and ceiling system flatness requirement specified.

B. Acoustical Insulation: ASTM C665, friction fit type, unfaced batts.
1. Thickness: 2 inch.

C. Acoustical Sealant For Perimeter Moldings: Specified in Section 07 90 05.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.2 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C 636, ASTM E 580, and manufacturer's instructions and as supplemented in this section.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

C. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.

D. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

E. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

F. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

G. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.

H. Do not eccentrically load system or induce rotation of runners.

3.3 INSTALLATION - TILES

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install units after above-ceiling work is complete.

E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

F. Cutting Acoustical Units:
   1. Cut to fit irregular grid and perimeter edge trim.
   2. Make field cut edges of same profile as factory edges.

G. Install hold-down clips on each panel to retain panels tight to grid system; comply with fire rating requirements.

H. Install hold-down clips on panels within 20 ft of an exterior door.

3.4 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.5 SCHEDULE

A. See Finish Schedule in Drawings.

END OF SECTION

SECTION 09 64 23
HARDWOOD FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wood plank flooring, adhesive applied.

B. Surface finishing for WD-1.

C. Special requirements for museum environments.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete03 30 00: Concrete subfloor surface.

1.03 REFERENCE STANDARDS

A. MFMA (SPEC) - Guide Specifications for Maple Flooring Systems; current edition.

B. NWFA (IG) - Installation Guidelines; current edition located at www.nwfa.org.

1.04 SUBMITTALS

A. See Section 01340 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for flooring and floor finish materials.

C. Shop Drawings: Indicate floor joint pattern and termination details.

D. Samples: Submit two samples 12x5 inch in size illustrating floor finish, color, and sheen.

E. Installation Instructions: Indicate standard. Include manufacturer's recommendations for accessory products.

F. Maintenance Data: Include maintenance procedures, recommended maintenance materials, suggested schedule for cleaning, and polishes and waxes.

G. Maintenance Materials: Furnish the following for Southern Mississippi Investment Company, Inc.'s use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Flooring Material: 10 square yards matching installed flooring.
   3. Extra Adhesive: Quantity necessary for installation of extra flooring material.

1.05 QUALITY ASSURANCE

A. Perform work of this section in accordance with MFMA (SPEC) and NWFA (IG).

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing work of this section with minimum five years experience.

D. This product is being installed in a museum environment housing priceless artifacts. Products that will off-gas initially or over time will not be approved for use. This includes but is not limited to products that contain the following: PVC (polyvinyl chloride), PVDC (polyvinylidene), PVA (polyvinyl acetate), Acidic Polyesters, Polyurethane Foams, Chloroprene, Formaldehyde.

1.06 FIELD CONDITIONS

A. Do not install wood flooring until wet construction work is complete and ambient air at installation space has moisture content stabilized at maximum moisture content of 40 percent.

B. Provide heat, light, and ventilation prior to installation.

C. Store materials in area of installation for minimum period of 24 hours prior to installation.

D. Maintain minimum room temperature of 65 degrees F and relative humidity in accordance with adhesive manufacturer's instructions for a minimum period of 48 hours prior to delivery of materials to installation space, during installation, and after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hardwood Flooring:
   1. Armstrong World Industries, Inc: www.armstrong.com.
   2. Substitutions: See Section 01 63 00.

2.02 MATERIALS

A. Wood Plank Flooring - Type WD-1: Armstrong Hardwood Flooring: Commercial Hardwood - Performance Plus - ESP5254.
   1. Species: Walnut.
   2. Color: Earthly Shade.
   3. Moisture Content: 10 to 12 percent.
   4. Actual Thickness: 3/8 inch.
   5. Unit Size: 5 x 48 and varing lengths inch.
   6. Factory Finish: Natural.

B. Primers and Adhesives: Water-resistant; types recommended by flooring manufacturer for project substrates.

2.03 ACCESSORIES

A. Primers and Adhesives: Water-resistant; types recommended by flooring manufacturer for project substrates.

B. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.

C. Transition Strip: Same species and finish as flooring material; profiles indicated.

2.04 SOURCE QUALITY CONTROL

A. Inspect and stamp species and grade on underside of each piece of wood flooring at factory.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive wood flooring.

B. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of materials to sub-floor surfaces.

C. Verify that concrete sub-floor surfaces are ready for wood flooring installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by adhesive materials manufacturer.

D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Prepare sub-floor to receive wood flooring in accordance with manufacturer's, MFMA, and NWFA instructions.

B. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.

C. Prohibit traffic until filler is cured.

D. Vacuum clean substrate.

3.03 INSTALLATION

A. Adhesives:
   1. Spread only enough adhesive to permit installation of materials before initial set. Exceeding adhesive manufacturer's recommended spread rate of adhesive for substrate is prohibited.
   2. Remove excess adhesive extruded through floor surface as work progresses.

B. Wood Flooring:
   1. Install wood flooring in accordance with manufacturer's, MFMA, and NWFA installation instructions.
   2. Set wood flooring in place, press with heavy roller to attain full adhesion.
   3. Lay flooring parallel to length of room areas. Verify alignment as work progresses.
   4. Arrange flooring with end matched grain set flush and tight.
   5. Terminate flooring at centerline of door openings where adjacent floor finish is dissimilar; provide divider strips and transition strips in accordance with flooring manufacturer's recommendations and as indicated.
   6. Install edge strips at unprotected or exposed edges, and where flooring terminates.
   7. Secure edge strips before installation of flooring with stainless steel screws.
   8. Install flooring tight to floor access covers.

3.04 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damaging surfaces.

B. Clean and polish floor surfaces in accordance with floor finish manufacturer's instructions.

3.05 PROTECTION

A. Prohibit traffic on floor finish for 48 hours after installation.

B. Place protective coverings over finished floors; do not remove coverings until Substantial Completion.

END OF SECTION

SECTION 09 65 00
RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient base.

1.02 REFERENCE STANDARDS

A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2014c.

B. ASTM F1861 - Standard Specification for Resilient Wall Base; 2008 (Reapproved 2012).

C. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2015.

1.03 SUBMITTALS

A. See Section 01340 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

C. Selection Samples: Submit manufacturer's complete set of color samples for Albert & McCleskey Associates Architects's initial selection.

D. Verification Samples: Submit two samples, 2 by 2 inch in size illustrating color and pattern for each resilient flooring product specified.

E. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Protect roll materials from damage by storing on end.

1.05 FIELD CONDITIONS

A. Maintain temperature in storage area between 55 degrees F and 90 degrees F.

B. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

1.06 EXTRA MATERIALS

A. Provide 2% of flooring, 2% lineal feet of base, of each type and color specified.

PART 2 PRODUCTS

2.01 RESILIENT BASE

A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove.
   1. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648 or NFPA 253.
   2. Height: 6 inch.
   3. Thickness: 0.125 inch thick.
   4. Finish: Satin.
   5. Length: Roll.
   6. Color: Color as selected from manufacturer's standards.
   7. Accessories: Premolded external corners and end stops.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.

3.02 PREPARATION

A. Clean substrate.

3.03 INSTALLATION

A. Starting installation constitutes acceptance of sub-floor conditions.

B. Install in accordance with manufacturer's instructions.

C. Spread only enough adhesive to permit installation of materials before initial set.

D. Fit joints tightly.

E. Set flooring in place, press with heavy roller to attain full adhesion.

F. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.

G. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.

H. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

3.04 RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.

B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.

C. Install base on solid backing. Bond tightly to wall and floor surfaces.

D. Scribe and fit to door frames and other interruptions.

3.05 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's instructions.

C. Clean, seal, and wax resilient flooring products in accordance with manufacturer's instructions.

END OF SECTION

Section 09 65 19

RESILIENT RUBBER TILE

PART 1 GENERAL

1.1 SUMMARY

Section Includes: RUBBER FLOOR TILE

1.2 REFERENCED DOCUMENTS

A. ASTM International

1. C423, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
2. D412, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension.
3. D395, Standard Test Methods for Rubber Property - Compression Set.
4. D471, Standard Test Method for Rubber Property-Effect of Liquids.
5. D624, Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
6. D792, Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
7. D2047, Standard Test Method for Static Coefficient of Friction as Measured by the James Machine.
8. D2199, Standard Test Method for Determining Dimensional Stability of Resilient Floor Tile after Exposure to Heat.
9. D2859, Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials.
10. D3389, Standard Test Method for Coated Fabrics Abrasion Resistance (Rotary Platform, Double- Head Abrader).
11. E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
12. E90, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
13. E492, Standard Test Method for Laboratory Measurement of Impact Sound Transmission through Floor-Ceiling Assemblies Using the Tapping Machine.
14. E595, Standard Test Method for Total Mass Loss and Collected Volatile Condensable Materials from Outgassing in a Vacuum Environment.
15. E648, Standard Test Method for Critical Radiant Flux of Flooring Systems Using a Radiant Energy Source.
16. E662, Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials.
17. F137, Standard Test Method for Flexibility of Resilient Flooring Materials with Cylindrical Mandrel Apparatus.
18. F373, Standard Test Method for Embossed Depth of Resilient Floor Coverings.
19. F386, Standard Test Method for Thickness of Resilient Flooring Materials Having Flat Surfaces.
20. F511, Standard Test Method for Quality of Cut (Joint Tightness) of Resilient Floor Tile.
21. F710, Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
22. F925, Standard Test Method for Resistance to Chemicals of Resilient Flooring.
23. F970, Standard Test Method for Static Load Limit.
24. F1344, Standard Specification for Rubber Floor Tile.
25. F1482, Standard Guide to Wood Underlayment Products Available for Use Under Resilient Flooring.
26. F1514, Standard Test Method for Measuring Heat Stability of Resilient Flooring by

Color Change.
27. F1515, Standard Test Method for Measuring Light Stability of Resilient Flooring by Color Change.
28. F1859, Standard Specification for Rubber Sheet Floor Covering Without Backing.
29. F2055, Standard Test Method for Size and Squareness of Resilient Floor Tile by Dial Gage Method.
30. F2240, Standard Test Method for Rubber Property - Durometer Hardness.
31. G21, Standard Test Method for Determining Resistance of Synthetic Polymeric Materials to Fungi.

B. Other Referenced Documents
1. National Fire Protection Association (NFPA) 255, Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Energy Source.
2. National Fire Protection Association (NFPA) 258, Test Method for Specific Density of Smoke Generated by Solid Materials.
3. FMVSS 302, Title 49, Part 571, Flammability of Interior Materials.
4. IMO Resolution A.653 (16), Surface Flammability of Deck Finish (Shipboard use).
5. Title 16, CFR Chapter II, Subchapter D, Part 1630, Standard for the Surface Flammability of Carpets and Rugs (FF 70).
6. California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65).
7. The Collaborative for High Performance Schools (CHPS).

1.3 SUBMITTALS

A. Product Data: Submit product data, including manufacturer's specification summary sheet for specified products.
B. Shop Drawings: Submit shop drawings showing layout, finish colors, patterns and textures.
C. Samples: Submit selection and verification samples for finishes, colors, and textures.
D. Quality Assurance Submittals: Submit the following
1. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
2. Manufacturer's Instructions: Manufacturer's installation and maintenance instructions.
E. Maintenance Information: Maintenance information for installed products in accordance with Division 1 sections.
1. Methods for maintaining installed products.
2. Precautions against cleaning materials and methods detrimental to finishes and performance.
F. Warranty: Warranty documents specified herein.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Installer experienced in performing work of this section who has specialized in installing work similar to that required for this project.
B. Regulatory Requirements
1. Fire Performance characteristics: Provide resilient rubber floor covering with the following Fire performance characteristics as determined by testing products in accordance with ASTM method (and NFPA method) indicated below by a certified testing laboratory or another testing and inspecting agency acceptable to authorities having jurisdiction.
a. ASTM E648 (NFPA 253), Critical Radiant Flux of Floor Covering Systems; Class 1, Greater than 0.45 W/cm^2.
b. ASTM E662 (NFPA 258), Specific Optical Density of Smoke Generated by Solid Materials; < 450.

C. Single-Source Responsibility: Obtain rubber floor tile and manufacturer’s recommended adhesive from a single supplier.
D. Pre-Installation Meetings: Conduct pre-installation meeting to verify project requirements,

Manufacturer's conditions, recommended adhesive depending on product, substrate type and type of installation, manufacturer's installation instructions and manufacturer's warranty requirements. Comply with requirements in Division 1.

1.5 DELIVERY, STORAGE AND HANDLING

A. General: Comply with requirements in Division 1.
B. Ordering: Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays.
C. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with Identification labels intact.
D. Storage and Protection: Store materials protected from exposure to harmful weather conditions and acclimated to site conditions at temperature and humidity conditions recommended by manufacturer.

1.6 PROJECT CONDITIONS

A. Environmental Requirements/Conditions: In accordance with manufacturer's recommendations, areas to receive rubber flooring shall be clean, fully enclosed, weather tight with the permanent HVAC set at a uniform temperature of 65º - 85º F for 48 hours prior to, during and thereafter installation of rubber flooring. Rubber flooring and adhesive shall be conditioned in the same manner. Rubber flooring/tile must be un-boxed at least 48 hours prior to installation in the areas in which it will be installed.
B. Existing Conditions: (Specify existing conditions affecting product use and installation).

1.7 SEQUENCING AND SCHEDULING

A. Finishing Operations: Install rubber flooring after finishing operations, including floor covering, painting and ceiling operations, have been completed.

1.8 MAINTENANCE

A. Extra Materials: Deliver to Owner extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Division 1, Closeout Submittals Section.
B. Quantity: Furnish quantity of Rubber flooring equal to 5% of amount to be installed.
C. Delivery, Storage and Protection: Comply with Owner's requirements for delivery, storage and protection of extra materials.
D. Maintenance of finished floor covering to be conducted per Manufacturer's Maintenance Guide.

1.9 WARRANTY

A. Manufacturer's Materials Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.
   1. Warranty: 1 year limited warranty commencing on Date of Substantial Completion. Notice of any defect must be made in writing to manufacturer within 30 days after buyer learns of the defect.
   2. Limited Wear Warranty: 10 year limited wear warranty available depending on product type/design & type of use.

PART 2 PRODUCTS

2.1 RUBBER TILE FLOORING

A. Manufacturer: Flexco Corporation, 1401 E. 6th Street, Tuscumbia, AL 35674. Phone: 800-633-3151, Fax: 800-346-9075, Web: www.flexcofloors.com
B. Test results
   1. ASTM C423, Sound Absorption (Noise Reduction Coefficient); 0.05

2. ASTM D2047, Static Coefficient of Friction (Slip Resistance); Passes, flat surface
3. ASTM D2240, Hardness (Shore A Durometer); > 85
4. ASTM D3389, Abrasion Resistance; Passes
5. ASTM E84 (NFPA 255), Surface Burning Characteristics, Flamespread; Standard Formula is Class B (26-75), Class A Formula is Class A (0-25)
6. ASTM E90, Airborne Sound Transmission (Sound Transmission Class); 51
7. ASTM E492, Impact Sound Transmission (Impact Insulation Class); 37
8. ASTM E595, Outgassing; Excellent, Test Results Available
9. ASTM E648 (NFPA 253), Critical Radiant Flux; Class 1, > 1.00 W/cm^2
10. ASTM E662 (NFPA 258), Specific Optical Density of Smoke Generated by Solid Materials; Passes, < 450
11. ASTM F137, Flexibility; Passes, bends around a ¾" mandrel with no cracks or breaks
12. ASTM F925, Resistance to Chemicals; Passes, List available
13. ASTM F970, Static Load Limit; 250 psi,
14. ASTM F1344, Specification for Rubber Floor Tile; Class I, Type A
15. ASTM F1515, Light Stability; Passes, Delta E < 8.0
16. ASTM G21, Determining Resistance of Synthetic Polymeric Materials to Fungi; 0, No Growth
17. FMVSS 302, Title 49, Part 571, Flammability of Interior Materials; Passes
18. IMO Resolution A.653(16), Surface Flammability of Deck Finish (Shipboard use); Passes
19. Complies with California Proposition 65
20. Approved for Collaborative for High Performance Schools 01350, Low-Emitting Material Criteria

C. Product Warranty
   1. Manufacturer's one year limited warranty for manufacturing defects.
   2. Manufacturer's ten year limited wear warranty.

D. Proprietary Product(s): Flexco Rubber Floor Tile.
   1. **Radial® Texture (RBT & RLT)**
      a. Formulation:
         1) Class A Formulation
      b. Color:
         1) "Evolving Styles - Creative Elements # [Delft Pansy], complies with ASTM F1344; class 1B, Through Mottled Homogeneous
      c. Size: 12" x 12" (457.2 mm x 457.2 mm)
      d. Thickness: 1/8" (3.175 mm)
      e. Disc size: 1" (25.4 mm) nominal
      f. Disc Height (select one):
         1) Style RBT 0.035" (high profile) nominal

2.2 PRODUCT SUBSTITUTIONS

A. Substitutions: As permitted by Section 01 63 00.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's requirements as published in Flexco installation instructions
B. Adhesive: Flexco brand adhesives, as required, based on product specified, job site conditions, subfloor type, and planned use of finished floor
   1. Section 2.01 Rubber Tile Flooring
      a. Flexco 16/86 Multi-Purpose Tile & Tread Adhesive
      b. Flexco 77 Solvent Free Epoxy Adhesive (Should always be used for Repel Formulation, IMO Formulation, properly prepared non-porous substrates, below grade, rolling loads,

lateral sheer stress, non climate controlled areas and/or direct sunlight)

3.2 EXAMINATION

A. Site Verification of Conditions: Confirm substrate conditions (which have been previously addressed under other sections) are acceptable for product installing in accordance with manufacturer's instructions.

B. Material Inspection: In accordance with manufacturer's installing requirements, visually inspect materials prior to installing. Material with visual defects shall not be installed.

3.3 PREPARATION

A. Adjacent Surfaces Protection: Protect adjacent work areas and finish surfaces from damage while installing.

B. Substrate Preparation: Prepare substrate to be free of paint, old adhesive, sealers, coatings, finishes, dirt, film-forming curing compounds, or other substances which may affect the adhesion of floor covering to the substrate.

1. Concrete Substrate: Reference Standard ASTM F710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring. If the following test results exceed the floor covering manufacturer's limits, installing shall not commence until results conform to limits.
   a. Concrete Moisture Test: Per ASTM F1869 Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
      1) Flexco 16/86 Multi-Performance Tile and Tread Adhesive, 4 lbs or less
      2) Flexco 77 Solvent Free Epoxy Adhesive, 5 lbs or less
      3) Flexco FlexTuft Adhesive, 4 lbs or less
      4) Flexco 220 Sports Flooring Adhesive, 5 lbs or less
   b. Concrete Moisture Test: Per ASTM F2170 Determining Relative Humidity in Concrete Floor Slabs using *in situ* Probes
      1) Flexco 16/86 Multi-Performance Tile and Tread Adhesive, 70% RH or less
      2) Flexco 77 Solvent Free Epoxy Adhesive, 75% RH or less
      3) Flexco FlexTuft Adhesive, 70% RH or less
      4) Flexco 220 Sports Flooring Adhesive, 75% RH or less
   c. Concrete pH Test: Perform pH tests on concrete regardless of its age or grade level or history of use. Readings below 7.0 and above 10.0 can adversely affect resilient flooring or adhesives, or both.
2. Ceramic Tile, Cementitious Terrazzo and Metal: Refer to Flexco Conductive/Static Dissipative Product Data Sheet for installation over these substrates.
3. Do not install over existing floor covering or over substrates not approved by manufacturer.

3.4 INSTALLING

A. Refer to Flexco installation instructions for specific Rubber Flooring detailed specifications on installing.

1. Accessories: Architect shall specify manufacturers' color coordinated accessories as required, including (but not limited to) resilient wall base, stair nosing, reducers or other edgings, welding rods for heat welded seams.

3.5 FIELD QUALITY REQUIREMENTS

A. Manufacturer's Field Services: Upon Owner's request and with minimum 72 hours' notice, provide manufacturer's field service consisting of product use recommendations and periodic site visits to confirm installing of product is in accordance with manufacturer's instructions.

3.6 PROTECTION

A. Protection: Protect installed product and finish surfaces from damage during construction.

Remove and legally dispose of protective covering at time of substantial completion.

B. No heat welding for first 48 hours.
C. Restrict foot traffic from new floor covering for first 48 hours.
D. Restrict furniture, fixtures and rolling traffic for first 72 hours.
E. Restrict cleaning/buffing for first 72 hours.

3.7 INITIAL MAINTENANCE PROCEDURES

A. General: Include in contract sum cost for initial maintenance procedures and execution by professional maintenance personnel after floor covering has been installed for 72 hours as specified in the Flexco maintenance instructions.

3.8 CLEANING

A. Cleaning: See Flexco maintenance instructions. Remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions prior to owner's acceptance. Remove construction debris from project site and legally dispose of.
B. Floor finishes: See Flexco product data information for information on floor finishes to be used.

End of Section

SECTION 09 65 66

RESILIENT ATHLETIC FLOORING

Part 1 – General

1.01 Definitions
A. This specification refers to Reztec™ and Reztec Chunks rubber flooring.
B. Installer is defined as a competent, experienced person assigned to install the flooring material.

1.02 Installer Experience Level
A. Installer must be experienced and competent in the installation of resilient rubber flooring materials. Installer must install flooring per instructions provided by Expanko, Inc.

1.03 Description of Work
A. Prepare sub-floor per manufacturers' instructions in areas specified to receive Reztec flooring.
B. Install flooring material using manufactures' recommended installation products in accordance with manufacturers' instructions.

1.04 Delivery, Storage and Handling
A. All flooring materials are to be delivered to the job site 72 hours prior to installation and are to be stored where they are to be installed. Roll goods are to be stored on end. Roll goods must be unrolled 24 hours prior to installation. A temperature level of 65˚- 75˚ F and relative humidity level of 45° - 65° must be maintained 72 hours prior to, during and 72 hours after installation.

Part 2 – Products

2.01 General
A. Product recommendations and installation and maintenance instructions are based upon Reztec rubber flooring.

2.02 Approved Manufacturers
A. Expanko Resilient Flooring 800.345.6202; www.expanko.com
B. Approved substitutions according to Section 01 63 00.

2.03 Submittals
A. Submit product data, samples and installation and maintenance recommendations for each item specified.
B. Submit two samples to illustrate product shade, design and finish. Samples shall be used as a standard for material to be installed.

2.04 Warranties
A. Manufacturer shall provide a five (5) year warranty against manufacturing defects.

2.05 Materials
A. Reztec rubber flooring shall meet the following specifications.

1. Flooring shall be made of minimum 5% SBR and maximum 95% EPDM rubber with a non-yellowing urethane binder. Material shall be colored throughout the tile with fade resistant pigments. Material shall be rated for flammability as class I (ASTM E648) if 70% or greater EPDM material is specified. Material shall be rated for flammability as class II for materials specified with less than 70% EPDM.
    a. Color: Jet Blue.
2. Physical Properties:
    a. Dimensions: Specify material dimension and thickness in millimeters or inches.
        i. Standard Dimensions:
            aa. Tile: 24" X 24",
        ii. Standard Thickness:
            aa. Tile: 6.0mm

b. Density: Material density shall exceed 78 lbs/ft3

Part 3 - Execution

3.01 Sub-floor preparation

A. Prepare sub-floor according to manufacturers' recommendations.
B. Conduct calcium chloride moisture tests according to manufacturers' recommendations.
C. Sub-floor moisture emissions level shall be less than 3 lbs./1000ft/24 hrs for glue down applications.
D. Provide detailed sub-floor preparation guidelines to those responsible for sub-floor preparation (*Document ID :010 Preinstallation Guidelines)*.

3.02 Application

A. Provide detailed manufacturers' installation instructions to floor installer.
B. Maintain sub-floor temperature for 72 hours prior, during and 72 hours after installation between 65°F and 75°F.
C. Conditions in area of installation must be maintained for 72 hours prior, during and 72 hours after installation between 65°F and 75°F with relative humidity between 45% and 65%.
D. Install Reztec flooring material according to manufacturers' instructions.
E. Install roll goods and tiles in an ashlar or staggered joint pattern. Ex-loc interlocking tile shall be installed with all joints aligned.
F. Install roll goods and tiles using only those adhesives, sealers and floor preparation materials recommended by the manufacturer.
G. Install interlocking tiles without adhesive, using sealers and floor preparation materials recommended by the manufacturer.
H. Roll goods and tile shall be rolled with a 3 section, 100 lb roller 3 times after installation.

3.03 Curing, Cleaning and Protection

A. After installation, the floor will require a minimum of 24 hours to set. Do not finish or clean floor during this period. After 24 hours, the floor shall be maintained according to manufactures post installation maintenance instructions. Where required, floor is to be sealed with the manufactures recommended floor sealer.
B. Only light foot traffic is permitted on floor for 24 hours after installation. Do not use rolling carts, ladders or any other object on the floor that can cause damage.
C. Protect the floor against scratching and gouging with material (reinforced paper, Masonite etc.) suited to the type of traffic it will be submitted to during the completion of construction.
D. After completion of construction, the floor shall be cleaned according to manufacturers' post installation maintenance instructions (*Document ID: 311)*.
E. Provide manufacturers detailed post installation maintenance instructions to those responsible for post installation maintenance (*Document ID: 311).*

END OF SECTION

SECTION 09 68 00
CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Carpet, direct-glued.

B. Accessories.

1.02 REFERENCE STANDARDS

A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2006 (Reapproved 2011).

B. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2005.

C. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2014c.

D. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.

E. CRI (CIS) - Carpet Installation Standard; Carpet and Rug Institute; 2009.

F. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2015.

1.03 SUBMITTALS

A. See Section 01340 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

C. Samples: Submit two samples 24 x24 inch in size illustrating color and pattern for each custom carpet type and two samples 24 x 24 inch in size illustrating color and pattern for each standard carpet type.

D. Submit two, 12 inch long samples of edge strip for each color specified.

E. Manufacturer's Installation Instructions: Indicate special procedures.

F. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet with minimum three years documented experience.

B. Installer Qualifications: Company specializing in installing carpet with minimum three years documented experience.

1.05 FIELD CONDITIONS

A. Store materials in area of installation for minimum period of 24 hours prior to installation.

B. Maintain minimum 70 degrees F ambient temperature 24 hours prior to, during and 24 hours after installation.

C. Ventilate installation area during installation and for 72 hours after installation.

D. Provide (1) full 12 foot x 40 foot roll of each carpet type, color, pattern specified minimum.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Carpet Manufacturers (note: for the purpose of establishing quality and design, Shaw Contract Carpet has been specified:
   1. Shaw Contract:

2.02 CARPET

A. General Carpet Specification:
   1. Roll Width: 12 feet.
   2. Electrostatic Propensity: Less than 3.5 KV - permanent conductive filament.
   3. Flammability: Passes DOC-FF-1-70 Pill Test.
   4. Flooring Radiant Panel Test: Meets NFPA Class 1 whent tested under ASTM E-648 glue down.
   5. Smoke Density: NBS Smoke Chamber NFPA-258 - Less than 450 Flaming Mode.
   6. Warranty: Lifetime Warranty Against Edge Unraveling, Delamination, Zipper, and no more than 10% face yarn lost. 10 year Lightfastness and Atmospheric Contaminant Warranty.
   7. Dye Method: 100% Solution Dyed.

B. Carpet Type CPT-4:
   1. Collection: Silk Collection manufactured by Shaw Contract.
   2. Roll Width: 12 ft.
   3. Color: Good Life; 50220.
   4. Style Name: Twine.
   5. Style Number: 60748.
   6. Construction: Multi-level pattern loop.
   7. Fiber Product: Solution q extreme nylon.
   8. Protective Treatments: SSP Shaw Soil Protection.
   9. Gauge: 1/12 inch.
   10. Stitches per inch: 11.0.
   11. Finished Pile Thickness: .139 inches.
   12. Dye Method: 100% Solution Dyed.
   13. Average Density: 7,770 oz./yd3.
   14. Weight Density: 233,100.
   15. Secondary Backing: Ecoworx performance broadloom.
   16. Warranty: Lifetime Commercial Limited.
   17. Pattern Repeat: 12"W x 24"L.

2.03 ACCESSORIES

A. Sub-Floor Filler: Type recommended by carpet manufacturer.

B. Tackless Strip: Carpet gripper, of type recommended by carpet manufacturer to suit application, with attachment devices.

C. Seam Adhesive: Recommended by carpet manufacturer.

D. Carpet Adhesive: Recommended by carpet manufacturer.

E. Contact Adhesive: Compatible with carpet material; releasable type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive carpet.

B. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesives to sub floor surfaces.

C. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for flooring installation by testing for moisture and alkalinity (pH).
   1. Test in accordance with ASTM F710.
   2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

B. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler.

C. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.

D. Clean substrate.

3.03 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of sub-floor conditions.

B. Install carpet in accordance with manufacturer's instructions.

C. Verify carpet match before cutting to ensure minimal variation between dye lots.

D. Lay out carpet and locate seams in accordance with shop drawings.
   1. Locate seams in area of least traffic, out of areas of pivoting traffic, and parallel to main traffic.
   2. Do not locate seams perpendicular through door openings.
   3. Align run of pile in same direction as anticipated traffic and in same direction on adjacent pieces.
   4. Locate change of color or pattern between rooms under door centerline.
   5. Provide monolithic color, pattern, and texture match within any one area.

E. Install carpet tight and flat on subfloor, well fastened at edges, with a uniform appearance.

3.04 DIRECT-GLUED CARPET

A. Double cut carpet seams, with accurate pattern match. Make cuts straight, true, and unfrayed. Apply seam adhesive to cut edges of woven carpet immediately.

B. Apply contact adhesive to floor uniformly at rate recommended by manufacturer. After sufficient open time, press carpet into adhesive.

C. Apply seam adhesive to the base of the edge glued down. Lay adjoining piece with seam straight, not overlapped or peaked, and free of gaps.

D. Roll with appropriate roller for complete contact of adhesive to carpet backing.

E. Trim carpet neatly at walls and around interruptions.

3.05 CLEANING

A. Remove excess adhesive from floor and wall surfaces without damage.

B. Clean and vacuum carpet surfaces.

END OF SECTION

SECTION 09 68 13
TILE CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Carpet tile, fully adhered.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors.

1.03 REFERENCE STANDARDS

A. CRI (CIS) - Carpet Installation Standard; Carpet and Rug Institute; 2011.

B. CRI (GLA) - Green Label Testing Program - Approved Adhesive Products; Carpet and Rug Institute; Current Edition.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate layout of joints, direction of carpet pile, and location of edge moldings.

C. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

D. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.

E. Manufacturer's Installation Instructions: Indicate special procedures.

F. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

G. Maintenance Materials: Furnish the following for Southern Mississippi Investment Company, Inc.'s use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet tile with minimum three years documented experience.

B. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience and approved by carpet tile manufacturer.

1.06 FIELD CONDITIONS

A. Store materials in area of installation for minimum period of 24 hours prior to installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Shaw Contract Group .

B. Masland Contract.

2.02 MATERIALS

A. Tile Carpet: Type CPT-1.
   1. Product: Resonate; manufactured by Masland Contract.
   2. Style: T502 Resonate.
   3. Color: 50208 Azores.
   4. Fiber Content: EarthSmart Refreshfiber Type 6,6 nylon.
   5. Tile Size: 24"x24".

6. Installation Method: Brick.

B. Carpet: CPT-2
   1. Product: Shade; manufactured by Shaw Contract.
   2. Style: 59529 Brilliance Tile.
   3. Color: 29500 Black Forest.
   4. Fiber: Eco Solution q nylon.
   5. Tile Size: 24"x24".
   6. Installation Method: Ashlar.

C. Carpet: CPT-3
   1. Product: Noble Materials; manufactured by Shaw Contract.
   2. Style: 5T136 Form.
   3. Color: 33555 Cornerstone Copper.
   4. Fiber: Eco Solution q nylon.
   5. Tile Size: 24"x24".
   6. Installation Method: Brick

2.03 ACCESSORIES

A. Sub-Floor Filler: White premix latex; type recommended by flooring material manufacturer.

B. Edge Strips: Embossed aluminum, color as selected.

C. Carpet Tile Adhesive: Recommended by carpet tile manufacturer; releasable type.

D. Adhesives: Acceptable to carpet tile manufacturer, compatible with materials being adhered; maximum VOC of 50 g/L; CRI Green Label certified; in lieu of labeled product, independent test report showing compliance is acceptable.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive carpet tile.

C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to sub-floor surfaces.

D. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for flooring installation by testing for moisture and pH.
   1. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

B. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler.

C. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.

D. Vacuum clean substrate.

3.03 INSTALLATION

A. Starting installation constitutes acceptance of sub-floor conditions.

B. Install carpet tile in accordance with manufacturer's instructions and CRI (CIS).

C. Blend carpet from different cartons to ensure minimal variation in color match.

D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.

E. Lay carpet tile in square pattern, with pile direction parallel to next unit, set aligned as indicated on shop drawings. See installation method for each type of carpet listed above.

F. Fully adhere carpet tile to substrate.

G. Trim carpet tile neatly at walls and around interruptions.

H. Complete installation of edge strips, concealing exposed edges.

3.04 CLEANING

A. Remove excess adhesive without damage, from floor, base, and wall surfaces.

B. Clean and vacuum carpet surfaces.

END OF SECTION

SECTION 09 69 00

ACCESS FLOORING

PART 1 - GENERAL

1.1 Section Includes

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Work of this section includes, but is not limited to: access floor panels, floor coverings, understructure and various electrical, data and communication accessories.

1.2 Related Sections

A. Concrete sealer shall be compatible with pedestal adhesive, see Division 3.

B. See Division 26 Section “Grounding and Bonding for Electrical Systems” for connection to ground of access flooring understructure. Note: The electrical engineer or contractor shall determine requirements for grounding and the electrical contractor shall provide the necessary labor and materials to electrically connect the access flooring to the building ground if it is required.

1.3 Environmental Conditions for Storage and Installation

A. Area to receive and store access floor materials shall be enclosed and maintained at ambient temperatures between 35° to 95° F and relative humidity levels between 20 to 80%. All floor panels shall be stored at ambient temperatures between 50° to 90° F for at least 24 hours before installation begins. All areas of installation shall be enclosed and maintained at ambient temperature between 50° to 90° F and at relative humidity levels between 20% to 80% and shall remain within these environmental limits throughout occupancy.

1.4 References

A. CISCA (Ceilings & Interior Systems Construction Association) - “Recommended Test Procedures for Access Floors” shall be used as a guideline when presenting load performance product information.

1.5 Performance Certification

A. Product tests shall be witnessed and certified by independent engineering and testing laboratory based in the U.S. with a minimum of five years experience testing access floor components in accordance CISCA “Recommended Test Procedures for Access Floors”.

1.6 Country-of-Origin and Product Marking

A. Access floor materials shall comply with the provisions outlined in FAR Subpart 25.2 – Buy American Act – Construction Materials.

B. Floor panels shall be permanently marked with manufacturer’s name, product identification and logo, manufacturing date and country-of-origin. Removable Product ID stickers are not acceptable.

1.7 Performance Requirements

A. **Design Load:** Panel supported on actual understructure (the system) shall be capable of supporting a safe working load or design load of 1250 lbs. This rating signifies that the system will withstand not only a concentrated load placed on a one square inch area at any location on the panel without yielding but also demonstrate the ability to withstand an overload capacity of two times its rating (i.e. a safety factor of 2). (For a detailed description of this important criterion, refer to the Design Load bulletin at http://www.tateinc.com/ and click on Technical Resources/Whitepapers)

B. **Safety Factor**: Panel supported on actual understructure (the system) shall be capable of withstanding a minimum of (2) two times the design load anywhere on the panel without failure. Failure is defined as the point at which the system will no longer accept the load.

C. **Rolling Load**: Panel supported on actual understructure (the system) shall be able to withstand the following rolling loads at any location on the panel without developing a local and overall surface deformation greater than 0.040 inches. Note: wheel 1 and wheel 2 tests shall be performed on two separate panels.

Wheel 1:	Size: 3” dia x 1 13/16” wide	Load: 1125 lbs.	Passes: 10
Wheel 2:	Size: 6” dia x 2” wide	Load: 800 lbs.	Passes: 10,000

D. **Impact Load**: Panel supported on actual understructure (the system) shall be capable of supporting an impact load of 150 lbs. dropped from a height of 36 inches onto a one square inch area (using a round or square indentor) at any location on the panel.

E. **Panel Drop Test**: Panel shall be capable of being dropped face up onto to a concrete slab from a height of 36”, after which it shall continue to meet all load performance requirements as previously defined.

F. **Panel Cutout**: Panel shall not receive cutouts, substitute standard ConCore® 1250 in any areas of requirement.

G. **Recycled Content:** Panel shall be required to have a minimum recycled content of 41%

H. **Axial Load**: Pedestal support assembly shall provide a minimum 5000 lb. axial load without permanent deformation.

I. **Overturning Moment**: Pedestal support assembly shall provide an average overturning moment of 1000 in-lbs. when glued to a clean, sound, uncoated concrete surface. ICBO number for the specific system or structural calculations shall be required attesting to the lateral stability of the system under seismic conditions.

J. **Energy Capacity**: Panel shall contain 2.3 lbs (1.04 kg) of micro encapsulated phase change material with a core material that shall melt at a specified temperature of 75.2°F (24°C) and absorb up to 141 Btu (148.8 kJ) of thermal energy.

K. **Phase Change Material**: Phase change material shall be micro encapsulated and comprised of a polymer shell and vegetable based bio degradable core thoroughly mixed into the cementitious fill material.

1.8 Design Requirements:

A. Access floor system, where indicated on the design documents, shall consist of modular and removable fully encased cementitious filled welded steel panels fastened onto, and supported by, adjustable height pedestal assemblies. Pedestal head and panel corner design must provide a positive location and lateral engagement of the panel to the understructure support system without the use of fasteners.

B. Panel shall be easily removed by one person with a suction cup lifting device and shall be interchangeable.

C. Panel shall be located in areas with daily changes in thermal loading such as the perimeter of the building adjacent to the façade.

D. Quantities, finished floor heights (FFH) and location of accessories shall be as specified on the contract drawings.

1.9 Submittals for Review

A. Detail sheets, for each proposed product type, which provide the necessary information to describe the product and its performance.

B. Test reports, certified by an independent testing laboratory with a minimum of five years experience testing access floor components in accordance CISCA Recommended Test Procedures, certifying that component parts perform as specified.

1.10 **Submittals for Information**

A. Manufacturer's installation instructions and guidelines.

B. Manufacturer's Owner Manual outlining recommended care and maintenance procedures.

PART 2 - PRODUCTS

2.1 **Manufacturers**

A. Access floor system shall be as manufactured by Tate Access Floors, Inc. and shall consist of the ConCore® 1250 access floor panels supported by PosiLock understructure system.

B. Alternative products shall meet or exceed all requirements as indicated herein and must receive prior written approval by the architect or designer.

C. Access floor manufacture shall be ISO9001:2000 certified demonstrating it has a robust and well documented quality management system with continual improvement goals and strategies.

D. Access floor manufacturer's facilities shall be ISO14001:2004 certified demonstrating that they maintain an environmental management system.

2.2 **Support Components**

Pedestals:

A. Pedestal assemblies shall be corrosive resistant, all steel welded construction, and shall provide an adjustment range of +/- 1" for finished floor heights 6" or greater.

B. Pedestal assemblies shall provide a means of leveling and locking the assembly at a selected height, which requires deliberate action to change height setting and prevents vibration displacement.

C. Pedestal head shall be designed with locating tabs and integral shape to interface with the panel for positive lateral retention and positioning without fasteners. Note: This allows the floor to be installed during the construction process without screws so that access by other related trades can be accomplished quickly and easily. It also enables the user to have a mixed installation of fastened and unfastened panels within the same installation.

D. Hot dip galvanized steel pedestal head shall be welded to a threaded rod which includes a specially designed adjusting nut. The nut shall provide location lugs to engage the pedestal base assembly, such that deliberate action is required to change the height setting.

E. Threaded rod shall provide a specially designed anti-rotation device, such that when the head assembly is engaged in the base assembly, the head cannot freely rotate (for FFH of 6" or greater). Note: This prevents the assembly from inadvertently losing its leveling adjustment when panels are removed from the installation during use.

F. Hot dip galvanized pedestal base assembly shall consist of a formed steel plate with no less than 16 inches of bearing area, welded to a 7/8" square steel tube and shall be designed to engage the head assembly.

2.3 **Panel Components**

Floor Panels:

A. Panels shall consist of a top steel sheet welded to a formed steel bottom pan filled internally with a cementitious material fill. Mechanical or adhesive methods for attachment of the steel top and bottom sheets are unacceptable.

B. Cementitious fill material shall be totally encased within the steel welded shell.

C. Cementitious fill material shall contain micro encapsulated phase change material with a core vegetable based material designed to melt at 75.2°F (24°C).

D. Panel shall have an electrically conductive epoxy paint finish.

E. Corner of panel shall have a locating tab and integral shape design to interface with the pedestal head for positive lateral retention and positioning with or without fasteners.

F. Fastening of panels to pedestal heads shall be accomplished by the use of a machine screw which is specially designed to be self capturing within the body of the panel. Note: This prevents the inadvertent loss of panel fastening screws when accessing the underfloor space and potential damage to objects by screws which extend beyond the depth of the panel.

G. Fit between the pedestal head, panel, and screw shall enable an installation with an average panel to panel gap of 0.015".

2.4 Accessories

A. Provide 10 spare floor panels and 40 square feet of understructure systems for each type used in the project for maintenance stock. Deliver to project in manufacturer's standard packaging clearly marked with the contents.

B. Provide 2 panel lifting devices.

2.5 Finishes

A. Finish the surface of floor panels with floor covering material as indicated on the contract drawings. Where floor coverings are by the access floor manufacturer, the type, color and pattern shall be selected from manufacturer's standard.

2.6 Fabrication Tolerances

A. Floor panel flatness measured on a diagonal: +/- 0.035"

B. Floor panel flatness measured along edges: +/- 0.025"

C. Floor panel width or length of required size: +/- 0.010"

D. Floor panel squareness tolerance: +/- 0.015"

PART 3 - EXECUTION

3.1 Preparation

A. Examine structural subfloor for unevenness, irregularities and dampness that would affect the quality and execution of the work. Do not proceed with installation until structural floor surfaces are level, clean, and dry as completed by others.

B. Concrete sealers, if used, shall be identified and proven to be compatible with pedestal adhesive. Verify that adhesive achieves bond to slab before commencing work.

C. Verify dimensions on contract drawings, including level of interfaces including abutting floor, ledges and doorsills.

D. The General Contractor shall provide clear access, dry subfloor area free of construction debris and other trades throughout installation of access floor system.

E. Area to receive and store access floor materials shall be enclosed and maintained at ambient temperatures between 35° to 95° F and relative humidity levels between 20 to 80%. At least 24 hrs. before installation begins, all floor panels shall be stored at ambient temperatures between 50° to 90° F and relative humidity levels between 20% to 80% and shall remain within these environmental limits throughout occupancy.

3.2 Installation

A. Pedestal locations shall be established from approved shop drawings so that mechanical and electrical work can be installed without interfering with pedestal installation.

B. Installation of access floor shall be coordinated with other trades to maintain the integrity of the installed system. All traffic on access floor shall be controlled by access floor installer. No traffic but that of access floor installers shall be permitted on any floor area for 24 hours to allow the pedestal adhesive to set. Access floor panels shall not be removed by other trades for 72 hours after their installation.

C. Floor system and accessories shall be installed under the supervision of the manufacturer's authorized representative and according to manufacturer's recommendations.

D. No dust or debris producing operations by other trades shall be allowed in areas where access floor is being installed to ensure proper bonding of pedestals to subfloor.

E. Access floor installer shall keep the subfloor broom clean as installation progresses.

F. Partially complete floors shall be braced against shifting to maintain the integrity of the installed system where required.

G. Additional pedestals as needed shall support panels where floor is disrupted by columns, walls, and perimeter cutouts.

H. Understructure shall be aligned such that all uncut panels are interchangeable and fit snugly but do not bind when placed in alternate positions.

I. Finished floor shall be level, not varying more than 0.062" in 10 feet or 0.125" overall.

J. Inspect system prior to application of floor covering and replace any floor panels that are cracked, broken and structurally damaged and do not comply with specified requirements.

K. Installed panels shall be straight and square and spaced so that the distance from one end to the other of any line of 12 panels is not less than 24 feet and does not exceed 24' 1/8".

L. Location requiring cutout or partially cut panel shall be replaced with Standard ConCore® Panel prior to installation.

M. Acceptance: General contractor shall accept floor in whole or in part prior to allowing use by other trades.

END OF SECTION

SECTION 09 84 10

SOUND ABSORPTIVE WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Sound absorptive wall panels.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 09 21 16 – GYPSUM BOARD ASSEMBLIES for plaster and gypsum board walls and ceilings.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data including certified laboratory test reports and other data required to show compliance with these specifications.

B. Samples: Submit 11-1/2 by 11-1/2 inch samples of representative panel with factory detailed edge, and representative samples of mounting devices.

1.3 QUALITY ASSURANCE

A. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Project Conditions: Protect system components from excessive moisture in shipment, storage, and handling. Deliver in unopened bundles and store in a dry place with adequate air circulation. Do not deliver material to building until wet conditions such as concrete, plaster, paint, and adhesives have been completed and cured to a condition of equilibrium.

1.5 LIMITED WARRANTY

A. Limited Warranty: Provide manufacturer's standard limited 3-year warranty against manufacturing defects in material or workmanship.

PART 2 - PRODUCTS

2.1 SOUND ABSORPTIVE WALL PANELS

A. Basis-of-Design: Conwed Designscape | Wall Technology Respond® IR108 Series Acoustical Panels

1. Construction: Composite core of dimensionally stable rigid fiberglass, laminated with impact resistant 16-20 pcf molded glass fiber.
2. Core Fiberglass Density: 6 - 7 pcf.

3. Cores laminated with 1/8 inch layer of 16 - 20 pcf molded glass fiber.
4. Recycled Content: For fiberglass, 52 percent pre-consumer and 5 percent post-consumer recycled content.
5. Core Thickness: 2-1/8 inch.
6. Manufacturing Tolerances: Standard +/- 1/16 inch for width and length.
7. Width: 24-60 inches (sizes shown on drawings).
8. Length: 24-120 inches (sizes shown on drawings).
9. Corners: Square.
10. Edge Profile: Square.
11. Edge Treatment: Resin hardened.
12. Fabric Finish: Manufacturer, pattern and color as selected; applied directly over face and edges of panels to provide full finished edge, fully tailored corners.
13. Mounting Type: Aluminum Z-Clip.
14. Flammability (ASTM E 84): Panel components shall have a Class “A” rating per ASTM E 84.
15. Resistivity To Heat Or Cold: R-factor of 4.16 per inch of thickness.
16. Acoustical Performance: Values below are for panels mounted in accordance with ASTM C 423 (Type F5 Mounting) and vary by panel thickness and finish.
    a. Noise Reduction Coefficient (NRC) for 2-1/8 inch Thickness: 1.05.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify wet work such as plastering and concrete is complete and dry. Verify building is enclosed and under standard occupancy conditions (60 - 85 degrees F and not more than 70 percent relative humidity) prior to start of installation. Commencement of installation constitutes Installer’s acceptance of surfaces and conditions.

B. Install products in accordance with manufacturer’s written instructions and in proper relationship with adjacent construction, including the following:

1. For adhesive installation to substrate, provide temporary support to prevent panel slippage. Note: Impaling clips are designed to help hold panels in place until adhesive dries.

C. Touch-up, repair or replace damaged units until satisfactory results are obtained.

END OF SECTION

SECTION 09 84 53

SOUND BARRIER MULLION TRIM CAP

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section for all offices engaging the exterior window framing, as shown on drawings.

1.02 SUMMARY

A. Section includes sound barrier mullion trim caps providing sound transmission control at curtain wall.

B. Related Requirements:

1. Section 04 23 00 "Glass Unit Masonry" for glass block installations.
2. Section 07 92 05 "Joint Sealers" for joint sealing.
3. Section 08 44 13 "Glazed Aluminum Curtain Wall" for curtain wall construction.
4. Section 09 21 16 "Gypsum Board Assemblies" for interior wall construction.

1.03 ACTION SUBMITTALS

A. Product Data:

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for sound barrier wall end cap system.

B. Shop Drawings:

1. Include typical dimensioned cross-section(s) at the location where drywall partition and/or glass masonry partitions terminates at the perimeter curtain wall, indicating:

a. Dimensions
b. Finish

C. Samples: For each exposed product and for each color and texture specified.

1. Size: 6 inch (152 mm) sound barrier mullion trim cap sample and 2” x3-1/2” (51 mm x 89 mm) custom color paint sample.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each sound barrier mullion trim cap assembly, for ASTM E 90 tests performed by a qualified third party testing agency.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer of aluminum extrusions and anodizing shall be ISO-9001 certified.

B. Installer Qualifications: An entity that employs installers and supervisors who are approved by manufacturer.

C. Testing Agency Qualifications: ASTM E 90 testing to be performed by laboratory accredited by IAS as complying with ISO/IEC Standard 17025.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver sound barrier mullion trim caps until spaces to receive them are clean, dry, and ready for their installation.

B. Store sound barrier mullion trim caps in original undamaged packaging inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1.07 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace sound barrier mullion trim caps that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Ten years limited warranty from date of Substantial Completion.
2. Limited warranty does not cover adjacent products or improper installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide the following:

1. MULL-it-OVER Products**;** Sound barrier mullion trim cap systems.

a. Tel: (616) 730-2162
b. url: www.mullitoverproducts.com

2.02 SYSTEM DESCRIPTION

A. General: Provide sound barrier mullion trim caps of design, basic profile, materials, and operation indicated. Provide units with capability to accommodate variations in adjacent surfaces.

1. Furnish units in lengths of sufficient additional length to allow for field trimming to required length to match variations in construction tolerances of adjacent systems.

2.03 PERFORMANCE REQUIREMENTS

A. Sound Transmission:

1. Single Sided Installations: STC 50 or higher.
2. Double-Sided Installations: **[STC 55]** or higher.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Mullion trim cap to be sized to accommodate thermal movement.

2.04 SOUND BARRIER MULLION TRIM CAP

A. Sound Barrier Mullion Trim Cap:

1. Products: MULL-it-OVER Products**;** Mullion Trim Cap.

B. Profile: [**55 Classic Mullion Trim Cap**] or [**55 Wide Mullion Trim Cap**] as shown in the drawings.

C. To be used at all locations where aluminum walls meet glass walls.

2.05 COMPONENTS

A. Aluminum Extrusions:

1. Thickness: 0.125 inches.
2. Profile: As selected and approved by Architect to allow solid attachment and fastening to the partition wall framing.

B. Sound Absorbing Foam:

1. Resistant to smoke, flame, and microbial growth.
2. Fire Rating: ASTM E 84 Class 1.
3. Fungi Resistance: Zero rating per ASTM G 21.

C. Compressible Foam: Between edge of extrusion and interior face of curtain wall glass.

1. Thickness: Standard 1/2 inch (12.7 mm), or 1 inch (25.4 mm) to accommodate a larger mullion deflection.

2. Color: [**Light gray.**] or [**Charcoal.**] as selected by Architect.

D. Fasteners:

1. Self Tapping or appropriate threaded fastener.
2. Compatible with all materials fasteners will contact with and not causing galvanic corrosion.

E. Snap Cover: Snap-on fastener cover.

F. Acoustical Sound Sealant: Acrylic latex based.

2.06 ACCESSORIES

A. Provide necessary and related parts and tools to complete installation.

2.07 FABRICATION

A. Extrusions and generic profiles to be shipped in custom lengths as required to meet project requirements or shipped in standard incremental foot lengths and cut to exact length on jobsite.

2.08 FINISHES

A. Exposed surfaces of exposed aluminum extrusion:

1. Standard Finish: Supplied in clear anodized finish.
2. Custom Finish: Custom anodized finishes and painted finishes available upon request.

B. Finishes:
1. Aluminum - clear anodize when connecting to clear anodized aluminum frames:

a. Clear anodized finish in accordance with AA-M10 C22 A41 Class I (0.7 to 1.0 thick anodic coating)

2. Aluminum - color anodize or painted when connecting to color anodized or painted aluminum frames:

a. Color Choice with matte or bright finish. Select from manufacturer's custom color offering.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine walls and adjacent curtain wall for suitable conditions where sound barrier wall end cap will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Measure and cut sound barrier wall end cap to proper lengths.

B. Notch around horizontal mullions, sills, or other obstructions leaving appropriate gap for differential movement between the sound barrier wall end cap and the obstruction.

C. Apply continuous bead of acoustical sealant to the unexposed side of extruded aluminum surface that will be in contact with the drywall edge.

D. Place sound barrier wall end cap on the vertical surface of the drywall partition wall and loosely install fasteners in the top and bottom slotted holes of the wall end cap.

E. Plumb the wall end cap leaving recommended gap spacing between the interior glass surface and the wall end cap. Foam gasket to be in contact with glass.

F. Tighten top and bottom fasteners to secure end cap.

G. Install additional fasteners at 12 inches on center, minimum.

H. Install snap cover to conceal fasteners.

I. Apply color matched sealant at joints of dissimilar materials as desired.

3.03 CLEANING

A. After work is complete in adjacent areas, clean exposed surfaces with suitable cleaner that will not harm or attack the finish.

3.04 PROTECTION

A. Protect sound barrier wall end caps from damage during installation, general construction activities, and until turnover of structure.

END OF SECTION

SECTION 09 91 13
EXTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints, stains, and varnishes.

C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.

D. Do Not Paint or Finish the Following Items:
   1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
   5. Non-metallic roofing and flashing.
   6. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, zinc, and lead.
   7. Marble, granite, slate, and other natural stones.
   8. Floors, unless specifically indicated.
   9. Ceramic and other types of tiles.
   10. Brick, glass unit masonry, architectural concrete, cast stone, integrally colored plaster and stucco.
   11. Glass.
   12. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

A. Section 05 50 00 - METAL FABRICATIONS: Shop-primed items.

B. Section 05 51 00 - Metal Stairs: Shop-primed items.

C. Section 09 91 23 - Interior Painting.

1.03 DEFINITIONS

A. Conform to ASTM D16 for interpretation of terms used in this section.

1.04 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2012.

C. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating; 2005 (Reapproved 2012).

D. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials; 2007.

E. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; current edition, www.paintinfo.com.

F. SSPC-SP 1 - Solvent Cleaning; 2015.

G. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2004).

H. SSPC-SP 6 - Commercial Blast Cleaning; Society for Protective Coatings; 2007.

I. SSPC-SP 13 - Surface Preparation of Concrete; Society for Protective Coatings; 2003 (Reaffirmed 2015).

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. MPI product number (e.g. MPI #47).
   3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
   4. Manufacturer's installation instructions.
   5. If proposal of substitutions is allowed under submittal procedures, explanation of substitutions proposed.

C. Samples: Submit One paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.
   2. Where sheen is not specified, discuss sheen options with Albert & McCleskey Associates Architects before preparing samples, to eliminate sheens definitely not required.
   3. Paint color submittals will not be considered until color submittals for major materials not to be painted, such as masonry, siding, factory finished metals, and wood doors, have been approved.

D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.

E. Maintenance Materials: Furnish the following for Southern Mississippi Investment Company, Inc.'s use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
   3. Label each container with color in addition to the manufacturer's label.
   4. Coating Maintenance Manual: Upon conclusion of the project, the Contractor or paint manufacturer/supplier shall furnish a coating maintenance manual, such as Sherwin-Williams “Custodian Project Color and Product Information” report or equal. Manual shall include an Area Summary with finish schedule, Area Detail designating where each product/color/finish was used, product data pages, Material Safety Data Sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum Five years experience and approved by manufacturer.

1.07 MOCK-UP

A. See Section 01 40 00 - Quality Requirements, for general requirements for mock-up.

B. Provide panel, 8 feet long by 8 feet wide, illustrating paint color, texture, and finish.

C. Locate where directed by Architect.

D. Mock-up may remain as part of the work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.09 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

D. Minimum Application Temperatures for Latex Paints: 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

E. Minimum Application Temperature for Varnish Finishes: 65 degrees F for exterior, unless required otherwise by manufacturer's instructions.

F. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
   1. In the event that a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Albert & McCleskey Associates Architects is obtained using the specified procedures for substitutions.

B. Paints:
   1. Sherwin-Williams Company: www.sherwin-williams.com.

C. Transparent Finishes:
   1. Sherwin-Williams Company: www.sherwin-williams.com.

D. Stains:
   1. Sherwin-Williams Company: www.sherwin-williams.com.

E. Primer Sealers: Same manufacturer as top coats.

F. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready mixed, unless required to be a field-catalyzed paint.
   1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
   3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
   4. Supply each paint material in quantity required to complete entire project's work from a single production run.

5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content:
1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
b. Architectural coatings VOC limits of State in which the project is located.
2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

C. Flammability: Comply with applicable code for surface burning characteristics.

D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Albert & McCleskey Associates Architects from the manufacturer's full line.

E. Colors: To be selected from manufacturer's full range of available colors.
1. Selection to be made by Albert & McCleskey Associates Architects after award of contract.
2. Allow for minimum of three colors for each system, unless otherwise indicated, without additional cost to Southern Mississippi Investment Company, Inc..
3. Extend colors to surface edges; colors may change at any edge as directed by Albert & McCleskey Associates Architects.

2.03 PAINT SYSTEMS - EXTERIOR - note, all paint conditions are shown for quality, refer to drawings for quantity of each paint condition required in this project. Some paint types may not be required if condition requiring paint type does not exist in drawings.

A. Paint E-OP - Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including concrete, concrete masonry units, brick, cement board, primed wood, and primed metal.
1. Two top coats and one coat primer.
2. Top Coat(s): Exterior Latex.
a. Products:
1) A-100 Exterior Latex (A6,A82,A8) Series
2) Substitutions: Section 01 60 00 - Product Requirements.
3. Top Coat(s): Exterior Light Industrial Coating, Water Based.
a. Products:
1) Pro Industrial Acrylic (B66-600,650,660) Series
2) Substitutions: Section 01 60 00 - Product Requirements.
4. Top Coat(s): Exterior Alkyd Enamel.
a. Products:
1) Pro Industrial Urethane Alkyd Enamel (b54-150) Series
2) Substitutions: Section 01 60 00 - Product Requirements.
5. Top Coat(s): Exterior Pigmented Elastomeric, Water Based.
a. Products:
1) ConFlex XL High Build Coating (A5-450) Series
2) Substitutions: Section 01 60 00 - Product Requirements.
6. Top Coat(s): Textured Latex Coating.
a. Products:
1) UltraCrete Texture Coating (A44-800) Series
2) Substitutions: Section 01 60 00 - Product Requirements.
7. Top Coat(s): Siloxane Water Repellent.
a. Products:
1) Loxon 7% Siloxane Water Repellant (A10T7)

2) Substitutions: Section 01 60 00 - Product Requirements.

8. Top Coat(s): Aluminum Paint, Solvent Based.
   a. Products:
      1) Silver-Brite Aluminum (B59S11)
      2) Substitutions: Section 01 60 00 - Product Requirements.
9. Primer: As recommended by top coat manufacturer for specific substrate.

B. Paint E-OP-FL - Concrete Floors and Wood Decks to be Painted.
   1. Two top coats and one coat primer.
   2. Top Coat(s): High Build Acrylic Deck and Floor Coating.
      a. Products:
         1) SuperDeck Exterior Deck & Dock Elastomeric Coating (SD9) Series
         2) Substitutions: Section 01 60 00 - Product Requirements.
   3. Top Coat(s): Latex Floor Paint, Low Gloss.
      a. Products:
         1) Porch & Floor Enamel Int/Ext Acrylic Satin (A32-200) Series
         2) Substitutions: Section 01 60 00 - Product Requirements.
   4. Top Coat(s): Latex Floor Paint, Gloss.
      a. Products:
         1) ArmorSeal TreadPlex Water Based Coating (B90) Series
         2) Substitutions: Section 01 60 00 - Product Requirements.
   5. Primer: As recommended by top coat manufacturer for specific substrate.

C. Paint E-TR-W - Stain on Wood:
   1. 2 coats stain.
   2. Stain: Exterior Solid Stain for Wood, Water Based.
      a. Products:
         1) SuperDeck Exterior Waterborne Solid Color Stain (SD7) Series
         2) Substitutions: Section 01 60 00 - Product Requirements.
   3. Stain: Exterior Semi-Transparent Stain for Wood, Water Based.
      a. Products:
         1) SuperDeck Exterior Waterborne Semi-Transparent Stain (SD3T15)
         2) Substitutions: Section 01 60 00 - Product Requirements.

D. Paint E-TR-C - Transparent Finish on Concrete Floors:
   1. 1 coat stain.
   2. Stain: Semi-Transparent Stain for Concrete Floors.
      a. Products:
         1) H&C Semi-Transparent Decorative Stain
         2) Substitutions: Section 01 60 00 - Product Requirements.
   3. Stain: Solid Color Stain for Concrete.
      a. Products:
         1) H&C Concrete Stain Solid Color Water Based
         2) Substitutions: Section 01 60 00 - Product Requirements.
   4. Sealer: Water Based for Concrete Floors.
      a. Products:
         1) H&Concrete Sealer Wet Look Water-Based
         2) Substitutions: Section 01 60 00 - Product Requirements.

E. Paint WE-OP-3L - Wood, Opaque, Latex, 3 Coat:
   1. One coat of latex primer sealer.
   2. Gloss: Two coats of latex enamel; A-100 Exterior Latex Gloss (A8 Series)
   3. Satin: Two coats of latex enamel; A-100 Exterior Latex Satin (A82 Series)

F. Paint WE-TR-V - Wood, Transparent, Varnish, No Stain:

1. One coat sealer.
2. Gloss: One coat of varnish.
3. Satin: One coat of varnish.
4. Flat: One coat of varnish.

G. Paint WE-TR-VS - Wood, Transparent, Varnish, Stain:
1. One coat of stain.
2. One coat sealer.
3. Gloss: One coat of varnish.
4. Satin: One coat of varnish.

H. Paint WE-TR-S - Wood, Transparent, Sealer, Optional Stain:
1. One coat of stain.
2. One coat of clear sealer.

I. Paint CE-OP-3L - Masonry/Concrete, Opaque, Latex, 3 Coat:
1. One coat of block filler.
2. Satin: Two coats of latex enamel; A-100 Exterior Latex Satin (A82 Series)
3. Flat: Two coats of latex enamel; A-100 Exterior Latex Flat (A6 Series)

J. Paint GE-OP-3L - Exterior Gypsum Board and Exterior Plaster, Opaque, Latex, 3 Coat:
1. One coat of latex primer sealer.
2. Flat: Two coats of latex; A-100 Exterior Latex Flat (A6 Series)

K. Paint ME-OP-3L - Ferrous Metals, Unprimed, Latex, 3 Coat:
1. One coat of latex primer.
2. Gloss: Two coats of latex enamel; Pro Industrial Acrylic Gloss (B66-600 Series)
3. Semi-gloss: Two coats of latex enamel; Pro Industrial Acrylic S/G (B66-650 Series)

L. Paint MgE-OP-3L - Galvanized Metals, Latex, 3 Coat:
1. One coat galvanize primer.
2. Gloss: Two coats of latex enamel; Pro Industrial Acrylic Gloss (B66-600 Series)
3. Semi-gloss: Two coats of latex enamel; Pro Industrial Acrylic S/G (B66-650 Series)

M. Paint MaE-OP-3A - Aluminum and Copper, Unprimed, Alkyd, 3 Coat:
1. One coat etching primer.
2. Gloss: Two coats of alkyd enamel; Pro Industrial Urethane Alkyd Enamel (B54-150 Series
3. Semi-gloss: Two coats of alkyd enamel; DTM Alkyd S/G (B55 Series)

2.04 PRIMERS

A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
1. Alkali Resistant Water Based Primer.
   a. Products:
      1) Loxon Masonry Primer (A24W8300)
      2) Substitutions: Section 01 60 00 - Product Requirements.
2. Interior/Exterior Latex Block Filler.
   a. Products:
      1) Loxon Block Surfacer (A24W200)
      2) Substitutions: Section 01 60 00 - Product Requirements.
3. Anti-Corrosive Alkyd Primer for Metal.
   a. Products:
      1) Kem Kromik Universal Metal Primer (B50Z Series)
      2) Substitutions: Section 01 60 00 - Product Requirements.
4. Interior/Exterior Quick Dry Alkyd Primer for Metal.
   a. Products:
      1) Kem Bond HS Universal Metal Primer (B50Z Series)

2) Substitutions: Section 01 60 00 - Product Requirements.

5. Alkyd Primer for Galvanized Metal.
   a. Products:
      1) Galvite Primer (B50WZ30)
      2) Substitutions: Section 01 60 00 - Product Requirements.
6. Water Based Primer for Galvanized Metal.
   a. Products:
      1) Pro Industrial Pro-Cryl Universal Acrylic Primer (B66-310 Series)
      2) Substitutions: Section 01 60 00 - Product Requirements.
7. Rust-Inhibitive Water Based Primer.
   a. Products:
      1) Pro Industrial Pro-Cryl Universal Acrylic Primer (B66-310 Series)
      2) Substitutions: Section 01 60 00 - Product Requirements.
8. Interior/Exterior Quick Dry Primer for Aluminum.
   a. Products:
      1) Pro Industrial Pro-Cryl Universal Acrylic Primer (B66-310 Series)
      2) Substitutions: Section 01 60 00 - Product Requirements.
9. Stain Blocking Primer.
   a. Products:
      1) PrepRite ProBlock Primer/Sealer Latex (B51-620 Series)
      2) Substitutions: Section 01 60 00 - Product Requirements.
10. Latex Primer for Exterior Wood.
    a. Products:
       1) Exterior Latex Wood Primer (B42W8041)
       2) Substitutions: Section 01 60 00 - Product Requirements.
11. Alkyd/Oil Primer for Exterior Wood.
    a. Products:
       1) Exterior Oil-Based Wood Primer (Y24W8020)
       2) Substitutions: Section 01 60 00 - Product Requirements.
12. Bonding Primer, Water Based.
    a. Products:
       1) PrepRite ProBlock Primer/Sealer Latex (B51-620 Series)
       2) Substitutions: Section 01 60 00 - Product Requirements.
13. Acrylic Surface Conditioner; Masonry.
    a. Products:
       1) Loxon Conditioner (A24 Series)
       2) Substitutions: Section 01 60 00 - Product Requirements.

2.05 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

C. If substrate preparation is the responsibility of another installer, notify Albert & McCleskey Associates Architects of unsatisfactory preparation before proceeding.

D. Test shop-applied primer for compatibility with subsequent cover materials.

E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Exterior Plaster and Stucco: 12 percent.
   2. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
   3. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.
   4. Concrete Floors and Traffic Surfaces: 8 percent.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or repair existing paints or finishes that exhibit surface defects.

D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.

E. Seal surfaces that might cause bleed through or staining of topcoat.

F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

G. Concrete:
   1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
   2. Clean surfaces with pressurized water. Use pressure range of 1500 to 4000 psi at 6 to 12 inches. Allow to dry.
   3. Clean concrete according to ASTM D4258. Allow to dry.
   4. Prepare surface as recommended by top coat manufacturer and according to SSPC-SP 13.

H. Masonry:
   1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
   2. Prepare surface as recommended by top coat manufacturer.
   3. Clean surfaces with pressurized water. Use pressure range of 600 to 1500 psi at 6 to 12 inches. Allow to dry.

I. Exterior Gypsum Board: Fill minor defects with exterior filler compound. Spot prime defects after repair.

J. Exterior Plaster: Fill hairline cracks, small holes, and imperfections with exterior patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

K. Asphalt, Creosote, or Bituminous Surfaces: Remove foreign particles to permit adhesion of finishing materials. Apply latex based sealer or primer.

L. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.

M. Concrete Floors and Traffic Surfaces: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.

N. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

O. Galvanized Surfaces:
   1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

2. Prepare surface according to SSPC-SP 2.

P. Ferrous Metal:
1. Solvent clean according to SSPC-SP1.
2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

Q. Exterior Wood Surfaces to Receive Opaque Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior calking compound after prime coat has been applied. Back prime concealed surfaces before installation.

R. Exterior Wood to Receive Transparent Finish: Remove dust, grit, and foreign matter; seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes with tinted exterior calking compound after sealer has been applied. Prime concealed surfaces.

S. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Exterior Wood to Receive Opaque Finish: If final painting must be delayed more than 2 weeks after installation of woodwork, apply primer within 2 weeks and final coating within 4 weeks.

C. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

D. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

E. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

F. Apply each coat to uniform appearance.

G. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply additional coats until complete hide is achieved.

H. Sand wood and metal surfaces lightly between coats to achieve required finish.

I. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

J. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

K. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection.

3.05 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 09 91 23
INTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints, stains, and varnishes.

C. Materials for backpriming woodwork.

D. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
   1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
   2. Elevator pit ladders.
   3. Surfaces inside cabinets.
   4. Prime surfaces to receive wall coverings.
   5. Mechanical and Electrical:
      a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
      b. In finished areas, paint shop-primed items.

E. Do Not Paint or Finish the Following Items:
   1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
   5. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, and lead items.
   6. Marble, granite, slate, and other natural stones.
   7. Floors, unless specifically indicated.
   8. Ceramic and other tiles.
   9. Brick, architectural concrete, cast stone, integrally colored plaster and stucco.
   10. Glass.
   11. Acoustical materials, unless specifically indicated.
   12. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

A. Section 05 50 00 - METAL FABRICATIONS: Shop-primed items.

B. Section 05 51 00 - Metal Stairs: Shop-primed items.

C. Section 09 91 13 - Exterior Painting.

1.03 DEFINITIONS

A. Conform to ASTM D16 for interpretation of terms used in this section.

1.04 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2012.

C. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating; 2005 (Reapproved 2012).

D. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials; 2007.

E. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; current edition, www.paintinfo.com.

F. SSPC-SP 1 - Solvent Cleaning; 2015.

G. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2004).

H. SSPC-SP 6 - Commercial Blast Cleaning; Society for Protective Coatings; 2007.

I. SSPC-SP 13 - Surface Preparation of Concrete; Society for Protective Coatings; 2003 (Reaffirmed 2015).

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. MPI product number (e.g. MPI #47).
   3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
   4. Manufacturer's installation instructions.
   5. If proposal of substitutions is allowed under submittal procedures, explanation of substitutions proposed.

C. Samples: Submit One paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.
   2. Where sheen is not specified, discuss sheen options with Albert & McCleskey Associates Architects before preparing samples, to eliminate sheens definitely not required.
   3. Paint color submittals will not be considered until color submittals for major materials not to be painted, such as masonry, factory finished metals, wood cabinets, and wood doors, have been approved.

D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.

E. Manufacturer's Instructions: Indicate special surface preparation procedures.

F. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.

G. Maintenance Materials: Furnish the following for Southern Mississippi Investment Company, Inc.'s use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
   3. Label each container with color in addition to the manufacturer's label.
   4. Coating Maintenance Manual: Upon conclusion of the project, the Contractor or paint manufacturer/supplier shall furnish a coating maintenance manual, such as Sherwin-Williams “Custodian Project Color and Product Information” report or equal. Manual shall include an Area Summary with finish schedule, Area Detail designating where each product/color/finish was used, product data pages, Material Safety Data Sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum Five years experience and approved by manufacturer.

1.07 MOCK-UP

A. See Section 01 40 00 - Quality Requirements, for general requirements for mock-up.

B. Provide panel, 8 feet long by 8 feet wide, illustrating paint color, texture, and finish.

C. Locate where directed by Architect.

D. Mock-up may remain as part of the work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.09 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply materials when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F above the dew point; or to damp or wet surfaces.

D. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.

E. Minimum Application Temperature for Varnish Finishes: 65 degrees F for interior, unless required otherwise by manufacturer's instructions.

F. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
   1. In the event that a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Albert & McCleskey Associates Architects is obtained using the specified procedures for substitutions.

B. Paints:
   1. Sherwin-Williams Company: www.sherwin-williams.com.

C. Transparent Finishes:
   1. Sherwin-Williams Company: www.sherwin-williams.com.

D. Stains:
   1. Sherwin-Williams Company: www.sherwin-williams.com.

E. Primer Sealers: Same manufacturer as top coats.

F. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready mixed, unless intended to be a field-catalyzed paint.
   1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
   3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
   4. Supply each paint material in quantity required to complete entire project's work from a single production run.
   5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content:
   1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
      a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
      b. Architectural coatings VOC limits of State in which the project is located.
   2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

C. Flammability: Comply with applicable code for surface burning characteristics.

D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Albert & McCleskey Associates Architects from the manufacturer's full line.

E. Colors: To be selected from manufacturer's full range of available colors.
   1. Selection to be made by Albert & McCleskey Associates Architects after award of contract.
   2. Allow for minimum of three colors for each system, unless otherwise indicated, without additional cost to Southern Mississippi Investment Company, Inc..
   3. Extend colors to surface edges; colors may change at any edge as directed by Albert & McCleskey Associates Architects.
   4. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under.
   5. In utility areas, finish equipment, piping, conduit, and exposed duct work in colors according to the color coding scheme indicated.

2.03 PAINT SYSTEMS – INTERIOR - note, all paint conditions are shown for quality, refer to drawings for quantity of each paint condition required in this project. Some paint types may not be required if condition requiring paint type does not exist in drawings.

A. Paint I-OP - Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board, concrete, concrete masonry units, brick, wood, plaster, uncoated steel, shop primed steel, galvanized steel, and aluminum.
   1. Two top coats and one coat primer.
   2. Top Coat(s): High Performance Architectural Interior Latex. (Epoxy)(High Traffic Areas)
      a. Products:
         1) Sherwin-Williams Pre-Catalyzed Waterbased Epoxy, Eg-Shel. (MPI #139)
         2) Sherwin-Williams Pre-Catalyzed Waterbased Epoxy, Semi-Gloss. (MPI #141)
         3) Substitutions: Section 01 60 00 - Product Requirements.
   3. Top Coat(s): Interior Latex. (Normal Conditions)
      a. Products:

1) Sherwin-Williams Harmony Interior Acrylic Latex, Flat. (MPI #53)
2) Sherwin-Williams Harmony Interior Acrylic Latex, Semi-Gloss. (MPI #54)
3) Sherwin-Williams Harmony Interior Acrylic Latex, Eg-Shel. (MPI #44)
4) Sherwin-Williams ProMar 200 Zero VOC Interior Latex, Flat.
5) Sherwin-Williams ProMar 200 Zero VOC Interior Latex, Semi-Gloss. (MPI #43)
6) Sherwin-Williams ProMar 200 Zero VOC Interior Latex, Low Sheen. (MPI #44)
7) Sherwin-Williams ProMar 200 Zero VOC Interior Latex, Eg-Shel. (MPI #52)
8) Substitutions: Section 01 60 00 - Product Requirements.

4. Top Coat Sheen:
   a. Flat: MPI gloss level 1; use this sheen for ceilings and other overhead surfaces.
   b. Velvet: MPI gloss level 2; use this sheen at all locations.
   c. Eggshell: MPI gloss level 3; use this sheen at all locations.
   d. Satin: MPI gloss level 4; use this sheen for items subject to frequent touching by occupants, including door frames and railings.
   e. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.
   f. Gloss: MPI gloss level 6; use this sheen at all locations.
5. Primer: As recommended by top coat manufacturer for specific substrate.

B. Paint I-OP-MD-DT - Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals and wood:
1. Medium duty applications include doors, door frames, railings, handrails, guardrails, and balustrades.
2. Two top coats and one coat primer.
3. Top Coat(s): Interior Epoxy-Modified Latex. (High Performance Upgrade)
   a. Products:
      1) 1) Sherwin-Williams Pro Industrial Waterbased Catalyzed Epoxy, Gloss. (MPI #115)
      2) Sherwin-Williams Waterbased Catalyzed Epoxy, Semi-Gloss.
      3) Sherwin-Williams Waterbased Catalyzed Epoxy, Gloss.
      4) Substitutions: Section 01 60 00 - Product Requirements.
4. Top Coat(s): High Performance Architectural Interior Latex. (Epoxy)(High Traffic Areas)
   a. Products:
      1) Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, Eg-Shel. (MPI #139)
      2) Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, Semi-Gloss. (MPI #141)
      3) Substitutions: Section 01 60 00 - Product Requirements.
5. Top Coat(s): Interior Light Industrial Coating, Water Based. (Normal Conditions)
   a. Products:
      1) Sherwin-Williams Pro Industrial Acrylic Coating, Semi-Gloss. (MPI #153)
      2) Sherwin-Williams Pro Industrial Acrylic Coating, Gloss. (MPI #154)
      3) Substitutions: Section 01 60 00 - Product Requirements.
6. Top Coat(s): Interior Alkyd,. (Normal Conditions
   a. Products:
      1) Sherwin-Williams ProMar 200 Alkyd, Eg-Shel.
      2) Sherwin-Williams ProMar 200 Alkyd, Gloss.
      3) Sherwin-Williams ProMar 200 Alkyd, Semi-Gloss.
      4) Substitutions: Section 01 60 00 - Product Requirements.
7. Top Coat Sheen:
   a. Eggshell: MPI gloss level 3; use this sheen at all locations.
   b. Satin: MPI gloss level 4; use this sheen at all locations.
   c. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.
   d. Gloss: MPI gloss level 6; use this sheen at all locations.

8. Primer: As recommended by top coat manufacturer for specific substrate.

C. Paint I-OP-MD-WC - Medium Duty Vertical and Overhead: Including gypsum board, plaster, concrete, concrete masonry units, uncoated steel, shop primed steel, galvanized steel, and aluminum.
   1. Two top coats and one coat primer.
   2. Top Coat(s): Interior Epoxy-Modified Latex. (High Performance Upgrade)
      a. Products:
         1) Sherwin-Williams Pro Industrial Waterbased Catalyzed Epoxy, Gloss. (MPI #115)
         2) Sherwin-Williams Waterbased Catalyzed Epoxy, Gloss.
         3) Sherwin-Williams Waterbased Catalyzed Epoxy, Semi-Gloss.
   3. Top Coat(s): High Performance Architectural Interior Latex. (High Traffic Areas)
      a. Products:
         1) Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, Eg-Shel. (MPI #139)
         2) Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, Semi-Gloss. (MPI #141)
         3) Sherwin-Williams Pro Industrial Acrylic Coating, Eg-Shel.
         4) Sherwin-Williams Pro Industrial Acrylic Coating, Semi-Gloss. (MPI #141)
         5) Substitutions: Section 01 60 00 - Product Requirements.
   4. Top Coat(s): Institutional Low Odor/VOC Interior Latex. (Normal Conditions)
      a. Products:
         1) Sherwin-Williams Pro Industrial Acrylic Coating, Eg-Shel.
         2) Sherwin-Williams Pro Industrial Acrylic Coating, Gloss. (MPI #148)
         3) Sherwin-Williams Pro Industrial Acrylic Coating, Semi-Gloss. (MPI #147)
         4) Sherwin-Williams Harmony Interior Acrylic Latex, Eg-Shel. (MPI #144)
         5) Sherwin-Williams Harmony Interior Acrylic Latex, Flat. (MPI #143)
         6) Sherwin-Williams ProMar 200 Zero VOC Interior Latex, Flat.
         7) Sherwin-Williams ProMar 200 Zero VOC Interior Latex, Low Sheen. (MPI #144)
         8) Sherwin-Williams ProMar 200 Zero VOC Interior Latex, Semi-Gloss.
         9) Substitutions: Section 01 60 00 - Product Requirements.
         6) Substitutions: Section 01 60 00 - Product Requirements.
   5. Top Coat Sheen:
      a. Flat: MPI gloss level 1; use this sheen for ceilings and other overhead surfaces.
      b. Velvet: MPI gloss level 2; use this sheen at all locations.
      c. Eggshell: MPI gloss level 3; use this sheen at all locations.
      d. Satin: MPI gloss level 4; use this sheen at all locations.
      e. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.
      f. Gloss: MPI gloss level 6; use this sheen at all locations.
   6. Primer: As recommended by top coat manufacturer for specific substrate.

D. Paint I-OP-DF - Dry Fall: Metals; exposed structure and overhead-mounted services in utilitarian spaces, including shop primed steel deck, structural steel, metal fabrications, galvanized ducts, galvanized conduit, and galvanized piping.
   1. Shop primer by others.
   2. One top coat.
   3. Top Coat: Alkyd Dry Fall.
      a. Products:
         1) Sherwin-Williams Dryfall Flat. (MPI #55)
         2) Sherwin-Williams Super Save-Lite Dryfall, Semi-Gloss. (MPI #89)
         3) Sherwin-Williams Super Save-Lite Dryfall, Gloss VOC Complying.
         4) Substitutions: Section 01 60 00 - Product Requirements.
   4. Top Coat: Latex Dry Fall.

a. Products:
1) Sherwin-Williams Waterborne Acrylic Dryfall, Flat. (MPI #118)
2) Sherwin-Williams Waterborne Acrylic Dryfall, Eg-Shel. (MPI #155, 226)
3) Sherwin-Williams Waterborne Acrylic Dryfall, Semi-Gloss. (MPI #226)
4) Substitutions: Section 01 60 00 - Product Requirements.

5. Top Coat Sheen:
a. Flat: MPI gloss level 1; use this sheen at all locations.
b. Eggshell: MPI gloss level 3; use this sheen at all locations.
c. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.
d. Gloss: MPI gloss level 6; use this sheen at all locations.

6. Primer: As recommended by top coat manufacturer for specific substrate.

E. Paint I-OP-FL - Concrete and Wood Floors to be Painted.
1. Two top coats and one coat primer.
2. Top Coat(s): Latex Floor Paint, Low Gloss.
a. Products:
1) Sherwin-Williams Porch and Floor Enamel.
2) Sherwin-Williams Tread-Plex Acrylic Floor Coating. (MPI #60)
3) Substitutions: Section 01 60 00 - Product Requirements.

3. Top Coat Sheen:
a. Eggshell: MPI gloss level 3; use this sheen at all locations.
b. Satin: MPI gloss level 4; use this sheen at all locations.
c. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.
d. Gloss: MPI gloss level 6; use this sheen at all locations.

4. Primer: As recommended by top coat manufacturer for specific substrate.

F. Paint I-TR -W - Transparent Finish on Wood.
1. Stain: Semi-Transparent Stain for Wood.
a. Products:
1) Sherwin-Williams Wood Classics 250 VOC Oil Stain. (MPI #90)
2) Sherwin-Williams Wood Classics Interior Oil Stain. (MPI #90)
3) Substitutions: Section 01 60 00 - Product Requirements.

2. Sealer: Alkyd, Sanding Sealer, Clear.
a. Products:
1) Sherwin-Williams Wood Classics FastDry Sanding Sealer. (MPI #102)
2) Substitutions: Section 01 60 00 - Product Requirements.

3. Top Coat(s): Polyurethane Varnish, Oil Modified.
a. Products:
1) Sherwin-Williams Wood Classics Polyurethane Varnish, Satin. (MPI #57)
2) Substitutions: Section 01 60 00 - Product Requirements.

4. Top Coat(s): Alkyd Varnish
a. Products:
1) Sherwin-Williams Wood Classics FastDry Varnish, Satin. (MPI #73)
2) Sherwin-Williams Wood Classics FastDry Varnish, Gloss. (MPI #75)
3) Substitutions: Section 01 60 00 - Product Requirements.

5. Top Coat(s): Clear Water Based Varnish.
a. Products:
1) Rodda Waterborne Alkyd Urethane Varnish, 593 Series. (MPI #128, 129, 130)
2) Sherwin-Williams Wood Classics Waterborne Polyurethane Varnish, Gloss. (MPI #130)
3) Sherwin-Williams Wood Classics Waterborne Polyurethane Varnish, Satin.
4) Substitutions: Section 01 60 00 - Product Requirements.

6. Top Coat Sheen:
a. Flat: MPI gloss level 1; use this sheen at all locations.

b. Eggshell: MPI gloss level 3; use this sheen at all locations.
c. Satin: MPI gloss level 4; use this sheen at all locations.
d. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.
e. Gloss: MPI gloss level 6; use this sheen at all locations.

G. Paint I-TR-FL - Transparent Finish on Wood Floors:
1. 2 top coats over stain.
2. Stain: Semi-Transparent Stain for Wood.
a. Products:
1) Sherwin-Williams Wood Classics 250 VOC Oil Stain. (MPI #90)
2) Sherwin-Williams MinWax 250 VOC Oil Stain. (MPI #90)
3) Sherwin-Williams Wood Classics Interior Oil Stain. (MPI #90)
4) Substitutions: Section 01 60 00 - Product Requirements.
3. Top Coat(s): Polyurethane Varnish, Oil Modified.
a. Products:
1) Sherwin-Williams Wood Classics Polyurethane Varnish, Gloss. (MPI #56)
2) Substitutions: Section 01 60 00 - Product Requirements.
4. Top Coat Sheen:
a. Satin: MPI gloss level 4; use this sheen at all locations.
b. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.
c. Gloss: MPI gloss level 6; use this sheen at all locations.

H. Paint I-TR-C - Transparent Finish on Concrete Floors.
1. 1 coat stain.
2. Sealer: Water Based for Concrete Floors.
a. Products:
1) H&C Wet Look Sealer: 50.048054
2) Substitutions: Section 01 60 00 - Product Requirements.
3. Sealer Sheen:
b. Gloss: MPI gloss level 6; use this sheen at all locations.

2.04 PRIMERS

A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
1. Alkali Resistant Water Based Primer.
a. Products:
1) Loxon Concrete & Masonry Primer: A24W8300
2) Substitutions: Section 01 60 00 - Product Requirements.
2. Interior Institutional Low Odor/VOC Primer Sealer.
a. Products:
1) Pro Mar 200 0 VOC Primer: B28W2600
2) Substitutions: Section 01 60 00 - Product Requirements.
3. Interior/Exterior Latex Block Filler.
a. Products:
1) Loxon Block Surfacer: A24W200.
2) Substitutions: Section 01 60 00 - Product Requirements.
4. Interior Latex Primer Sealer.
a. Products:
1) PrepRite ProBlock Primer Sealer B51-620 Series
2) Substitutions: Section 01 60 00 - Product Requirements.
5. Interior Drywall Primer Sealer.
a. Products:
1) Pro Mar 200 0 VOC Primer: B28W2600
2) Substitutions: Section 01 60 00 - Product Requirements.

6. Anti-Corrosive Alkyd Primer for Metal; MPI #79.
   a. Products:
      1) Kem Kromik Universal Metal Primer: B50Z Series
      2) Substitutions: Section 01 60 00 - Product Requirements.
7. Interior Rust-Inhibitive Water Based Primer;
   a. Products:
      1) Pro Industrial Pro-Cryl Universal Acrylic Primer: B66-310 Series.
      2) Substitutions: Section 01 60 00 - Product Requirements.
8. Interior/Exterior Quick Dry Alkyd Primer for Metal; MPI #76.
   a. Products:
      1) Kem Bond HS Universal Alkyd Primer: B50WZ4
      2) Substitutions: Section 01 60 00 - Product Requirements.
9. Interior Water Based Primer for Galvanized Metal.
   a. Products:
      1) Pro Industrial Pro-Cryl Universal Acrylic Primer: B66-310 Series
      2) Substitutions: Section 01 60 00 - Product Requirements.
10. Alkyd Primer for Galvanized Metal.
    a. Products:
       1) Galvite HS: B50WZ30
       2) Substitutions: Section 01 60 00 - Product Requirements.
11. Interior/Exterior Quick Dry Primer for Aluminum.
    a. Products:
       1) Pro Industrial Pro-Cryl Universal Acrylic Primer: B66-310 Series
       2) Substitutions: Section 01 60 00 - Product Requirements.
12. Interior Latex Enamel Undercoat.
    a. Products:
       1) Premium Wall & Wood Primer: B28W8111
       2) Substitutions: Section 01 60 00 - Product Requirements.
13. Stain Blocking Primer.
    a. Products:
       1) PrepRite ProBlock Primer Sealer B51-620 Series
       2) Substitutions: Section 01 60 00 - Product Requirements.
14. Stain Blocking Primer, Water Based.
    a. Products:
       1) PrepRite ProBlock Primer Sealer B51-620 Series
       2) Substitutions: Section 01 60 00 - Product Requirements.
15. Latex Primer for Interior Wood.
    a. Products:
       1) Premium Wall & Wood Primer: B28W8111
       2) Substitutions: Section 01 60 00 - Product Requirements.
16. Bonding Primer, Water Based.
    a. Products:
       1) PrepRite ProBlock Primer Sealer B51-620 Series
       2) Substitutions: Section 01 60 00 - Product Requirements.

2.05 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

D. If substrate preparation is the responsibility of another installer, notify Albert & McCleskey Associates Architects of unsatisfactory preparation before proceeding.

E. Test shop-applied primer for compatibility with subsequent cover materials.

F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Gypsum Wallboard: 12 percent.
   2. Plaster and Stucco: 12 percent.
   3. Masonry, Concrete, and Concrete Masonry Units : 12 percent.
   4. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
   5. Concrete Floors and Traffic Surfaces: 8 percent.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or repair existing paints or finishes that exhibit surface defects.

D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

E. Seal surfaces that might cause bleed through or staining of topcoat.

F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

G. Concrete:
   1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
   2. Clean surfaces with pressurized water. Use pressure range of 1500 to 4000 psi at 6 to 12 inches. Allow to dry.
   3. Clean concrete according to ASTM D4258. Allow to dry.
   4. Prepare surface as recommended by top coat manufacturer and according to SSPC-SP 13.

H. Masonry:
   1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
   2. Prepare surface as recommended by top coat manufacturer.
   3. Clean surfaces with pressurized water. Use pressure range of 600 to 1500 psi at 6 to 12 inches. Allow to dry.

I. Concrete Floors and Traffic Surfaces: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.

J. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.

K. Plaster: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

L. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.

M. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

N. Galvanized Surfaces:
   1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
   2. Prepare surface according to SSPC-SP 2.

O. Ferrous Metal:
   1. Solvent clean according to SSPC-SP1.
   2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
   3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

P. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

Q. Wood Surfaces to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.

R. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.

S. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

E. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

F. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.

G. Sand wood and metal surfaces lightly between coats to achieve required finish.

H. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

I. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

J. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection.

3.05 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 10 14 00
SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cash allowance for signs.

B. Room and door signs.

1.02 PRICE AND PAYMENT PROCEDURES

A. See Section 01 21 00 - Allowances, for cash allowances affecting this section.

B. Allowance amount covers purchase and delivery but not installation.

1.03 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

C. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.

C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.

1. When room numbers to appear on signs differ from those on the drawings, include the drawing room number on schedule.
2. When content of signs is indicated to be determined later, request such information from Southern Mississippi Investment Company, Inc. through Albert & McCleskey Associates Architects at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
3. Submit for approval by Southern Mississippi Investment Company, Inc. through Albert & McCleskey Associates Architects prior to fabrication.

D. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.

B. Package room and door signs in sequential order of installation, labeled by floor or building.

C. Store tape adhesive at normal room temperature.

1.07 FIELD CONDITIONS

A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.

B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.01 SIGNAGE APPLICATIONS

A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.

B. Room and Door Signs: Provide a sign for every doorway, whether it has a door or not, not including corridors, lobbies, and similar open areas.
   1. Sign Type: Flat signs with engraved panel media as specified.
   2. Provide "tactile" signage, with letters raised minimum 1/32 inch and Grade II braille.
   3. Character Height: 1 inch.
   4. Sign Height: 2 inches, unless otherwise indicated.
   5. Office Doors: Identify with room numbers to be determined later, not the numbers shown on the drawings .
   6. Conference and Meeting Rooms: Identify with room numbers to be determined later, not the numbers shown on the drawings .
   7. Service Rooms: Identify with room names and numbers to be determined later, not those shown on the drawings.
   8. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN", room numbers to be determined later, and braille.

2.02 SIGN TYPES

A. Flat Signs: Signage media without frame.
   1. Edges: Square.
   2. Corners: Square.
   3. Wall Mounting of One-Sided Signs: Tape adhesive.

B. Color and Font: Unless otherwise indicated:
   1. Character Font: Helvetica, Arial, or other sans serif font.
   2. Character Case: Upper case only.
   3. Background Color: TBD.
   4. Character Color: Contrasting color.

2.03 TACTILE SIGNAGE MEDIA

A. Engraved Panels: Laminated colored plastic; engraved through face to expose core as background color:
   1. Total Thickness: 1/16 inch.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install neatly, with horizontal edges level.

C. Locate signs where indicated:
   1. Room and Door Signs: Locate on wall at latch side of door with centerline of sign at 60 inches above finished floor.
   2. If no location is indicated obtain Southern Mississippi Investment Company, Inc.'s instructions.

D. Protect from damage until Substantial Completion; repair or replace damage items.

END OF SECTION

SECTION 10 14 19

DIMENSIONAL LETTERS

PART 1 GENERAL

1.1 SUMMARY

A. Related Documents: Provisions established within the General and Supplementary Conditions of the Contract, Division 1 - General Requirements, and the Drawings are collectively applicable to this Section.
B. Section Includes:
   1. Dimensional Letters of Lightweight fabricated metal construction.

1.2 QUALITY ASSURANCE

A. Supplier: Obtain all products in this section from a single supplier.
B. Regulatory Requirements: Products shall meet requirements of the Americans With Disabilities Act Accessibility Guidelines (ADAAG) and local amendments and modifications.
C. Installer: Installation shall be performed by installer specialized and experienced in work similar to that required for this project.

1.3 SUBMITTALS

A. Submit in accordance with requirements of Division 1.
B. Product Data: Submit product data for specified products. Include material details for each sign specified.
C. Shop Drawings: Submit shop drawings showing layout, profiles, and product components, including dimensions, anchorage, and accessories.
D. Samples: Submit supplier=s standard color chart for selection purposes and selected colors for verification purposes.
E. Installation: Submit supplier=s installation instructions.
F. Closeout Submittals:
   1. Submit operation and maintenance data for installed products, including precautions against harmful cleaning materials and methods.
   2. Submit warranty documents specified herein.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of Division 1.
   1. Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.
   2. Deliver products in manufacturer's original, unopened, undamaged containers with identification labels intact.
   3. Store products protected from weather, temperature, and other harmful conditions as recommended by supplier.
   4. Handle products in accordance with manufacturer's instructions.

1.5 MOCK-UP AND SAMPLES

A. Contractor to include a full sized template mock-up of all dimensional letter locations shown in the drawings in final location for review and approval by the Architect before installation of any and all dimensional letters.

B. Contractor to provide a full size sample of each type of dimensional letter for approval by the Architect before ordering the balance of all letters.

1.6 WARRANTY

A. Project Warranty: Comply with requirements of Division 1.

B. Manufacturer's Warranty: Submit manufacturer's standard warranty document executed by authorized company official.
   1. Warranty Period: One year from product ship date. Warranty specifically excludes letter mounting substrate.

PART 2 PRODUCTS

2.1 DIMENSIONAL LETTERING

A. Acceptable Manufacturers:
   1. ASI Sign Systems, 1430 Lelia Drive, Jackson, MS 39216, PH (601)981-9540; FX(601)981-9541
   2. Substitutions: Submit in accordance with Section 01 63 00.

B. Letter Material:
   1. Aluminum with Kynar 500 Finish or annodized as shown in the drawings.

C. Fabricated Letters:
   1. Height: As shown in drawings.
   2. Depth: As shown in the drawings
   3. Letter style: As shown in drawings.

D. Mounting Method: Projecting Mount.

2.3 FABRICATION B GENERAL

A. General: Comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.

B. Design, fabricate, and install sign assemblies to prevent buckling, opening up of joints, and over-stressing of welds and fasteners.

C. Mill joints to a tight, hairline fit. Form joints exposed to the weather to exclude water penetration.

D. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.

E. Create signage to required sizes and layout. Comply with requirements indicated for design, dimensions, finish, color, and details of construction.

3 EXECUTION

3.1 EXAMINATION

A. Site Verification of Conditions: Verify installation conditions previously established under other sections are acceptable for product installation in accordance with manufacturer's instructions.

B. Scheduling of installation by Owner or it=s representative implies that substrate and conditions are prepared and ready for product installation. Proceeding with installation implies installer=s acceptance of substrate and conditions.

3.2 INSTALLATION

A. Install product in accordance with supplier=s instructions.

B. Install product in locations indicated using mounting methods recommended by sign manufacturer and free from distortion, warp, or defect adversely affecting appearance.

C. Install product level, plumb, and at heights indicated.

D. Install product at heights to conform to Americans with Disabilities Act Accessibility Guidelines (ADAAG) and applicable local amendments and regulations.

E. Install signs within the following tolerances and in accordance with manufacturer's recommendations:
   1. Interior Signs: Within 1/4 inch vertically and horizontally of intended location.

3.3 CLEANING, PROTECTION, AND REPAIR

A. Repair scratches and other damage which might have occurred during installation. Replace components where repairs were made but are still visible to the unaided eye from a distance of 10 feet.

B. Remove temporary coverings and protection to adjacent work areas. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance. Remove construction debris from project in accordance with provisions in Division 1.

3.4 SIGN SCHEDULE

A. Schedule: Refer to Drawings for sizes, locations, and layout of signage types, sign text copy, and graphics.

END OF SECTION

SECTION 10 21 13

STAINLESS STEEL TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Stainless steel toilet compartment partitions floor mounted, overhead braced for following applications:

    a. Toilet enclosures.
    b. Privacy screens.
    c. Urinal screens.
    d. Shower stall doors

B. Related Requirements:

1. Division 03 Section "Cast in Place Concrete" for compartment anchorage to concrete substrates.
2. Division 05 Section "Metal Fabrications" for miscellaneous structural and support metal components required to secure compartments.
3. Division 06 Section "Rough Carpentry" for compartment anchorage to frame walls.

1.2 REFERENCES

A. ASTM International (ASTM):

1. ASTM A 240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
2. ASTM A 666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
3. ASTM A 743/A 743M - Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application.
4. ASTM B 86 - Standard Specification for Zinc and Zinc-Aluminum (ZA) Alloy Foundry and Die Castings.
5. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
6. ASTM B 221/B 221M - Standard Specification for Zinc and Zinc-Aluminum (ZA) Alloy Foundry and Die Castings.

B. International Code Council (ICC)/American National Standards Institute (ANSI):

1. ICC/ANSI A117.1 - Accessible and Usable Buildings and Facilities, as applicable to toilet compartments designated as accessible.

C. United States Department of Justice:

1. ADA - Americans with Disabilities Act, Excerpt from 28 CFR Part 36 - ADA Standards for Accessible Design.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer's data sheets for each type of product indicated. Include fabrication details, description of materials and finishes.

1. Product Test Reports: When requested by Architect, submit documentation by qualified independent testing agency indicating compliance of products with requirements.

B. Shop Drawings: Include overall product dimensions, floor plan, elevations, sections, details, and attachments to other work. Include choice of options with details.

C. Samples for Selection: Furnish samples of manufacturer's full range of finishes for initial selection.

D. Samples for Verification: Furnish physical sample of material in selected finish.

1. Size: 6 by 6 inch (52 by 52 mm) minimum, in type of finish specified.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance and cleaning instructions.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Approved manufacturer listed in this section, with minimum 5 years experience in the manufacture of toilet compartments.

B. Installers Qualifications: Experienced Installer regularly engaged in installation of toilet compartments for minimum 3 years.

C. Source Limitations: Obtain toilet compartment components and accessories from single manufacturer.

D. Accessibility Requirements: Comply with requirements of ICC/ANSI 117.1, and with requirements of authorities having jurisdiction.

E. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 0.
2. Smoke-Developed Index: 0.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver toilet compartments to site until building is enclosed and HVAC systems are in operation.

1. Deliver toilet compartments in manufacturer's original packaging.
2. Store in an upright condition.

1.8 WARRANTY

A. Special Manufacturer's Warranty: Provide manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship during the following period after substantial completion:

1. Stainless Toilet Partitions: Against rust-out: 15 years.

2. Stainless Steel Hardware: Lifetime.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide products of **The Mills Company, Marion, OH 43302**.

1. Contact Information: (800)272-3539, fax (262)251-5817; Email info@BradleyCorp.com; Website www.bradleycorp.com.

B. Substitutions permitted as per Section 01 63 00.

2.2 MATERIALS

A. Stainless Steel Sheet: A 666, 300 series commercial stainless steel sheet suitable for exposed applications. Provide smooth material, without creases or ripples.

1. Provide with No. 5WL finish.

B. Stainless Steel Castings: ASTM A 743/A 743M.

C. Zinc Aluminum Magnesium and Copper Alloy (Zamac): ASTM B 86.

D. Aluminum: ASTM B 221/B 221M.

2.3 STAINLESS STEEL TOILET COMPARTMENTS

A. Toilet Compartment Type:

1. Overhead braced.

a. Basis of Design Product: **Bradley, Mills Partitions, Sentinel, Series 400**.

B. Urinal Screen Style:

1. Government-flanged with Wing Bracket:

a. Basis of Design Product: **Bradley, Mills Partitions, Model No. 5**.
b. Provide with continuous bracket in addition to wing bracket.

C. Door, Panel, and Pilaster Construction, General: Form edges with interlock to provide watertight fit without crown molding. Braze corners and finish smooth.

1. Provide exposed surfaces free of pitting, visible seams and fabrication marks, stains, telegraphing of core material, or other imperfections.
2. Core Material: Manufacturer's standard sound-deadening, water resistant honeycomb in thickness required to provide finished thickness for doors, panels and pilasters.

D. Door Construction: 1 inch (25 mm) thick, constructed from 0.0313 inch/22 ga (0.794 mm) stainless steel.

1. Provide each door with internal 0.0625 inch/16 ga (1.59 mm) and 0.0781 inch/14 ga (1.98 mm) welded reinforcements at top and bottom hinge locations, with factory installed concealed true gravity cam hinges.
2. Provide pre-punched hole to permit field installation of ADA-compliant concealed slide latch.

E. Panel Construction: 1 inch (25 mm) thick, constructed from 0.0313 inch/22 ga (0.794 mm) stainless steel.

1. Grab-Bar Reinforcement: Provide concealed internal reinforcement for grab bars mounted on units.

F. Pilaster Construction: 1 1/4 inch (32 mm) thick, constructed from 0.048 inch/18 gauge (1.219 mm) stainless steel.

1. Provide pilaster with internally welded bracket suitable to accept minimum 3 inch (76 mm) long, 5/16 inch (7.9 mm) stainless steel hex bolt for leveling.

G. Headrail: Extruded anodized aluminum headrail with anti-grip profile. Provide fasteners for attachment to pilaster and stainless steel brackets to secure to wall.

H. Shoes: 4 inches (102 mm) high minimum, Type 304 stainless steel with No. 4 satin brushed finish. Secured to the floor with tamper-resistant screws.

I. Urinal-Screen Construction: Matching toilet compartment panel construction

J. Brackets (Fittings):

1. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel.

2.4 HARDWARE

A. Hardware, Heavy Duty: Manufacturer's heavy-duty stainless steel castings, including stainless steel tamper-resistant fasteners:

1. Hinges: Self-closing continuous spring-loaded type, adjustable to hold doors open at any angle up to 90 degrees, with emergency access by lifting door. Mount with stainless steel through-bolts.
2. Latch and Keeper: Concealed slide latch with flat rubber faced combination door strike and keeper, with provision for emergency access meeting requirements for accessibility at accessible compartments
3. Coat Hook: Combination hook and rubber-tipped stop, sized to prevent door from hitting compartment-mounted accessories. Provide wall bumper where door abuts wall. Provide formed L-shaped hook without stop at outswing doors. Mount with stainless steel through-bolts.
4. Door Pull: Standard unit on outside of inswing doors. Provide pulls on both sides of outswing doors.

2.5 FABRICATION

A. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

B. Floor-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine work area to verify that measurements, substrates, supports, and environmental conditions are in accordance with manufacturer's requirements to allow installation.

1. Proceed with installation once conditions meet manufacturer's requirements.

3.2 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

B. Install toilet partitions and screens in spaces with operating, temperature controlled HVAC systems. Shield partitions and screens from direct sunlight.

C. Clearances: Install with clearances indicated on Drawings. Where clearances are not indicated, allow maximum 1/2 inch (13 mm) between pilasters and panels, and 1 inch (25 mm) between panels and walls.

D. Stirrup Brackets: Secure panels to walls and to pilasters with no fewer than three brackets attached at midpoint and near top and bottom of panel. Locate wall brackets so holes for wall anchors occur in masonry or tile joints. Align brackets at pilasters with brackets at walls.

3.3 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 15 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

3.4 FINAL CLEANING

A. Remove packaging and construction debris and legally dispose of off-site.

B. Clean partition and screen surfaces with materials and cleansers in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 10 22 19

DEMOUNTABLE PARTITIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them.

1.2 DESCRIPTION OF WORK

A. This Section includes the following:
1. The extent of the demountable partition or butt-glazed entrances/storefronts work as shown on the drawings, and as specified herein.
2. Provide all materials, labor, and equipment to install demountable partitions or butt-glazed entrances/storefronts. The system shall offer maximum flexibility and reusability to accommodate frequent and quick relocation work without loss of materials, damage or modification to panels or to adjoining structures such as ceilings, fixed walls and floors. The factory assembled system must be unitized or pre-assembled (not stick built), non-progressive and modular, allowing the removal of individual panels from any location without disturbing adjoining units and providing interchangeability of panels and door units on the same module.
3. The head detail shall be flush to the ceiling without a reveal. All ceiling leveling adjustment is hidden within the head detail.
4. The panel thickness at the base shall be 2” thick providing the user more usable space when space planning.
5. The base assembly with an integrated leveling system shall be permanently attached to the panel. Detached and loosely shipped floor tracks and leveling components shall not be permitted.
6. The factory assembled movable walls should very flexible to accommodate the building conditions. The wall shall have flexible vertical adjustability. An adjustable, ceiling head assembly shall provide a ± 1/2" adjustment at the ceiling. At the floor, a self-contained leveling glide system and a 2 ½”, 3 ¼” and 4” high base cover shall allow for floor adjustment of + 1/4” for a 2 ½” base, + 1” for a 3 ¼” base, and 1 3/4” for a 4” base. Where the wall system meets the building core walls, columns or window mullions, u-channel extrusions shall allow for horizontal adjustment.

B. Related Sections include the following:
1. Wood Doors – Section 08 14 00
2. Door Hardware – Section 08 71 00
3. Glass and Glazing – Section 08 81 00
4. Acoustical Ceilings – 09 51 00
5. Wall Finishes – Section 09 70 00
6. Electrical and Lighting– Division 26
7. Communications – Division 27

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has successfully completed demountable partition or butt-glazed entrance/storefront installations similar in material, design, and extent to that indicated for this Project and are mutually accepted by the manufacturer and the customer.

B. Performance Bond: The successful demountable partition or butt-glazed entrances/storefronts manufacturer should have the ability to provide a performance bond to insure Project completion.

C. Sound Control: Glass panel's sound transmission will be dependent upon glass type used.

D. Indoor Air Quality: Demountable partition or butt-glazed entrances/storefronts wall manufacturer's non-wood products must meet the SCS Indoor Advantage™ Gold Certification or equivalent. This approval guarantees conformance to indoor air concentrations meeting ANSI/BIFMA M7.1-2011, California Specification 01350, and ANSI/BIFMA e3-2012 testing, conducted in an independent third-party air quality testing laboratory.

E. Glass Association of North America (GANA) Guidelines: Recommends the use of ½" thick glass when used in butt-glazed demountable partition or entrances/storefronts mounted or restrained at the top and bottom only for ceilings from 96" to 120".

F. 2012 IBC, Section 2403.4: When two adjacent interior demountable partition or butt-glazed entrances/storefronts walls mounted or restrained at the top and bottom only are installed adjacent to a walking surface, the differential deflection shall not be greater than the thickness of the panels (glass thickness) when a force of 50 pounds per linear foot is applied horizontally to one panel at any point up to 42 inches above the walking surface.

G. 2010 ADA:

Doors Clear Width (ADA 404.2.3) *Suggested Specification.* Doorways shall have a minimum clear opening of 32" (815mm) with the door open 90°, measured between the face of the door and the opposite stop, and shall have 80" (2030mm) minimum clear headroom

Doors Opening Force (ADA 404.2.9) *Suggested Specification.* Interior hinged, sliding or folding doors shall require no more than five pounds of force to open.

Doors Door Hardware (ADA 404.2.7) *Suggested Specification.* Door handles shall be levers that can be operated with a closed fist. Hardware shall be mounted no higher than 48" (1220mm) above finished floor and a minimum of 34" above finished floor.

Office Layout Wheelchair Turning Space (ADA 304.3) *Suggested Specification*. Allow 60" (1525mm) diameter clear space within office to allow a wheelchair to make a 180° turn.

H. 2012 IBC Section 1607.14: Interior demountable partition or butt-glazed entrances/storefronts wall manufacturer that exceed 6 feet (1829 mm) in height, including their finish materials, shall have adequate strength to resist the loads which they are subjected but not less than a horizontal load of 5 psf (0.240 kN/m2).

I. Certification: Include supporting certified laboratory testing data indicating that material meets specified test requirements.

J. Mock up for Verification Purposes: In a location designated by the Architect, install a full scale installation incorporating at least one of each type of panel, and accessory required, illustrating each installation condition. Retain mock up installation until completion of total installation or dismantle earlier at the

direction of the Architect. Materials used for the mock up installation will not be considered part of either the base contract materials or the attic stock materials. If life cycle costs of the product are important decision criteria, the mock up installation and reconfiguration should be timed, and the reuse of components should be evaluated.

1.4 SUBMITTALS

A. Product Data: Product data on physical characteristics, durability, resistance to fading, and flame spread characteristics for each type of partition and accessory.

B. Shop Drawings: Shop drawings showing location and extent of partitions. Include plans, elevations, sections, details, and attachments to other work.

C. Samples:
   1. Samples for Initial Selection: Samples for initial selection purposes in form of manufacturer's standard color charts showing full range of colors, textures, and patterns available for each type of material exposed to view.
   2. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
      a. Panel Finish Face: Manufacturer's standard-size unit, but not less than 3 inches (75 mm) square.
      b. Base Trim: 12-inch- (300-mm-) long Samples.
      c. Door Finish Face: Manufacturer's standard-size unit, but not less than 3 inches (75 mm) square.
      d. Glazing: Manufacturer's standard-size unit, but not less than 3 inches (75 mm) square.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of demountable partition or butt-glazed entrance/storefront.

E. Contract Closeout Information:
   1. Warranty.
   2. Maintenance Data: For demountable partitions or butt-glazed entrances/storefronts to include in maintenance manuals.
      a. Recommended cleaning materials and warnings about cleaning methods that could be detrimental to finishes and performance.
      b. Installation manual detailing methods to move reuse and adjust demountable partition or butt-glazed entrance/storefront product.

1.5 PROJECT CONDITIONS

A. Delivery, Storage, and Handling: Deliver materials to Project Site in original factory wrappings and containers/skids, clearly labeled with identification of manufacturer, brand name, model number and order number. Store materials in original undamaged packages and containers, inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, humidity; store product according to installation manual and away from other trades.

B. Environmental Limitations: Do not deliver or install demountable partitions or butt-glazed entrance/storefront components until building is enclosed and finishing operations, including ceiling and floor-covering installation and painting, are complete.

C. Field Measurements: Indicate measurements on Shop Drawings.

D. Coordination of Work: Coordinate layout and installation of demountable partitions or butt-glazed entrance/storefront components with other units of Work. Installation of ceilings, floor coverings, lighting fixtures, HVAC equipment, and fire-suppression systems should be completed before demountable partitions are installed.

E. Special Requirements: Comply with instructions and recommendations of manufacture for special delivery, storage, and handling requirements.

1.6 EXTRA MATERIALS

Deliver to the Owner, not less than three percent of the Project total for each component, panel and accessory of each type, color, and finish of demountable partition or butt-glazed entrance/storefront system exclusive of material required to properly complete installation. Furnish accessory components and installation tools as indicated on schedule. Furnish extra materials from same production run as materials installed. Package extra materials with protective covering, identified with appropriate labels.

1.7 WARRANTY

Demountable or butt-glazed entrance/storefront system glazed units, door frames, and related components to be without defects in material or workmanship for a period of ten (10) years from the date of delivery. Wood doors shall be warranted for ten (10) years from the date of delivery, subject to the manufacturer's terms and conditions. Third party supplied product such as door hardware and film applied to glass will be warranted based on their own warranty terms.

This warranty does not cover defects or damage resulting from accidents, misuse, improper relocation methods or transfer to storage. Plastic laminates, and wood veneer finishes are not warranted against fading or wearing, or if improperly cleaned or treated by the Owner or by others.

1.8 NON-OBSOLENCE

Demountable or butt-glazed entrance/storefront system components and parts, with exception of third party supplied product (such as door hardware, glass, film applied to glass) are guaranteed to be compatible and available for purchase for ten years from the date of the original order.

PART 2 - PRODUCTS

2.1 DEMOUNTABLE PARTITIONS OR BUTT-GLAZED ENTRANCE/STOREFRONT

A. Basis-of-Design Product: Subject to compliance with requirements, provide KI “Lightline" demountable partition or butt-glazed entrance/storefront.

B. Butted Glass Panel-to-Panel Glazing Seal:
1. In-line Joint Seal Type: Factory-installed VHB tape dry glass seal and ¼” rigid seal
2. Frameless Corner Glass Overlap (not-mitered) Glazing Seal Type: Factory-installed VHB tape dry glass seal and 1/8” rigid seal

C. Glass and Glazing: Safety glazing in compliance with Glass and Glazing – Section 08 81 00.
1. Single Glazed Thickness: ½”
2. Glass Type: Laminate
3. Exposed Glass Edge Type: Polished and Aris (chamfered)
4. Glass Panel Configuration: Single Center mounted

D. Aluminum Trim: Base trim is continuous to 10', factory-finished, snap-on type or recessed; adjustable for variations in floor. Ceiling trim is continuous to 10' and ceiling irregularities are hidden.
   1. Base Trim Height: [2 ½"]
   2. Ceiling Trim Profile: 3" Flush
   3. Exposed-Metal Trim Finish: [Clear Anodized]
   4. Trim Color: [Clear Anodized]
   5. Typical Corner Ceiling Trim: Outside corner is factory mitered and are 2 ½" x 2 ½". Inside corner is a butt-joint.
   6. Typical Corner Base Trim: Outside corner is factory mitered and are 2 ½" x 2 ½". Inside corner is a butt-joint.

E. Post Connections:
   1. Universal Post Configuration Demising Wall. Please denote typical wall connection: [2 1/8" Lightline]
   2. Permanent Drywall Connection (Connection sealed with gasket): [2 1/8" Post]

F. Wood Door Leaves: Manufacturer's standard 5-ply construction and 1-3/4 inches (45 mm) thick. Leaves should be constructed with no visible stop. Standard core material is Timber strand which is considered a rapidly renewable material. Standard stile/rail thickness is 5".
   1. Door Veneer Type: <Cherry to match typical wood finish>
   2. Door Veneer Finish: <Cherry to match typical wood finish>
   3. Door Leaf Type: [Solid Core]

G. Type of Door Frame: Sliding door frame track is surface-mounted and finished with a valence. Provide double acting soft stop mechanism. Pivot hinge is reversible. Door frame units are pre-assembled or unitized.
   1. Frame Height: [Ceiling height]
   2. Frame Type: [Single Sliding]
   3. Frame Finishes: [Clear Anodized]
   4. Frame Color: [Clear Anodized]
   5. Vertical Post Size: 2 1/8"
   6. Optional Door Seal on vertical posts and along horizontal top: [Yes]

H. Door Hardware: As specified in Hardware Section 08 71 00

I. Seals: Manufacturer's standard.

2.2 FABRICATION

A. Demountable or butt-glazed entrance/storefront panels: Factory-assembled, butt-glazed pre-assembled glass units (not stick-built or site built). Fabricate panels for installation with concealed fastening devices and pressure-fit components that will not damage ceiling or floor coverings. Fabricate panels with continuous light-and-sound seals at floor, ceiling, and other locations where panels abut fixed construction.

B. Components: Fabricate components for installation with concealed fastening devices and pressure-fit members that will not damage ceiling or floor coverings. Fabricate for installation with continuous seals at floor, ceiling, and other locations where partition assemblies abut fixed construction and for installation of sound attenuation insulation in partition cavities.

2.3 FINISHES, GENERAL

A. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prior to installation of demountable or butt-glazed entrance/storefront system, clean floor to remove dust, debris, and loose particles.

B. Illuminate areas of installation to provide an ambient light level of at least 100 foot candles measured in the area where partitions are to be installed.

C. Maintain temperature in the area of installation at a constant minimum of 65 degrees F with relatively humidity less than 70 percent for a period of 48 hours prior to installation and during installation process.

D. General Contractor will deliver all GWB construction interfacing with the demountable or movable partition system in true and plumb condition.

E. For manufacturer to accept responsibility of dimensional compatibility between demountable or movable partition wall system and GWB construction, manufacturer shall have access to the completed GWB for accurate field measuring eight weeks prior to requiring product on site to commence installation. If time line does not permit the eight weeks lead time, demountable manufacturer shall provide “hold-to” dimensions for the General Contractor. General Contractor then assumes responsibility that GWB construction delivers on “hold-to” dimensions.

F. Demountable or butt-glazed entrance/storefront manufacturer determines that conditions are acceptable to receive the work of this section. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to installer. Starting of work shall be construed as acceptance of conditions.

3.2 INSTALLATION

A. Install Demountable or butt-glazed entrance/storefront systems rigid, level, plumb, and aligned. Install seals to prevent light and sound transmission at connections to floors, ceilings, fixed walls, and abutting surfaces.

1. Installation Tolerance: Install each demountable partition so surfaces vary not more than 1/8 inch (3 mm) from the plane formed by the faces of adjacent partitions.

B. Do not alter ceiling suspension system.

C. Install door-and-frame, and glazing-and-glazing-frame assemblies securely anchored to partitions and with doors aligned and fitted. Install and adjust door hardware for proper operation.

3.3 DEMONSTRATION

A. Engage a factory-authorized service representative to demonstrate and train Owner's maintenance personnel to adjust, operate, and maintain Demountable or butt-glazed entrance/storefront system. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION

SECTION 10 26 00

CRASH RAILS

Part 1 - General

1.01 Summary

A. This section includes the following types of wall protection systems:
  1. Crash Rails

B. Related sections: The following sections contain requirements related to this section:
  1. Handrails, Corner Guards, Bumper Guards, Accent Rails, Wall Covering, Wall Panels.
  2. Blocking in walls for fasteners; refer to section 09 21 16.

1.02 References

A. American Society for Testing and Materials (ASTM)

1.03 Submittals

A. General: Submit the following in accordance with conditions of contract and Division 1 specification section 01 33 00 “Submittal Procedures”.

B. Product data and detailed specifications for each system component and installation accessory required, including installation methods for each type of substrate.

C. Shop drawings showing locations, extent and installation details of crash rails. Show methods of attachment to adjoining construction.

D. Samples for verification purposes: Submit the following samples, as proposed for this work, for verification.
  1. 12" (304.8mm) long sample of each model specified.

E. Maintenance data for wall protection system components for inclusion in the operating and maintenance manuals specified in Division 1.

1.04 Quality Assurance

A. Installer qualifications: Engage an installer who has no less than 3 years experience in installation of systems similar in complexity to those required for this project.

B. Manufacturer’s qualifications: Not less than 5 years experience in the production of specified products and a record of successful in-service performance.

C. Single source responsibility: Provide all components of the wall protection system manufactured by the same company to ensure compatibility of color, texture and physical properties.

1.05 Delivery, Storage and Handling

A. Deliver materials to the project site in unopened original factory packaging clearly labeled to show manufacturer.

B. Material must be stored flat.

1.06 Project Conditions

A. Materials must be acclimated in an environment of 65°-75° (18°-24°) for at least 24 hours prior to beginning the installation.

B. Installation areas must be enclosed and weatherproofed before installation commences.

Part 2 - Products

2.01 Manufacturers

A. Interior surface protection products specified herein and installed on the submittal drawings shall be manufactured by Construction Specialties, Inc.

2.02 Materials

A. Stainless steel: To be type 304 alloy with #4 satin finish, 16 gauge.

B. All necessary fasteners to be supplied by the manufacturer.

2.03 Crash Rails

A. Heavy duty crash rails shall be supplied by Construction Specialties: Heavy duty SS guard shall be securely locked over stainless steel mounting clips. Lengths to be supplied

prefabricated with end plates installed, all units predrilled. Mounting hardware shall be supplied by the manufacturer.

1. Model SCR-16SSV Heavy duty stainless steel crash rail 5-½" h (140mm) with V-groove in the face of the rail mounted over stainless steel mounting clips. Stainless steel end plates to be factory installed.

2.04 Finishes

A. General: Comply with NAAMM "Metal Finishes Manual" for recommendations relative to applications and designations of finishes.

2.05 Fabrication

A. General: Fabricate wall protection systems to comply with requirements indicated for design, dimensions, detail, finish and sizes. All based upon required field verified dimensions.

Part 3 - Execution

3.01 Examination

A. Verification of conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

1. Do not proceed until unsatisfactory conditions have been corrected.

3.02 Preparation

A. Surface preparation: Prior to installation, clean substrate to remove dirt, debris and loose particles. Perform additional preparation procedures as required by manufacturer's instructions.

B. Protection: Take all necessary steps to prevent damage to material during installation as required in manufacturer’s installation instructions.

3.03 Installation

A. Install the work of this section in strict accordance with the manufacturer's recommendations and the required field verified dimensions.

B. Use only approved mounting hardware, and locating all components firmly into position, level and plumb.

3.04 Cleaning

A. General: Immediately upon completion of installation, clean material in accordance with manufacturer’s recommended cleaning method.

B. Remove surplus materials, rubbish and debris resulting from installation as work progresses and upon completion of work.

3.05 Protection

A. Protect installed materials to prevent damage by other trades. Use materials that may be easily removed without leaving residue or permanent stains.

END OF SECTION

SECTION 10 26 05

CORNER GUARDS

Part 1 - General

1.01 Summary

A. This section includes the following types of wall protection systems:
  1. Corner Guards

B. Related sections: The following sections contain requirements related to this section:
  1. Handrails, Bumper Guards, Crash Rails, Accent Rails, Wall Covering, Wall Panels.
  2. Blocking in walls for fasteners; refer to section 09 21 05.

1.02 References

A. American Society for Testing and Materials (ASTM)

1.03 Submittals

A. General: Submit the following in accordance with conditions of contract and Division 1 specification section 01 33 00 “Submittal Procedures”.

B. Product data and detailed specifications for each system component and installation accessory required, including installation methods for each type of substrate.

C. Shop drawings showing locations, extent and installation details of corner guards. Show methods of attachment to adjoining construction.

D. Samples for verification purposes: Submit the following samples, as proposed for this work, for verification of guard.
  1. 12" (304.8mm) long sample of each model specified.

E. Product test reports from a qualified independent testing laboratory showing compliance of each component with requirements indicated.

F. Maintenance data for wall protection system components for inclusion in the operating and maintenance manuals specified in Division 1.

1.04 Quality Assurance

A. Installer qualifications: Engage an installer who has no less than 3 years experience in installation of systems similar in complexity to those required for this project.

B. Manufacturer’s qualifications: Not less than 5 years experience in the production of specified products and a record of successful in-service performance.

C. Single source responsibility: Provide all components of the wall protection system manufactured by the same company to ensure compatibility of color, texture and physical properties.

1.05 Delivery, Storage and Handling

A. Deliver materials to the project site in unopened original factory packaging clearly labeled to show manufacturer.

B. Material must be stored flat.

1.06 Project Conditions

A. Installation areas must be enclosed and weatherproofed before installation commences.

Part 2 - Products

2.01 Manufacturers

A. Interior surface protection products specified herein and installed on the submittal drawings shall be manufactured by Construction Specialties, Inc.

2.02 Materials

A. Stainless steel: To be type 304 alloy with #4 satin finish.

B. All necessary fasteners to be supplied by the manufacturer.

2.03 Corner Guards

A. Stainless steel corner guards to be by Construction Specialties: Surface mounted guards to be 16 gauge stainless steel.

1. Model CO-8 90° stainless steel corner guard with 3-½" (88.9mm) standard legs. Mounted with construction adhesive standard; stainless steel screws optional. Available in variable angles and custom sizes. For odd angle specify model CO-8M.

2.04 Fabrication

A. General: Fabricate wall protection systems to comply with requirements indicated for design, dimensions, detail, finish and member sizes.

B. Preassemble components in shop as much as possible to minimize field assembly.

2.05 Finishes

A. General: Comply with NAAMM "Metal Finishes Manual" for recommendations relative to applications and designations of finishes.

Part 3 - Execution

3.01 Examination

A. Verification of conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

1. Do not proceed until unsatisfactory conditions have been corrected.

3.02 Preparation

A. Surface preparation: Prior to installation, clean substrate to remove dirt, debris and loose particles. Perform additional preparation procedures as required by manufacturer's instructions.

B. Protection: Take all necessary steps to prevent damage to material during installation as required in manufacturer's installation instructions.

3.03 Installation

A. Install the work of this section in strict accordance with the manufacturer's recommendations, using only approved mounting hardware, and locating all components firmly into position, level and plumb.

3.04 Cleaning

A. General: Immediately upon completion of installation, clean material in accordance with manufacturer's recommended cleaning method.

B. Remove surplus materials, rubbish and debris resulting from installation as work progresses and upon completion of work.

3.05 Protection

A. Protect installed materials to prevent damage by other trades. Use materials that may be easily removed without leaving residue or permanent stains.

END OF SECTION

SECTION 10 26 41

BULLET RESISTANT COMPOSITE (FIBERGLASS)

PART 1 GENERAL

1.1 REFERENCE

A. Underwriters Laboratory UL 752-Standard for Bullet Resisting Equipment & ASTM E119-98-Standard Test Methods for Fire Tests of Building Construction and Materials, NIJ Standard 0108.01-(National Institute of Justice) Standard for Ballistic Resistant Protective Materials, MIL-P-46593A-Numerical simulation of ballistic impact on composite laminates, MIL-STD-622F- V50 Ballistic Test for Armor.

1.2 SUBMITTALS

A. The following shall be submitted by the manufacturer in accordance with Sections 13070 and any Special Contract Requirements: Submit for approval prior to fabrication: samples, test reports, shop drawings (dimensioned profiles including anchorage and finishes), product specifications, test reports (current UL Listing Verification & UL 752 Test Results as provided by Underwriters Laboratories), and printed data in sufficient detail to indicate compliance with the contract documents. ASTM E119-98 One Hour Fire Rating of Building and Construction Materials. Manufacturer's Instructions for installation of TSS Bullet Resistant Fiberglass Panels. All required submittals shall be approved prior to installation.

1.3 DESIGN

A. Through the design, manufacturing techniques and material application the Bullet Resistant Fiberglass shall be of the "non-ricochet" type. This design is intended to permit the encapture and retention of an attacking projectile lessening the potential of a random injury or lateral penetration.

1.4 QUALITY ASSURANCE

A. Manufacturer shall be a Company that specializes in manufacturing products of the specified type with a minimum of three years experience. Installer shall be a Company that specializes in product type.

1.5 DELIVERY, STORAGE & HANDLING

A. Delivery of the materials to the project with the manufacturer's Labels intact and legible. Handle the materials with care to prevent damage. Store materials inside and under cover, stack flat and off floor. Project conditions (temperature, humidity, and ventilation) shall be within the maximum limit recommendations set by manufacturer. Do not install products that are under conditions outside these limits.

1.6 WARRANTY

A. All materials shall be warranted against defects for a period of 1 year for the date of receipt at the project site. All workmanship, shall be installed by a certified installer, shall be guaranteed against defects for a period of 1 year from the date of installation. Certificates of warranty shall be provided at project completion.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products shall be manufactured by: Total Security Solutions, Inc, 170 National Park Drive, Fowlerville, MI 48836, 866-930-7807. Jim Richards info@demandtss.com, www.tssbulletproof.com

B. Substitutions permitted: See Section 01 63 00.

2.2 BULLET RESISTANT COMPOSITE (FIBERGLASS) MATERIAL

A. Composite Panel Product: TSS Total Armor Ballistic Resistant Fiberglass Panel, shall be selected from the chart below. The panels shall be made of multiple layers of woven roving ballistic grade fiberglass cloth impregnated with a thermoset polyester resin and compressed into flat rigid sheets. Fabrication: the technique and materials used shall provide the controlled internal delamination to permit the encapture of the penetrating projectile with Carbide grit edge saw blades. Exposed fasteners shall be non-corrosive.

Product shall be: TSS Total ARMOR Ballistic Resistant Fiberglass Panel TA-3

TSS BULLET RESISTANT FIBERGLASS PANELS

PRODUCT	TEST CRITERIA/PERFORMANCE LEVEL	BALLISTIC DATA
NOMINAL THICKNESS	LBS/SQ FT	
TA-1	UL 752/Level 1 (UL Listed)	9MM, 124 Gr, 1175 Ft. Sec, FMJ
1/4”	2.4	
	NIJ 0108.01 / Level IIA	9MM, 124 Gr, 1090 Ft. Sec, FMJ
TA-2	UL 752/Level 2 (UL Listed)	357 Mag, 158 Gr, 1250 Ft. Sec, LSP
5/16”	3.0	
	NIJ 0108.01 / Level II	357 Mag, 158 Gr, 1395 Ft. Sec, JSP
TA-3	UL 752/Level 3 (UL Listed)	44 Mag, 240 Gr, 1350 Ft. Sec, SWC
1/2”	4.0	
	NIJ 0108.01 / Level IIIA	44 Mag, 158 Gr, 1400Ft. Sec, SWC

A. Size shall be: As shown in the drawings.
B. Color/finish shall be: Painted color to be selected by Architect.

2.3 SECURITY LEVEL

A. The TSS Bullet Resistant Fiberglass will be rated and tested for UL 752 and NIJ—0108.01 at the Level indicated by the product selected.

PART 3 EXECUTION

3.1 CONTRACT DOCUMENTS

A. Prior to installing the bullet resistant material, the contractor shall verify that all supports have been installed as required by the contract documents and architectural drawings, and approved shop/CAD drawings, if required.

3.2 INSTALLATION

A. Do not begin installation until openings have been verified and surfaces properly prepared in accordance with Drawings. Prepare all surfaces per recommendations of manufacturer. Install in accordance with manufacturer's instructions and UL 752. Set all equipment plumb. Fire rated assemblies in accordance with NFPA80.

B. TSS Bullet Resistant Fiberglass panels can be installed using industrial adhesive, mastic, screws and bolts. Method of application shall maintain bullet resistive rating at junctures with concrete floor, door and window frames and other penetrations. Installation tolerance shall not exceed 1/16th of an inch (1.6mm) for squareness, alignment, twist and plumb. Install hardware as specified.

C. Field painting is specified in Section 9.

3.3 JOINTS

A. All joints shall be reinforced by a back-up layer of bullet resistive material. The bullet resistance of the joint, as reinforced, shall be at least equal to that of the panel. Minimum width of reinforcing layer shall be 4" (2" on each panel) or a 2" overlap minimum. No rigid high-density material shall be used adjacent to the panel's inner surface, allow ¼" gap.

3.4 POST APPLICATION

A. Total Security Solution (TSS) Bullet Resistant Fiberglass Panels shall be installed in accordance with manufacturer's printed recommendations, including adhering to industrial adhesive, mastic, screws, and bolts. Method of application shall maintain the bullet resistive rating at junctures with concrete floor slabs, the concrete roof slabs, the bullet resistive door frames, the bullet resistive window frames and all required penetrations.

B. Inspection and Cleaning: Verify installation is complete and complies with manufacturer's requirements. Clean product and accessories, removing excess sealant, labels and protective covers.

C. Touch-up, repair or replace damaged products before Substantial Completion.

D. Product Warranty: Applicable warranty shall be issued to owner upon final release of completed project.

END OF SECTION

SECTION 10 28 00

TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Accessories for toilet rooms, showers, and utility rooms.

1.02 REFERENCE STANDARDS

A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

B. ASTM C1036 - Standard Specification for Flat Glass; 2011.

C. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2008 (Reapproved 2013).

1.03 ALLOWANCE

A. See Section 01 20 00 Allowances. This Section includes information on installation, product quality and procedures. Each individual accessory will be selected during construction.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Toilet Accessories:
   1. Bobrick: www.bobrick.com.
   2. American Specialties, Inc: www.americanspecialties.com.
   3. Bradley Corporation: www.bradleycorp.com.
   4. Substitutions: Section 01 60 00 - Product Requirements.

B. All items of each type to be made by the same manufacturer.

2.02 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.

B. Keys: Provide 4 keys for each accessory to Southern Mississippi Investment Company, Inc.; master key lockable accessories.

C. Stainless Steel Sheet: ASTM A666, Type 304.

D. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.

E. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

2.03 FINISHES

A. Stainless Steel: No. 4 Brushed finish, unless otherwise noted.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

C. Verify that field measurements are as indicated on drawings.

D. See Section 09 21 16 and Section 06 10 00 for installation of blocking, reinforcing plates, and concealed anchors in walls.

3.02 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.

B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on the drawings.

B. Install plumb and level, securely and rigidly anchored to substrate.

C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.
   1. Grab Bars: As indicated on the drawings.
   2. Other Accessories: As indicated on the drawings.

3.04 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION

SECTION 10 28 14
DETENTION TOILET ACCESSORIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Toilet tissue holders.

B. Grab bars.

C. Stainless-steel mirrors.

1.2 RELATED SECTIONS

1. Division 01 Section "Special Project Procedures for Detention Facilities" for general requirements for detention work.
2. Division 10 Section "Commercial Toilet Accessories" for toilet and shower accessories in non-secure portions of detention facilities.

1.3 REFERENCES

A. American National Standards Institute (ANSI):

1. ANSI A 117.1 - Accessible and Usable Buildings and Facilities.

B. ASTM International (ASTM):

1. ASTM A 153/A 153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
2. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
3. ASTM A 666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
4. ASTM A 1008/A 1008M- Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
5. ASTM B 456 - Standard Specification for Electrodeposited Coatings of Copper plus Nickel plus Chromium and Nickel plus Chromium.
6. ASTM E 488 - Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements.
7. ASTM F 446 - Standard Consumer Safety Specification for Grab Bars and Accessories Installed in the Bathing Area.

C. American Welding Society (AWS):

1. AWS D1.1/D1.1M - Structural Welding Code – Steel.
2. AWS D1.3 - Structural Welding Code - Sheet Steel.
3. AWS D1.6 - Structural Welding Code - Stainless Steel.

1.4 ACTION SUBMITTALS

A. Product Data: For each product:

1. Manufacturer's product data sheets indicating operating characteristics, materials and finishes. Mark each sheet with product designation.
2. Mounting requirements and rough-in dimensions.

B. Samples: For each type of detention toilet accessory.

1.5 INFORMATION SUBMITTALS

A. Sample warranty.

B. Operation, care, and cleaning instructions.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance data.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Security Fasteners: Furnish not less than 1 box of each type and size of security fastener.

B. Tools: Provide two sets of each type of tool required for installation of detention toilet accessories.

1.8 QUALITY ASSURANCE

A. Source Limitations: For products listed, obtain products from single source from single manufacturer.

B. Manufacturer Qualifications: Approved manufacturer listed in this section, with minimum [5] years experience in the manufacture of product types. Manufacturers seeking approval must submit the following:

1. Product data, including test data from qualified independent testing agency indicating compliance with requirements.
2. Samples of each product specified.
3. List of successful installations of similar products available for evaluation by Architect.
4. Submit substitution request in accordance with Instructions to Bidders and Division 01 General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Products: Subject to compliance with requirements, provide commercial toilet accessories manufactured by Bradley Corporation, Menomonee Falls, WI 53051, (800) 272-3539, fax: (262) 251-5817; Email info@BradleyCorp.com; Website: www.bradleycorp.com.

1. Submit comparable products of one of the following for approval by Architect:

2.2 MATERIALS

A. Stainless Steel: ASTM A 666 Type 304 (18-8); satin finish exposed surfaces unless otherwise indicated.

B. Steel Sheet: ASTM A 1008/A 1008M, Designation CS, manufacturer's standard thickness.

C. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating, manufacturer's standard thickness.

D. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

E. Security Fasteners: Exposed: Screws, bolts, and other devices of same material as accessory unit and Pinned Torx-Plus head.

F. Concealed Bolts: ASTM A 307, Grade A, hot dipped galvanized steel.

G. Cast-in-Place Anchors in Concrete: Corrosion-resistant, supporting four times imposed load per ASTM E 488, malleable iron or cast steel, hot-dip galvanized per ASTM A 153/ A 153M.

H. Welding Rods and Bare Electrodes: Select per AWS.

I. Security Sealant: Type recommended by manufacturer for application.

2.3 DETENTION TOILET TISSUE HOLDERS

A. Toilet Tissue Roll Dispenser, Front-mounted **TTHS**:

1. Basis of Design: **Bradley Corp., Model [SA-10]**.
2. Application: **[**At each water closet, unless otherwise indicated.**]**
3. Capacity: **[**Single roll**]**
4. Finish and Base Material: Satin-finish stainless steel.
5. Tissue Access: Exposed.
6. Delivery: Non-controlled.
7. Mounting: Front mounted.

2.4 DETENTION GRAB BARS

A. Detention Grab Bar, Fixed **[**DGB24**] [**DGB36**]**:

1. Basis of Design, Fixed Grab Bar: **Bradley Corp., Model SA70** 1-1/2 inch (38 mm) diameter.
2. Application: **[**Where indicated**].**
3. Mounting: 3-1/8 inch (79 mm) diameter, 11 ga./0.125 inch (3.2 mm) stainless steel flanges with exposed fasteners for installation into wall anchors.
4. Material: Stainless steel, 18 ga./0.050 inch (1.27 mm) thick. Closure Plate: 11 ga./0.125 inch (3.2 mm) stainless steel.
5. Length: As indicated.

6. Finish: Satin, stainless steel, **[**smooth**]** finish.

2.5 DETENTION

MIRRORS

1. Framed Mirror Unit **MG**: Basis of Design: **Bradley Corp., Model [SA-01]**.
2. Size and Application: **[**12 by 16 inches (305 by 406 mm)**]** **[**at each wash station**].**
3. Frame: 14 ga./0.0781 inch (1.98 mm) stainless-steel, seamless, with installation by **[**1/4-20 Torx-head screws**]**.
4. Mirror:

    a. Reflective Surface: No. 8 polished 20 ga/0.0375 inch (0.95 mm) stainless steel.

2.6 FABRICATION

A. General: Fabricate units with tight seams and joints, with edges and corners free of sharp edges. Remove burrs. Hem edges of sheet metal minimum 1/2 inch (12 mm) on unexposed side. Minimize joints; form connections with hairline joints in inconspicuous locations.

B. Equip units for concealed anchorage where indicated, utilizing corrosion-resistant backing plates. Fabricate anchors to secure detention toilet accessories rigidly in place and to resist anticipated loads. PART 3 - EXECUTION

3.1 INSTALLATION

A. Assemble fixtures and associated fittings and trim in accordance with manufacturer's instructions.

B. Install supports attached to building structure for equipment requiring supports.

C. Grab Bars: Install grab bars to withstand downward load of not less than 250 lbf (1112 N) per ASTM F 446.

D. Apply security sealant in a continuous ribbon around perimeter of back of surface-mounted detention toilet accessories.

E. Install detention toilet accessories using security fasteners recommended by manufacturer for application.

F. Install equipment level, plumb, and firmly in place in accordance with manufacturer's rough-in drawings.

3.2 CLEANING AND PROTECTION

A. Repair or replace defective work, including damaged equipment and components.

B. Clean unit surfaces, and leave in ready-to-use condition.

C. Clean mirrors with products recommended by mirror manufacturer.

1. Do not clean Plexiglas mirrors with abrasive cleaning products.

D. Turn over keys, tools, maintenance instructions, and maintenance stock to Owner.

3.3 TESTING AND ADJUSTING

A. Test each piece of equipment provided with moving parts to assure proper operation, freedom of movement, and alignment.

B. Repair or replace malfunctioning equipment, or equipment with parts that bind or are misaligned.

END OF SECTION

SECTION 10 44 00
FIRE EXTINGUISHERS & CABINETS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire extinguishers.

B. Fire blankets.

C. Fire extinguisher cabinets.

D. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 09 21 16-Gypsum Board Assemblies: Roughed-in wall openings.

1.03 REFERENCE STANDARDS

A. NFPA 10 - Standard for Portable Fire Extinguishers; 2013.

B. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.04 SUBMITTALS

A. See Section 01 33 00 - Administrative Requirements, for submittal procedures.

B. **Fire Extinguisher and Fire Extinguisher Cabinets must be coordinated so that one fits inside the other perfectly before purchasing.**

C. Shop Drawings: Indicate cabinet physical dimensions.

D. Product Data: Provide extinguisher operational features.

E. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

G. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.05 FIELD CONDITIONS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguisher Cabinets and Accessories:
   1. Larsen's Manufacturing Co; Architectural Series: www.larsensmfg.com.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent. Provide fire extinguisher type suitable for location.
   1. Provide extinguishers labeled by UL for the purpose specified and indicated.

B. Water Type Fire Extinguishers: Stainless steel tank, pressurized, with premixed antifreeze solution, including hose and nozzle.
   1. Class: 2A.
   2. **Size and classification must be checked and approved by fire marshall for all locations in building before purchasing extinguishers.**
   3. Finish: Polished chrome.

C. Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gage.
   1. Cartridge Operated: Spun shell.
   2. Class: A:B:C.
   3. Size: 10 pound.

4. **Size and classification must be checked and approved by fire marshall for all locations in building before purchasing extinguishers.**
5. Finish: Baked polyester powder coat, red color.

D. Foam Type Fire Extinguishers: Stainless steel tank, with pressure gage.
1. Class: A:B.
2. **Size and classification must be checked and approved by fire marshall for all locations in building before purchasing extinguishers.**
3. Temperature range: 40 degrees F to 120 degrees F.

E. Carbon Dioxide Type Fire Extinguishers: Aluminum tank, with pressure gage.
1. Class: B:C.
2. Size: 5 pound.
3. **Size and classification must be checked and approved by fire marshall for all locations in building before purchasing extinguishers.**

F. FE-36 Type Fire Extinguishers: Stainless steel tank, with pressure gage.
1. Class: A:B:C.
2. Size: 2.5 pound.
3. **Size and classification must be checked and approved by fire marshall for all locations in building before purchasing extinguishers.**

2.03 FIRE EXTINGUISHER CABINETS

A. Cabinet Configuration: Recessed type. Use where marked as "FE#2" on plans.
1. Sized to accommodate accessories.
2. Trim: Flat, 5/16 inch wide face.

B. Door: 0.036 inch thick, reinforced for flatness and rigidity; latch. Hinge doors for 180 degree opening with continuous piano hinge. Provide roller type catch.

C. Door Glazing: Glass, clear, 1/8 inch thick tempered. Set in resilient channel gasket glazing.

D. Cabinet Mounting Hardware: Appropriate to cabinet. Pre-drill for anchors.

E. Weld, fill, and grind components smooth.

F. Finish of Cabinet Exterior Trim and Door: No. 4 Stainless Steel.

G. Finish of Cabinet Interior: White enamel.

2.04 ACCESSORIES

A. Fire Blanket: Fire retardant treated wool; red, 62 by 84 inch size.

B. Extinguisher Brackets: Formed steel, chrome-plated for use where marked as "FE#1" on plans.

C. Cabinet Signage: Vertical letters, red in color, down face of class.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Secure rigidly in place.

C. Place extinguishers on wall brackets.

END OF SECTION

SECTION 10 51 13

METAL LOCKERS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

Personal Storage Lockers with built-in bench drawers.

B. Related Work, Not Furnished:

1. Finish floor covering material and installation.
2. Attachment to building HVAC system and balancing air flow through locker system. Manufacturer will provide guidance only upon request.

Finish floor covering materials and installation.

C. Related Sections: 09 30 00 Tiling.

1.3 REFERENCES

A. American National Standards Institute (ANSI) Standards:

Applicable standards for fasteners used for assembly.

B. American Society for Testing and Materials (ASTM) Standards:

Applicable standards for steel sheet materials used for fabrication

Applicable standards for the testing of electrostatically applied Powder Coat Paint

C. American Institute Of Steel Construction (AISC) Standards:

Applicable standards for steel materials used for fabrication.

1.4 DESCRIPTION

A. General: Welded Metal Lockers only with end-user reconfigurable interior. Specialized lances to provide the flexibility of on-site, end-user reconfiguration/addition of internal components anytime, anywhere, now or in the future.

B. Finishes:

Fabricated Metal Components and Assemblies: All components to be painted with an electro-statically applied Powder Coat paint that can meet or exceed test requirements set out by ASTM standard D3451-06 Standard Guide for Testing Coating Powders and Powder Coatings.

C. Sizes:

Personal Storage Lockers with built-in bench drawers: nominal heights of [84] inche; Built-in bench drawer nominal height is [18] inches and nominal depth is [36] inches.

1.5 PERFORMANCE REQUIREMENTS

A. Design Requirements:

Limit overall width not to exceed specified nominal width; locker width designed for zero growth.

B. Seismic Performance: Provide Welded Metal Lockers capable of withstanding the effects of earthquake movement when required by applicable building codes.

C. ADA Requirements: Personal Storage Lockers with nominal height of [72] inches meet ADA requirements.

1.6 SUBMITTALS

A. Product Data: Submit manufacturer's product literature and installation instructions for each type of welded metal locker required. Include data substantiating that products to be furnished comply with requirements of the contract documents.

B. Shop Drawings: Show fabrication, assembly, and installation details, including descriptions of procedures and diagrams. Show complete locker installation layout, including quantities, locations and types of accessory units required. Include notations and descriptions of all installation items and components.

Show installation details at non-standard conditions, if any.

Provide layout, dimensions, and identification of each unit, corresponding to sequence of installation procedures.

Provide installation schedule and procedures to ensure proper installation.

C. Samples: Provide minimum [3] inches square example of each color and texture on actual substrate for each component to remain exposed after installation.

D. Selection Samples: For initial selection of colors and textures, submit manufacturer's color charts, consisting of actual product pieces, showing full range of colors and textures available.

E. Warranty: Submit draft copy of proposed warranty for review by the [Architect].

F. Maintenance Data: Provide written documentation of the manufacturer’s statement, claiming the maintenance free nature of the product.

G. Reference List: Provide a list of recently installed welded metal lockers to be visited by owner, architect, and contractor. Intent of list is to aid in verifying the suitability of manufacturer's products and comparison with materials and product specified in this section. Include contact name, address, and phone numbers.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Engage an experienced manufacturer who is ISO 9001:2008 certified for the design, production, installation and service of welded metal lockers. Furnish certification attesting ISO 9001:2008 quality system registration.

B. Installer Qualifications: Engage an experienced installer who is the manufacturer's authorized representative for the specified products for installing welded metal lockers.

Minimum Qualifications: 1-year experience installing welded metal lockers of comparable size and complexity to specified project requirements.

1.8 DELIVERY, STORAGE AND HANDLING

A. Follow manufacturer’s instructions and recommendations for delivery, storage and handling requirements.

1.9 PROJECT CONDITIONS

A. Field Measurements: Verify quantities of welded metal locker units before fabrication. Indicate verified measurements on shop drawings. Coordinate fabrication and delivery to ensure no delay in progress of the work.

B. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating welded metal lockers units without field measurements. Coordinate construction to ensure actual dimensions correspond to established dimensions.

1.10 SEQUENCING AND SCHEDULING

A. Sequence welded metal lockers [with other work] to minimize possibility of damage and soiling, during remainder of construction period.

B. Schedule installation of specified welded metal lockers after finishing operations, including painting, have been completed.

C. Provide components, which must be built in at a time, which causes no delays in the general progress of the work.

D. Pre-installation Conference: Schedule and conduct conference on project site to review methods and procedures for installing welded Metal Lockers including, but not limited to, the following:

Recommended attendees include:

1. Owner's Representative.
2. Prime Contractor or representative.
3. The [Architect].
4. Manufacturer's representative.
5. Subcontractors or installers whose work may affect, or be affected by, the work of this section.

1.11 WARRANTY

A. Provide a written warranty, executed by Contractor, Installer, and Manufacturer, agreeing to repair or replace units, which fail in materials or workmanship within the established warranty period. This warranty shall be in addition to, and not a limitation of, other rights the Owner may have under General Condition's provisions of the Contract Documents.

B. Limited Lifetime Warranty: Subject to the terms in the written warranty, warrant the original purchaser exclusively that the locker frames manufactured by it will be free from defects in materials and workmanship for the lifetime of the locker.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. General: Free**Style**™ Personal Storage with built-in bench drawers; based upon welded metal lockers manufactured by Spacesaver Corporation, 1450 Janesville Avenue, Fort Atkinson, Wisconsin 53538-2798. Telephone: 800-492-3434.

2.2 BASIC MATERIALS

A. General: Provide materials and quality of workmanship, which meets or exceeds established industry standards for products specified. Use furniture grade sheet metal, solid hardwood benches and fasteners for component fabrication unless indicated otherwise. Material thicknesses/gauges are manufacturer's option unless indicated otherwise.

2.3 LOCKER TYPES

A. [Personal Storage Lockers. Provide personal storage lockers with built-in bench drawers by Spacesaver Corporation.]

B. Note:

1. All locker types (except Multi-Tier) to be equipped with environmental ventilation functionality for applications where Mechanical Air Extraction is desired to remove unpleasant odors from the locker.
2. All locker types (except Multi-Tier) to be equipped with the functionality of attaching a modular electrical system as required.
3. All locker types to be equipped with the functionality of attaching a continuous sloped top.

2.4 MANUFACTURED COMPONENTS

A. Welded Frame:

1. The welded frame must consist of top, bottom, back, and sides constructed of a minimum of 18-gauge or [1.214] millimeters steel. All frame components shall be joined using resistance welding. Riveting of structural members will not be permitted.

2. Horizontal front flanges will be a minimum of [2] inches or [50.8] millimeters. Vertical front flanges will be a minimum of [1] inch or [25.4] millimeters. Horizontal and vertical flanges will overlap and be secured with a minimum two (2) resistance welds per corner.
3. Corner gussets shall be MIG and spot welded in each of the four front corners of the locker for increased stiffness and rigidity.
4. Provide side panel lances evenly spaced on [3] inch or [76.2] millimeter centers. Lances to provide the flexibility of on-site, end-user reconfiguration/addition of internal components anytime, anywhere, now or in the future.
5. Bench Housing for built-in bench drawer
    a. Welded frame construction shall consist of top, bottom, and side components joined by using resistance welding. Riveting of bench housing structural members will not be permitted.
    b. Corner gussets shall be welded in the two (2) front bottom corners of the bench housing for increased stiffness and rigidity.
    c. Horizontal front flanges will be a minimum of [1] inch or [25.4] millimeters
    d. Vertical front flanges will be a minimum of [1] inch or [25.4] millimeters
    e. Horizontal and Vertical front flanges will overlap and shall be secured with minimum of one (1) resistance weld per corner.
    f. Side panels – Lances symmetric and evenly spaced to provide optimum component locations (standard based on [3] inch or [76.2] millimeter on center vertical placement to match mating locker lance design).
    g. Return flanges on housing to securely fasten housing to welded frame of locker.
    h. Base of bench housing shall include four (4) 3/8”-16 UNC threaded weld-nuts and corresponding leveling feet.
    i. Top of bench housing shall include hole pattern for mating bench seat.
    j. Sides of bench housing shall include mounting holes in the event lockers are ganged together.
6. Lockers with built-in bench drawer and built-in external access drawer shall have intermediate base shelf with interlocking mechanism for securing drawer when locker door is closed.
7. Provide four (4) [0.875] inch or [22.23] millimeter diameter electrical knock-outs per locker, two (2) located on top of the locker in both right and left rear corners, and two (2) located in the back of locker centered at a distance no greater than [24] inches or [609.6] millimeters from the top and bottom. Knock-outs allow end-user flexibility of adding electrical capability to lockers.
8. Provide a minimum of four (4) duplex receptacle electrical knock-outs per locker; to be used with a UL listed manufactured electrical wiring system as required. This manufactured electrical wiring system is a simple, unique, flexible, and cost effective method of providing electrical capability to the lockers. This electrical system can be added in the future.
    a. Top of the locker shall have four (4) duplex electrical knock-outs.
    b. Top of locker shall have electrical duplex receptacle knock-outs located on both right and left side of locker.
    c. Back panel of locker shall have a minimum of two (2) duplex electrical knock-outs.

d. Back of locker shall have electrical duplex receptacle knock-outs located on both right and left side of locker and no farther than [24] inches or [609.6] millimeters from the top of the locker.

9. Provide ventilation holes in top of locker to allow mechanically extracted air to be pulled up through the locker system as required. Ventilation shall be controlled by eight (8) evenly spaced [0.625] inch or [15.875] millimeter diameter holes. Proper ventilation system ensures unpleasant odors are removed from locker system.
10. Lockers shall be prepared with mounting holes for use with the continuous sloped top system.
11. Lockers shall be prepared with mounting holes for attaching necessary trim components
12. Locker shall be prepared with mounting holes for ganging lockers back-to-back or side-by-side
13. Base of lockers shall include four (4) 3/8”-16 UNC threaded weld-nuts and corresponding leveling feet.
14. Base shelf for lockers with built-in external access drawers and bench drawers shall have holes to accommodate double-door lock rod and door stop bracket. (only on [24] inch or [609.6] millimeters wide and larger)
15. End Panels: End Panels with no exposed fasteners shall be provided on the end of each locker run; thus providing a clean and aesthetically pleasing appearance.
16. All locker sizes and types to be specified by architect.
    a. Width:
        1) Personal Storage Locker with built-in bench drawer or external access drawer: [24] inches.
    b. Height:
        1) Personal Storage Locker with built in bench drawer or external access drawer: [84] inches.
    c. Depth:
        1) All lockers [24] inches.
        2) Bench drawers: [36] inches.
            c) Bench seat depth [9.5] inches.
            c) Leading edge of bench seat to extend [1.125] inches from front of bench drawer.

B. Ventilation:

1. Provide ventilation holes in top of locker to allow mechanically extracted air to be pulled up through the locker system as required. Ventilation shall be controlled by eight (8) evenly spaced [0.625] inch or [15.875] millimeter diameter holes. Proper ventilation system ensures odors are removed from locker system.
2. Provide an adjustable air baffle for system balancing when mechanical air extraction is used. Upon balancing system, air baffle shall be secured with a fastener to maintain ventilation setting.
3. Provide louvered air vents in bottom of the main locker door/s to allow mechanically extracted air to be pulled up through the locker system.

4. Provide louvered air vents in drawer front when built-in bench drawer or built-in external access drawer models are required.
5. Minimum [0.500] inch or [12.7] millimeter gap between back of shelving components and back of locker to provide uninterrupted air flow up the rear of the locker system.
6. Minimum [2.00] inches or [558.8] millimeter gap between front of shelving and locker door to provide uninterrupted air flow up the front of the locker system.
7. Upon request manufacturer shall provide HVAC tech data to serve as a guideline for the General Contractor and HVAC Contactor. It is the General Contractor and/or HVAC contractors' responsibility to establish/balance air flow through locker system according to building HVAC constraints.

C. Electrical

1. Shall provide four (4) electrical knock-outs per locker as described in section 2.4-A item 7. This feature provides the end-user the opportunity for hard wire electrical connection points for each locker. End-user or General Contractor is responsible for final electrical installation.
2. Shall provide a minimum of four (4) duplex receptacle electrical knock-outs per locker as described in section 2.4-A item 8.
3. Shall provide UL Listed manufactured electrical wiring system as required. This manufactured electrical wiring system provides connection for a maximum of 78 receptacles per hardwired power in-feed (Note: total number of receptacles is dependent on load requirements). This manufactured electrical wiring system is a modular, unique, flexible, and cost effective method of providing electrical capability to the lockers. This electrical system can be added in the future.

D. Drawers (for bench drawer and external access drawer):

1. Drawer body wrapper shall have welded frame construction. Riveting of structural members will not be permitted.
2. Drawers for locker with built-in bench drawers and built-in external access drawers shall have box-formed drawer front.
3. Provide interlock system for securing drawer when main locker doors are closed and provide access only when main locker door/s is opened.
4. Built-in bench drawer shall have a nominal [36] inches or [914.4] millimeters depth.
5. Provide a flush mounted pull handle.
6. Drawer Slides: Provide [200] lbs or [90.72] kilograms maximum load capacity and pass 50,000 cycle performance testing (Max. load, uniform distribution) (Test data to be provided by manufacturer upon request)
7. Drawer base minimum [21] inches [533.4] millimeter drawer extension
8. Bench drawer minimum [26.5] inches [673.1] millimeter drawer extension
9. Provide louvered air vents in drawer front when built-in bench drawer or built-in external access drawer models are required.
10. Provide capability of attaching glides for Body Armored Drying Rack, as requested.

E. Bench Seat:

1. Provide [9.5] inches or [241.3] millimeter deep laminated kiln dried maple bench seat; material thickness [1.25] inches or [31.8] millimeters.
2. Front (leading edge) of bench seat to have [.625] inch or [15.88] millimeter radius bull nose.
3. Finish of bench seat shall be sanded smooth and have two (2) coats of catalyzed varnish applied.

F. Single-Piece Welded Doors (Single and Double Door Models):

1. Shall be formed from two (2) pieces of minimum 18-gauge [1.2] millimeter cold rolled steel box formed and welded together using modern GMAW techniques. Single-piece door with inner and outer door panels shall have a combined steel thickness of no less than [0.096] inches or [2.4] millimeters thick. Welded door design with inner panel optimizes structural integrity of locker door system over and above any single frame door design.
2. Exterior door panel shall be constructed with formed flanges and return flanges to add stiffness.
3. Internal door panel shall be constructed with formed flanges for added stiffness.
4. All inner door panel (except Multi-Tier) heights shall be minimum 70% of external door height.
5. Multi-Tier inner door panels shall be full height.
6. Single-piece welded door frame shall consist of internal door panel nested inside exterior door panel and welded per the following requirements:
    a. Top / bottom. Exterior and Interior panels to be welded in a minimum of three (3) places with weld spacing not to exceed [6] inches or [152.4] millimeters between adjacent welds and [1] inch or [25.4] millimeters from any corner.
    b. Sides. Exterior and interior panels to be welded with spacing not to exceed [12] inches or [304.8] millimeters between adjacent welds and [1] inch or [25.4] millimeters from any corner.
7. Inner door panel to have peg board style hole pattern, allowing the attachment of Document Holder and any standard peg board accessory.
8. Inner door panel to have [4] inch or [101.6] millimeter rectangular slot centered towards the top of the locker.
9. External door panel shall have louvers to provide adequate air circulation throughout locker system.
    a. Louvered air vents shall be located at the bottom of the locker door to enhance circulation of mechanically extracted air from the bottom of the locker out of the top.
    b. Louvered air vents shall be approximately [3] inches or [76.2] millimeters in width and [0.75] inches or [19.05] millimeters in height and spaced on [1] inch or [25.4] millimeter centers.
10. Single door designs available in [24] inch or [609.6] millimeter locker widths
11. All doors shall have neoprene silencers on each door for noise reduction
12. Diamond Perforated Pattern:
    a. Single and Double door designs shall be available in diamond perforated pattern

b. Pattern is defined as [0.875] by [0.875] inch or [22.2] by [22.2] millimeter diamond perforations on [1.768] inch or [44.9] millimeter centers

13. Door torsional deflection shall not exceed [0.1875] inch or [4.76] millimeter with a [20] lb or [9.071] kilogram point load. (Test data to be provided by manufacturer upon request)

14. Hinge:

a. Provide 16-gauge full length hinge for increased strength and security of locker system.

b. Hinges to be welded to door frame with spot welds not to exceed [6] inch or [152.4] millimeter separation.

15. Door assembly to be riveted to door frame on factory pre-established hole pattern.

16. Locking Mechanism.

a. Provide three locking options (all locking options have protective stainless steel cover plate for durability and scratch resistance):

1) Padlock hasp only.

2) Keyed lock with master and padlock hasp.

3) Combination lock with master and padlock hasp.

b. Keyed and combination locking mechanisms shall have the capability of locking automatically.

c. Keyed and Combination locking mechanisms shall have master key override.

d. Combination locking mechanism shall have user changeable preset combinations.

e. Single door models: Provide three locking options as listed above.

f. Double door models: Provide three locking options on the primary door and simple secure lift latch mechanism with [0.3125] inch or [7.94] millimeter lock rod for secondary door.

G. Interior/Accessory components:

1. All interior components must be constructed of minimum 18-gauge or [1.214] millimeter steel (unless otherwise clarified in specification).

2. For added security, internal component can be secured utilizing blind rivets, threaded fasteners, or bending specially designed tab.

3. All interior components available at time of order and as post-installation upgrades in the future.

4. Shelves (available all locker models)

a. Shelf with integral hanger bracket

1) Size specified by locker width

2) Hanger bracket designed with perforations on approximately [3] inch or [76.2] millimeter centers to insure clothing separation for optimum ventilation

3) Performance: Uniform load rating [300] lbs or [136.08] kilograms

b. Plain

1) Size specified by locker width

2) Performance: Uniform load rating [100] lbs or [45.36] kilograms

c. Heavy Duty

1) Size specified by locker width

2) Performance: Uniform load rating [300] lbs or [136.08] kilograms

d. Perforated (use as drying rack)

1) Size specified by locker width

2) Tested performance: Uniform load rating [100] lbs or [45.36] kilograms

e. Shelf rear return flange stops minimum [0.50] inch or [12.7] millimeters short of locker back panel on order to allow air circulation throughout entire locker assembly

f. All performance test data shall be provided by manufacturer upon request.

5. Modular Shelf (available in all models except Multi-Tier)

a. Provides storage compartment for smaller items

b. Approximate compartment size: [9] inches or [228.6] millimeters wide and [12] inches or [304.8] millimeters high

c. Optional extended height of [24] inches or [609.6] millimeters available

d. Modular shelves to have tabs to interlock with frame side panel lances

e. Modular shelves vertical sides to have lances that match with opposing side panel lances.

f. Modular shelves shall have two (2) locations on vertical side panel for attaching hooks, and one (1) location on bottom for attaching double hook accessories.

g. Shelf rear return flange stops approximately [1] inch or [25.4] millimeters short of locker back panel on order to allow air circulation throughout modular shelf.

h. Provide modular shelf with slots for connection with file dividers and shelf back stop. File dividers will aid in maintaining a neat and orderly locker system.

6. Provide lockable compartment for small valuables (available in all models except Multi-Tier)

a. Lockable compartment shall be integral to modular shelf accessory

b. Provide a 14-gauge [1.897] millimeter padlock-able compartment door.

c. Provide [0.188] inch or [4.77] millimeter diameter zinc plated steel hinge rod.

d. Door to be mounted with zinc plated steel hinge rod and two shoulder washers for smooth, quiet operation.

e. Provide an 18-gauge or [1.214] millimeter hasp bracket for securing lockable compartment door.

7. Adjustable Shelf (available in all models except Multi-Tier)

a. Integral with modular shelf

b. Shelf to have tabs to interlock with frame side panel and modular shelf lances.

c. Shelf shall contain slots for file divider accessories as previously defined

8. Vinyl Mat (modular shelf) (available in all models except Multi-Tier)

a. Material – Vinyl

b. Color – Black

c. Type – longitudinal round corrugated ribs

9. Document Holder (available in all models except Multi-Tier)

a. Width – [10.5] inches or [266.7] millimeters

b. Height – [6] inches or [152.4] millimeters

c. Depth – [1.5] inches or [38.1] millimeters

d. Design to include matching hole pattern to allow various attachment locations on inner door panel

10. Mirror

a. Material – [0.0625] inch or [1.59] millimeter thick plastic with mirror surface on one side

b. [0.0625] inch or [1.59] millimeter thick flexible magnet attached to non-mirrored side

c. Size – [3.875] inches or [98.43] millimeters height and [5.875] inches or [149.23] millimeter width

11. Boot Tray

a. Material – Rubber

b. Dimensions:

1) Width – [12.90] inches or [327.7] millimeters

2) Depth – [19.90] inches or [505.5] millimeters

3) Height – [1.25] inches or [34.75] millimeters

c. Manufactured from Natural rubber compounds, environmentally friendly, durable, water repellant easily cleaned with soap and water, resistant to alkalis and weak acids, mold, mildew, and dust mites.

12. Body Armor Drying Rack

a. Shall be available in bench drawer model widths of [24] inch

b. Size of tray is controlled by locker width

c. Bottom of drying tray shall have louvered pattern to provide air circulation throughout

d. Shall have the ability to adjust/glide frontward and backward, while mounted in the bench drawer.

13. Internal Drawers

a. Shall be available in all [24] inch wide locker models

b. Drawer shall have a depth of approximately [19] inches or [482.6] millimeters

c. Shall be available in [9] inch or [381] millimeters height, respectively.

d. Drawer shall have locking option when specified by customer/architect

e. Drawer shall have a tested weight capacity rating of [50] lbs or [22.7] kilograms

14. File Dividers (modular shelf) (available in all models except Multi-Tier)
15. EZ Rail™
    a. Available in two versions – Level and Sloped – attaches to the inside of the locker and can support various storage accessories
        1) EZ Rail™ Level version stores industry standard hanging bins, slat wall accessories, and Spacesacer UWR™ weapon storage accessories
        2) EZ Rail™ Sloped version stores industry standard hanging bins.
    b. Shall be available in all [24] inch or wide locker models
16. UWR™ Universal Base and Support Rail
    a. Shall be available in all [24] inch wide locker models
    b. Shall be capable of using standard Spacesaver stock cups and barrel supports for weapons storage within the locker
17. Hooks
    a. Single Hooks – shall have the ability to attach single hooks on the side of the Modular Shelf and on the side panel lances
    b. Double Hook – shall have the ability to attach a double hook to the underside of the Modular Shelf
    c. Hook Bracket Hanger Assembly – shall have the ability to attach a three-hook bracket assembly to any lanced location on the side panels of the locker.

H. Electrical system
1. UL listed manufactured electrical wiring system with plug-in-play component design
2. Receptacles – standard 20 amp duplex receptacles and 20 amp GFCI duplex receptacles

I. HVAC
1. All lockers (except Multi-Tier) shall be equipped with mechanical air extraction capabilities and adjustable air balancing capabilities
2. When mechanical air extraction is required, manufacturer shall provide locker system HVAC guidelines and recommendations to aid in overall locker and building system integration. It is the General Contractor and HVAC Contractors' responsibility to establish/balance air flow through locker system according to building HVAC constraints.

J. Locker Tag Numbers
1. Shall provide locker numbers on each locker per customer requirement

K. ACCESSORIES:
1. [Individual Welded Base: Provide manufacturer's standard.]
2. [Trim and Fillers: Provide manufacturer's standard.]
3. [Continuous Sloped Top. Provide manufacturers standard.]

2.5 FABRICATION

A. General: Coordinate fabrication and delivery to ensure no delay in progress of the work.

2.6 FINISHES

A. Colors: [Provide in custom colors as selected by [Architect].

B. Paint Finish: Textured (Standard) – Provide factory applied electrostatic powder coat paint. Meet or exceed specifications of the American Society for Testing and Materials (ASTM) Standards:

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Lockers scheduled to receive accessories [with Installer present] for compliance with requirements for installation tolerances and other conditions affecting performance of specified accessory items.

B. Proceed with accessory installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Follow manufacturer’s written instructions for installation of each type of accessory item specified.

3.3 FIELD QUALITY CONTROL

A. Verify accessory unit alignment and plumb after installation. Correct if required, following manufacturer’s instructions.

B. Remove components that are chipped, scratched, or otherwise damaged and which do not match adjoining work. Replace with new matching units, installed as specified and in manner to eliminate evidence of replacement.

3.4 ADJUSTING

A. Adjust all accessories to provide smoothly operating, visually acceptable installation.

3.5 CLEANING

A. Immediately upon completion of installation, clean components and surfaces. Remove surplus materials, rubbish and debris, resulting from installation, upon completion of work and leave areas of installation in neat, clean condition.

3.6 DEMONSTRATION/TRAINING

A. Schedule and conduct demonstration of installed accessory items and features with Owner's personnel.

B. Schedule and conduct maintenance training with Owner's maintenance personnel. Training session should include lecture and demonstration of all maintenance and repair procedures that end-user personnel would normally perform.

3.7 PROTECTION

A. Protect system against damage during remainder of construction period. Advise owner of additional protection needed to ensure that system will be without damage or deterioration at time of substantial completion.

END OF SECTION

SECTION 10 73 00

METAL CANOPIES

Part 1 General

1.1 Description of Work

A. Work in this section includes furnishing and installation of roll-formed aluminum overhead hanger rod style canopies, labeled in drawings as 'Pre-Manufactured Wall Hung Alum. Canopy' equal to the 'Lumishade Canopy' manufactured by Mapes Industries Inc.
B. Related Items and Considerations
   1. Flashing of various designs may be required.
   2. Determine wall construction, make-up and thickness.
   3. Ensure adequate wall condition to carry canopy loads where required.
   4. Consider water drainage away from canopy where necessary.
   5. Any necessary removal or relocation of existing structures, obstructions or materials.

1.2 Quality Assurance

A. Products meeting these specifications established standard of quality required as manufactured by Mapes Industries, Inc. Lincoln, Nebraska 1-800-228-2391.

1.3 Field Measurement

A. Confirm dimensions prior to preparation of shop drawings.
B. Supply manufacturer's standard literature and specifications for canopies.
C. Submit shop drawings showing structural component locations/positions, material dimensions and details of construction and assembly.

1.4 Performance Requirements

A. Canopy must conform to local building codes.
B. Determine if specific load requirements have been established for canopies and if stamped calculations are required for location in which canopy is installed.

1.5 Deliver, Storage, Handling

A. Deliver and store all canopy components in protected areas.

Part 2 Products

2.1 Manufacturer

A. Mapes Industries, Inc., Lincoln, Nebraska, Phone: 1-800-228-2391, Fax: 1-800-737-6756.
B. Substitutions: Refer to Section 01630.

2.2 Materials

A. Decking shall consist of an interlocking roll-formed 2 _ W style pan (minimum .032 aluminum.)
B. Intermediate framing members shall be extruded aluminum, alloy 6063-T6, in profile and thickness shown in current Mapes brochures.
C. Hanger rods and attachment hardware shall be galvanized/zinc plated.

D. Fascia shall be standard 8 extruded J style (minimum .125 aluminum).

2.3 Finishes

A. Provide samples of manufacturer's standard two-coat Kynar colors.

2.4 Fabrication

A. All Lumishade canopies are shipped in preassembled sections for ease of installation.
B. All connections shall be mechanically assembled utilizing 3/16 fasteners with a minimum shear stress of 350 lb. Pre-welded or factory-welded connections are not acceptable.
C. Decking shall be designed with interlocking roll-formed aluminum members.
D. Concealed drainage. Water shall drain from covered surfaces into intermediate trough and be directed to either the front for front drainage or to the rear for ground level discharge via one or more designated downspouts.

Part 3 Execution

3.1 Inspection

A. Confirm that surrounding area is ready for the canopy installation.
B. Installer shall confirm dimensions and elevations to be as shown on drawings provided by Mapes Industries.
C. Erection shall be performed by an approved installer and scheduled after all concrete, masonry and roofing in the area is completed

3.2 Installation

A. Installation shall be in strict accordance with manufacturer s shop drawings. Particular attention should be given to protecting the finish during handling and erection.

3.3 Cleaning

A. After installation, entire system shall be left in a clean condition.

END OF SECTION

SECTION 10 75 00
FLAGPOLES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Aluminum Flagpoles.

1.2 REFERENCE STANDARDS

A. AASHTO M 36 - Standard Specification for Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains; American Association of State Highway and Transportation Officials; 2014.

B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2013.

C. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.

1.3 SUBMITTALS

A. See Division 1 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on pole, accessories, and configurations.

C. Shop Drawings: Indicate detailed dimensions, base details, anchor requirements, and imposed loads.

1.4 QUALITY ASSURANCE

1.5 DELIVERY, STORAGE, AND HANDLING

A. Spiral wrap flagpole with protective covering and pack in protective shipping tubes or containers.

B. Protect flagpole and accessories from damage or moisture.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Flagpoles:
   1. American Flagpole: www.americanflagpole.com.
   2. Concord Industries, Inc: www.concordindustries.com.
   3. Pole-Tech Co., Inc: www.poletech.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 FLAGPOLES

A. Flagpoles: Aluminum.
   1. Design: Straight shaft.
   2. Mounting: Ground mounted type.
   3. Nominal Height: 50 ft; measured from nominal ground elevation.
   4. Provide all other dimensions based on a standard 50ft high pole.
   5. Mounting: Ground mounted type.
   6. Design: Venetian entasis tapered.
   7. Halyard: Interior type .

B. Performance Requirements:
   1. Flagpole With Flag Flying: Resistant without permanent deformation to See Structural Notes on Sheet S0.1 miles/hr wind velocity; non-resonant, safety design factor of 2.5.
   2. Flagpole Without Flag: Resistant without permanent deformation to See Structural Notes on Sheet S0.1 miles/hr wind velocity; non-resonant, safety design factor of 2.5.

2.3 POLE MATERIALS

A. Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

2.4 ACCESSORIES

A. Finial Ball: Aluminum, 10 inch diameter.

B. Truck Assembly: Cast aluminum; revolving, stainless steel ball bearings, non-fouling.

C. Cleats: 9 inch size, aluminum with galvanized steel fastenings, two per halyard.

D. Halyard: 3/8 inch diameter stainless steel aircraft cable.

2.5 MOUNTING COMPONENTS

A. Foundation Tube Sleeve: AASHTO M 36M, corrugated 16 gage, 0.0598 inch steel, galvanized, depth of (as shown on drawings) inches as indicated.

B. Pole Base Attachment: Flush; steel base with base cover.

C. Lighting Ground Rod: 6 inch long copper rod, 3/4 inch diameter.

2.6 FINISHING

A. Metal Surfaces in Contact With Concrete: Asphaltic paint.

B. Aluminum: Mill finish.

C. Finial: Spun finish.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that concrete foundation is ready to receive work and dimensions are as indicated on shop drawings.

3.2 PREPARATION

A. Coat metal sleeve surfaces below grade and surfaces in contact with dissimilar materials with asphaltic paint.

3.3 INSTALLATION

A. Install flagpole, base assembly, and fittings in accordance with manufacturer's instructions.

B. Fill foundation tube sleeve with concrete specified in Section 03 30 00.

3.4 TOLERANCES

A. Maximum Variation From Plumb: 1 inch.

3.5 ADJUSTING

A. Adjust operating devices so that halyard and flag function smoothly.

END OF SECTION

SECTION 11 13 19.13
LOADING DOCK LEVELERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Prefabricated steel leveler with integral bumpers.

B. Operating hardware.

1.02 RELATED REQUIREMENTS

A. Section 03 10 00 - Concrete Forming and Accessories: Placement of leveler frame into concrete loading dock.

B. Section 03 30 00 - Cast-in-Place Concrete: Concrete pit.

1.03 SUBMITTALS

A. See Section 01340 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide materials and finish, installation details, roughing-in measurements, and operation of unit .

C. Shop Drawings: Indicate required opening dimensions, tolerances of opening dimensions, perimeter conditions of construction.

D. Manufacturer's Installation Instructions: Indicate special requirements.

E. Operation Data: Provide operating instructions, identify unit limitations.

F. Maintenance Data: Provide unit maintenance information, lubrication cycles, spare parts manual.

1.04 WARRANTY

A. Dock level manufacturer shall provide a written 10 year warranty on dock leveler structural parts; a written 5 year warranty on dock leveler hydrolic parts; and a 1 year parts and labor warranty on all other parts.

B. In addition to all other warranties, the manufacturer shall guarantee that the equipment will perform in a manner satisfactory to the Owner for a perior of 12 months after date of installation. If the Owner is not then satisfied with the performance of the equipment, the Owner may notify the manufacturer and the manufacturer shall remove the equipment and refund the equipment purchase price to the Owner.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Dock Levelers:
   1. Rite-Hite Corp: www.ritehite.com.
   2. Substitutions: See Section 01 63 00.

2.02 COMPONENTS

A. Dock Leveler:
   1. Product: RHE Mechanical (Edge of Dock Leveler) with integral bumpers.
   2. Operation: Manual.
   3. Overal Width: 120 inch.
   4. Leveler Width: 84 inch.
   5. Operating Range: 5 inches above dock level, 5 inches below dock level.
   6. Capacity: 20,000 lbs.

2.03 ACCESSORIES

A. Dock Bumpers: Included with the RHE Edge of Dock Leveler.

2.04 FINISHES

A. Leveler Platform: Hot dip galvanized to 1.25 oz/sq ft finish.

B. Leveler Frame: Hot dip galvanized to 1.25 oz/sq ft finish.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that rough-in openings are acceptable.

3.02 INSTALLATION

A. Install dock leveler unit in prepared opening in accordance with manufacturer's instructions.

B. Set square and level. Shim as required.

C. Anchor unit securely, flush with dock. Weld back of leveling dock to pit frame. Touch-up weld with primer.

3.03 ADJUSTING

A. Adjust installed unit for smooth and balanced operation.

END OF SECTION

SECTION 12 35 53

STAINLESS STEEL LABORATORY CASEWORK

PART 1 – GENERAL

Summary: The subsequent specifications are designed to describe to the provider of the laboratory casework system the standards and expectations that the owner and architect allow for a quality and functional installation of the laboratory casework.

1.1 SECTION INCLUDES

A. Modular Casework

B. Stainless Steel Casework

C. Overhead Service Carriers

D. Shelving

E. Electrical Fixtures

1.2 RELATED SECTIONS

A. Division 09 Section 65 13, “Resilient Base and Accessories”

B. Division 11 Section 53 00, “Laboratory Equipment”

C. Division 12 Section 31 00, “Manufactured Metal Casework”

D. Division 12 Section 32 00, “Manufactured Wood Casework”

E. Division 12 Section 36 00, “Countertops”

F. Division 13 Section 21 00, “Controlled Environment Rooms”

G. Division 22 Section 40 00, “Plumbing Fixtures”

H. Related Work To Be Performed By Others:
1. Final installation of all plumbing, service and electrical fixtures attached to casework or countertop (excluding piping and wiring within fume hoods).

2. Final connection to service lines of all plumbing, service and electrical fixtures attached to laboratory casework or furniture.

1.3 REFERENCES

A. SEFA 8: Laboratory Furniture – Casework, Shelving and Tables
Guidelines Science Equipment and Furniture Association (SEFA)

B. ISO 9001:2008 – Quality Management
International Standards Organization
(ISO)

C. ADA (ATBCB ADAAG) Americans with Disabilities Act Accessibility
Guidelines Americans with Disabilities Act (ADA)

1.4 SUBMITTALS

A. Product Data:

Drawings shall include data and details for construction of the laboratory casework as well as information regarding the name, quantity, type and construction of materials (such as hardware, gauges, etc), that will be used to complete the project.

B. Shop Drawings:

1. The laboratory casework manufacturer shall furnish shop drawings illustrating the layout and placement of all laboratory casework and fume hoods as well as any products included in this section.

2. Indicate the type and location of all service fittings and associated supply connections.

3. Preparation instructions and recommendations.

4. Storage and handling requirements and recommendations.

5. Installation methods.

C. Selection Samples:

Submit the following:

1. One complete set of color chips representing the manufacturer's full range of available colors. Minimum sample size 2 inches by 3 inches (50mm x 76mm.
2. One Countertop backsplash and finished edge.

D. Quality Assurance/Control

1. Design Data/Test Reports: Manufacturer shall submit test data and design criteria which are in compliance with the project specifications.

2. Certificates: All certifications required in the specifications shall be submitted with the original submittal package under separate cover. Certificates must be provided with the signature of a qualified individual of the supplier.

3. Manufacturers' Instructions: Provide manufacturer's instructions for installation and maintenance of all products provided and installed within this section. Instructions will be in bound form, tabbed and organized by section number.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. The following list of information will be provide to the Architect at least ten (10) days prior to the bid opening:

2. List of manufacturing facilities;

3. A list of ten (10) installations of comparable stature completed within the past 5 years;

4. Construction details depicting the materials, sizes and methods of construction;

5. Independent laboratory test reports that include information on cabinet, fume hood and table top finish and performance that have been conducted within the last two years.

1.6 DELIVERY, STORAGE AND HANDLING

A. Packaging, Shipping, Handling and Unloading

1. Packaging: Products shall have packaging adequate enough to protect finished surfaces from soiling or damage during shipping, delivery and installation.

2. Delivery: Casework delivery shall only take place after painting, utility rough-ins and related activities are completed that could otherwise damage, soil or deteriorate casework in installation areas.

3. Handling: Care, such as the use of proper moving equipment, experienced movers, etc., shall be used at all times to avoid damaging the casework. Until installation takes place, any wrapping, insulation or other method of protection applied to products from the factory will be left in place to avoid accidental damage.

B. Acceptance at Site:

Casework will not be delivered or installed until the conditions specified under Part 3, Installation section of this document have been met.

C. Storage:

Casework shall be stored in the area of installation. If, prior to installation, it is necessary for casework to be temporarily stored in an area other than the installation area, the environmental conditions shall meet the environmental requirements specified under the Project Site Conditions article of this section.

D. Waste Management and Disposal:

The supplier of the laboratory casework is responsible for removing any waste or refuse resulting from the installation of, or work pertaining to laboratory casework; thereby leaving the project site clean and free of debris. Trash container(s) to be provided by others.

1.7 PROJECT SITE CONDITIONS

A. Building must be enclosed (windows and doors sealed and weather-tight);

B. An operational HVAC system that maintains temperature and humidity at occupancy levels must be in place;

C. Adjacent and related work shall be complete;

D. Ceiling, overhead ductwork and lighting must be installed;

E. Site must be free of any further construction such as “wet work”;

F. Required backing and reinforcements must be installed accurately and the project must be ready for casework installation.

1.8 WARRANTY

A. Furnish a written warranty that Work performed under this Section shall remain free from defects as to materials and workmanship for a period of two (2) years from date of shipment. Defects in materials and workmanship that may develop within this time are to be replaced without cost or expense to the Owner.

Defects include, but are not limited to:

1. Ruptured, cracked, or stained coating
2. Discoloration or lack of finish integrity
3. Cracking or peeling of finish.
4. Slippage, shift, or failure of attachment to wall, floor, or ceiling
5. Weld or structural failure
6. Warping or unloaded deflection of components
7. Failure of hardware

B. The warranty with respect to products of another manufacturer sold by Mott Manufacturing is limited to the warranty extended by that manufacturer to Mott Manufacturing.

PART 2 – PRODUCTS

2.1 MANUFACTURER

A. Acceptable Manufacturer:
Mott Manufacturing Ltd.; 452 Hardy Rd. Brantford, ON, Canada N3T 5L8. Tel: (519) 752-7825. Fax: (519) 752-2895. Email: inquire@mott.ca, www.mott.ca.

B. Substitutions:
Must meet all specification requirements and have prior approval.

C. Requests for substitutions:
All requests will be considered in accordance with provisions of Section 01 60 00.

2.2 CASEWORK MATERIALS

A. Stainless Steel:
1. Sheet: ASTM A240, Type 304 or 316 alloy.

2. Finish: Unless otherwise indicated, AISI No. 4 Brushed Finish

B. Galvanized Sheet Steel:

Commercial quality galvanized sheet steel to ASTM 653, Designation Z275.

C. Glass:

Clear Float, 6mm and 3mm thick, conforming to CAN2 12.3-M76, Glazing Quality. Laminated Glass: CAN/CGSB-12.1-M90, Type 1 with clear PVB interlayer. Total nominal thickness of laminated glass: 6 mm.

D. Sealant:

One component, RTV silicone sealant. Color to suit application.

E. Resilient Base and Adhesive:

Top set coved, 3mm (1/8") thick, 150mm (6") high and 100mm (4") high as indicated for base units, including pre-molded stops and external corners or color selected by Consultant from full range. Continuous lengths. Adhesive for rubber base shall be trowelled on giving 100% coverage. Use an adhesive compatible with both surfaces, as recommended by the base manufacturer.

2.3 CASEWORK CONSTRUCTION

A. Materials and Thickness:

Use the following minimum steel thicknesses for furniture manufacturing:

1. 3mm (11 Ga) leveling bolt gusset plates.

2. 1.9mm (14 Ga) drawer slides and side suspension channels.

3. 1.5mm (16 Ga) for tubular rails, legs for tables, gusset plates, cabinet top and intermediate horizontal rails.

4. 1.2mm (18 Ga) for door and drawer fronts, cabinet floor, cabinet sides, vertical front members, cabinet toe kick, service cover panels, table and kneehole frames, front rails, gable legs and dust caps, false panels, furring and filler panels.

5. 0.9mm (20 Ga) for drawer backs, door backs, vertical closure channel, removable back panels, shelves, drawer bodies, drawer dividers, bin bodies, and pull-out shelves.

B. Cabinet Frame:

1. Provide one-piece die-formed cabinet bottom construction with return side flanges turned down. Spot weld flanges to cabinet sides.

2. Cabinet bottoms shall be turned down at front to form 32mm (1-1/4") "U" channel to accept toe kick and turn down 133mm (5-1/4") at back with 16mm (5/8") return to form the back lower member of cabinet base. Provide punched 19mm (3/4") dia. corner holes for access to levelers and to accept PVC press plugs. It shall be possible to access levelers from above cabinet without removing drawers or drawer supports.

3. Provide additional vertical 75mm (3") "HAT" shaped channels, spot-welded to or formed with the rear vertical corner. Channel shall be provided with pre-punched holes to receive shelf clips, and slotted holes to receive drawer suspension tracks. Cabinets 762mm (30") wide and larger shall be provided with intermediate 117mm (4-5/8") "HAT" channels to brace cabinet and accept shelf clips and drawer tracks

4. Where applicable, the front corner posts shall be pre-punched and slotted to accept drawer suspension systems and suspension pull-out shelves. Front vertical posts shall form inboard flush front construction for doors and drawers acting as the cabinet main member side gable tying the cabinet bottom and horizontal member together to form a rigid case. Front post rear closure channels shall be **"J"** shaped 9mm (11/32") x 33mm (1-5/16") x 49mm (1-15/16"). Provide channel with pre-punched holes to receive shelf clips.

5. Doors and drawers shall overlay top intermediates and floor horizontal members.

6. Top horizontal front framing member shall form a **"J"** shaped section 75mm (3") wide, 10mm (3/8") return by 25mm (1") deep with 16mm (5/8") return.

7. Intermediate horizontal framing members shall form a "U" 32mm (1-1/4") high with a 25mm (1") return on top and 16mm (5/8") return on bottom.

8. Top rear horizontal framing member shall be 50mm (2") x 32mm (1-1/4") angle section welded to back corner lapped post and side gables with welded corner gusset plates acting as cabinet bracing and counter top material fixing member.

9. Enclose cabinetry toe space shall be 75mm (3") deep x 100mm (4") high and shall act as a total enclosure to bottom of cabinet. Toe space section shall key up into "U" shaped front floor member and act as reinforcement. Toe space, front floor of cabinet and corner post sections shall be spot welded together forming one structural member.

10. The toe space members, side gable returns, and back lower member shall form all welded structural corner to accept leveler gussets and 10mm (3/8") leveling bolts.

11. Cabinet construction shall be electro spot-welded to form a strong well-fitted, one-piece unit.

12. Exposed horizontal structural cabinet members between doors and drawers shall be unacceptable.

C. Cabinet Hardware:

1. Pulls: Provide handles for drawers and hinged doors in 100mm (4") stainless steel.

2. Door Hinges: Provide five knuckle-type barrel door hinges of 1.9mm (14 Ga) steel screwed into door and fastened to cabinet side stile with two counter sunk #8-32 zinc plated machine screws & captive serrated tooth washer nuts. Hinge finish shall be stainless steel.

D. Base Cabinet Components:

1. Provide removable back panels for cupboard base cabinets. Provide partial back panels 229mm (9") in height to accommodate plumbing at sink units. When requested, provide back panels and security panels on cabinets requiring locks.

2. Shelving edges; turned down on all four sides 25mm (1”), and returned under on front and back 25mm (1”). Shelves 914mm (36”) and longer shall be provided with “HAT’ channel reinforcement at front edge.

3. Doors:
   a) Fabricate doors of 2 telescoping metal panels, 19mm (3/4”) thick, with a sound-deadening material extending continuously full-width, and top to bottom. Reinforce hinged side of door adequately with hinge machine screws to prevent sagging. Secure recessed hinges to cabinet posts with machine screws and concealed self-locking nuts. Provide nylon roller friction catches, mounted on horizontal top or intermediate members pull side of doors. Provide each hinged door with 2 rubber bumpers.

   b) Doors, drawers, tracks and back panels shall be replaceable in the field without requiring special tools.

   c) All standard double door cabinets shall be designed without center stiles to maximize access to the cabinet.

4. Drawers:
   a) Fabricate drawer fronts of 2 telescoping metal panels and totally filled with sound-deadening material to eliminate possible drumming effect. Form removable outside panel with lip to fit over inside panel on top edge, and to lock into position at bottom with rivets to form a rigid, one-piece 19mm (3/4”) thick drawer front.

   b) Provide drawer operation on Full Extension Drawer Slides, 508mm (20”) extension, load capacity 45kg (100 pounds).: Equal to: Knape & Vogt #8400B.

   c) Drawer body shall consist of one piece stainless steel construction including the bottom, two sides, back and inner front flanged end which shall be welded to the interior drawer front head. The exterior drawer front shall have a channel formation on the top edge with ground smooth and fully finished return edges telescoping together to form fully sounded-deadened drawer front. Drawer bodies shall have a reinforcing bend on top edges.

   d) Provide built-in stops to prevent inadvertent removal of drawers, with allowance for drawer to be removed by lifting front of drawers and pulling out.

   e) Provide drawer pulls in central location of drawer face. Two handles shall be provided on units 762mm (30”) and larger.

5. Leg Sets:
   a) Leg sets shall consist of two 50mm (2”) square metal tubular legs complete with steel bolt levelers and slip on PVC shoes.

   b) Legs, when secured together, shall be provided with 25mm (1”) x 50mm (2”) steel rail centered 203mm (8”) up from bottom of leg.

   c) Top of legs, both standing and sitting heights, shall have a 1.9mm (14 Ga) triangular mounting plate welded in position for securing to underside of countertop.

6. Apron Drawer Assembly:
    a) Apron drawer assembly shall be fabricated from metal channel shaped skirting panels of modular widths the same as standard base cabinets. Rails 95mm (3-3/4") high channel ends shall be turned to fit into end mounting brackets. Drawer suspension framing shall be mechanically fixed to channels, welded integrally with front and back channel sections formed into a rigid one-piece frame.

    b) Where called for, drawers located in table aprons shall be supplied in a maximum width of 381mm (15") with two drawers supplied in tables 1219mm (48") and wider. Drawer suspension shall be with 25mm (1") nylon ball bearing rollers and self-closing action, custom manufactured 1.5mm (16 Ga) suspension system.

7. Front Rails:
    a) Front rail units shall be fabricated from a single metal channel-shaped skirting panel in modular widths the same as standard base cabinets. Channel ends shall be turned to fit into end mounting brackets. Rails are 95mm (3-3/4") high.

8. Acid Storage Cabinets:
    a) Construct in similar manner to standard steel base cabinets with entire interior lined with 5mm (3/16") thick fiber glass reinforced polyester thermo set resin similar to fume hoods.

    b) The lining on the back of doors shall be fitted so that when the door is in a closed position the lining shall fit inside the interior lining of the cabinet.

    c) Acid storage cabinets shall contain adjustable polyethylene shelves.

    d) Secure removable back panels in place with stainless steel screws fixed to vertical back framing members.

    e) Provide one door with decal signifying "ACID" storage. Exhaust ports shall be provided in back exterior of cabinets for fume evacuation to ducting when shown on drawings.

    f) Cabinets occurring under fume hoods, when shown on drawings, shall be provided with two exhaust ducts which shall extend up through the top material into the hood side wall and terminate with entry into hood chamber at a point above the upper baffle. Ducting material shall be 38mm (1-1/2") diameter O.D. flexible plastic tubing supplied separate for installation on site by installer.

9. Bin Cabinets:
    a) Constructed the same as a standard base cabinet, except the door panels shall be hinged at the bottom to permit the door to tilt out from the top. Bin section shall have its own built-in catch, designed to stop and hold the loaded bin at a predetermined opened position.

    b) Bin door shall have one integral bin compartment capable of supporting 45kg (100 pounds) without sagging or binding.

    c) Bin cabinets shall be suitably fastened in place only in fixed bench assemblies to

prevent any tipping action when bin sections are loaded and in an open position. When shown on drawings, removable leak-proof bin liners with two lift out handles shall be designed to fit into bin compartment and fabricated of either Type 304, 1.2mm (18 Ga) stainless steel.

10. Control Panel Base Cabinets [457mm (18") or 559mm (22") optional depths]:
    a) Constructed the same as standard base cabinets, except blank panels are provided above cupboard doors for the mounting of remote control fittings. Cabinet shall be complete with removable back panels.

11. File Drawer Cabinets:
    a) Construct file drawer cabinets in similar manner to standard base cabinets, and consisting of 1 or 2 double height file drawers for low height or standard height file cases.

    b) Provide each file drawer complete with 2 file supports and hanger rods.

    c) The file drawer shall be provided with 508mm (20") full extension telescoping drawer tracks.

    d) Hanger rods are adjustable to accommodate legal or letter size files.

12. Service Cover Panels:
    a) Service cover panels shall be provided, where called for, between base cabinets to enclose the pipe space. Service cover panels shall be designed in two sections. The lower section shall be fixed in place to mount cove base molding. The upper section shall be fitted between the base cabinets and shall be removable.

13. Filler Panels:
    a) Fabricate front filler panels complete with flanges on both sides and a 75mm x 100mm (3" x 4") toe space along the working face.

    b) Scribe filler panels shall be flanged on one side and flat on the other, to be cut on jobsite to suit wall conditions, and shall fit into double angles secured to the wall. No visible mounting screws permitted.

    c) Corner filler panels shall be a two-piece construction, one fixed panel and the other a variable panel to facilitate room dimensions. Each shall have flanges and an integral 75mm x 100mm (3" x 4") toe space filler to interlock with its counterpart.

    d) End closing filler panels shall be flanged on one side 25mm (1") and secured to back of cabinet. The edge extending to wall shall be flat and fit into a double angle secured to wall. No visible mounting screws permitted.

14. Safety Storage Cabinets; Fume Hood Base Type:
    a) Construct storage cabinets of double wall, welded sheet steel construction with double panel door; overall thickness, 50mm (2"). Provide cabinets with 4 adjustable levelling devices to compensate for approximately 25mm (1") base building floor differential. Raise door sill 50mm (2") above bottom of the cabinet to form a liquid-tight well. Overlap cabinet frame with hinged doors having continuous piano type hinges with three-point locking mechanism ship lapped at opening stile.

b) Provide adjustable galvanized sheet steel shelves with four edges turned down 25mm (1”) and additionally returned under 16mm (5/8”) on all edges. Provide 13mm (1/2”) incremental shelf adjustment.

c) Provide 50mm (2”) vents, complete with fire baffle covers on each vent, with 50mm (2”) dia. fine metal filter.

d) Provide overlaid red warning letters on doors as follows: "FLAMMABLE -- KEEP FIRE AWAY".

e) Construction shall meet requirements of OSHA Standard 1910-106(d)(3), considered as organized storage centres for flammable and combustible liquids. Cabinets shall comply with National Fire Protection Association's flammable and combustible liquids Code #30 and #45, 1996. Provide grounding screw lug in accordance with Codes.

f) Construct safety storage cabinets sized for under-counter and under fume hood configurations as required by Drawings.

15. Safety Storage Cabinets; Fume Hood Base Type (optional UL approved Model):

a) Construct storage cabinets of double wall, welded sheet steel construction with double panel door; overall thickness, 50mm (2”). Provide cabinets with 4 adjustable levelling devices to compensate for approximately 25mm (1”) base building floor differential. Raise door sill 50mm (2”) above bottom of the cabinet to form a liquid-tight well. Overlap cabinet frame with hinged doors having continuous piano type hinges with three-point locking mechanism ship lapped at opening stile. Shiplap shall be provided with braided fibreglass gasket.

b) Walls, back, side and top of cabinet shall be insulated with two inch (50mm) thick mineral fibre insulation.

c) Provide adjustable galvanized sheet steel shelves with four edges turned down 25mm (1”) and additionally returned under 16mm (5/8”) on all edges. Provide 13mm (1/2”) incremental shelf adjustment.

d) Provide 50mm (2”) vents, complete with fire baffle covers on each vent, with 50mm (2”) dia. fine metal filter.

e) Provide overlaid red warning letters 50mm (2”) high on doors as follows: "FLAMMABLE -- KEEP FIRE AWAY".

f) Construction shall meet requirements of OSHA Standard 1910-106(d)(3), considered as organized storage centers for flammable and combustible liquids. Cabinets shall comply with National Fire Protection Association's flammable and combustible liquids Code #30 and #45, 1996. Provide grounding screw lug in accordance with Codes.

g) Construct safety storage cabinets sized for under-counter and under fume hood configurations as required by Drawings.

h) Cabinet shall be listed and labeled to the UL1275 standard.

E. Floor/Wall Cabinet Components:

1. Materials and Thicknesses:
   Use the following standard steel thicknesses for this furniture manufacturing:

   a) 1.2mm (18 Ga) leveled prime grade furniture steel for sides, top, back, bottom, false bottom, dust caps and bases on tall storage cabinets.

   b) 3mm (11 Ga) cold rolled steel for leveling device brackets on floor storage cabinets only.

2. Wall Storage Cabinets Sliding Glass Door or Open Type:
   a) Cabinet sides, bottom and top shall be flat panels die-formed "U" shaped flange on front edge and a return flange on back edges. Provide top and bottom panels with 40mm (1-9/16”) flanges on both ends with double returns. Reinforce front flanges on both sides and top with a flanged "U" shaped member. Both front side stile reinforcing channels shall contain a vertical row of shelf support clip holes 5mm (3/16”) round or square and 13mm (1/2”) o.c. Reinforce bottom with "U" channel.

   b) Design of cabinet shall enable it to be easily converted to a sliding glass door cabinet.

   c) Wall cabinets shall be provided with a flush bottom enclosure interlocking with front floor of cabinet as a telescoping panel with flange at rear and secured through the cabinet back.

   d) Provide shelves with edges turned down on 4 sides 25mm (1”), and return under on front and back by 25mm (1”). Provide shelf adjustment on 13mm (1/2”) increments for full height of cabinet interior. Provide a minimum of four plated shelf clips per shelf. Provide shelves 914mm (36”) and longer with ‘HAT” channel reinforcement at front edge.

   e) Provide sliding glass doors in 6mm (1/4”) sheet glass with "H" shaped extruded aluminum shoes fixed to and running the full width of the door bottom. Provide vinyl glazing channel fixed into shoe. Provide 2 removable spring steel and nylon wheel assemblies, one located at each end. The door assembly shall run on an inverted double "Y" shaped extruded aluminum track. Provide each door at top with 2 PVC guides running in double "U" shaped extruded aluminum track. One finger pull per door shall be ground into glass on side of door next to cabinet frame.

   f) Install bumpers on vertical reinforcement members of the cabinet frame.

3. Wall Storage Cabinets; Sliding Metal Doors & Framed Glass Doors:
   a) Fabricate cabinet the same as in Para. 2.3.D.2.a. above, with modified front side posts to accept sliding metal doors, generally as specified in Para. 2.3.C.1.

   b) Doors shall be guided at the bottom with a full width black PVC double "U" channel fixed to floor of cabinet.

   c) Upper track for sliding metal and framed glass doors shall be galvanized; double-track, “V” grooved, and painted to match furniture. Provide 2 suspended rollers per door, with special set of brackets for fixing to sliding doors. Nylon rimmed ball

bearing rollers as specified for drawer track assemblies.

d) 3mm (1/8") glass shall be provided for frame glass doors.

4. Wall Storage Cabinets: Hinged Metal Doors:
   a) Fabricate cabinets as specified in Para. 2.3.D.2.a. with two front side frames modified to minimize dust penetration. Provide intermediate exposed vertical members in a double "U" shaped channel. The front edges of the top panel shall have a channel formation reinforced with a flanged "U" channel. The exterior bottom panel shall have a channel formation at front and fitted with a flanged interior floor.

   b) Hinged metal doors shall be as specified in Para. 2.3.C.3.

5. Floor Storage Cabinets - Hinged Metal Doors:
   a) Construct cabinets as per Para. 2.3.B. and 2.3.C., and modified as in Para. 2.3.C.5.a.

   b) Hinged metal doors as per Para. 2.3.C.3.

6. Dust Cap:
   a) Dust caps shall be fabricated from 1.2mm (18 Ga) steel, and shall mount flush with the front edge of the cabinet and extend back at an angle of 30 degrees to a point perpendicular to the rear of the cabinet. Ends shall be finished and flanged so as to allow attachment to the cabinet below.

PART 3 – EXECUTION

3.1 INSTALLERS

A. Installer Qualifications:

1. Installer shall have a minimum of 5 years continued experience in installation or application of systems similar to those required for this project.

2. Installer shall be authorized by either the distributor or manufacturer. Warranty will be void if unauthorized installer executes the installation.

3.2 EXAMINATION

A. Site Verification of Conditions:

1. Casework will not be delivered or installed until the following conditions have been met:
   a) Building must be enclosed (windows and doors sealed and weather-tight);

   b) An operational HVAC system that maintains temperature and humidity at occupancy levels must be in place;

   c) Ceiling, overhead ductwork and lighting must be installed;

   d) Site must be free of any further construction such as "wet work."

e) Required backing and reinforcements must be installed accurately and the project must be ready for casework installation.

B. ***NOTE:***

In the event that any of the specified requirements for installation are not present at the time of requested delivery, the general contractor or owner must provide the casework manufacturer with a letter of deviation that releases the manufacturer from any responsibility or liability from an damage to the products resulting from the unfavorable building conditions.

3.3 INSTALLATION

A. Casework Installation:

1. Casework shall be set with components plumb, straight and square, securely anchored to building structure with no distortion. Concealed shims shall be used as required.

2. Cabinets in continuous runs shall be fastened together with joints flush, uniform and tight with misalignment of adjacent units not to exceed 1/16 of an inch.

3. Wall casework shall be secured to solid material, not lath, plastic or gypsum board.

4. Top edge surfaces shall be abutted in one true plane. Joints are to be flush and gap shall not exceed 1/8 of an inch between tops units.

5. Casework and hardware shall be adjusted and aligned to allow for accurate connection of contact points and efficient operation of doors and drawers without any warping or binding.

B. Countertop Installation:

1. Countertops are to have been fabricated in lengths according to drawings, with ends abutting tightly and sealed with corrosion resistant sealant.

2. Tops will be anchored to base casework in a single true plane with ends abutting at hairline joints with no raised edges at joints.

3. Joints shall be factory prepared having no need for in-field processing of top and edge surfaces.

4. Joints shall be dressed smoothly, surface scratches removed and entire surface cleaned thoroughly.

3.4 CLEANING

A. Ensure all products are unsoiled and match factory finish. Remove or repair damaged or defective units.

B. Clean all finished surfaces, including drawers and cabinet shelves, and touch up as necessary.

C. Countertops shall be cleaned and free of grease or streaks.

3.5 PROTECTION:

A. Counter tops and ledges shall be protected with 1/4 inch ribbed cardboard for the remainder of the construction process.

B. Examine casework for damaged or soiled areas; replace, repair, and touch-up as required.

C. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 12 36 00
COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Countertops for architectural cabinet work.

1.02 RELATED REQUIREMENTS

A. Section 06 41 00 - Architectural Wood Casework.

1.03 REFERENCE STANDARDS

A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

C. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.

D. ISFA 3-01 - Classification and Standards for Quartz Surfacing Material; 2013.

E. MIA (DSDM) - Dimensional Stone Design Manual; VIII, 2016.

F. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Specimen warranty.

C. Shop Drawings: Complete details of materials and installation; combine with shop drawings of cabinets and casework specified in other sections.

D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.

E. Test Reports: Chemical resistance testing, showing compliance with specified requirements.

F. Installation Instructions: Manufacturer's installation instructions and recommendations.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: Same fabricator as for cabinets on which tops are to be installed.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.01 COUNTERTOP ASSEMBLIES

A. Quality Standard: See Section 06 41 00.

B. Plastic Laminate Countertops: High pressure decorative laminate sheet bonded to substrate.
   1. Laminate Sheet, Unless Otherwise Indicated: NEMA LD 3, Grade HGS, 0.048 inch nominal thickness.

a. Finish: Matte or suede, gloss rating of 5 to 20.
b. Surface Color and Pattern: As indicated on drawings.

2. Back and End Splashes: Same material, same construction.

C. Wood Countertops: One-piece, glued-laminated under pressure.
1. Thickness: 1-1/4 inch, minimum.
2. Color: To match wood flooring in room.
3. Species: Walnut; clear grade.
4. Exposed Edges: Rounded to approximately 3/8 inch radius.
5. Back and End Splashes: Same material, same construction; 3/4 inch thick, square edges.
6. Finish: Sanded smooth; two coat boiled linseed oil rubbed in with 48 hours between coats.

D. Stainless Steel Countertops: ASTM A666, Type 304, stainless steel sheet; 16 gage, 0.0625 inch nominal sheet thickness.
1. Finish: 4B satin brushed finish.
2. Edge and Backsplash Sink Details: As indicated on drawings.
3. Exposed Edge Shape: Straight turndown with return; 1-1/2 inch high face, 1/2 inch return to face of case; reinforced with hardwood or steel.
4. Back and End Splashes: Same material; welded 1/4 inch radius coved joint to countertop; square top edge with 1 inch wide top surface and minimum 1/2 inch turndown.
5. Splash Dimensions: 4 inch high by 1 inch thick, unless otherwise indicated.
6. Sinks: Same material, same thickness; flush welded to counter; bottom sloped to outlet; radiused interior corners; drain outlet located in back corner.

E. Natural Quartz and Resin Composite Countertops: Sheet or slab of natural quartz and plastic resin over continuous substrate.
1. Flat Sheet Thickness: 1-1/4 inch, minimum.
2. Natural Quartz and Resin Composite Sheets, Slabs and Castings: Complying with ISFA 3-01 and NEMA LD 3; orthopthalic polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
a. Factory fabricate components to the greatest extent practical in sizes and shapes indicated; comply with the MIA Dimension Stone Design Manual.
b. Surface Burning Characteristics: Flame spread 25, maximum; smoke developed 450, maximum; when tested in accordance with ASTM E84.
c. Finish on Exposed Surfaces: Polished.
d. Color and Pattern: As indicated on drawings.
3. Wall Panels: 1/2 inch, and 3/4 inch thick.
4. Other Components Thickness: 3/4 inch, minimum.
5. Exposed Edge Treatment: Built up to minimum 1-1/4 inch thick; square edge; use marine edge at sinks.
6. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.
7. Skirts: As indicated on drawings.

2.02 ACCESSORY MATERIALS

A. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

2.03 FABRICATION

A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
1. Join lengths of tops using best method recommended by manufacturer.
2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.

B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.

1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
2. Height: 4 inches, unless otherwise indicated.

C. Solid Surfacing: Fabricate tops up to 144 inches long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.

D. Stainless Steel: Fabricate tops up to 144 inches long in one piece including nosings and back and end splashes; accurately fitted mechanical field joints in lengths over that dimension are permitted.
1. Weld joints; grind smooth and polish to match.
2. Provide stainless steel hat channel stiffeners, welded or soldered to underside, where indicated on drawings.
3. Provide wall clips for support of back/end splash turndowns.
4. Sound Deadening: Apply water resistant, fire resistant sound deadening mastic to entire bottom surface.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Albert & McCleskey Associates Architects of unsatisfactory preparation before proceeding.

C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.

B. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch.

C. Attach wood countertops using screws with minimum penetration into substrate board of 5/8 inch.

D. Attach stainless steel countertops using stainless steel fasteners and clips.

E. Seal joint between back/end splashes and vertical surfaces.

3.04 TOLERANCES

A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.

B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.

C. Field Joints: 1/8 inch wide, maximum.

3.05 CLEANING

A. Clean countertops surfaces thoroughly.

3.06 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 14 21 05

ELECTRIC TRACTION ELEVATOR A 2500#

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Electric Traction Elevators.

B. Products Supplied But Not Installed Under this Section:

1. Hoist Beam
2. Pit Ladder
3. Inserts mounted in block walls for rail attachments

C. Work Supplied Under Other Sections:

1. Temporary lighting, including temporary lighting in hoistway for machine space with switch located in hoistway on the strike jamb side of top landing door.
2. Main line disconnects for each elevator.
   a. One fused three phase permanent power in building electrical distribution room
   b. One non fused three phase permanent power in hoist way at top landing
3. Hoistway ventilation shall be in accordance with local and national building code requirements.
4. Guide Rail Support shall be structurally adequate to extend from pit floor to top of hoistway, with spans in accordance with requirements of authority having jurisdiction and final layouts.
5. Removable barricades at all hoistway openings, in compliance with OSHA 29 CFR 1926.502 in addition to any local code requirements.
6. Lifeline attachments capable of withstanding 5000 lb load in accordance with OSHA 29 CFR 1926.502. Provide a minimum of 2 at the top, front of each hoistway.
7. Pit lighting: Fixture with switch and guards. Provide illumination level equal to or greater than that required by ASME A17.1/CSA B44 2000, or applicable version.
8. Control space lighting with switch. Coordinate switch with lighting for machine space as allowable by code.

D. Related sections:

1. Section 01 50 00 - Temporary Facilities and Controls
2. Section 03 30 00 - Cast-in-Place Concrete:
3. Section 04 22 00 – Concrete Masonry Units

4. Section 05 50 00 - Metal Fabrications
5. Section 26 05 11 – Electrical General Requirements
6. Section 31 23 18 – Earthwork for Structures

E. Industry and government standards:

1. ICC/ANSI A117.1 Accessible and Usable Buildings and Facilities
2. ADAAG - Accessibility Guidelines for Buildings and Facilities
3. ANSI/NFPA 70, National Electrical Code
4. ANSI/NFPA 80, Standard for Fire Doors and Fire Windows
5. ASME/ANSI A17.1, Safety Code for Elevators and Escalators.

1.02 DESCRIPTION OF ELEVATOR

A. Elevator Equipment: KONE EcoSpace™ gearless traction elevator

B. Equipment Control: KCM831

C. Drive: Non Regenerative

D. Quantity of Elevators: [1]

E. Landings: [3]

F. Openings: [3] Front Openings

G. Travel: [30' 0" +/- ; 150']

H. Rated Capacity: [2500 lbs]

I. Rated Speed: [150] fpm

J. Clear Inside Dimensions (W x D): [6'-8" x 4'-3"]

K. Cab Height: [8' 0"]

L. Clear height under suspended ceiling: [13']

M. Entrance Width and Type: [3'-6" Center (as shown in drawings)]

N. Entrance Height: [7'-0"]

O. Main Power Supply: [480] Volts + 5%, three-phase

P. Operation: [Simplex]

Q. Machine Location: Inside the hoistway mounted on car guide rail

R. Control Space Location: [Integrated]

S. Elevator Equipment shall conform to the requirements of seismic zone: [non-seismic]

T. Maintenance Service Period: [12] months

1.03 PERFORMANCE REQUIREMENTS

A. Car Performance

1. Car Speed ± 5% of contract speed under any loading condition or direction of travel.

2. Car Capacity: Safely lower, stop and hold (per code) up to 125% of rated load.

B. System Performance

1. Vertical Vibration (maximum): 25 mg

2. Horizontal Vibration (maximum): 25 mg

3. Jerk Rate (maximum): 1.3 ft/sec3

4. Acceleration (maximum) 1.3 ft/sec2

5. In Car Noise: = 55 dB(A)

6. Leveling Accuracy: ±0.2 inches

7. Starts per hour (maximum): 120

1.04 SUBMITTALS

A. Comply with Section 01 33 00 - Submittal Procedures.

B. Product Data: Submit manufacturer's product literature for each proposed system.

1. Cab design, dimensions and layout.

2. Layout, finishes, and accessories and available options.

3. Controls, signals and operating system.

4. Color selection charts for cab and entrances.

C. Shop Drawings:

1. Clearances and travel of car.

2. Clear inside hoistway and pit dimensions.

3. Location and layout of equipment and signals.

4. Car, guide rails, buffers and other components in hoistway.

5. Maximum rail bracket spacing.

6. Maximum loads imposed on building structure.

7. Hoist beam requirements.

8. Location and sizes of access doors.

9. Location and details of hoistway door and frames.

10. Electrical characteristics and connection requirements.

D. Operation and maintenance data:

1. Provide manufacturer's standard maintenance and operation manual.

E. Diagnostic Tools

1. Prior to seeking final acceptance for the completed project as specified by the Contract Documents, the Elevator Contractor shall deliver to the Owner any specialized tool(s) that may be required to perform diagnostic evaluations, adjustments, and/or parametric software changes and/or test and inspections on any piece of control or monitoring equipment installed. This shall include any specialized tool(s) required for monitoring, inspection and/or maintenance where the means of suspension other than conventional wire ropes are furnished and installed by the Elevator Contractor. Any and all such tool(s) shall become property of the Owner. Any diagnostic tool provided to the Owner by the Elevator Contractor shall be configured to perform all levels of diagnostics, systems adjustment and parametric software changes which are available to the Elevator Contractor. In those cases where diagnostic tools provided to the Owner require periodic recalibration/or re-initiation, the Elevator Contractor shall perform such tasks at no additional cost to the Owner for a period equal to the term of the maintenance agreement from the date of final acceptance of the competed project During those intervals in which the Owner might find it necessary to surrender a diagnostic tool for re-calibration, re-initiation, or repair, the Elevator Contractor shall provide a temporary replacement for the tool at no additional cost to the Owner. The Elevator Contractor shall deliver to the Owner, printed instructions for the proper use of any tool that may be necessary to perform diagnostic evaluations, system adjustment, and/or parametric software changes on any unit of microprocessor-based elevator control equipment and means of suspension other than standard elevator steel cables furnished and install by the Elevator Contractor. Accompanying the printed instructions shall be any and all access codes, password, or other proprietary information that is necessary to interface with the microprocessor-control equipment.

1.05 QUALITY ASSURANCE

A. Manufacturer: Minimum of fifteen years experience in the fabrication, installation and service of elevators of the type and performance of the specified. The manufacturer shall have a documented quality assurance program.

B. Installer: The equipment manufacturer shall install the elevator.

C. Inspection and Testing: In accordance with requirements of local jurisdiction, obtain required permits, inspections and tests.

1.06 DELIVERY, STORAGE AND HANDLING

A. Comply with manufacturer’s recommendations for delivery, storage and handling.

B. If the construction site is not prepared to receive the elevator equipment at the agreed ship date, the General Contractor shall be responsible to provide a safe, dry, and easily accessible storage area on or off the premises. Additional lablor costs for double handling will be the responsibility of the general contractor.

C. Delivered elevator materials shall be stored in a protected environment in accordance with manufacturer recommendations. A minimum storage area of 10 feet by 20 feet is required adjacent to the hoistway.

1.07 WARRANTY

A. Provide manufacturer warranty for a period of one year. The warranty period is to begin upon Substantial Completion of the Contract. Warranty covers defects in materials and workmanship. Damage due to ordinary use, vandalism, improper or insufficient maintenance, misuse, or neglect do not constitute defective material or workmanship.

1.08 MAINTENANCE SERVICE

A. The elevator manufacturer shall provide maintenance service consisting of regular examinations and adjustments of the elevator equipment for a period of [12] months after date of substantial completion. Replacement parts shall be produced by the original equipment manufacturer.

B. Maintenance service be performed during regular working hours of regular working days and shall include [regular time call back service].

C. Maintenance service shall not include adjustments, repairs or replacement of parts due to negligence, misuse, abuse or accidents.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Provide AC gearless machine room-less elevator systems subject to compliance with the design and performance requirements of this specification. Elevator manufacturers may include but are not limited to one of the following:

1. Basis of Design: EcoSpace™ traction elevators by KONE, Inc. (www.kone.com).

2. Other acceptable machine room-less products: manufacturer with minimum 15 years experience in manufacturing, installing, and servicing elevators of the type required for the project.

2.02 EQUIPMENT: CONTROL COMPONENTS AND CONTROL SPACE

A. Controller: Provide microcomputer based control system to perform all of the functions.

1. All high voltage (110V or above) contact points inside the controller cabinet shall be protected from accidental contact in a situation where the controller doors are open.

2. Controller shall be separated into two distinct halves; Motor Drive side and Control side. High voltage motor power conductors shall be routed and physically segregated from the rest of the controller.

3. Provide a serial cardrack and main CPU board containing a non-erasable EPROM and operating system firmware.

4. Variable field parameters and adjustments shall be contained in a non-volatile memory module.

B. Drive: Provide Variable Voltage Variable Frequency AC drive system to develop high starting torque with low starting current.

C. Controller Location: Locate controller{s} in the front wall integrated with the top landing entrance frame, machine side of the elevator. A separate control space should not be required.

2.03 EQUIPMENT: HOISTWAY COMPONENTS

A. Machine: AC gearless machine, with permanent magnet synchronous motor, direct current electro-mechanical disc brakes and integral traction drive sheave, mounted to the car guide rail at the top of the hoistway.

B. Governor: Friction type over-speed governor rated for the duty of the elevator specified.

C. Buffers, Car and Counterweight: [Polyurethane buffer].

D. Hoistway Operating Devices:

1. Emergency stop switch in the pit

2. Terminal stopping switches.

3. Emergency stop switch on the machine

E. Positioning System: System consisting of magnets and proximity switches.

F. Guide Rails and Attachments: Steel rails with brackets and fasteners.

2.04 EQUIPMENT: HOISTWAY ENTRANCES

A. Hoistway Entrances

1. Sills: extruded.

2. Doors: Hollow metal construction with vertical internal channel reinforcements.

3. Fire Rating: Entrance and doors shall be UL fire-rated for 1-1/2 hour.

4. Entrance Finish: [Stainless Steel].

5. Entrance Markings Jamb Plates: Provide standard entrance jamb tactile markings on both jambs, at all floors. Plate Mounting: Refer to manufacturer drawings.

2.05 EQUIPMENT: CAR COMPONENTS

A. Car Frame: Provide car frame with adequate bracing to support the platform and car enclosure.

B. Platform: Platform shall be all steel construction.

C. Car Guides: Provide guide-shoes mounted to top and bottom of both car and counterweight frame. Each guide-shoe assembly shall be arranged to maintain constant contact on the rail surfaces. Provide retainers in areas with Seismic design requirements.

D. Steel Cab Finish: Glass Series (Spring)

1. Car Wall Panels: Colored Glass White on Back wall (Siberian Glaze GW1) Stainless Steel on side walls. Frame: Polished Aluminum. Reveal: Satin Stainless Steel behind the raised panels.

2. Car Front Finish: Stainless Steel (standard).

3. Car Door Finish: Stainless Steel (standard).

4. Ceiling: LF-98, Satin Stainless Steel.

5. Handrail: 1.25" Round Stainless Steel

    a. Finish: Stainless Steel (standard).; rails to be located on [back] of car enclosure.

6. Flooring: By others. (Not to exceed 2sqft and 1/2" finished depth.)

7. Threshold: Aluminum

E. Emergency Car Signals

1. Emergency Siren: Siren mounted on top of cab that is activated when the alarm button in the car operating panel is engaged. Siren shall have rated sound pressure level of 80 dB(A) at a distance of three feet from device. Siren shall respond with a delay of not more than one second after activation of alarm button.

2. Emergency Car Lighting: Provide emergency power unit employing a 12-volt sealed rechargeable battery and totally static circuits shall illuminate the elevator car and provide current to the alarm bell in the event of building power failure.

3. Emergency Exit Contact: An electrical contact shall be provided on the car-top exit.

4. Ventilation: [fan].

2.06 EQUIPMENT: SIGNAL DEVICES AND FIXTURES

A. Car Operating Panel: Provide car operating panel with all push buttons, key switches, and message indicators for elevator operation. Fixture finish to be: Stainless Steel (standard).

1. Signalization: KSS 570 Flush (Solid Snow White).

2. Flush mounted car operating panel shall contain a bank of round, mechanical, illuminated buttons marked to correspond to landings served, emergency call button, door open button, door close button, and key switches for lights, inspection, and exhaust fan. Buttons have [blue] illumination (halo). All buttons to have raised text and Braille marking on left hand side. The car operating display panel shall be [blue] DOT-matrix. All texts, when illuminated, shall be [blue].

3. Additional features of car operating panel shall include:

    a. Car Position Indicator within operating panel [blue].

    b. Elevator Data Plate marked with elevator capacity and car number on car top.

    c. Help buttons with raised markings.

    d. In car stop switch per local code.

    e. Firefighter's hat.

    f. Firefighter's Phase II Key-switch.

    g. Call Cancel Button.

h. Pre-programmed integrated ADA phone (complete description of krms features included as standard)

i. Help Button/Communicator. Activation of help button will initiate two-way communication between car and a location inside the building, switching over to alternate location if call is unanswered, where personnel are available to take the appropriate action. Visual indicators are provided for call initiation and call acknowledgement.

B. Hall Fixtures: Wall mounted hall fixtures shall be provided with necessary push buttons and key switches for elevator operation. Wall mounted hall fixtures shall have a brushed stainless steel finish.

1. Hall fixtures shall feature round, mechanical, buttons in applied mount face frame. Hall fixtures shall correspond to options available from that landing. Buttons shall be in a vertically mounted fixture. Hall fixtures shall not be jamb-mounted. Hall lanterns shall feature [blue] illumination.

C. Car Lantern and Chime: A directional lantern visible from the corridor shall be provided in the car entrance. When the car stops and the doors are opening, the lantern shall indicate the direction in which the car is to travel and a chime will sound. The chime will sound once for up and twice for down.

2.07 EQUIPMENT: ELEVATOR OPERATION AND CONTROLLER

A. Elevator Operation

1. Simplex Collective Operation: Using a microprocessor-based controller, operation shall be automatic by means of the car and hall buttons. If all calls in the system have been answered, the car shall park at the last landing served.

2. Zoned Car Parking.

3. Relative System Response Dispatching.

B. Standard Operating Features to include:

1. Full Collective Operation

2. Fan and Light Control.

3. Load Weighing Bypass.

4. Ascending Car Uncontrolled Movement Protection

5. Top of Car Inspection Station.

C. Additional Operating Features to include:

1. Independent Service

2. Hoistway Access Bottom Landing

3. Hoistway Access Top Landing

4. Car Secure Access.

5. Provision for Card Reader in Car (Card Reader provided and Installed by others)

6. Provide provisions for coaxial cable for CCTV. CCTV by others.

7. Intercom Provisions

8. Emergency Battery Power Supply

   a. When the main line power is lost for longer than 5 seconds the emergency battery power supply provides power automatically to the elevator controller. The elevator will rise or lower to the first available landing, open the doors, and shut down. The elevator will return to service upon the return of normal main line power. An auxiliary contact on the main line disconnect and shunt trip breaker (if used) will be provided by others.

D. Elevator Control System for Inspections and Emergency

1. Provide devices within controller to run the elevator in inspection operation.

2. Provide devices on car top to run the elevator in inspection operation.

3. Provide within controller an emergency stop switch to disconnect power from the brake and prevents motor from running.

4. Provide the means from the controller to mechanically lift and control the elevator brake to safely bring car to nearest available landing when power is interrupted.

5. Provide the means from the controller to reset the governor over speed switch and also trip the governor.

6. Provide the means from the controller to reset the emergency brake when set because of an unintended car movement or ascending car over speed.

7. Provide the means for the control to reset elevator earthquake operation.

2.08 EQUIPMENT: DOOR OPERATOR AND CONTROL

A. Door Operator: A closed loop permanent magnet VVVF high-performance door operator shall be provided to open and close the car and hoistway doors simultaneously. Door movement shall be cushioned at both limits of travel. Electro-mechanical interlock shall be provided at each hoistway entrance to prevent operation of the elevator unless all doors are closed and locked. An electric contact shall be provided on the car at each car entrance to prevent the operation of the elevator unless the car door is closed.

B. The door operator shall be arranged so that, in case of interruption or failure of electric power, the doors can be readily opened by hand from within the car, in accordance with applicable code. Emergency devices and keys for opening doors from the landing shall be provided as required by local code.

C. Doors shall open automatically when the car has arrived at or is leveling at the respective landings. Doors shall close after a predetermined time interval or immediately upon pressing of a car button. A door open button shall be provided in the car. Momentary pressing of this button shall reopen the doors and reset the time interval.

D. Door hangers and tracks shall be provided for each car and hoistway door. Tracks shall be contoured to match the hanger sheaves. The hangers shall be designed for power operation with provisions for vertical and lateral adjustment. Hanger sheaves shall have polyurethane tires and pre-lubricated sealed-for-life bearings.

E. Electronic Door Safety Device. The elevator car shall be equipped with an electronic protective device extending the full height of the car. When activated, this sensor shall prevent the doors from closing or cause them to stop and reopen if they are in the process of closing. The doors shall remain open as long as the flow of traffic continues and shall close shortly after the last person passes through the door opening.

PART 3 EXECUTION

3.01 EXAMINATION

A. Field measure and examine substrates, supports, and other conditions under which elevator work is to be performed.

B. Do not proceed with work until unsatisfactory conditions are corrected.

C. Prior to start of Work, verify hoistway is in accordance with shop drawings. Dimensional tolerance of hoistway from shop drawings: -0 inches +2 inches. Do not begin work of this section until dimensions are within tolerances.

D. Prior to start of Work, verify projections greater then 2 inches (4 inches if ASME A17.1/CSA B44 2000 applies) must be beveled not less then 75 degrees from horizontal.

E. Prior to start of Work, verify landings have been prepared for entrance sill installation. Traditional sill angle or concrete sill support shall not be required.

F. Prior to start of Work, verify elevator pit has been constructed in accordance with requirements, is dry and reinforced to sustain vertical forces, as indicated in approved submittal. Verify that sumps or sump pumps located within pit will not interfere with installed elevator equipment.

G. Prior to start of Work, verify control space has been constructed in accordance with requirements, with access coordinated with elevator shop drawings, including Sleeves and penetrations.

H. Verify installation of GFCI protected 20-amp in pit and adjacent to each signal control cabinet in control space.

3.02 PREPARATION

A. Coordinate installation of anchors, bearing plates, brackets and other related accessories.

3.03 INSTALLATION

A. Install equipment, guides, controls, car and accessories in accordance with manufacturer installation methods and recommended practices.

B. Properly locate guide rails and related supports at locations in accordance with manufacturer’s recommendations and approved shop drawings. Anchor to building structure using isolation system to minimize transmission of vibration to structure.

C. All hoistway frames shall be securely fastened to fixing angles mounted in the hoistway. Coordinate installation of sills and frames with other trades.

D. Lubricate operating system components in accordance with manufacturer recommendations.

E. Perform final adjustments, and necessary service prior to substantial completion.

3.04 CONSTRUCTION

A. Interface with Other Work:

1. Guide rail brackets attached to steel shall be installed prior to application of fireproofing.

2. Coordinate construction of entrance walls with installation of door frames and sills. Maintain front wall opening until elevator equipment has been installed.

   a. Ensure adequate support for entrance attachment points at all landings.

   b. Coordinate wall openings for hall push buttons, signal fixtures and sleeves. Each elevator requires sleeves within the hoistway wall.

   c. Coordinate emergency power transfer switch and power change pending signals as required for termination at the primary elevator signal control cabinet in each group.

   d. Coordinate interface of elevators and fire alarm system.

   e. Coordinate interface of dedicated telephone line.

   f. Coordinate the installation of the non fused three phase permanent power disconnect in hoist way at top landing

3.05 TESTING AND INSPECTIONS

A. Perform recommended and required testing in accordance with authority having jurisdiction.

B. Obtain required permits and provide originals to Owner’s Representative.

3.06 DEMONSTRATION

A. Prior to substantial completion, instruct Owner’s Representative on the proper function and required daily maintenance of elevators. Instruct personnel on emergency procedures.

END OF SECTION

SECTION 14 21 10

ELECTRIC TRACTION ELEVATOR B 5000#

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Electric Traction Elevators.

B. Products Supplied But Not Installed Under this Section:

1. Hoist Beam
2. Pit Ladder
3. Inserts mounted in block walls for rail attachments

C. Work Supplied Under Other Sections:

1. Temporary lighting, including temporary lighting in hoistway for machine space with switch located in hoistway on the strike jamb side of top landing door.
2. Main line disconnects for each elevator.
   a. One fused three phase permanent power in building electrical distribution room
   b. One non fused three phase permanent power in hoist way at top landing
3. Hoistway ventilation shall be in accordance with local and national building code requirements.
4. Guide Rail Support shall be structurally adequate to extend from pit floor to top of hoistway, with spans in accordance with requirements of authority having jurisdiction and final layouts.
5. Removable barricades at all hoistway openings, in compliance with OSHA 29 CFR 1926.502 in addition to any local code requirements.
6. Lifeline attachments capable of withstanding 5000 lb load in accordance with OSHA 29 CFR 1926.502. Provide a minimum of 2 at the top, front of each hoistway.
7. Pit lighting: Fixture with switch and guards. Provide illumination level equal to or greater than that required by ASME A17.1/CSA B44 2000, or applicable version.
8. Control space lighting with switch. Coordinate switch with lighting for machine space as allowable by code.

D. Related sections:

1. Section 01 50 00 - Temporary Facilities and Controls
2. Section 03 30 00 - Cast-in-Place Concrete:

3. Section 04 22 00 – Concrete Masonry Units
4. Section 05 50 00 - Metal Fabrications
5. Section 26 05 11 – Electrical General Requirements
6. Section 31 23 18 – Earthwork for Structures

E. Industry and government standards:

1. ICC/ANSI A117.1 Accessible and Usable Buildings and Facilities
2. ADAAG - Accessibility Guidelines for Buildings and Facilities
3. ANSI/NFPA 70, National Electrical Code
4. ANSI/NFPA 80, Standard for Fire Doors and Fire Windows
5. ASME/ANSI A17.1, Safety Code for Elevators and Escalators.

1.02 DESCRIPTION OF ELEVATOR

A. Elevator Equipment: KONE EcoSpace™ gearless traction elevator

B. Equipment Control: KCM831

C. Drive: Non Regenerative

D. Quantity of Elevators: [1]

E. Landings: [3]

F. Openings: [3] Front Openings

G. Travel: [25' 0" +/- ; 150']

H. Rated Capacity: [5000 lbs]

I. Rated Speed: [150] fpm

J. Clear Inside Dimensions (W x D): [5'-6-3/16" x 8'-9-3/16"]

K. Cab Height: [8' 0"]

L. Clear height under suspended ceiling: [13']

M. Entrance Width and Type: [4'-0" Center (as shown in drawings)]

N. Entrance Height: [7'-0"]

O. Main Power Supply: [480] Volts + 5%, three-phase

P. Operation: [Simplex]

Q. Machine Location: Inside the hoistway mounted on car guide rail

R. Control Space Location: [Integrated]

S. Elevator Equipment shall conform to the requirements of seismic zone: [non-seismic]

T. Maintenance Service Period: [12] months

1.03 PERFORMANCE REQUIREMENTS

A. Car Performance

1. Car Speed ± 5% of contract speed under any loading condition or direction of travel.

2. Car Capacity: Safely lower, stop and hold (per code) up to 125% of rated load.

B. System Performance

1. Vertical Vibration (maximum): 25 mg

2. Horizontal Vibration (maximum): 25 mg

3. Jerk Rate (maximum): 1.3 ft/sec3

4. Acceleration (maximum) 1.3 ft/sec2

5. In Car Noise: = 55 dB(A)

6. Leveling Accuracy: ±0.2 inches

7. Starts per hour (maximum): 120

1.04 SUBMITTALS

A. Comply with Section 01 33 00 - Submittal Procedures.

B. Product Data: Submit manufacturer's product literature for each proposed system.

1. Cab design, dimensions and layout.

2. Layout, finishes, and accessories and available options.

3. Controls, signals and operating system.

4. Color selection charts for cab and entrances.

C. Shop Drawings:

1. Clearances and travel of car.

2. Clear inside hoistway and pit dimensions.

3. Location and layout of equipment and signals.

4. Car, guide rails, buffers and other components in hoistway.

5. Maximum rail bracket spacing.

6. Maximum loads imposed on building structure.

7. Hoist beam requirements.

8. Location and sizes of access doors.

9. Location and details of hoistway door and frames.

10. Electrical characteristics and connection requirements.

D. Operation and maintenance data:

1. Provide manufacturer's standard maintenance and operation manual.

E. Diagnostic Tools

1. Prior to seeking final acceptance for the completed project as specified by the Contract Documents, the Elevator Contractor shall deliver to the Owner any specialized tool(s) that may be required to perform diagnostic evaluations, adjustments, and/or parametric software changes and/or test and inspections on any piece of control or monitoring equipment installed. This shall include any specialized tool(s) required for monitoring, inspection and/or maintenance where the means of suspension other than conventional wire ropes are furnished and installed by the Elevator Contractor. Any and all such tool(s) shall become property of the Owner. Any diagnostic tool provided to the Owner by the Elevator Contractor shall be configured to perform all levels of diagnostics, systems adjustment and parametric software changes which are available to the Elevator Contractor. In those cases where diagnostic tools provided to the Owner require periodic recalibration/or re-initiation, the Elevator Contractor shall perform such tasks at no additional cost to the Owner for a period equal to the term of the maintenance agreement from the date of final acceptance of the competed project During those intervals in which the Owner might find it necessary to surrender a diagnostic tool for re-calibration, re-initiation, or repair, the Elevator Contractor shall provide a temporary replacement for the tool at no additional cost to the Owner. The Elevator Contractor shall deliver to the Owner, printed instructions for the proper use of any tool that may be necessary to perform diagnostic evaluations, system adjustment, and/or parametric software changes on any unit of microprocessor-based elevator control equipment and means of suspension other than standard elevator steel cables furnished and install by the Elevator Contractor. Accompanying the printed instructions shall be any and all access codes, password, or other proprietary information that is necessary to interface with the microprocessor-control equipment.

1.05 QUALITY ASSURANCE

A. Manufacturer: Minimum of fifteen years experience in the fabrication, installation and service of elevators of the type and performance of the specified. The manufacturer shall have a documented quality assurance program.

B. Installer: The equipment manufacturer shall install the elevator.

C. Inspection and Testing: In accordance with requirements of local jurisdiction, obtain required permits, inspections and tests.

1.06 DELIVERY, STORAGE AND HANDLING

A. Comply with manufacturer’s recommendations for delivery, storage and handling.

B. If the construction site is not prepared to receive the elevator equipment at the agreed ship date, the General Contractor shall be responsible to provide a safe, dry, and easily accessible storage area on or off the premises. Additional lablor costs for double handling will be the responsibility of the general contractor.

C. Delivered elevator materials shall be stored in a protected environment in accordance with manufacturer recommendations. A minimum storage area of 10 feet by 20 feet is required adjacent to the hoistway.

1.07 WARRANTY

A. Provide manufacturer warranty for a period of one year. The warranty period is to begin upon Substantial Completion of the Contract. Warranty covers defects in materials and workmanship. Damage due to ordinary use, vandalism, improper or insufficient maintenance, misuse, or neglect do not constitute defective material or workmanship.

1.08 MAINTENANCE SERVICE

A. The elevator manufacturer shall provide maintenance service consisting of regular examinations and adjustments of the elevator equipment for a period of [12] months after date of substantial completion. Replacement parts shall be produced by the original equipment manufacturer.

B. Maintenance service be performed during regular working hours of regular working days and shall include [regular time call back service].

C. Maintenance service shall not include adjustments, repairs or replacement of parts due to negligence, misuse, abuse or accidents.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Provide AC gearless machine room-less elevator systems subject to compliance with the design and performance requirements of this specification. Elevator manufacturers may include but are not limited to one of the following:

1. Basis of Design: EcoSpace™ traction elevators by KONE, Inc. (www.kone.com).

2. Other acceptable machine room-less products: manufacturer with minimum 15 years experience in manufacturing, installing, and servicing elevators of the type required for the project.

2.02 EQUIPMENT: CONTROL COMPONENTS AND CONTROL SPACE

A. Controller: Provide microcomputer based control system to perform all of the functions.

1. All high voltage (110V or above) contact points inside the controller cabinet shall be protected from accidental contact in a situation where the controller doors are open.

2. Controller shall be separated into two distinct halves; Motor Drive side and Control side. High voltage motor power conductors shall be routed and physically segregated from the rest of the controller.

3. Provide a serial cardrack and main CPU board containing a non-erasable EPROM and operating system firmware.

4. Variable field parameters and adjustments shall be contained in a non-volatile memory module.

B. Drive: Provide Variable Voltage Variable Frequency AC drive system to develop high starting torque with low starting current.

C. Controller Location: Locate controller{s} in the front wall integrated with the top landing entrance frame, machine side of the elevator. A separate control space should not be required.

2.03 EQUIPMENT: HOISTWAY COMPONENTS

A. Machine: AC gearless machine, with permanent magnet synchronous motor, direct current electro-mechanical disc brakes and integral traction drive sheave, mounted to the car guide rail at the top of the hoistway.

B. Governor: Friction type over-speed governor rated for the duty of the elevator specified.

C. Buffers, Car and Counterweight: [Polyurethane buffer].

D. Hoistway Operating Devices:

1. Emergency stop switch in the pit

2. Terminal stopping switches.

3. Emergency stop switch on the machine

E. Positioning System: System consisting of magnets and proximity switches.

F. Guide Rails and Attachments: Steel rails with brackets and fasteners.

2.04 EQUIPMENT: HOISTWAY ENTRANCES

A. Hoistway Entrances

1. Sills: extruded.

2. Doors: Hollow metal construction with vertical internal channel reinforcements.

3. Fire Rating: Entrance and doors shall be UL fire-rated for 1-1/2 hour.

4. Entrance Finish: [Stainless Steel].

5. Entrance Markings Jamb Plates: Provide standard entrance jamb tactile markings on both jambs, at all floors. Plate Mounting: Refer to manufacturer drawings.

2.05 EQUIPMENT: CAR COMPONENTS

A. Car Frame: Provide car frame with adequate bracing to support the platform and car enclosure.

B. Platform: Platform shall be all steel construction.

C. Car Guides: Provide guide-shoes mounted to top and bottom of both car and counterweight frame. Each guide-shoe assembly shall be arranged to maintain constant contact on the rail surfaces. Provide retainers in areas with Seismic design requirements.

D. Steel Cab Finish: Brushed Stainless Steel.

1. Car Wall Panels: Stainless Steel on side and rear walls.

2. Car Front Finish: Stainless Steel (standard).

3. Car Door Finish: Stainless Steel (standard).

4. Ceiling: LF-1.

5. Handrail: 1.25" Round Stainless Steel

   a. Finish: Stainless Steel (standard).; rails to be located on [back] of car enclosure.

6. Flooring: By others. (Not to exceed 2sqft and 1/2" finished depth.)

7. Threshold: Aluminum

E. Emergency Car Signals

1. Emergency Siren: Siren mounted on top of cab that is activated when the alarm button in the car operating panel is engaged. Siren shall have rated sound pressure level of 80 dB(A) at a distance of three feet from device. Siren shall respond with a delay of not more than one second after activation of alarm button.

2. Emergency Car Lighting: Provide emergency power unit employing a 12-volt sealed rechargeable battery and totally static circuits shall illuminate the elevator car and provide current to the alarm bell in the event of building power failure.

3. Emergency Exit Contact: An electrical contact shall be provided on the car-top exit.

4. Ventilation: [fan].

2.06 EQUIPMENT: SIGNAL DEVICES AND FIXTURES

A. Car Operating Panel: Provide car operating panel with all push buttons, key switches, and message indicators for elevator operation. Fixture finish to be: Stainless Steel (standard).

1. Signalization: KSS 570 Flush (Solid Snow White).

2. Flush mounted car operating panel shall contain a bank of round, mechanical, illuminated buttons marked to correspond to landings served, emergency call button, door open button, door close button, and key switches for lights, inspection, and exhaust fan. Buttons have [blue] illumination (halo). All buttons to have raised text and Braille marking on left hand side. The car operating display panel shall be [blue] DOT-matrix. All texts, when illuminated, shall be [blue].

3. Additional features of car operating panel shall include:

   a. Car Position Indicator within operating panel [blue].

   b. Elevator Data Plate marked with elevator capacity and car number on car top.

   c. Help buttons with raised markings.

   d. In car stop switch per local code.

e. Firefighter's hat.

f. Firefighter's Phase II Key-switch.

g. Call Cancel Button.

h. Pre-programmed integrated ADA phone (complete description of krms features included as standard)

i. Help Button/Communicator. Activation of help button will initiate two-way communication between car and a location inside the building, switching over to alternate location if call is unanswered, where personnel are available to take the appropriate action. Visual indicators are provided for call initiation and call acknowledgement.

B. Hall Fixtures: Wall mounted hall fixtures shall be provided with necessary push buttons and key switches for elevator operation. Wall mounted hall fixtures shall have a brushed stainless steel finish.

1. Hall fixtures shall feature round, mechanical, buttons in applied mount face frame. Hall fixtures shall correspond to options available from that landing. Buttons shall be in a vertically mounted fixture. Hall fixtures shall not be jamb-mounted. Hall lanterns shall feature [blue] illumination.

C. Car Lantern and Chime: A directional lantern visible from the corridor shall be provided in the car entrance. When the car stops and the doors are opening, the lantern shall indicate the direction in which the car is to travel and a chime will sound. The chime will sound once for up and twice for down.

2.07 EQUIPMENT: ELEVATOR OPERATION AND CONTROLLER

A. Elevator Operation

1. Simplex Collective Operation: Using a microprocessor-based controller, operation shall be automatic by means of the car and hall buttons. If all calls in the system have been answered, the car shall park at the last landing served.

2. Zoned Car Parking.

3. Relative System Response Dispatching.

B. Standard Operating Features to include:

1. Full Collective Operation

2. Fan and Light Control.

3. Load Weighing Bypass.

4. Ascending Car Uncontrolled Movement Protection

5. Top of Car Inspection Station.

C. Additional Operating Features to include:

1. Independent Service

2. Hoistway Access Bottom Landing

3. Hoistway Access Top Landing

4. Car Secure Access.

5. Provision for Card Reader in Car (Card Reader provided and Installed by others)

6. Provide provisions for coaxial cable for CCTV. CCTV by others.

7. Intercom Provisions

8. Emergency Battery Power Supply

   a. When the main line power is lost for longer than 5 seconds the emergency battery power supply provides power automatically to the elevator controller. The elevator will rise or lower to the first available landing, open the doors, and shut down. The elevator will return to service upon the return of normal main line power. An auxiliary contact on the main line disconnect and shunt trip breaker (if used) will be provided by others.

D. Elevator Control System for Inspections and Emergency

1. Provide devices within controller to run the elevator in inspection operation.

2. Provide devices on car top to run the elevator in inspection operation.

3. Provide within controller an emergency stop switch to disconnect power from the brake and prevents motor from running.

4. Provide the means from the controller to mechanically lift and control the elevator brake to safely bring car to nearest available landing when power is interrupted.

5. Provide the means from the controller to reset the governor over speed switch and also trip the governor.

6. Provide the means from the controller to reset the emergency brake when set because of an unintended car movement or ascending car over speed.

7. Provide the means for the control to reset elevator earthquake operation.

2.08 EQUIPMENT: DOOR OPERATOR AND CONTROL

A. Door Operator: A closed loop permanent magnet VVVF high-performance door operator shall be provided to open and close the car and hoistway doors simultaneously. Door movement shall be cushioned at both limits of travel. Electro-mechanical interlock shall be provided at each hoistway entrance to prevent operation of the elevator unless all doors are closed and locked. An electric contact shall be provided on the car at each car entrance to prevent the operation of the elevator unless the car door is closed.

B. The door operator shall be arranged so that, in case of interruption or failure of electric power, the doors can be readily opened by hand from within the car, in accordance with applicable code. Emergency devices and keys for opening doors from the landing shall be provided as required by local code.

C. Doors shall open automatically when the car has arrived at or is leveling at the respective landings. Doors shall close after a predetermined time interval or immediately upon

pressing of a car button. A door open button shall be provided in the car. Momentary pressing of this button shall reopen the doors and reset the time interval.

D. Door hangers and tracks shall be provided for each car and hoistway door. Tracks shall be contoured to match the hanger sheaves. The hangers shall be designed for power operation with provisions for vertical and lateral adjustment. Hanger sheaves shall have polyurethane tires and pre-lubricated sealed-for-life bearings.

E. Electronic Door Safety Device. The elevator car shall be equipped with an electronic protective device extending the full height of the car. When activated, this sensor shall prevent the doors from closing or cause them to stop and reopen if they are in the process of closing. The doors shall remain open as long as the flow of traffic continues and shall close shortly after the last person passes through the door opening.

PART 3 EXECUTION

3.01 EXAMINATION

A. Field measure and examine substrates, supports, and other conditions under which elevator work is to be performed.

B. Do not proceed with work until unsatisfactory conditions are corrected.

C. Prior to start of Work, verify hoistway is in accordance with shop drawings. Dimensional tolerance of hoistway from shop drawings: -0 inches +2 inches. Do not begin work of this section until dimensions are within tolerances.

D. Prior to start of Work, verify projections greater then 2 inches (4 inches if ASME A17.1/CSA B44 2000 applies) must be beveled not less then 75 degrees from horizontal.

E. Prior to start of Work, verify landings have been prepared for entrance sill installation. Traditional sill angle or concrete sill support shall not be required.

F. Prior to start of Work, verify elevator pit has been constructed in accordance with requirements, is dry and reinforced to sustain vertical forces, as indicated in approved submittal. Verify that sumps or sump pumps located within pit will not interfere with installed elevator equipment.

G. Prior to start of Work, verify control space has been constructed in accordance with requirements, with access coordinated with elevator shop drawings, including Sleeves and penetrations.

H. Verify installation of GFCI protected 20-amp in pit and adjacent to each signal control cabinet in control space.

3.02 PREPARATION

A. Coordinate installation of anchors, bearing plates, brackets and other related accessories.

3.03 INSTALLATION

A. Install equipment, guides, controls, car and accessories in accordance with manufacturer installation methods and recommended practices.

B. Properly locate guide rails and related supports at locations in accordance with manufacturer’s recommendations and approved shop drawings. Anchor to building structure using isolation system to minimize transmission of vibration to structure.

C. All hoistway frames shall be securely fastened to fixing angles mounted in the hoistway. Coordinate installation of sills and frames with other trades.

D. Lubricate operating system components in accordance with manufacturer recommendations.

E. Perform final adjustments, and necessary service prior to substantial completion.

3.04 CONSTRUCTION

A. Interface with Other Work:

1. Guide rail brackets attached to steel shall be installed prior to application of fireproofing.

2. Coordinate construction of entrance walls with installation of door frames and sills. Maintain front wall opening until elevator equipment has been installed.

a. Ensure adequate support for entrance attachment points at all landings.

b. Coordinate wall openings for hall push buttons, signal fixtures and sleeves. Each elevator requires sleeves within the hoistway wall.

c. Coordinate emergency power transfer switch and power change pending signals as required for termination at the primary elevator signal control cabinet in each group.

d. Coordinate interface of elevators and fire alarm system.

e. Coordinate interface of dedicated telephone line.

f. Coordinate the installation of the non fused three phase permanent power disconnect in hoist way at top landing

3.05 TESTING AND INSPECTIONS

A. Perform recommended and required testing in accordance with authority having jurisdiction.

B. Obtain required permits and provide originals to Owner’s Representative.

3.06 DEMONSTRATION

A. Prior to substantial completion, instruct Owner’s Representative on the proper function and required daily maintenance of elevators. Instruct personnel on emergency procedures.

END OF SECTION

THE CITY OF HATTIESBURG

PUBLIC SAFETY COMPLEX

HISTORIC HOSPITAL BUILDING
POLICE AND COURT BUILDING

PROJECT MANUAL

VOLUME TWO

November 19, 2018

Albert & McCleskey Associates Architects
Hattiesburg, Mississippi

PROJECT MANUAL
FOR
THE CITY OF HATTIESBURG

PUBLIC SAFETY COMPLEX

HATTIESBURG, MISSISSIPPI

Corrected November 19, 2018



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SECTION 21 13 00

FIRE SUPPRESSION SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 WORK INCLUDED

A. This section is a performance specification section only. The design build fire protection contractor shall be fully responsible for the design and to provide necessary equipment and hardware per the AHJ's and Owner's Insurance Underwriter's requirements.

B. Furnish all labor, materials, tools, and equipment to complete the automatic fire sprinkler system and standpipe system as hereinafter described, ready for service to the entire satisfaction of the Owner, Architect, Authority Having Jurisdiction (AHJ) and Owner's Insurance Underwriter. Provide hydraulically calculated systems as defined in the adopted edition of NFPA 13 and NFPA 14 and in accordance with the AHJ and Owner's insurance requirements.

C. The fire sprinkler system shall fully comply with the Mississippi Conveyance Safety Act (MCSA). Specifically, the sprinkler system shall comply with (but not limited to) the MCSA regarding sprinklers in the elevator shafts, elevator pits, and elevator equipment (machine) rooms.

D. Fire Sprinkler System Notes:

1. The automatic sprinkler system shall conform to the requirements of the adopted edition of NFPA Standard 13.
2. The standpipe and hose systems shall conform to the requirements of the adopted edition of NFPA Standard 14.
3. Provide a complete automatic fire sprinkler system for all new interior and exterior covered spaces, and interstitial spaces, attics, overhangs, canopies, etc. as required for a comprehensive fire sprinkler system.
4. Installation of the sprinkler system shall not be started until complete plans and specifications including water supply design information and type of existing sprinkler system, if any have been submitted and approved by the State Fire Marshal, Fire/Life Safety Section. At various stages and upon completion, the system must be tested in the presence of the Inspector of Record (IOR) and/or AHJ.
5. Underground firewater and sprinkler system work shall conform to the requirements of NFPA 24 and NFPA 13n. Prior to installation of the underground fire water supply system, submit shop drawings and specifications of system, including water flow test data to the State Fire Marshal, Fire/Life Safety Section for approval. Submittal shall include thrust block location and size, type of piping and catalog cut sheets on all valves and fittings. An inspection of the underground installation, back flush and hydrostatic test shall be conducted and witnessed by the Architect, IOR and/or AHJ prior to backfill.

E. Verify electrical requirements of alarm valves, flow switches, valve supervision switches, alarm bells and pumps with electrical contractor.

1.3 RELATED WORK AND REQUIREMENTS

A. All Division 21 sections.

B. Section 230010 – Mechanical General Provisions.

C. Division 26, Fire Alarm Systems.

1.4 REFERENCE STANDARDS

A. American National Standards Institute (ANSI).

1. B16.1 Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800.
2. B16.3 Malleable-Iron Castings.
3. B16.4 Cast-Iron Threaded Fittings Class 125 and 300.
4. B16.5 Pipe Flanges and Flanged Fittings.
5. B16.9 Factory-Made wrought Steel Butt welding Fittings.
6. B16.11 Forged Fittings, Socket-Welding and Threaded.
7. B16.22 Wrought Copper and Bronze Solder Joint Pressure Fittings.
8. B16.25 Butt welding Ends.

B. American Society for Testing and Materials (ASTM).

1. A36 Structural Steel.
2. A47 Ferritic, Malleable Iron Castings.
3. A53 Pipe, Steel, Black and Hot-Dipped, Zinc Coated.
4. A135 Specification for Electric-Resistance-Welded Steel Pipe.
5. A194 Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure and High-Temperature Service.
6. A320 Specification for Alloy Steel Bolting Materials for Low-Temperature Service.
7. A795 Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use.
8. B88 Seamless Copper Water Tube.

C. American Water Works Association (AWWA).

1. DDC104 Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
2. C110 Gray Iron and Ductile Iron Fittings.
3. C111 Rubber Gasket Joints for Ductile-Iron and Grey-Iron Pressure: Pipe and Fittings.
4. C151 Thickness of Ductile-Iron Pipe – Centrifugally Cast.
5. C200 Steel Water Pipe 6” and larger.
6. C503 Wet-Barrel Fire Hydrants.

D. International Association of Plumbing and Mechanical Officials (IAPMO).

1. PS 31 Backflow Prevention Devices.

E. National Fire Protection Association (NFPA).

1. 13 – Standard for the Installation of Sprinkler Systems.
2. 14 – Standard for the Installation of Standpipe and Hose Systems.

F. Underwriter’s Laboratory (UL).

1. 262 Gate Valves for Fire Protection Service.
2. Indicator Post for Fire-Protection Service.

1.5 DESIGN CRITERIA

A. Design sprinkler systems and obtain approval from AHJ.

B. Determine the static and residual pressure for the site as required for accurate determination of system requirements. Base system calculations on the lowest expected static and residual pressure for the area.

1. Test data for static and residual pressure shall be measured by the Contractor. Test shall be made within the presence of the Architect and at a time approved by the Architect and Owner.

C. It is the intent of these Specifications and Drawings to provide for a complete and operating automatic fire protection sprinkler system in full compliance with the standards of the National Fire Protection Association as set forth in NFPA 13, NFPA 14, and NFPA 24, currently adopted editions.

D. Review Architectural and Structural Drawings to determine the extent of construction and resultant fire protection coverage to comply with NFPA. Interstitial spaces, if utilized, will require sprinkler protection.

E. Provide fire sprinklers to protect all building overhangs greater than 4 feet wide, or as required by local authority.

F. Provide additional fire sprinklers where required to meet the requirements of NFPA13 and/or AHJ(s). Coordinate with the work of other trades especially when it may create interferences and or obstructions requiring special protection, additional piping and heads and drains.

G. The maximum permissible flow velocity through automatic sprinkler piping shall be 15 feet per second. The minimum starting pressure at the most remote sprinkler head shall be not less than the minimum required to operate the sprinkler head.

H. Reduction in area of operation when use of quick response sprinkler heads as defined in NFPA 13 will not be allowed.

I. Use of piping lighter than Schedule 10 is not allowed.

J. The initial building shall contain basic sprinkler coverage which can be modified and extended for the future build-out of unimproved spaces.

K. Design shall comply with the Owner’s Insurance Underwriters’ requirements.

1.6 COORDINATION/SPECIAL CONSIDERATIONS

A. Coordinate with other trades all equipment locations, pipe, duct and conduit runs, electrical outlets and fixtures, air inlets and outlets, and structural and architectural features. Provide information on location of piping and bracing to all other trades as required for a completely coordinated project.

B. Contract Drawings: All piping required for the sprinkler and standpipe systems is not shown, but general arrangement of system piping, required standpipes, outlets and valves, alarm valves and areas requiring sprinkler protection are shown.

C. Where heads are located at suspended ceiling, spacing shall be as required by NFPA 13, except as follows: In all locations, sprinkler heads shall be equidistant between lights, between wall and lights, between lights and air diffusers, and between wall, lights, and air diffusers. Provide uniform and repetitive pattern for each room. Locate by reflected ceiling plan where shown.

D. Install sprinkler all sprinkler heads in center of ceiling tiles.

E. Provide approved dry pendant sprinkler heads in spaces subject to freezing.

F. Provide high temperature sprinkler heads in all electrical rooms or other areas with elevated temperatures such as mechanical rooms.

G. Coordinate Work among the trades in accordance with Division 01 avoid any interference with the effectiveness of the fire protection system. Shop drawings shall include elevations of equipment and piping to assure coordination. The fire protection system shall be coordinated with other trades to assure that conflicts will not arise with structural, mechanical, electrical or architectural features of the building.

H. Coordinate with the fire alarm contractor to ensure full awareness of the location of control valves, flow switches, tamper switches, and alarm and signal switches.

1.7 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of fire protection products, of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer: A firm with at least five years of successful installation experience on projects with fire sprinkler piping similar to that required for this project.

C. Requirements of Regulatory Agencies:

1. Install fire protection systems in accordance with IBC – 2012 Edition, Chapter 9 “Fire Protection Systems”.
2. NFPA Compliance: Install fire protection systems in accordance with NFPA 13 "Standard for the Installation of Sprinkler Systems", and other applicable NFPA requirements. Additionally, comply with NFPA 14 “Standard for the installation of Standpipe and Hose Systems”.
3. FM Compliance: Comply with Factory Mutual "Approval Guide".
4. UL Labels: Provide fire sprinkler piping products which have been approved and labeled by Underwriters' Laboratories.
5. Fire Marshal Compliance: Install fire protection systems in accordance with Fire Marshal or other AHJ.
6. Owner’s Insurance Underwriter’s Compliance: Install fire protection systems in accordance with Owner’s Insurance Underwriter’s requirements.
7. Screw Thread Connections: Comply with local fire department/marshal regulations for sizes, threading, and arrangement of connections for fire department equipment to systems.

D. Fire stop penetrations with an approved material as prescribed in the International Building Code (IBC).

E. Installation of the sprinkler system shall not be started until complete plans and specifications (including water supply information and type of existing sprinkler system, if any) have been reviewed and approved by the AHJ and the Owner’s Insurance Underwriter.

F. At various stages and upon completion, the system must be tested in the presence of the enforcing agency.

G. The fire extinguishing system shall be installed by a licensed fire systems contractor.

1.8 SUBMITTALS

A. See Section 230010 Mechanical General Provisions.

B. Submit product data, O&M data, and samples and show item on shop and coordination drawings according to the following table.

1. "R" means required.
2. "R2" means required only for products and equipment differing for the specified manufacturer and model and for "or equals" where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Pipe, fittings, valves	R			
Sprinkler heads	R			R
Gauges	R			R
Sleeves and Escutcheons	R			
Flow and tamper switches	R			R
Alarm bells	R			R
Pipe hangers and supports	R			R
Identification signs	R			
Sprinkler head cabinets	R			R
Hose Valve cabinets	R			R
Coordination drawings				R
AHJ approval letter				R
Insurance Underwriter's approval letter				R
Hydraulic calculations				R
Static and residual flow tests results				R

C. Submit shop drawings as follows:

1. Prepare and submit preliminary drawing to the Owner showing the proposed location of the fire sprinkler heads coordinated with and in relation to the ceiling tile pattern, light fixture and duct inlets/outlets. Review of this drawing and the AHJ's review stamp thereon shall be a prerequisite for the preparation of further working plans.
2. Detailed working drawings and hydraulic calculations shall be prepared and submitted for approval before fabrication of the project. Working drawings shall be submitted in complete sets (partial submission will not be acceptable) and shall bear the Contractor's license stamp, identity of the system designer and computer program used in the calculation of hydraulic information.
3. AHJ approval of submittals is for permission to proceed and does not authorize design, products or installation not conforming to referenced codes and standards and this specification. Substitutions or alternates require specific approval by the Owner.

4. Upon completion of the Work, the Contractor shall provide AutoCAD Record Drawings to the Architect. Refer also to Division 01. Final approvals are subject to receipt of acceptable Record Drawings.

D. Submittals having any content that is incomplete or unclear will be returned without review or approval.

E. Deferred Approval Documents: Do not proceed with fabrication or installation of fire sprinkler system until deferred approval documents have been approved by AHJ and Architect.

1. General: Provide detailed drawings, specifications, hydraulic calculations, and any other documentation as required by the AHJ and Owner's insurance underwriter.
2. Make additions, changes and corrections as directed by Architect and resubmit.
3. Agency Review: Submit documents to Owner and/or AHJ. Make additions, changes and corrections required by Owner / AHJ at no cost to Owner and resubmit to Architect.

F. Provide all necessary information to ceiling suspension work of Division 09, Finishes, to provide coordinated submittals.

G. Discharge patterns and application data shall be included in submittals for sidewall, water curtain, and similar special purpose sprinklers.

H. Operating Instructions: Provide instruction charts describing operation and proper maintenance of system equipment per Division 01 and Section 230100 Mechanical General Provisions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Provide piping materials and factory-fabricated piping products of sizes, types, pressure rating, temperature ratings, and capacities as required. Provide sizes and types matching piping and equipment connections; provide fittings of materials that match pipe materials used in fire protection systems.

B. Equipment to be furnished under this specification shall be essentially standard product of manufacturer. Where two or more units of same class of equipment are required, these units shall be products of a single manufacturer. However, component parts of system need not be products of same manufacturer.

C. Manufacturers: Subject to compliance with requirements, manufacturer offering automatic sprinklers which may be incorporated in the work include the following:

1. Specialty Valves and Devices:

a. Badger Fire Protection, Inc.
b. Grinnell Corp.
c. Viking Corp.
d. Or equal.

2. Water-Flow Indicators and Supervisory Switches:

a. Grinnell Corp.
b. Potter Electric Signal Co.

c. Viking Corp.
d. Or equal.

3. Sprinkler, Drain and Alarm Test Fittings:

a. Central Sprinkler Corp.
b. Grinnell Corp.
c. Victaulic Co.
d. Or equal.

4. Sprinkler, Branch-Line Test Fittings:

a. Elkhart Brass Mfg. Co. Inc.
b. Smith Industries, Inc; Potter-Roemer Div.
c. Or equal.

5. Sprinkler, Inspector's Test Fittings:

a. G/J Innovations, Inc.
b. Triple R Specialty of Ajax, Inc.

6. Fire Department Connections:

a. Badger Fire Protection, Inc.
b. Elkhart Brass Mfg. Co., Inc.
c. Grinnell Corp.
d. Or equal.

7. Sprinklers:

a. Badger Fire Protection, Inc.
b. Grinnell Corp.
c. Viking Corp.
d. Or equal.

8. Indicator Posts and Indicator-Post, Gate Valves:

a. Grinnell Corp.
b. McWane, Inc.; Kennedy Valve Div.
c. Nibco, Inc.
d. Or equal.

9. Indicator Valves:

a. Grinnell Corp.
b. McWane, Inc.; Kennedy Valve Div.
c. Nibco, Inc.
d. Or equal.

10. Fire-Protection-Service Valves:

a. Grinnell Corp.
b. McWane, Inc.; Kennedy Valve Div.
c. Nibco, Inc.
d. Or equal.

11. Grooved-End Fittings for Steel Piping:

    a. Victaulic Co.
    b. Or equal.

2.2 VALVE AND ALARM SYSTEM IDENTIFICATION

A. Provide identification complying with Section 230553 Mechanical Identification section in accordance with the following listing:

1. Fire Protection Valves: Brass valve tags.
2. Fire Protection Signs: Provide the following signs:

    a. At each sprinkler valve, including roof manifold, sign indicating what portion of system valve controls.
    b. At each outside alarm device, sign indicating what authority to call if device is activated.

2.3 BASIC PIPES AND TUBES

A. Piping shall be new, designed for 300 psi working pressure, conforming to ASTM specifications and have the manufacturer's name or brand along with the pipe applicable ASTM standard marked on each length of pipe.

B. All piping shall be UL listed and FM approved.

C. Piping installed underground: Ductile Iron AWWA C111 and C151.

D. Piping installed above ground 2 inch and smaller shall be Schedule 40 black steel pipe. Pipe shall be manufactured in accordance with specifications ASTM A-135 and A-53.

E. Piping installed above ground 2-1/2 inch and larger shall be Schedule 10 black steel pipe. Pipe shall be manufactured in accordance with specification ASTM A 135.

F. All fire protection piping shall be provided with factory-applied antimicrobial coatings to inhibit Microbiologically-Influenced Corrosion (MIC). Allied Tube and Conduit "ABF II", Wheatland Tube Company "MIC Shield" or equal.

G. Sprinkler piping and fittings exposed to weather, used in a corrosive atmosphere or as noted on drawings shall be galvanized.

H. In-Building Risers shall be installed as indicated on the plans. Risers shall be composed of a single extended 90 degree fitting of fabricated 304 stainless steel tubing, maximum working pressure 300 psi. The fitting shall have a grooved-end connection on the outlet (building) side and a CIPS coupler on the inlet (underground) side. The In-Building Riser shall be an Ames Fire & Waterworks Series IBR (or equal).

2.4 PIPE AND TUBE FITTINGS

A. Cast-Iron Threaded Flanges: ASME B16.1.

B. Cast-Iron Threaded Fittings: ASME B16.4.

C. Ductile-Iron Fitting: AWWA C110, ductile-iron or cast-iron type; or AWWA C153, ductile-iron, compact mechanical-joint type. Include cement-mortar lining and seal coat according to AWWA C104 and glands, rubber gaskets, and bolts and nuts according to AWWA C111.

D. Ductlie-Iron Fittings: ASTM A47, malleable-iron or ASTM A 536 ductile-iron casting complying with AWWA pipe size; with ends factory grooved according to AWWA C606.

E. Malleable-Iron Threaded Fittings: ASME B16.3.

F. Steel, Threaded Couplings: ASTM A 865.

G. Steel Welding Fittings: ASTM A 234/A 234M, ASME B16.9, or ASME B16.11.

H. Steel Flanges and Flanged Fittings: ASME B16.5.

2.5 PIPING SPECIALTIES

A. Provide piping specialties in accordance with the following listing:

1. Pipe escutcheons.
2. Dielectric unions.
3. Pipe sleeves.
4. Sleeve seals.

2.6 JOINING MATERIALS

A. Grooved-End Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel pipe OD. Include ductile-iron housing with keys matching steel pipe fitting grooves, prelubricated rubber gasket listed for use with housing and steel bolts and nuts. Include listing for dry-pipe service for couplings for dry piping.

B. Steel, Grooved-End Fittings: UL-listed and FM approved, ASTM A47, malleable iron or ASTM A 536, ductile iron, with dimensions matching steel pipe and ends factory grooved according to AWWA C606.

C. Transition Couplings: AWWA C219, sleeve type, or other manufactured fitting the same size as, with pressure rating at least equal to, and with ends compatible with piping to be joined.

2.7 POLYETHYLENE ENCASEMENT

A. Polyethylene Encasement for Ductile-Iron Piping: ASTM A674 or AWWA C105 film, 0.008-inch minimum thickness, tube or sheet.

2.8 SUPPORTS AND ANCHORS

A. Spacing and details of the support and bracing of fire sprinkler piping shall comply with the currently adopted edition of NFPA 13. U-hook hangers used as sway bracing must have legs bent out 10 degrees and must have a slenderness ratio not exceeding 200.

B. Concrete Inserts: Uni-Strut P-3200 continuous insert or M24 spot insert Kin-line or equal. Do not use powder actuated fasteners for support of overhead piping unless approved by Architect.

2.9 VALVES

A. Provide valves, UL listed and FM approved, in accordance with the following listing. Provide sizes and types which mate and match piping and equipment connections.

1. Gate Valves: Provide iron gate control valve, outside screw and yoke (OS&Y), 175-lb rated working pressure, of sizes indicated, to close by turning to the right and to be sealed with approved metal seals. Valves shall be iron body, bronze fitted. Valves 2 inches and smaller shall be screwed and valves over 2 inches shall be flanged. For reference purposes, Mueller A-2073-6. Grinnell, Kennedy, Stockham or equal.
2. Butterfly Valve: Provide UL listed FM approved butterfly valves (slow-close) with position indicators. Electric motor operated valves shall be normally open and shall fail in the open position. For reference purposes, Mueller B-3211. Grinnell, Kennedy, Stockham or equal.
3. Swing Check Valves: Provide UL listed flanged, swing type, iron body, bronze seat ring and disc ring, and 175 psi pressure rating. For reference purposes, Mueller A-2120-6, Grinnell, Kennedy, Stockham or equal.
4. Riser Drain Valves: Main Riser Drain valves shall be angle or globe type, bronze body, screwed, 200 psi pressure rating, 2 inches size, with renewable composition soft disc. For reference purposes, Grinnell 3210, Stockham, NIBCO, Fairbanks or equal.
5. Auxiliary Drain Valve: Valves for auxiliary drains and Owner's Test connections shall be globe type, bronze body, screwed, 200 psi pressure rating, 1 inch size, with a renewable composition soft disc, For reference purposes, Grinnell 3210, Stockham, NIBCO, Fairbanks or equal.
6. Indicating Valves, 2-1/2 inches and Smaller: UL 1091; butterfly or ball-type, bronze body with threaded ends; and integral indicating device.
7. Indicator Posts: UL 789, vertical type, cast iron body, with windows for target plates that indicate valve position, extension rod and coupling, locking device, and red enamel finish.
8. Swing Check Valves, 2 inches and Smaller: UL 312 or MSS SP-80, Class 150; bronze body with bronze disc and threaded ends.
9. Swing Check Valves, 2-1/2 inches and Larger: UL 312, cast-iron body and bolted cap, with bronze disc or cast-iron disc with bronze-disc ring and flanged ends.
10. Split-Clapper Check Valves, 4 inches and Larger: UL 312, cast-iron body with rubber seal, bronze-alloy discs, and stainless-steel spring and hinge pin.
11. For other valves not required to be UL listed and FM approved refer to Section 230523 Valves.

2.10 METERS AND GAUGES

A. Provide meters and gauges complying with Section 230519 Meters and Gages, in accordance with the following listing:

1. Pressure gauges: UL 393, 3-1/2- to 4-1/2-inch- diameter dial with dial range of 0 to 300 psig.

2.11 SPECIALTY VALVES

A. Sprinkler System Control Valves: UL listed or FMG approved, cast or ductile-iron body with flanged or grooved ends, and 175-psig minimum pressure rating.

1. Available Manufacturers:

   a. Grinnell Corp.
   b. Victaulic Co.
   c. Viking Corp.

d. Or equal.

2. Alarm Check Valves: UL 193, designed for horizontal or vertical installation, with bronze grooved seat with O-ring seals, single-hinge pin, and latch design. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber, and fill-line attachment with strainer.

   a. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.

3. Ball Drip Valves: UL 1726, automatic drain valve, NPS 3/4, ball check device with threaded ends.

2.12 FIRE PROTECTION SPECIALTIES

A. Provide fire protection specialties, UL listed, in accordance with the following listing. Provide sizes and types that match piping and equipment connections.

1. Install drains on main risers and auxiliary drains at all low points in the system.
2. One Owner's test drain shall be installed for each sprinkler system.
3. Drains and Owner's tests shall be at locations approved by the Architect.
4. Drains and Owner's tests shall be installed at locations as shown on the Drawings.
5. Provide drain line to floor sink or to outside, as required, to suit Project conditions.
6. Five or fewer trapped heads will not require a drain valve but may be drained through a plugged fitting.
7. Drain valve shall be of the angle type. Install in accordance with the requirements of NFPA Pamphlet No. 13.
8. Pipe drain valves to a floor sink or to the outside of the building. Discharge shall be visible from sight drain fitting or open end drain pipe. Provide flushing connections at ends of all cross mains.
9. Flow Alarm: Furnish and install a flow alarm system for each main sprinkler riser as shown on the Drawings. The systems shall be complete with Grinnell F-620, Viking or equal, flow switch. As part of Division 26, wire flow alarm to the fire alarm control panel. Provide 3/4-inch conduit and two #14 wires from the tamper switch to the fire department control panel.
10. Provide wiring between switch, bell, and junction box. Provide junction box under Division 26. Wiring shall meet the requirements of Division 26. All controls shall be identified by permanent metal tags or other approved means. Alarm switch shall be UL or FM approved and shall have adjustable retard mechanism and two sets of contacts. Wiring between electrical distribution panel and junction box will be provided under Division 26.
11. Water-Flow Indicators: UL 346; electrical-supervision, vane-type water-flow detector; with 250-psig pressure rating; and designed for horizontal or vertical installation. Include two single-pole, double-throw, circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
12. Pressure Switches: UL 753; electrical-supervision-type, water-flow switch with retard feature. Include single-pole, double-throw, normally closed contacts and design that operates on rising pressure and signals water flow.
13. Valve Supervisory Switches: UL 753; electrical; single-pole, double throw; with normally closed contacts. Include design that signals controlled valve is in other than fully open position, Grinnell Model F640, Viking or equal, with single pole double throw switch actuator installed to change switch position when OS&Y valve is being closed.
14. Indicator-Post Supervisory Switches: UL 753; electrical; single-pole, double throw, with normally closed contacts. Include design that signals controlled indicator-post valve is in other than fully open position.
15. As part of Division 26, wire supervisory switch to the fire alarm control panel. Provide 3/4-inch conduit and two #14 wires from the tamper switch to the fire department control panel.

2.13 AUTOMATIC SPRINKLERS

A. Provide automatic sprinklers in accordance with the following listing. Provide fusible links for 165 degrees F. unless otherwise noted; UL or FM approved.

B. Automatic Sprinklers: With heat-responsive element complying with the following:

1. UL 199, for applications except residential.
2. UL 1767, for early suppression, fast-response applications.

C. Type: Spray pattern type, automatic closed-type heads of ordinary degree temperature rating, except that sprinklers to be installed in vicinity of heating equipment shall be of temperature ratings required for such locations by the currently adopted edition of NFPA 13.

1. Flush ceiling sprinklers, including escutcheon.
2. Pendent, dry-type sprinklers.
3. Quick-response sprinklers.
4. Sidewall, dry-type sprinklers.
5. Upright sprinklers.
6. Concealed ceiling sprinklers, including cover plate.

D. Sprinkler heads shall be UL or FM listed.

1. Exposed Locations: Provide upright type heads at all areas with no finished ceilings.
2. Where heads are located at height of less than 8 feet above finished floor, or where heads are located in mechanical equipment areas, provide wire guards to protect heads from damage.
3. Concealed Locations: Provide upright-type heads or pendent-type heads.
4. Sidewall Locations: Where required and where approved by the Architect.
5. Finished Ceilings: Locate at all ceilings with lay-in acoustical tile ceiling and at plaster or gypsum board type ceilings. Provide satin chrome finish and adjustable chrome finish metal ceiling escutcheons. Provide fully recessed pendant type and white enamel metallic cover in ceilings of finished spaces.
6. Where fire sprinkler heads are located in rooms with surface mounted lights, provide 2 piece adjustable sprinkler escutcheon, with adjustment from 1-7/8" to 3-1/8" below finished ceiling. Fire sprinkler drop nipple should be mounted 2-1/4" below the finished ceiling surface.
7. Sprinkler heads in light hazard area shall be quick response type.
8. Extended coverage sprinklers shall not be used.

E. Sprinkler Finishes: Chrome-plated, bronze, and painted.

F. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

1. Ceiling Mounting: Chrome-plated steel, one piece, flat.
2. Sidewall Mounting: Chrome-plated steel, one piece, flat.

G. Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler.

H. Sprinkler Cabinet and Wrench: Furnish steel, baked red enameled, sprinkler box with capacity to store sprinklers and wrench sized to sprinklers. Spare sprinklers and wrenches called for under "Extra Stock."

2.14 SPECIALTY SPRINKLER FITTINGS

A. Specialty Fittings: UL listed and FM approved; made of steel, ductile iron, or other materials compatible with piping.

B. Drop-Nipple Fittings: UL 1474, with threaded inlet, threaded outlet, and seals; adjustable.

C. Sprinkler, Drain and Alarm Test Fittings: UL-listed, cast- or ductile-iron body; with threaded inlet and outlet, test valve, and orifice and sight glass.

D. Sprinkler, Branch-Line Test Fittings: UL-listed, brass body; with threaded inlet and capped drain outlet and threaded outlet for sprinkler.

E. Sprinkler, Inspector's Test Fittings: UL-listed, cast- or ductile-iron housing; with threaded inlet and drain outlet and sight glass.

F. Flexible Hose Assemblies: FlexHead Industries flexible stainless steel hose assembly consisting of a mounting bracket and a one-piece, leak tested sprinkler drop. The mounting bracket shall be compatible with any suspended or gypsum board ceiling system and FM/UL approved sprinklers. Assembly shall be FM approved and UL listed for use intended. Lengths of assemblies shall be selected with minimum length required to connect sprinkler without loops, traps, etc.

2.15 FIRE DEPARTMENT CONNECTIONS

A. Exposed Inlet type, Fire Department Connections: UL 405, 175-psig minimum pressure rating; with corrosion-resistant-metal body with brass inlets, brass wall escutcheon plate, brass lugged caps with gaskets and brass chains, and brass lugged swivel connections. Include inlets with threads according to NFPA 1963 and matching local fire department sizes and threads, outlet with pipe threads, check devices or clappers for inlets, and escutcheon plate with marking similar to "AUTO SPKR."

1. Finish: Polished chrome-plated.

PART 3 - EXECUTION

3.1 PRODUCT HANDLING AND PROTECTION

A. Deliver packaged materials in their original, unopened wrapping with labels intact. Protect materials from water, the elements and other damage during delivery, storage and handling.

3.2 PREPARATORY PROVISIONS

A. The Contractor shall be responsible for the examination and acceptance of all conditions affecting the proper construction and/or installation of the Work of this Section and shall not proceed until all unsatisfactory conditions have been corrected. Commencing work shall be construed as acceptance of all conditions by the Contractor as satisfactory for the construction and/or installation of the Work

B. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations.

C. Report test results promptly and in writing

3.3 EARTHWORK

A. Refer to Division 31 for excavating, trenching, and backfilling.

3.4 PIPING APPLICATIONS

A. Do not use welded joints with galvanized steel pipe.

B. Flanges, unions, and transition and special fittings with pressure ratings the same as or higher than system's pressure rating may be used in aboveground applications, unless otherwise indicated.

C. Piping between Fire Department Connections and Check Valves: Use galvanized, standard-weight steel pipe with threaded ends; cast- or malleable-iron threaded fittings; and threaded joints.

D. Underground Water Supply and Service-Entrance Piping: Use ductile-iron, mechanical-joint pipe and fittings and restrained joints. Include corrosion protective encasement. Use In-Building Riser for service-entrance piping

3.5 SPRINKLER SYSTEM PIPING APPLICATIONS

A. Pipe and Fitting Schedule:

1. 1-1/2 inches and Smaller: Standard-weight black steel pipe with threaded ends, cast-or malleable-iron threaded fittings, and threaded joints.
2. 2 inch: Standard-weight black steel pipe with threaded ends, cast- or malleable-iron threaded fittings, and threaded joints.
3. 2 inch: Standard-weight black steel pipe with grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
4. 2-1/2 to 3-1/2 inches: Schedule 40 black steel pipe with threaded ends, cast- or malleable-iron threaded fittings, and threaded joints.
5. 2-1/2 to 3-1/2 inches: Schedule 10 black steel pipe with roll-grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
6. 2-1/2 to 3-1/2 inches: Schedule 30 black steel pipe with plain ends, steel welding fittings, and welded joints.
7. 4 inch: Schedule 40 steel pipe with threaded ends, cast-or malleable-iron threaded fittings, and threaded joints.
8. 4 inch: Schedule 10 black steel pipe with roll-grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
9. 4 inch: Schedule 40 black steel pipe with plain ends, steel welding fittings, and welded joints.
10. 5 and 6 inches: Standard-weight black steel pipe with threaded ends, cast- or malleable-iron threaded fittings, and threaded joints.
11. 5 and 6 inches: Standard-weight black steel pipe with grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
12. 5 and 6 inches: Standard-weight black steel pipe with plain ends, steel welding fittings, and welded joints.

3.6 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Fire-Protection-Service Valves: UL listed and FM approved for applications where required by NFPA 13.

   a. Shutoff Duty: Use gate valves.

2. General-Duty Valves: For applications where UL-listed and FM-approved valves are not required by NFPA 13.

   a. Shutoff Duty: Use gate, ball, or butterfly valves.
   b. Throttling Duty: Use globe, ball, or butterfly valves.

3.7 JOINT CONSTRUCTION

A. Threaded Joints: Comply with NFPA 13 for pipe thickness and threads. Do not thread pipe smaller than NPS 8 with wall thickness less than Schedule 40 unless approved by authorities having jurisdiction and threads are checked by a ring gage and comply with ASME B1.20.1.

B. Steel-Piping, Grooved Joints: Use Schedule 10 steel pipe with cut or roll-grooved ends and Schedule 30 or Schedule 10 steel pipe with roll-grooved ends; steel, grooved-end fittings; and steel, keyed couplings. Assemble joints with couplings, gaskets, lubricant, and bolts according to coupling manufacturer's written instructions. Use gaskets listed for dry-pipe service for dry piping.

C. Dissimilar-Metal Piping Joints: Construct joints using dielectric fittings compatible with both piping materials.

1. 2 inch and Smaller: Use dielectric couplings or nipples.
2. 2-1/2 to 4 inches: Use dielectric flanges.
3. 5 inch and Larger: Use dielectric flange insulation kits.

D. Dissimilar-Piping-Material Joints: Construct joints using adapters or couplings compatible with both piping materials. Use dielectric fittings if both piping materials are metal. Refer to Division 21 Section "Common Work Results for Fire Suppression" for dielectric fittings.

3.8 WATER SUPPLY AND SERVICE-ENTRANCE PIPING AND PIPING TO FIRE DEPARTMENT CONNECTION

A. Connect water supply piping to fire main; connect sprinkler piping to fire-service piping of size and in location indicated for service entrance to building.

B. Install shut-off valve, backflow preventer, pressure gage, and other accessories indicated at connection to water supply piping.

3.9 INSTALLATION OF FIRE SPRINKLER PIPING

A. General: Comply with the requirements of the Division 21 sections and referenced NFPA standards for installation of fire sprinkler piping material. Install fire sprinkler piping products where shown, in accordance with the manufacturer's written instructions, and in accordance with recognized industry

practices to ensure that fire sprinkler piping complies with requirements and serves its intended purpose.

B. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.

C. Coordination: Coordinate all piping, heads, and sprinkler work to Architectural, Structural, Mechanical, and Electrical Work. Conceal piping, except where so indicated otherwise or where absolutely necessary. Place exposed piping where required by the Architect. Provide any offsets or additional piping required to coordinate this system with all other Work.

1. If piping is installed such that it is exposed to view in any location normally available to the users of the building or the public, it shall be relocated and concealed to the Architect's satisfaction, and at no additional cost to the Owner.

D. Any differences or disputes concerning coordination, interference, head and pipe locations or extent of work shall be decided by Architect and his decision shall be final.

E. Supply System: Provide supply connections as required to service the sprinkler system.

1. Installation shall conform to the applicable requirements of NFPA 13 and IBC.
2. Make joints as specified herein and in a manner approved by Architect. Leave joints exposed until final inspection and tests have been made.
3. Brace or clamp bends in accordance with the requirements. The clamp rods at the flange and spigot piece shall be long enough to pass through the flange.
4. Before connection of sprinkler system to underground supply, flush supply connections out thoroughly in accordance with NFPA.

F. Supply System: Provide supply connections as required to service the sprinkler system.

1. Install pipe, fittings, and hangers in accordance with requirements of IBC current adopted edition, "Fire Protection Systems".
2. Cutting structural members for passage of sprinkler piping or for pipe hanger fastening will not be permitted except on review of Architect for each specific case.
3. Holes through walls, floors, and ceilings shall be large enough to accommodate pipe expansion. Provide suitable plates at each hole to ensure the effectiveness of floor or wall as a fire stop. Foundation penetration shall have a 2-inch annular space around pipe sealed watertight.
4. Provide long runs of pipe with suitable means to permit free movement due to expansion and contraction.
5. Make reduction in pipe sizes with one-piece concentric tapered reducing fittings. Bushings will not be acceptable.
6. Couplings shall not be used except where the length of pipe between fittings exceeds 20 feet 0 inches.
7. Use flanged fittings in control valves and drain assembly and at the base of risers.
8. Use malleable iron unions of the ground joint type in looped sprinkler systems where pipe is 2 inches in diameter or smaller. Where loops larger than 2 inches are used, companion flanges shall be installed.
9. Special couplings approved for use in sprinkler systems may be used in place of unions and flanged connections where applicable.
10. Install sectional valves in inlet piping, at bottom of each riser, and in all loops as required.

11. Mount supervisory switches on each sectional valve.
12. Install pressure gages at top of each standpipe.
13. Install valved hose connections 3/4-inch size on sprinkler at ends of branch lines and cross mains.
14. Install Owner's test connection at most remote point from riser.

G. Install ductile iron underground water supply and service-entrance piping according to NFPA 24 and with restrained joints. Encase piping in corrosion-protective encasement.

H. Install unions adjacent to each valve in pipes 2 inches and smaller. Unions are not required on flanged devices or in piping installations using grooved joints.

I. Install flanges or flange adapters on valves, apparatus, and equipment having 2-1/2 inches and larger connections.

J. Install "Inspector's Test Connections" in sprinkler piping, complete with shutoff valve, sized and located according to NFPA 13.

K. Install sprinkler zone control valves, test assemblies, and drain risers adjacent to sprinkler risers when sprinkler branch piping is connected to sprinkler risers.

L. Install ball drip valves to drain piping between fire department connections and check valves. Drain to floor drain or outside building.

M. Install sectional valves in piping.

N. Mount supervisory switches on each sectional valve.

O. Install valved hose connections of the sizes indicated, or 3/4 inch size, if not otherwise indicated, on sprinklers at ends of branch lines and cross mains at locations where indicated.

P. Install drain piping at low points of fire sprinkler piping.

Q. Identification: Apply signs to control, drain, test and alarm valves to identify their purpose and function. Provide lettering size and style selected by Authority Having Jurisdiction.

R. Hangers and Supports: Comply with NFPA 13 for hanger materials and installation.

S. Install piping with grooved joints according to manufacturer's written instructions. Construct rigid piping joints, unless otherwise indicated.

T. Install new pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe, valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.

U. Fill wet-pipe sprinkler and standpipe system piping with water.

3.10 SPECIALTY SPRINKLER FITTING INSTALLATION

A. Install specialty sprinkler fittings according to manufacturer's written instructions.

3.11 VALVE INSTALLATION

A. Refer to Section 230523 Valves for installing general-duty valves. Install fire-protection specialty valves, trim, fittings, controls, and specialties according to NFPA 13, manufacturer's written instructions, and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Specialty Valves:

1. Alarm Check Valves: Install in vertical position for proper flow, including bypass check valve and retarding chamber and drain-line connections.

3.12 SPRINKLER APPLICATIONS

A. General: Use sprinklers according to the following applications:

1. Rooms with Suspended Ceilings: Concealed sprinklers.
2. Mechanical Rooms, Basement, and Central Plant: Upright sprinklers.
3. Wall Mounting: Sidewall sprinklers.
4. Spaces Subject to Freezing: Upright; pendent, dry-type; and sidewall, dry-type sprinklers.
5. Special Applications: Use extended-coverage, flow-control, and quick-response sprinklers were applicable.
6. Sprinkler Finishes: Use sprinklers with the following finishes:

   a. Upright, Pendent, and Sidewall Sprinklers: Polished bronze in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view.
   b. Concealed Sprinklers: Rough brass with white cover.

3.13 FIRE DEPARTMENT CONNECTION INSTALLATION

A. Install Exposed-Inlet wall or free-standing type (See Drawings), fire department connections.

B. Install ball drip valve at each valve for fire department connection.

3.14 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Connect water-supply piping to fire-suppression piping. Include backflow preventer between potable-water piping and fire-suppression piping. Refer to Section 221119 Domestic Water Piping Specialties for backflow preventers.

D. Install ball drip valves at each check valve for fire department connection. Drain to floor drain or outside building.

E. Connect piping to specialty valves, hose valves, specialties, fire department connections, and accessories.

F. Connection of alarm devices to fire alarm system by Division 26 Contractor.

G. Ground equipment according to Division 26.

H. Connect wiring according to Division 26.

I. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.15 SLEEVES AND FLASHINGS

A. All sleeves shall be properly anchored in place during pouring of slabs. All pipe sleeves through water resistant floors shall extend at least 1-1/2 inches above the finished floor and shall be watertight with the pipes passing through the sleeves. Sleeves passing through all other floors shall be of sufficient length to be flush with bottom of slab and extend one inch above the finished floor, and shall be securely anchored to the slab.

B. All piping passing through membrane water resistant walls and floors shall be provided with a water resistant type pipe sleeve, with Schedule 40 pipe extension or equal. Pack water resistant sleeves with white oakum and mastic.

C. Wherever pipes are exposed and pass through walls, floors, partitions or ceilings, they shall be fitted with chromium plated cast steel escutcheons held in place with setscrews. Care shall be taken to protect the escutcheons during the course of construction.

D. Sleeves in masonry or other walls shall be put in place as the construction progresses, avoiding the cutting of completed work.

E. All piping passing through fire-rated assemblies shall be installed within fire-rated pipe sleeves.

3.16 INSPECTION

A. Examine areas and conditions under which fire protection materials and products are to be installed.

B. After completion of the fire protection installation and at the start of the guarantee period, execute the National Automatic Sprinkler and Fire Control Association, Inc. standard form of "Inspection Agreement", at no increase in Contract Sum, calling for four inspections of the sprinkler system during the guarantee year, plus the following maintenance to be performed during the course of the fourth inspection.

1. Operating of all control valves.
2. Lubrication of operating stems of all control valves.
3. Operating of electrical alarms.
4. Cleaning of alarm valves.
5. Lubrication of Fire Department hose connection inlets.

C. Fill out "Inspection Agreement" in triplicate after each inspection and send copies to the Owner, Insurance Carrier and Fire Department.

D. Welding inspection of the sprinkler system is to be done by the Architect.

3.17 INSTALLATION OF BASIC IDENTIFICATION

A. Install mechanical identification in accordance with Section 230553.

B. Install fire protection signs on piping in accordance with NFPA requirements.

C. Paint all exposed piping and including fire protection riser, color shall be selected by the Architect. See Division 09 Painting.

3.18 FIELD QUALITY CONTROL

A. Sprinkler Piping Flushing: Prior to connecting sprinkler risers for flushing, flush water feed mains, lead-in connections, and control portions of sprinkler piping. After fire sprinkler piping installation has been completed and before piping is placed in service, flush entire sprinkler system as required to remove foreign substances under pressure as specified in NFPA 13. Continue flushing until water is clear, and check to ensure that debris has not clogged sprinklers.

B. Hydrostatic Testing: After flushing system, test fire sprinkler piping hydrostatically for period of 2 hours at not less than 200 psi or at 50 psi greater than system pressure where pressure is anticipated to be in excess of 150 psi. Check system for leakage of joints. Measure hydrostatic pressure at low point of each system or zone being tested.

C. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. Leave entire work in condition satisfactory to Architect. At completion, carefully clean and adjust equipment and trim that are installed as part of this work. Leave systems and equipment in satisfactory operating condition. Repair or replace piping system as required to eliminate leakage in accordance with NFPA standards for "little or no leakage," and retest as specified to demonstrate compliance.

3.19 EXTRA STOCK

A. Heads: For each style and temperature range required, furnish additional sprinkler heads, amounting to one unit for every 100 installed units but not less than 10 heads, in proportion to the total number of each style of head.

B. Wrenches: Furnish two sprinkler wrenches for each type and size of sprinkler connection.

C. Obtain receipt from Owner that extra stock has been received.

3.20 CLEANING AND PROTECTION

A. Clean dirt and debris from sprinklers and other equipment.

B. Remove and replace sprinklers having paint other than factory finish.

C. Protect sprinklers from damage until Substantial Completion.

3.21 COMMISSIONING

A. Verify that specialty valves, trim, fittings, controls, and accessories are installed and operate correctly.

B. Verify that specified tests of piping are complete.

C. Verify that potable-water supplies have correct types of backflow preventers.

D. Verify that hose connections and fire department connections have threads compatible with local fire department equipment.

E. Fill wet-pipe standpipe piping with water.

F. Verify that hose connections are correct type and size.

G. Energize circuits to electrical equipment and devices.

H. Adjust operating controls and pressure settings.

I. Coordinate with fire alarm tests. Operate as required.

END OF SECTION 21 13 00

SECTION – 22 11 16

DOMESTIC WATER PIPING

PART 1 - **GENERAL**

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.
2. Encasement for piping.

B. Related Requirements:

1. Section 230010 – Mechanical General Provisions.
2. Section 230500 – Basic Mechanical Materials and Methods.
3. Section 230523 – Valves.
4. Section 230553 – Mechanical Identification.

1.3 SUBMITTALS

A. See Section 230010 – Mechanical General Provisions.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Piping and fitting materials	R			R
Solder	R			
Couplings	R			
System purging and disinfecting activities report.		R		

1.4 FIELD CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of water service.
2. Do not interrupt water service without Owner's written permission.

PART 2 - **PRODUCTS**

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Potable-water piping and components shall comply with NSF 14 and NSF 61 Annex G. Plastic piping components shall be marked with "NSF-pw."

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.

B. Soft Copper Tube: ASTM B 88, Type K water tube, annealed temper.

C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.

D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

F. Copper Unions:

1. MSS SP-123.
2. Cast-copper-alloy, hexagonal-stock body.
3. Ball-and-socket, metal-to-metal seating surfaces.
4. Solder-joint or threaded ends.

2.3 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials:

1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
2. Full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys.

D. Flux: ASTM B 813, water flushable.

E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

F. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.4 ENCASEMENT FOR PIPING

A. Standard: ASTM A 674 or AWWA C105/A21.5.

B. Form: tube.

C. Color: Blue (domestic cold water), Red (domestic hot water).

2.5 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

C. Sleeve-Type Transition Coupling: AWWA C219.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cascade Waterworks Mfg. Co.
b. Dresser, Inc.
c. Jay R. Smith Mfg. Co.
d. Viking Johnson.
e. Or equal.

D. Plastic-to-Metal Transition Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Charlotte Pipe and Foundry Company.
b. Spears Manufacturing Company.
c. Uponor.
d. Or equal.

2. Description:

a. PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions.
b. One end with threaded brass insert and one solvent-cement-socket end.

E. Plastic-to-Metal Transition Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Colonial Engineering, Inc.
    b. NIBCO INC.
    c. Spears Manufacturing Company.
    d. Or equal.

2. Description:

    a. PVC four-part union.
    b. Brass or stainless-steel threaded end.
    c. Solvent-cement-joint plastic end.
    d. Rubber O-ring.
    e. Union nut.

PART 3 - **EXECUTION**

3.1 EARTHWORK

A. Comply with requirements in Division 31 for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install underground copper tube in PE encasement according to ASTM A 674 or AWWA C105/A21.5.

D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 230519 – Meters and Gages and with requirements for drain valves and strainers in Section 221119 – Domestic Water Piping Specialties.

E. Install shutoff valve immediately upstream of each dielectric fitting.

F. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 230523 – Valves.

G. Install domestic water piping level and plumb.

H. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

I. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

J. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

K. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

L. Install piping to permit valve servicing.

M. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

N. Install piping free of sags and bends.

O. Install fittings for changes in direction and branch connections.

P. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

3.3 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

F. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

G. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.4 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
2. Fittings for NPS 2 and Larger: Sleeve-type coupling.

C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger, support products, and installation in Section 230529 – Hangers and Supports.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
2. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
3. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.7 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 230553 – Mechanical Identification.

B. Label pressure piping with system operating pressure.

3.8 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:

a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials (minimum of 150 psig). Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.9 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Fill and isolate system according to either of the following:

1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
d. Repeat procedures if biological examination shows contamination.
e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Clean non-potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

C. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.11 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

Service	Type of Pipe	Fittings	Joints
Under-building slab Domestic water	Soft copper, Type K	None	None
Above slab	Hard copper, Type L	Cast or wrought copper	Soldered

3.12 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball valves for piping 2-1/2 inch and smaller. Use gate valves with flanged ends for piping 3 inch and larger.
2. Throttling Duty: Use ball valves for piping 2 inch and smaller. Use butterfly or ball valves with flanged ends for piping 2-1/2 inch and larger.
3. Hot-Water Circulation Piping, Balancing Duty: Calibrated balancing valves.
4. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

Domestic Water Piping Test Log							
Date	System	Description of Piping Section Tested	Test Press. (psig)	Test Duration (hours)	Results Pass/ Fail	Witness (Contractor) Initials	Witness (Professional) Initials
This form stall be completed and submitted with the project closeout documents. Contractor shall copy this form if more sheets are required. Piping pressure test log shall be kept at project site and shall be made available to the Architect upon request.							

END OF SECTION 22 11 16

SECTION 221316

SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.
2. Specialty pipe fittings.

1.3 SUBMITTALS

A. See Section 230010 – Mechanical General Provisions.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Piping and fitting materials	R			R
Couplings	R			

1.4 FIELD CONDITIONS

A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of sanitary waste service.
2. Do not proceed with interruption of sanitary waste service without Architect's written permission.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.

2.2 PIPING MATERIALS

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service class(es).

B. Gaskets: ASTM C 564, rubber.

C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.4 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Heavy-Duty, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. ANACO-Husky.
   b. Charlotte Pipe and Foundry Company.
   c. Or equal.

2. Standards: ASTM C 1277 and ASTM C 1540.
3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.5 LAB WASTE AND VENT PIPING AND FITTINGS

A. Pipe and Fittings: Schedule 40 CPVC, drainage pattern with solvent-cemented joints.

B. Spears LabWaste or equal.

2.6 COPPER TUBE AND FITTINGS

A. Copper Type DWV Tube: ASTM B 306, drainage tube, drawn temper.

B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

C. Hard Copper Tube: ASTM B 88, Type L and Type M, water tube, drawn temper.

D. Copper Pressure Fittings:

1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

E. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.

1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

F. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.7 PVC PIPE AND FITTINGS

A. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

B. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

C. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

D. Adhesive Primer: ASTM F 656.

E. Solvent Cement: ASTM D 2564.

2.8 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
2. Unshielded, Nonpressure Transition Couplings:

a. Manufacturers: Subject to compliance with requirements, provide products by the following:

1) Fernco Inc.
2) Or equal.

b. Standard: ASTM C 1173.
c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
d. End Connections: Same size as and compatible with pipes to be joined.
e. Sleeve Materials:

1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

3. Pressure Transition Couplings:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Cascade Waterworks Mfg. Co.
2) Dresser, Inc.
3) Jay R. Smith Mfg. Co.
4) Or equal.

b. Standard: AWWA C219.
c. Description: Metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.
d. Center-Sleeve Material: Manufacturer's standard.
e. Gasket Material: Natural or synthetic rubber.
f. Metal Component Finish: Corrosion-resistant coating or material.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Division 31.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.

1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
2. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.

1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
2. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.

    a. Straight tees, elbows, and crosses may be used on vent lines.

3. Do not change direction of flow more than 90 degrees.
4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.

    a. Reducing size of waste piping in direction of flow is prohibited.

K. Lay buried building waste piping beginning at low point of each system.

1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
3. Maintain swab in piping and pull past each joint as completed.

L. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Waste: 2 percent downward in direction of flow for piping NPS 3 and smaller; 2 percent downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Sanitary Waste Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

M. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.

N. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

O. Install aboveground PVC piping according to ASTM D 2665.

P. Install underground PVC piping according to ASTM D 2321.

Q. Install engineered soil and waste and vent piping systems as follows:

1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
2. Hubless, Single-Stack Drainage System: Comply with ASME B16.45 and hubless, single-stack aerator fitting manufacturer's written installation instructions.
3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.

R. Plumbing Specialties:

1. Install backwater valves in sanitary waster gravity-flow piping.

a. Comply with requirements for backwater valves specified in Section 221319 – Sanitary Waste Piping Specialties.

2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.
3. Install drains in sanitary waste gravity-flow piping.

S. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

T. Install sleeves for piping penetrations of walls, ceilings, and floors.

U. Install sleeve seals for piping penetrations of concrete walls and slabs.

V. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.3 JOINT CONSTRUCTION

A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

C. Join stainless-steel pipe and fittings with gaskets according to ASME A112.3.1.

D. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

E. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

F. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 appendixes.

3.4 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in ODs.
2. In Waste Drainage Piping: Unshielded, nonpressure transition couplings.

3.5 VALVE INSTALLATION

A. Comply with requirements in Section 230523 – Valves for general-duty valve installation requirements.

B. Shutoff Valves:

1. Install shutoff valve on each sewage pump discharge.
2. Install gate or full-port ball valve for piping NPS 2 and smaller.
3. Install gate valve for piping NPS 2-1/2 and larger.

C. Check Valves: Install swing check valve, between pump and shutoff valve, on each sewage pump discharge.

D. Backwater Valves: Install backwater valves in piping subject to backflow.

1. Horizontal Piping: Horizontal backwater valves. Use normally closed type unless otherwise indicated.
2. Floor Drains: Drain outlet backwater valves unless drain has integral backwater valve.
3. Install backwater valves in accessible locations.
4. Comply with requirements for backwater valve specified in Section 221319 – Sanitary Waste Piping Specialties.

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger and support devices and installation specified in Section 230529 – Hangers and Supports.

1. Install galvanized-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install galvanized-steel pipe support clamps for vertical piping in noncorrosive environments.
3. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
4. Vertical Piping: MSS Type 8 or Type 42, clamps.
5. Install individual, straight, horizontal piping runs:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

6. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
7. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
2. NPS 3: 60 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
5. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.
6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

F. Install supports for vertical cast-iron soil piping every 15 feet.

G. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 72 inches with 3/8-inch rod.
2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
3. NPS 2-1/2: 108 inches with 1/2-inch rod.
4. NPS 3 and NPS 5: 10 feet with 1/2-inch rod.
5. NPS 6: 10 feet with 5/8-inch rod.
6. NPS 8: 10 feet with 3/4-inch rod.

H. Install supports for vertical copper tubing every 10 feet.

I. Install hangers for PVC, CPVC and polypropylene piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
2. NPS 3: 48 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 48 inches with 3/4-inch rod.
5. NPS 10 and NPS 12: 48 inches with 7/8-inch rod.

J. Install supports for vertical PVC, CPVC and polypropylene piping every 48 inches.

K. Support piping and tubing not listed above according to MSS SP-58 and manufacturer's written instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect waste and vent piping to the following:

1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.

3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Install horizontal backwater valves in pit with pit cover flush with floor.
6. Comply with requirements for backwater valves, cleanouts, and drains specified in Section 221319 – Sanitary Waste Piping Specialties.
7. Equipment: Connect waste piping as indicated.

    a. Provide shutoff valve if indicated and union for each connection.
    b. Use flanges instead of unions for connections NPS 2-1/2 and larger.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.8 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping.

B. Comply with requirements for identification specified in Section 230553 – Mechanical Identification.

3.9 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary waste and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.

    a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.

    a. Expose work that was covered or concealed before it was tested.

3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.

    a. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water.
    b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
    c. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.

    a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg.
    b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
    c. Air pressure must remain constant without introducing additional air throughout period of inspection.
    d. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.10 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

E. Repair damage to adjacent materials caused by waste and vent piping installation.

3.11 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

Description	Pipe	Fittings	Joints
Below grade, Soil, Waste, and Vent Piping	Solid-wall PVC	PVC socket fittings, DWV pattern	Solvent-cemented

Description	Pipe	Fittings	Joints
Above grade, Soil, Waste, and Vent Piping (not installed in return air plenum)	Solid-wall PVC	PVC socket fittings, DWV pattern	Solvent-cemented
Above grade, Soil, Waste, and Vent Piping (installed in return air plenum)	Cast-iron, hubless	Hubless, DWV pattern	Heavy-duty, couplings
Condensate drains (except on piping routed above roof from packaged units)	Copper, Type L	Copper, DWV pattern	Soldered
Condensate drains routed above roof from packaged units	Solid wall PVC	PVC socket fittings, DWV pattern	Solvent-cemented
Lab waste	Chemical resistant CPVC	CPVC, DWV pattern	Solvent cemented

Sanitary Waste and Vent Piping Test Log							
Date	System	Description of Piping Section Tested	Test Press. (psig)	Test Duration (hours)	Results Pass/ Fail	Witness (Contractor) Initials	Witness (Professional) Initials

This form stall be completed and submitted with the project closeout documents. Contractor shall copy this form if more sheets are required. Piping pressure test log shall be kept at project site and shall be made available to the Architect upon request.

END OF SECTION 22 13 16

SECTION 221316

STORM DRAINAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.
2. Specialty pipe fittings.

1.3 SUBMITTALS

A. See Section 230010 – Mechanical General Provisions.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Piping and fitting materials	R			R
Couplings	R			

1.4 FIELD CONDITIONS

A. Interruption of Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of storm drainage service.
2. Do not proceed with interruption of storm drainage service without Architect's written permission.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Storm Drainage Piping: 10-foot head of water.

2.2 PIPING MATERIALS

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service class(es).

B. Gaskets: ASTM C 564, rubber.

C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.4 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Heavy-Duty, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. ANACO-Husky.
   b. Charlotte Pipe and Foundry Company.
   c. Or equal.

2. Standards: ASTM C 1277 and ASTM C 1540.
3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.5 PVC PIPE AND FITTINGS

A. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

B. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

C. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

D. Adhesive Primer: ASTM F 656.

E. Solvent Cement: ASTM D 2564.

2.6 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
2. Unshielded, Nonpressure Transition Couplings:

a. Manufacturers: Subject to compliance with requirements, provide products by the following:

1) Fernco Inc.
2) Or equal.

b. Standard: ASTM C 1173.
c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
d. End Connections: Same size as and compatible with pipes to be joined.
e. Sleeve Materials:

1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

3. Pressure Transition Couplings:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Cascade Waterworks Mfg. Co.
2) Dresser, Inc.
3) Jay R. Smith Mfg. Co.
4) Or equal.

b. Standard: AWWA C219.
c. Description: Metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.
d. Center-Sleeve Material: Manufacturer's standard.
e. Gasket Material: Natural or synthetic rubber.
f. Metal Component Finish: Corrosion-resistant coating or material.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Division 31.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.

1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
2. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Make changes in direction for storm drainage and vent piping using appropriate branches, bends, and long-sweep bends.

1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
2. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.

    a. Straight tees, elbows, and crosses may be used on vent lines.

3. Do not change direction of flow more than 90 degrees.
4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.

    a. Reducing size of drainage piping in direction of flow is prohibited.

K. Lay buried storm drainage piping beginning at low point of each system.

1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.

2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
3. Maintain swab in piping and pull past each joint as completed.

L. Install storm drainage piping at the following minimum slopes unless otherwise indicated:

1. Building Storm Drainage Piping: 1 percent downward in direction of flow for piping NPS 3 and smaller; 2 percent downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Storm Drainage Piping: 2 percent downward in direction of flow.

M. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.

N. Install aboveground PVC piping according to ASTM D 2665.

O. Install underground PVC piping according to ASTM D 2321.

P. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

Q. Install sleeves for piping penetrations of walls, ceilings, and floors.

R. Install sleeve seals for piping penetrations of concrete walls and slabs.

S. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.3 JOINT CONSTRUCTION

A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

C. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 appendixes.

3.4 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in ODs.
2. In Storm Drainage Piping: Unshielded, nonpressure transition couplings.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger and support devices and installation specified in Section 230529 – Hangers and Supports.

1. Install galvanized-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install galvanized-steel pipe support clamps for vertical piping in noncorrosive environments.
3. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
4. Vertical Piping: MSS Type 8 or Type 42, clamps.
5. Install individual, straight, horizontal piping runs:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

6. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
7. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
2. NPS 3: 60 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
5. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.
6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

F. Install supports for vertical cast-iron soil piping every 15 feet.

G. Install hangers for PVC, CPVC and polypropylene piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
2. NPS 3: 48 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 48 inches with 3/4-inch rod.
5. NPS 10 and NPS 12: 48 inches with 7/8-inch rod.

H. Install supports for vertical PVC, CPVC and polypropylene piping every 48 inches.

I. Support piping and tubing not listed above according to MSS SP-58 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.

C. Connect storm drainage piping to roof drains, deck drains, catch basins, storm drainage specialties, etc..

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

3.7 IDENTIFICATION

A. Identify exposed storm drainage piping.

B. Comply with requirements for identification specified in Section 230553 – Mechanical Identification.

3.8 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.

    a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved.

    a. Expose work that was covered or concealed before it was tested.

3. Roughing-in Plumbing Test Procedure: Test storm drainage piping except outside leaders on completion of roughing-in.

    a. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water.

b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
c. Inspect joints for leaks.

4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

3.9 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect storm drainage piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

E. Repair damage to adjacent materials caused by storm drainage piping installation.

3.10 PIPING SCHEDULE

A. Piping Applications.

Description	Pipe	Fittings	Joints
Below grade, Storm Drainage Piping	Solid-wall PVC	PVC socket fittings, DWV pattern	Solvent-cemented
Above grade, Storm Drainage Piping (not installed in return air plenum)	Solid-wall PVC	PVC socket fittings, DWV pattern	Solvent-cemented
Above grade, Storm Drainage Piping (installed in return air plenum)	Cast-iron, hubless	Hubless, DWV pattern	Heavy-duty, couplings

Storm Drainage Piping Test Log							
Date	System	Description of Piping Section Tested	Test Press. (psig)	Test Duration (hours)	Results Pass/ Fail	Witness (Contractor) Initials	Witness (Professional) Initials
This form stall be completed and submitted with the project closeout documents. Contractor shall copy this form if more sheets are required. Piping pressure test log shall be kept at project site and shall be made available to the Architect upon request.							

END OF SECTION 22 13 16

SECTION 22 16 00

PLUMBING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following plumbing specialties:

1. Backflow preventers
2. Water regulators
3. Balancing valves
4. Strainers
5. Outlet Boxes
6. Water supply outlets
7. Trap seal primer valves
8. Drain valves
9. Miscellaneous piping specialties
10. Sleeve penetration systems
11. Cleanouts
12. Floor drains

B. Related Sections include the following:

1. Section 23 00 10 – Mechanical General Provisions
2. Section 23 05 00 – Basic Mechanical Materials and Methods
3. Section 23 05 16 – Piping Specialties

1.3 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping systems with following minimum working-pressure ratings, unless otherwise indicated:

1. Domestic Water Piping: 150 psig
2. Sanitary Waste and Vent Piping: 10-foot head of water
3. Storm Drainage Piping: 10-foot head of water

1.4 SUBMITTALS

A. Product Data: Include rated capacities and shipping, installed, and operating weights. Indicate materials, finishes, dimensions, required clearances, and methods of assembly of components; and piping and wiring connections for the following:

1. Backflow preventers and water regulators.
2. Balancing valves, water filters, and strainers.
3. Thermostatic water mixing valves and water tempering valves.

4. Water hammer arresters, air vents, and trap seal primer valves and systems.
5. Drain valves, hose bibbs, hydrants, and hose stations.
6. Outlet boxes and washer-supply outlets.
7. Backwater valves, cleanouts, floor drains, floor sinks, open receptors, trench drains, and roof drains.
8. Vent caps, vent terminals, and roof flashing assemblies.
9. Sleeve penetration systems.

B. Shop Drawings: Diagram power, signal, and control wiring

C. Field test reports

D. Maintenance Data: For plumbing specialties to include in maintenance manuals. Include the following:

1. Backflow preventers and water regulators
2. Water filters
3. Thermostatic water mixing valves and water tempering valves
4. Trap seal primer valves and systems
5. Hose stations and hydrants

E. Refer to Section 23 00 10 – Mechanical General Provisions for additional submittal requirements

1.5 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of plumbing specialties and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

B. Plumbing specialties shall bear label, stamp, or other markings of specified testing agency.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for piping materials and installation.

E. NSF Compliance:

1. Comply with NSF 61, "Drinking Water System Components--Health Effects, Sections 1 through 9," for potable domestic water plumbing specialties.

PART 2 - PRODUCTS

2.1 BACKFLOW PREVENTERS

A. Manufacturers:

1. Ames Co., Inc.
2. Watts Industries, Inc.; Water Products Div.
3. Zurn Industries, Inc.; Wilkins Div.

B. General: ASSE standard, backflow preventers.

1. NPS 2 and Smaller: Bronze body with threaded ends.
2. NPS 2-1/2 and Larger: Bronze, cast-iron, steel, or stainless-steel body with flanged ends.

a. Interior Lining: AWWA C550 or FDA-approved, epoxy coating for backflow preventers having cast-iron or steel body.

3. Interior Components: Corrosion-resistant materials.
4. Exterior Finish: Polished chrome plate if used in chrome-plated piping system.
5. Strainer: On inlet, if indicated.

C. Pipe-Applied, Atmospheric-Type Vacuum Breakers: ASSE 1001, with floating disc and atmospheric vent.

D. Hose-Connection Vacuum Breakers: ASSE 1011, nickel plated, with nonremovable and manual drain features, and ASME B1.20.7, garden-hose threads on outlet. Units attached to rough-bronze-finish hose connections may be rough bronze.

E. Intermediate Atmospheric-Vent Backflow Preventers: ASSE 1012, suitable for continuous pressure application. Include inlet screen and two independent check valves with intermediate atmospheric vent.

F. Reduced-Pressure-Principle Backflow Preventers: ASSE 1013, suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet; test cocks; and pressure-differential relief valve with ASME A112.1.2 air-gap fitting located between two positive-seating check valves.

1. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.

G. Antisiphon-Pressure-Type Vacuum Breakers: ASSE 1020, suitable for continuous pressure application. Include shutoff valves, spring-loaded check valve, spring-loaded floating disc, test cocks, and atmospheric vent.

1. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.

H. Reduced-Pressure Detector Assembly Backflow Preventers: ASSE 1047, FM approved or UL listed, and suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet. Include test cocks; pressure-differential relief valve with ASME A112.1.2 air-gap fitting located between two positive-seating check valves; and bypass with displacement-type water meter, valves, and reduced-pressure backflow preventer.

1. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.

I. Dual-Check-Valve-Type Backflow Preventers: Watts Series 7C or equal, ASSE 1024, suitable for continuous pressure application. Include union inlet and two independent check valves. BfP-1 is to be ½" NPS.

J. Double-Check-Valve-Type Backflow Prevention Assemblies: ASSE 1015, suitable for continuous pressure application. Include shutoff valves on inlet and outlet, strainer on inlet; test cocks; and two positive-seating check valves. Equal to Watts 007M2QT-S.

1. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.

K. Double-Check Detector Assembly Backflow Preventers: ASSE 1048, FM approved or UL listed,

and suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet. Include test cocks; two positive-seating check valves; and bypass with displacement-type water meter, valves, and double-check backflow preventer.

1. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.

L. Hose-Connection Backflow Preventers: ASSE 1052, suitable for at least 3-gpm flow and applications with up to 10-foot head of water back pressure. Include two check valves; intermediate atmospheric vent; and nonremovable, ASME B1.20.7, garden-hose threads on outlet.

M. Back-Siphonage Backflow Vacuum Breakers: ASSE 1056, suitable for continuous pressure and backflow applications. Include shutoff valves, check valve, test cocks, and vacuum vent.

2.2 WATER REGULATORS

A. Manufacturers:

1. Watts Industries, Inc.; Water Products Div.
2. Zurn Industries, Inc.; Wilkins Div.
3. Or equal

B. General: ASSE 1003, water regulators, rated for initial working pressure on 150 psig minimum. Include integral factory installed or separate field-installed, Y-pattern strainer.

1. NPS 2 and Smaller:

a. General-Duty Service: Single-seated, direct operated, unless otherwise indicated.
b. Booster Heater Water Supply: Single-seated, direct operated with integral bypass.

2. NPS 2-1/2 and Larger:

a. Type: Single-seated, direct operated.
b. Type: Pilot-operated, single- or double-seated, cast-iron body main valve, with bronze-body pilot valve.

3. Interior Components: Corrosion-resistance materials
4. Exterior-Finish: Polished chrome plate if used in chrome-plated piping system.

2.3 BALANCING VALVES

A. Calibrated Balancing Valves: Adjustable, with two readout ports and memory setting indicator. Include manufacturer's standard hoses, fittings, valves, differential pressure meter, and carrying case.

1. Manufacturers:

a. Armstrong Pumps, Inc.
b. ITT Industries; Bell & Gossett
c. Watts Industries, Inc; Water Products Div.

2. NPS 2 and Smaller: Bronze, Y-pattern body with adjustment knob and threaded ends.

2.4 STRAINERS

A. Strainers: Y-pattern, unless otherwise indicated, and full size of connecting piping. Include ASTM A666, Type 304, stainless steel screens with 3/34-inch round perforations, unless otherwise indicated.

1. Pressure rating: 125 psig minimum steam working pressure, unless otherwise indicated.
2. NPS 2 and smaller: Bronze body, with female threaded ends.
3. NPS 2-1/2 and Larger: Cast-iron body, with interior AWWA C550 or FDA-approved, epoxy coating and flanged ends.

2.5 OUTLET BOXES

A. Manufacturers

1. Guy Gray Manufacturing Co., Inc.
2. Acorn Engineering Company
3. Zurn Industries, Inc.

B. General: Recessed-mounting outlet boxes with supply fittings complying with ASME A112.18.1M. Include box with faceplate, services indicated for equipment connections and wood-blocking reinforcement. Boxes shall be metallic

C. Icemaker Outlet Boxes: Guy Gray stainless steel ice maker box

2.6 HOSE BIBBS & WALL HYDRANTS

a. Refer to Section 22 40 00 – Plumbing Fixtures

2.7 TRAP SEAL PRIMER VALVES

A. Trap Seal Primer System: Factory-fabricated, ASSE 1044:

1. Manufacturers (or equal):

a. Precision Plumbing Products, Inc.
b. Sloan
c. Zurn

2. Trap Priming Manifold Type

a. Piping: NPS 3/4, ASTM B 88, Type L (ASTM B 88M, Type B); copper, water tubing inlet and manifold with number of NPS 1/2 outlets as indicated.
b. Cabinet: Steel box with stainless-steel cover.
c. Water Hammer Arrester: ASSE 1010.
d. Vacuum Breaker: ASSE 1001.

3. Fixture Flush Pipe-Fed Type

a. One-piece, chrome-plated, vacuum breaker trap primer flush connection with integral water deflector
b. Cast-brass
c. NPS 3/8 minimum, elbow and flexible connector to wall
d. Wall flanges and fittings to connect to NPS 1/2 pipe

4. Pressure Drop Activated Type

    a. Cast-brass
    b. EPDM E70 o-rings
    c. Stainless steel mesh screen
    d. Stainless steel adjustment screw
    e. Prime 1-4 floor drains

2.8 DRAIN VALVES

A. Hose-End Drain Valves: MSS SP-110, NPS 3/4 ball valve, rated for 400-psig minimum CWP. Include two-piece, copper-alloy body with standard port, chrome-plated brass ball, replaceable seats and seals, blowout-proof stem, and vinyl-covered steel handle.

1. Inlet: Threaded or solder joint.
2. Outlet: Short-threaded nipple with ASME B1.20.7, garden-hose threads and cap.

B. Stop-and-Waste Drain Valves: MSS SP-110, ball valve, rated for 200-psig minimum CWP or MSS SP-80, Class 125, gate valve; ASTM B 62 bronze body, with NPS 1/8 side drain outlet and cap.

2.9 MISCELLANEOUS PIPING SPECIALTIES

A. Water Hammer Arresters: ASSE 1010 or PDI-WH 201, metal-bellows type with pressurized metal cushioning chamber. Sizes indicated are based on ASSE 1010 or PDI-WH 201, Sizes A through F.

1. Manufacturers:

    a. Josam Co.
    b. Smith, Jay R. Mfg. Co.
    c. Zurn Industries, Inc.; Specification Drainage Operation.
    d. Or equal

B. Optional Water Hammer Arresters: ASSE 1010 or PDI-WH 201, piston type with pressurized metal-tube cushioning chamber. Sizes indicated are based on ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

1. Manufacturers (or equal):

    a. Josam Co.
    b. Precision Plumbing Products, Inc.
    c. Watts Industries, Inc.; Drainage Products Div.
    d. Zurn Industries, Inc.; Wilkins Div.

C. Air Vents: Float type for automatic air venting.

1. Bolted Construction: Bronze body with replaceable, corrosion-resistant metal float and stainless-steel mechanism and seat; threaded NPS 1/2 minimum inlet; 125-psig minimum pressure rating at 140 deg F; and threaded vent outlet.
2. Welded Construction: Stainless-steel body with corrosion-resistant metal float, stainless-steel mechanism and seat, threaded NPS 3/8 minimum inlet, 150-psig minimum pressure rating, and threaded vent outlet.

D. Open Drains: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-

pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting, joined with ASTM C 564, rubber gaskets.

E. Deep-Seal Traps: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap seal primer valve connection.

1. NPS 2: 4-inch- minimum water seal.
2. NPS 2-1/2 and Larger: 5-inch- minimum water seal.

F. DST-1: Deep Seal Traps (with Open Funnel): Same as “Deep Seal Trap” specified above except that a bronze funnel is required. (Smith Figure 3822 or equal).

G. Floor-Drain Inlet Fittings: Cast iron, with threaded inlet and threaded or spigot outlet, and trap seal primer valve connection.

H. Backwater valve: Smith 7150 flapper-type backwater valve with cast iron body and extendable access cover.

I. Fixed Air-Gap Fittings: Manufactured cast-iron or bronze drainage fitting with semiopen top with threads or device to secure drainage inlet piping in top and bottom spigot or threaded outlet larger than top inlet. Include design complying with ASME A112.1.2 that will provide fixed air gap between installed inlet and outlet piping.

J. Stack Flashing Fittings: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.

K. Vent Caps: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and set-screws to secure to vent pipe.

L. Vent Terminals: Commercially manufactured, shop- or field-fabricated, frost-proof assembly constructed of galvanized steel, copper, or lead-coated copper. Size to provide 1-inch (25-mm) enclosed air space between outside of pipe and inside of flashing collar extension, with counterflashing.

M. Expansion Joints: ASME A112.21.2M, assembly with cast-iron body with bronze sleeve, packing gland, and packing; of size and end types corresponding to connected piping.

2.10 SLEEVE PENETRATION SYSTEMS

A. Manufacturers:

1. ProSet Systems, Inc.
2. Or equal.

B. Description: UL 1479, through-penetration firestop assembly consisting of sleeve and stack fitting with firestopping plug.

1. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
2. Stack Fitting: ASTM A 48 (ASTM A 48M), gray-iron, hubless-pattern, wye-branch stack fitting with neoprene O-ring at base and gray-iron plug in thermal-release harness in branch. Include PVC protective cap for plug.

a. Special Coating: Include corrosion-resistant interior coating on fittings for plastic chemical

waste and vent stacks.

2.11 FLASHING MATERIALS (COORDINATE WITH ROOFING SPECIFICATIONS)

2.12 CLEANOUTS

A. Service: Sanitary, soil and waste piping

B. Manufacturers;

1. Zurn
2. J.R. Smith
3. Josam
4. Cresline
5. Or equal

C. Cleanouts shall be the same size as pipe except that cleanouts larger than 4 inches are not required. Install cleanouts and/or test tees at the foot of all soil, waste and drain stacks; and on each building drain outside of building. Cleanouts shall be installed every 50 feet or less on all horizontal drain lines.

D. At ends of horizontal lines in unfinished areas: Wye fitting with cast brass plugs, threaded

E. At base of vertical lines in unfinished areas and hard piped downspouts. Wye fitting with cast brass plugs, threaded

F. Cleanouts shall be as follows:

1. Vertical Lines Concealed: Josam 58600-COT-20.
2. Vertical Lines Exposed: Josam 58910.
3. Horizontal Lines Exposed and/or Above Accessible Ceilings: Josam 58900-20.
4. Horizontal Lines Concealed Under Floors with Tile, Vinyl, Terrazzo and/or Concrete Finish: Josam 555000Z-2.
5. Horizontal Lines Concealed Under Floors with Carpet Finish: Josam 55000Z-2-14.
6. Inside building installed in finished floors: JR Smith 4020.
7. Cleanouts for PVC piping shall be equal to Cresline DW75A.

G. All interior cleanouts shall have nickel chrome finish. All exterior cleanouts shall have a brass finish unless otherwise noted. All flush grade/flush floor cleanouts shall have inset square key covers.

H. Cleanouts to Grade (exterior cleanout): Josam 58900, cast iron floor cleanout with round heavy duty cover. Locate cleanout set in concrete yard box with cast iron cover marked “sewer”, Brooks 3CI, Christy or equal large enough for two-way clean out assemblies.

2.13 FLOOR DRAINS & AREA DRAINS

A. Manufacturers:

1. J.R. Smith
2. Zurn
3. Wade

4. Josam

B. See Plumbing Fixture Schedule in the Construction Documents.

C. Provide trap primers to all floor drains and floor sinks, unless otherwise indicated.

2.14 DOMESTIC HOT WATER RECIRCULATION PUMPS

A. Manufacturers:

1. Bell & Gossett
2. Taco
3. Grundfos
4. Or equal

B. Description: Furnish and install domestic hot water recirculation pumps of the size and capacity shown in the Construction Documents.

C. Pump Construction:

1. Housing: Bronze
2. Impeller: Bronze, closed type
3. Shaft: Stainless Steel
4. Mechanical Seal: Stainless Steel
5. Motor: Open dripproof type with sleeve bearings and built-in automatic thermal overload protection, 1725 RPM

D. Provide and install strap-on aquastat to hot water recirculation line to control pump.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Section 23 05 00 - Basic Mechanical Materials and Methods for piping joining materials, joint construction, and basic installation requirements.

B. Examine roughing-in of water distribution piping to verify actual locations of connections before plumbing specialty or pump installation.

C. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
3. Do not install bypass piping around backflow preventers.

D. Install pressure regulators with inlet and outlet shutoff valves and balance valve bypass. Install pressure gages on inlet and outlet.

E. Install strainers on supply side of each control valve, pressure regulator, and solenoid valve.

F. Install trap seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

G. Install backwater valves in building drain piping where required. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

H. Install expansion joints on vertical risers, stacks, and conductors if indicated.

I. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

J. Install strainers on supply side of each control valve, pressure regulator, and solenoid valve.

K. Install cleanout deck plates with top flush with finished floor, for floor cleanouts for piping below floors.

L. Install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall, for cleanouts located in concealed piping.

M. Install flashing flange and clamping device with each stack and cleanout passing through floors with waterproof membrane.

N. Install vent flashing sleeves on stacks passing through roof. Secure over stack flashing according to manufacturer's written instructions.

O. Install floor drains at locations shown on Construction Drawings. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:

    a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
    b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
    c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.

3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

P. Fasten wall-hanging plumbing specialties securely to supports attached to building substrate if supports are specified and to building wall construction if no support is indicated.

Q. Fasten recessed-type plumbing specialties to reinforcement built into walls.

R. Install individual shutoff valve in each water supply to plumbing specialties. Use ball, gate, or globe valve if specific valve is not indicated. Install shutoff valves in accessible locations. Refer to Section 23 05 23 - Valves for general-duty ball, butterfly, check, gate, and globe valves.

S. Install air vents at piping high points. Include ball, gate, or globe valve in inlet [and drain piping from outlet to floor drain].

T. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

U. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Connect plumbing specialties to piping specified in other Division 22 Sections.

D. Ground equipment.

E. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

F. Connect plumbing specialties and devices that require power according to Division 26 Sections.

3.3 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each backflow preventer, thermostatic water mixing valve, water tempering valve, trap seal primer system.

1. Text: Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.
2. Refer to Section 23 00 10 – Mechanical General Provisions and Section 23 05 53 - Mechanical Systems Identification for nameplates and signs.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled trap seal primer systems and their installation, including piping and electrical connections. Report results in writing.

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.5 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

3.6 PACKAGED BOOSTER PUMP COMMISSIONING

A. Before operating pumps, perform the following checks:

1. Check piping connections for tightness.
2. Controls: Set for automatic starting, stopping, sequential, and alarm operations.
3. Final Checks before Starting: Perform the following preventative maintenance operations:

    a. Lubricate bearings.
    b. Verify that each pump is free to rotate by hand and that pump for handling hot liquids is free to rotate with pump hot and cold. Do not operate pump if it is bound or drags, until cause of problem is determined and corrected.
    c. Verify that pump controls are correct for required application.

B. Starting procedure for pumps is as follows:

1. Prime pumps by opening suction valves and closing drains and prepare pump for operation.
2. Open valves if pumps should not be operated against dead shutoff.
3. Start motors.
4. Open discharge valves slowly.
5. Check general mechanical operation of pumps and motors.
6. Close valves once there is sufficient flow though pumps to prevent overheating.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner’s maintenance personnel to adjust, operate, and maintain backflow preventers, pumps, and mixing valves. Refer to Secton 23 00 10 – Mechanical General Provisions.

END OF SECTION 22 16 00

SECTION 22 34 00

FUEL-FIRED TANKLESS, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Gas-fired, tankless, domestic-water heaters.
2. Domestic-water heater accessories.

1.3 SUBMITTALS

A. See Section 230010 – Mechanical General Provisions.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Water heaters	R	R		R
Accessories	R	R		R
Controls	R	R		R

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE/IESNA Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IESNA 90.1.

C. ASME Compliance:

1. Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube, domestic-water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.

D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects."

1.5 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired, domestic-water heaters that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including storage tank and supports.
b. Faulty operation of controls.
c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Periods: From date of Substantial Completion.

a. Gas-Fired, Tankless, Domestic-Water Heaters:

1) Heat Exchanger: Five years.
2) Controls and Other Components: Three years.

b. Compression Tanks: Five years.

PART 2 - PRODUCTS

2.1 GAS-FIRED, TANKLESS, DOMESTIC-WATER HEATERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Rheem Manufacturing Company.
2. Rinnai Corporation.
3. Takagi.
4. Or equal.

B. Standard: ANSI Z21.10.3/CSA 4.3 for gas-fired, instantaneous, domestic-water heaters for indoor application.

C. Construction: Copper piping or tubing complying with NSF 61 Annex G barrier materials for potable water, without storage capacity.

1. Tappings: ASME B1.20.1 pipe thread.

2. Pressure Rating: 150 psig.
3. Heat Exchanger: Copper tubing.
4. Insulation: Comply with ASHRAE/IESNA 90.1.
5. Jacket: Metal, with enameled finish, or plastic.
6. Burner: For use with tankless, domestic-water heaters and natural-gas fuel.
7. Automatic Ignition: Manufacturer's proprietary system for automatic, gas ignition.
8. Temperature Control: Adjustable thermostat.

D. Controls: Provide complete operating system with multiple unit controllers, controllers to select and change hot water supply temperature and non-polarized two-core cable. Controller shall rotate lead water heater to equalize multiple water heater operation time.

E. Support: Bracket for wall mounting.

2.2 DOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Compression Tanks:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. AMTROL, Inc.
   b. Smith, A. O. Corporation.
   c. Taco, Inc.
   d. Or equal.

2. Description: Steel, pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.

3. Construction:

   a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
   b. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
   c. Air-Charging Valve: Factory installed.

B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.

C. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1.

D. Heat-Trap Fittings: ASHRAE 90.2.

E. Manifold Kits: Domestic-water heater manufacturer's factory-fabricated inlet and outlet piping for field installation, for multiple domestic-water heater installation. Include ball valves to isolate each domestic-water heater and calibrated balancing valves to provide balanced flow through each domestic-water heater.

F. Comply with requirements for ball valves specified in Section 230523 – Valves.

G. Gas Shutoff Valves: ANSI Z21.15/CSA 9.1-M, manually operated. Furnish for installation in piping.

H. Gas Pressure Regulators: ANSI Z21.18/CSA 6.3, appliance type. Include pressure rating as required to match gas supply.

I. Combination Temperature-and-Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4-M.

J. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

K. Vent System: Provide complete concentric combination combustion air intake and exhaust vent piping system including but not limited to the following: vertical discharge adaptor, vertical concentric piping, vent pipe clamps, condensate collector, roof flashing assembly, roof discharge terminal and fittings.

2.3 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect assembled domestic-water heaters and storage tanks specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test commercial domestic-water heaters to minimum of one and one-half times pressure rating before shipment.

C. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Division 01 for retesting and reinspecting requirements and for requirements for correcting the Work.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

A. Tankless, Domestic-Water Heater Mounting: Install tankless, domestic-water heaters at least 30 inches above floor on wall bracket.

1. Maintain manufacturer's recommended clearances.
2. Arrange units so controls and devices that require servicing are accessible.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Anchor domestic-water heaters to substrate.

B. Install domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping.

C. Install gas-fired, domestic-water heaters according to NFPA 54.

1. Install gas shutoff valves on gas supply piping to gas-fired, domestic-water heaters without shutoff valves.
2. Install gas pressure regulators on gas supplies to gas-fired, domestic-water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
3. Install automatic gas valves on gas supplies to gas-fired, domestic-water heaters if required for operation of safety control.
4. Comply with requirements for gas shutoff valves, gas pressure regulators, and automatic gas valves specified in Section 231123 – Facility Natural-Gas Piping.

D. Install combination temperature-and-pressure relief valves in water piping for domestic-water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

E. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for domestic-water heaters that do not have tank drains.

F. Install thermometer on outlet piping of domestic-water heaters. Comply with requirements for thermometers specified in Section 230519 – Meters and Gauges.

G. Assemble and install inlet and outlet piping manifold kits for multiple domestic-water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each domestic-water heater. Include shutoff valve and thermometer in each domestic-water heater inlet and outlet, and throttling valve in each domestic-water heater outlet.

H. Fill domestic-water heaters with water.

I. Charge domestic-water compression tanks with air.

3.2 CONNECTIONS

A. Comply with requirements for domestic-water piping specified in Section 221116 – Domestic Water Piping.

B. Comply with requirements for gas piping specified in Section 231123 – Facility Natural-Gas Piping.

C. Drawings indicate general arrangement of piping, fittings, and specialties.

D. Where installing piping adjacent to fuel-fired, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 230553 – Mechanical Identification.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Division 01 for retesting and reinspecting requirements and for requirements for correcting the Work.

C. Prepare test and inspection reports.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain domestic-water heaters.

END OF SECTION 22 34 00

SECTION 22 40 00

PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. These Plumbing provisions specified herein apply to all Sections of Division 22.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 22.

1.2 WORK INCLUDED

A. This Section includes plumbing fixtures and related components.

1.3 RELATED WORK AND REQUIREMENTS

A. Requirements of General Conditions, Division 1

B. Section 22 16 00 - Plumbing Specialties

C. Section 23 00 10 – Mechanical General Provisions

1.4 DEFINITIONS

A. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.

B. Fitting: Device that controls flow of water into or out of plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

1.5 SUBMITTALS

A. See Division 1 - Shop Drawings, Product Data and Samples

B. See Section 23 00 10 – Mechanical General Provisions

C. Product Data: Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports and indicate materials and finishes, dimensions, construction details, and flow-control rates for each type of fixture indicated. All product data for plumbing fixtures shall be submitted to the Owner for review and approval.

D. Shop Drawings: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.

E. Maintenance Data: For plumbing fixtures to include in maintenance manuals specified in Division 1.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.

1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act".

D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

E. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

F. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

G. Comply with the following applicable standards and other requirements specified for plumbing fixtures:

1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
2. Hand Sinks: NSF 2 construction.
3. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.
4. Stainless-Steel Fixtures Other Than Service Sinks: ASME A112.19.3M.
5. Vitreous-China Fixtures: ASME A112.19.2M.
6. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.
7. Water-Closet, Flushometer Tank Trim: ASSE 1037.

H. Comply with the following applicable standards and other requirements specified for sink faucets:

1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
2. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
3. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
4. Faucet Hose: ASTM D 3901.
5. Faucets: ASME A112.18.1M.
6. Hose-Connection Vacuum Breakers: ASSE 1011.
7. Hose-Coupling Threads: ASME B1.20.7.
8. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
9. NSF Materials: NSF 61.
10. Pipe Threads: ASME B1.20.1.
11. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
12. Supply and Drain Fittings: ASME A112.18.1M.

I. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:

1. Atmospheric Vacuum Breakers: ASSE 1001.

2. Brass and Copper Supplies: ASME A112.18.1M.
3. Manual-Operation Flushometers: ASSE 1037.
4. Plastic Tubular Fittings and Piping: ASTM F 409.
5. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.
6. Tubular Brass Drainage Fittings and Piping: ASME A112.18.1M.

J. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Disposers: ASSE 1008 and UL 430.
2. Floor Drains: ASME A112.21.1M.
3. Grab Bars: ASTM F 446.
4. Hose-Coupling Threads: ASME B1.20.7.
5. Hot-Water Dispensers: ASSE 1023 and UL 499.
6. Off-Floor Fixture Supports: ASME A112.6.1M.
7. Pipe Threads: ASME B1.20.1.
8. Plastic Toilet Seats: ANSI Z124.5.
9. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.7 COORDINATION

A. Coordinate roughing-in and final plumbing fixture locations, and verify that fixtures can be installed to comply with original design and referenced standards.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General:

1. Provide fixtures and trim complete for proper installation as described in the manufacturer's catalog with the modifications as shown on Plumbing Fixture Schedule in the plans or specifications.
2. All fixtures, specified to be of vitreous ware, shall be of a quality known commercially as "twice fired" vitreous chinaware of the best quality, nonabsorbent, burned so that the whole mass is thoroughly fused and vitrified producing a material white in color, which when fractured will show a homogeneous mass, close-grained and free from pores. The glazed and vitreous china fixtures shall be white, thoroughly fused and united to the body, without discoloration, chips, or flaws and shall be free from cracks. Warped or otherwise imperfect fixtures will not be acceptable.
3. Factory grind back and bases of fixtures smooth.
4. Enamelware to be white cast iron with acid-resisting enamel.
5. Unless otherwise specified, water closets to have a waste passage to pass a 2-1/2 inch ball minimum. Bolt water closets to flanges with a 1-inch thick rubber foam gasket.
6. Fixture trim and exposed metal items shall be polished chrome-plated unless otherwise noted, and pipes passing through walls shall have polished chrome-plated escutcheon plates. All stainless steel shall be satin brushed (US32D) finish unless noted otherwise.
7. Fixtures shall be free from imperfections, true as to line, angles, curves, and color; smooth, watertight and practically noiseless in operation.
8. Exposed Pipe, Trim Including Fittings, Traps, Escutcheons, Valves, Valve Handles, and Accessories: Above and Below Fixtures:

a. Polished chrome plated CP brass.
b. Set-screw cast brass escutcheons for piping.

c. Traps: Cast brass with cleanout plugs.
d. Covering tubes not permitted.
e. Provide Hudee stainless steel rims, as applicable, for non-selfrimming counter mounted fixtures.

9. Supply Fixtures With:

a. Renewable seats or replaceable internal units.
b. Compositional washers.

2.2 MANUFACTURERS

A. Manufacturers for fixtures and trim:

1. Fixtures (vitreous china): Toto, Zurn, Kohler, American-Standard
2. Sinks (stainless steel): Just, Elkay, Kohler, American Standard
3. Floor drains, carriers, etc.: Zurn, J.R. Smith, Josam
4. Sink and lavatory trim: Zurn, Kohler, Delta
5. Electric water coolers: Haws, Elkay, or Equal
6. Flush Valves: Water closets and urinals shall be manual dual flush type
7. Shower fixtures: Delta, Zurn, Kohler

2.3 FLUSH VALVE PLUMBING FIXTURES

A. Provide vacuum breakers and angle control-stop valves for each flush valve. Vacuum breakers shall conform to ASSE 1001. Exposed to view and pressure containing components of flush valves, vacuum breaker, angle control-stop valve, tail pieces, slip nuts, escutcheon plates, and wall plates shall be chromium-plated copper alloy or polished stainless steel. Water flushing volume of the flush valve shall not exceed the gallons per flush required below, and is factory set as required by the fixture. Mount flush valves not less than 11 inches above neither the fixture nor more than 44 inches above the floor for ADA accessible fixtures. For ADA accessible water closets, controls for flush valves shall be located on the wide side of the toilet area.

B. Water Closets (WC): See plumbing fixture schedule on Drawings

2.4 LAVATORIES AND SINKS

A. Lavatories (L): See plumbing fixture schedule on Drawings

B. Sinks (S): See plumbing fixture schedule on Drawings

C. Service Sinks (SS): See plumbing fixture schedule on Drawings

2.5 SHOWERS

A. SHOWERS (SH): See plumbing fixture schedule on Drawings

2.6 PLUMBING FIXTURE FAUCETS, TRIM AND FITTINGS

A. ASME A112.18.1M for plumbing fixture faucets. The finish of plumbing fixture faucets, trim, valves, and fittings exposed to view shall be chromium-plate or polished stainless steel except as modified

herein. Bolts, nuts, and screws shall be copper alloy or stainless steel. Provide ball valves or 4 turn angle valve connections in each supply to each faucet; chromium-plated finish is not required if not exposed to view. Supply risers shall be chrome plated copper flex riser style smooth surface. Faucets shall be the washerless type and shall have threaded type end connections, coupling nuts, or union connections. Provide washers and lock nuts to secure faucets to lavatories and sinks.

B. Traps: Provide P-traps for each plumbing fixture that do not have integral traps. Provide 1.5 inch brass adjustable P-traps, 16 gauge tubing with slip nuts and gaskets; chromium-plated finish is required if exposed.

C. Continuous Waste: Tubular brass, 0.045-inch wall thickness, with slip-joint inlet and size to match equipment.

D. Indirect Waste: Tubular brass, 0.045-inch wall thickness, with slip-joint inlet and size to match equipment.

E. FHB-1 Freezeproof Hose Bibb: Nonfreeze concealed-outlet wall hydrants, ASSE 1019, self-drainable with flush-mounting box with cover, integral nonremovable hose-connection vacuum breaker, cast bronze casing and operating rod to match wall thickness, concealed outlet, and wall clamp. ASME A112.21.3M, key-operation hydrant with pressure rating of 125 psig. Inlet NPS 3/4 threaded or solder joint. Outlet ASME B1.20.7, garden hose threads. Operating keys, one with each key-operation hydrant.

1. Classification: Type A, for automatic draining with hose removed or Type B, for automatic draining with hose removed or with hose attached and nozzle closed.
2. Box and Cover Finish: polished nickel bronze.
3. Manufacturer: Woodford B65, Josam, Watts, Zurn

F. Hose Bibbs: Bronze body with replaceable seat disc complying with ASME A112.18.1M for compression-type faucets. Include NPS 1/2 or NPS 3/4 threaded or solder-joint inlet, of design suitable for pressure of at least 125 psig; integral [or field-installed,] nonremovable, drainable hose-connection vacuum breaker; and garden-hose threads complying with ASME B1.20.7 on outlet.

1. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
2. Finish for Service Areas: Chrome or nickel plated.
3. Finish for Finished Rooms: Chrome or nickel plated.
4. Operation for Equipment Rooms: Operating key.
5. Operation for Service Areas: Operating key.
6. Operation for Finished Rooms: Operating key.
7. Include operating key with each operating-key hose bibb.
8. Include wall flange with each chrome- or nickel-plated hose bibb.

2.7 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Guard: Manufactured, plastic covering or enclosure for hot- and cold-water supplies and trap and drain piping and complying with ADA requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water soil and for waste piping systems and supports to verify actual locations and sizes of piping connections and that locations and types of supports match those

indicated, before plumbing fixture installation. Use manufacturer's roughing-in data if roughing-in data are not indicated.

B. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Include supports for plumbing fixtures according to the following:

1. Heavy-Duty Chair Carriers: For accessible lavatories and other fixtures where indicated.

B. Include fitting insulation kits for accessible fixtures according to the following:

1. Lavatories: Cover Hot-and cold-water supplies, stops and handles, drain, trap, and waste to wall.
2. Fixtures with Offset Drain: Cover hot-and cold-water supplies, offset drain, trap, and waste to wall.
3. Other Fixtures: Cover exposed fittings below fixture.

3.3 FIXTURE INSTALLATION

A. Assemble fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. For wall-hanging fixtures, install off-floor supports affixed to building substrate.

1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.

C. Install back-outlet, wall-hanging fixtures onto waste fitting seals and attach to supports.

D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate. Closet flanges shall be anchored to the floor per manufacturer’s recommendations.

E. Install wall-hanging fixtures with tubular waste piping attached to supports.

F. Install counter-mounting fixtures in and attached to casework.

G. Install fixtures level and plumb according to manufacturers' written instructions and roughing-in drawings.

H. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

1. Exception: Use ball, gate, or globe valve if stops are not specified with fixture.
2. Refer to Section 23 05 23 - Valves for general-duty valves.

I. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

J. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.

K. Install toilet seats on water closets.

L. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

M. Install water-supply, flow-control fittings with specified flow rates in fixture supplies at stop valves.

N. Install faucet, flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

O. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.
2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

P. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Refer to Section 23 05 00 - Basic Mechanical Materials and Methods for escutcheons.

Q. Seal joints between fixtures and walls, floors, and counters using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Refer to Division 7 Section "Joint Sealants" for sealant and installation requirements.

3.4 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 and Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect water supplies from water distribution piping to fixtures.

C. Connect drain piping from fixtures to drainage piping.

D. Supply and Waste Connections to Plumbing Fixtures: Connect fixtures with water supplies, stops, risers, traps, and waste piping. Use size fittings required to match fixtures. Connect to plumbing piping.

E. Supply and Waste Connections to Fixtures and Equipment Specified in Other Sections: Connect fixtures and equipment with water supplies, stops, risers, traps, and waste piping specified. Use size fittings required to match fixtures and equipment. Connect to plumbing piping.

F. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

G. Arrange for electric-power connections to fixtures and devices that require power. Electric power is specified under Division 26.

3.5 FIELD QUALITY CONTROL

A. Verify that installed fixtures are categories and types specified for locations where installed.

B. Check that fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

E. Install fresh batteries in sensor-operated mechanisms.

3.6 ADJUSTING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Adjust water pressure at faucets, and flushometer valves to produce proper flow and stream.

C. Replace washers and seals of leaking and dripping faucets and stops.

3.7 CLEANING

A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:

1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
2. Remove sediment and debris from drains.

3.8 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 40 00

SECTION 23 00 10

MECHANICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. These heating, ventilating and air conditioning (HVAC) provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.2 DIVISION OF WORK

A. This section delineates the division of work between Divisions.

B. Consult all other Sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable installation. This section is provided to assist the Contractor in coordination of work scope but shall not be construed to limit Contractor's scope of work encompassed by the contract documents.

C. Coordination with other Trades: The following table is intended to assist the Contractors in coordinating the scope of work between Division 23 (Indicated as 23 in table), Section 23 09 00 Energy Management & Control System (indicated as 23C), and other Divisions as indicated. However, the General Contractor is ultimately responsible for coordination among his subcontractors regardless of what is listed in this Section.

INTERFACE/RESPONSIBILITY MATRIX						
System		Division under which the following is specified				Remarks
		Equipment	Installation	Power Wiring [1]	Control & Interlock Wiring [1]	
A. FIRE SPRINKLER SYSTEM						
1.	Flow switches	21	21	26	26	
2.	Valve monitors	21	21	26	26	
3.	Post indicating valves	2	2	26	26	
B. FIRE & LIFE SAFETY SYSTEMS						
1.	Fire alarm and smoke control systems	26	26	26	26	
2.	Duct mounted & in-direct mounted smoke detectors	26	23	26	26/ 23C	[2]
3.	Other smoke detectors	26	26	26	26	
4.	Smoke dampers with electric actuators	23	23	26	26	
5.	Smoke and fire damper end switches	23	23	26	26	[3]
C. MECHANICAL EQUIPMENT						

INTERFACE/RESPONSIBILITY MATRIX						
	System	Division under which the following is specified				Remarks
		Equipment	Installation	Power Wiring [1]	Control & Interlock Wiring [1]	
1.	Variable Refrigerant Flow (VRF) System (includes; outdoor units, indoor units, branch controllers, refrigerant piping, controls, etc.)	23	23	26	23/ 23C	[4]
2.	Chillers	23	23	26	23C	[12], [13]
3.	Boilers	23	23	26	23C	[12], [14]
4.	Energy recovery ventilator	23	23	26	23C	[7]
5.	Outdoor air handling unit	23	23	26	23/ 23C	[8]
6.	Air handling units	23	23	26	23C	
7.	Remote condenser	23	26	26	23C	
8.	Motors, 3 phase	23	23	26	-	
9.	Motor starters, 3 phase	23	23	26	23C	[5]
10.	Motors, 1 phase	23	23	26	23C	[6]
11.	Other powered equipment	23	23	26	23C	
12.	Disconnects	26/23	26/23	26	26	[9]
13.	Factory installed Variable Frequency Drives (VFDs)	23	23	26	23C	
14.	Field installed VFDs	23	23	26	23C	
15.	Computer-Room Air-Conditioners	23	23	26	23C	[15]
16.	Water treatment systems - closed systems	23	23	26	-	
17.	Unit heaters	23	23	26	23C	
D. ENERGY MANAGEMENT & CONTROL SYSTEM						
1.	Central control workstations & servers	23C	23C	26	23C	
2.	Control system network backbone	23C	23C	23C	23C	
3.	Control panels	23C	23C	23C	23C	[11]
4.	Control devices	23C	23C	23C	23C	
7.	Lighting occupancy sensors	26	26	26	26	
8.	Daylighting sensors and controls	26	26	26	26	
9.	Network IT WAN/LAN drop	-	26	26	23C	[16]
E. PLUMBING SYSTEMS						
1.	DHW heater venting and combustion air	23	23	-	-	
2.	Condensate drains including traps, primers	22	22	-	-	[17]
3.	Condensate pumps	23	23	23	-	
4.	Make-up water to hot/chilled/condenser water including backflow prevention	22	22	-	-	[18]
5.	Natural gas connections, pressure reducing station, gages	22	22	-	-	[19]
6.	Gas and water flow meters	23C	22	23C	23C	
7.	Recirculation pumps or heat tape	22	22	26	23C	
8.	Pipe gauges, thermometers, test plugs	22	22	-	-	
9.	Self-powered valves, pressure relief valve,	22	22	-	-	

INTERFACE/RESPONSIBILITY MATRIX						
	System	Division under which the following is specified				Remarks
		Equipment	Installation	Power Wiring [1]	Control & Interlock Wiring [1]	
	liquid level controllers, etc.					
10.	Sensor wells, meters and other pipe-mounted control devices	23C	22	23C	23C	
11.	Test plugs	22	22			[20]
F. HVAC HYDRONIC SYSTEMS						
1.	Pipe gauges, thermometers, test plugs	23	23	-	-	
2.	Self-powered valves, refrigerant powered head pressure control valves, pressure relief valves, liquid level controllers, etc.	23	23	-	-	
3.	Relief valve vent piping, equipment drain piping, etc. from equipment to floor drains/sinks	23	23	-	-	
4.	Automatic isolation and control valves	23C	23	23C	23C	
5.	Sensor wells, meters and other pipe-mounted control devices	23C	23	23C	23C	
6.	Test plugs	23	23			[20]
G. HVAC SHEET METAL						
1.	Duct mounted sensors	23C	23	23C	23C	
2.	Filter gauges	23C	23C	-	-	
4.	Control dampers	23	23	23C	23C	[22]
5.	Control damper actuators	23C	23C	23C	23C	[22],[23]
H. HVAC TERMINAL BOXES						
1.	Terminal box control transformer panel	23C	23C	23C	23C	[11]
2.	Terminal box with damper	23	23	-	-	
3.	Digital controller and damper actuator	23C	23	23C	23C	[25]
4.	Air-flow measurement pickup and piping	23	23	-	-	
5.	Air-flow measurement transducer and wiring	23C	23C	23C	23C	[25]
6.	Wall sensor module	23C	23C	23C	23C	
9.	HW control valve and actuator	23C	23	23C	23C	
G. MISCELLANEOUS						
1.	Trenching, backfilling, boring, soil compaction, saw-cutting, patching and paving for underground piping	31	31	-	-	
2.	Roofing, including cant strips and counterflashing at the sides of roof curbs	7	7	-	-	
3.	Thermal and acoustical insulation in and on partitions and ceilings	7	7	-	-	
4.	Louvers	23	8	-	-	
5.	Combination louver/damper	23	23	23C	23C	
6.	Concrete housekeeping pads, curbs, pedestals and inertia base fill etc. for	3	3	-	-	[27]

INTERFACE/RESPONSIBILITY MATRIX						
	System	Division under which the following is specified				Remarks
		Equipment	Installation	Power Wiring [1]	Control & Interlock Wiring [1]	
	equipment					
7.	Equipment, ductwork, and piping steel supports and frames	23	23	-	-	
8.	Painting of exposed piping, HVAC equipment, etc.	23	23	-	-	
9.	Fire-stopping around pipe and duct penetrations in floor and walls	23	23	-	-	
10.	Framing of walls and ceilings to accept air outlets, fire dampers, etc.	9	9	-	-	[29]
11.	Ceiling and wall access doors	23	8	-	-	[30]
12.	Rooftop unit curbs	23	23	-	-	[28]

NUMBERED REMARKS::

[1] Wiring includes raceway, fittings, wire, boxes and related items, all voltages

[2] Wiring of interlock of duct smoke detectors to shut off supply fans upon detection of smoke is specified under Section 23 09 00 Energy Management & Control System. All other smoke control/fire alarm related control wiring is specified under Division 26 Electrical.

[3] End switch required only for monitoring position of damper. See HVAC drawings and Division 23 smoke and fire damper specifications to see where required.

[4] VRF system network wiring, remote control wiring specified under Division 23 HVAC. VRF system BACnet communication gateway specified under Division 23 HVAC. Division 23 Contractor and VRF system vendor shall provide all necessary technical assistance to Division 23 Contractor in mapping across VRF system points to the EMCS.

[5] Motor starter control devices such as HOA switches and 120V control transformers are specified under Division 23 HVAC.

[6] Single phase 120V motors with integral motor overload protection specified under Division 23 HVAC. Line voltage control device such as thermostat or switch specified under 23 09 00 Energy Management & Control Systems; wiring and conduit between control device and motor specified under Division 26 Electrical.

[7] ERV field installed controls are specified under Section 23 09 00 Energy Management & Control Systems.

[8] BACnet communication card/gateway between the EMCS and OAU control panel specified with OAU under Division 23 HVAC. Installation of factory provided control devices and controllers (to be field installed) is specified under 23 09 00 Energy Management & Control System. OAU vendor to provide all necessary technical assistance to Division 23C Contractor in mapping across OAU points to the EMCS.

[9] Disconnects are specified under Division 23 HVAC where specifically called for in equipment schedules or specifications to be factory installed with equipment. Otherwise all disconnects are specified under Division 26 Electrical.

[11] Power to all EMCS control panels is specified under Section 23 09 00 Energy Management & Control Systems, coordinate with Division 26 contractor for available circuits.

[12] Factory installed starters and variable speed drives are specified under Division 23 HVAC. Prewired control panel is specified under Division 23 HVAC, single point power connection (unless otherwise noted on drawings) specified by Division 23 HVAC. Packaged mechanical

INTERFACE/RESPONSIBILITY MATRIX					
System	Division under which the following is specified				Remarks
	Equipment	Installation	Power Wiring [1]	Control & Interlock Wiring [1]	
equipment specified with BACnet communication cards/gateways shall be provided by Division 23 HVAC. Packaged mechanical equipment vendor to provide all necessary technical assistance to Division 23C Contractor in mapping across equipment points to the EMCS.					
[13] Chilled water flow switches (where required by chiller manufacturer) specified under Division 23 HVAC; wiring and conduit specified under Section 23 09 00 Energy Management & Control System; bi-directional (read/write) BACnet communication card/gateway between the EMCS and chiller control panels specified with chiller under Division 23 HVAC; chiller vendor to provide all necessary technical assistance to Division 23C Contractor in mapping across chiller points to the EMCS					
[14] BACnet communication card/gateway between the EMCS and boiler control panel specified with boiler under Division 23 HVAC; boiler vendor to provide all necessary technical assistance to Division 23C Contractor in mapping across boiler points to the EMCS					
[15] BACnet communication card/gateway between the EMCS and computer-room air-conditioner control panel specified with equipment under Division 23 HVAC; unit vendor to provide all necessary technical assistance to Division 23C Contractor in mapping across boiler points to the EMCS					
[16] Network IT LAN drop at required EMCS location(s) specified under Division 26. It shall be the responsibility of the Division 23C contractor to communicate required IT LAN drop location(s) with Division 26. Connection(s) to Owner's IT LAN and termination to wall jack specified under Section 230900 Energy Management and Control System.					
[17] Coordinate piping from condensate pans to the sewer system including trap and final connections is specified under Division 22 Plumbing. Piping from auxiliary drain pans where provided at air handling equipment in furred spaces is specified under Division 23 HVAC.					
[18] Domestic make-up water, including shut-off valve, backflow prevention, rough-in and final connection to hot water, chilled water, condenser water and any other HVAC systems requiring make-up water is specified under Division 22 Plumbing. Pressure reducing valves with bypass valve and shut-off valves at each closed-system make-up water connection are specified under Division 23 HVAC.					
[19] Pressure reducing valves to deliver gas at the pressure required by mechanical equipment, including final connections and shut-off cock, is specified under Division 22 Plumbing. All other gas control and regulating devices provided under the Section providing the gas-fired equipment. Venting of gas regulating devices and other equipment gas-train devices where required is specified under Division 22 Plumbing.					
[20] Test plugs mounted adjacent to all temperature well (for calibration) specified under Division 23					
[21] Not used					
[22] Duct access doors required for access to control devices where required specified under Division 23 HVAC.					
[23] Actuators for motorized dampers supplied with fans or hood where scheduled on HVAC drawings are specified under Division 23 HVAC, mounted and wired.					
[24] Not used					
[25] Section 23 09 00 Energy Management & Control Systems contractor to coordinate with Division 23 HVAC contractor to have controller and actuator factory mounted.					
[26] Not used					
[27] Shop drawings showing dimensions of all curbs, bases, etc. specified under Division 23 HVAC.					

INTERFACE/RESPONSIBILITY MATRIX					
System	Division under which the following is specified				Remarks
	Equipment	Installation	Power Wiring [1]	Control & Interlock Wiring [1]	
[28] Shims to level curb specified under Division 6. Curb insulation specified under Division 23 HVAC. All roof curbs shall be approved by roofing manufacturer. [29] Additional T-bar or spline and cut ceiling tile as required to accept air outlets is specified under Division 9. [30] Dimensioning of access doors to mechanical equipment and coordination with Architect and Division 8 specified under Division 23.					

D. HVAC/Electrical Design Coordination

1. The power ratings of motors and other HVAC equipment and the electrical characteristics of electrical systems serving them, as specified herein and indicated on the Drawings, have been established as minimums which will allow that equipment to satisfactorily function while producing the required capacities. These power ratings include a safety factor deemed appropriate to accommodate common differences between design parameters and field construction practices. Under no circumstances shall equipment with power ratings less than those indicated on the Drawings or specified herein be provided.

2. Reasonable efforts have been made to coordinate the electrical requirements of the HVAC equipment with the electrical systems serving that equipment. Differences among manufacturers of HVAC equipment make it impossible to produce a single electrical design which will satisfy the varying electrical requirements of those manufacturers. Consequently, the Contractor shall coordinate the electrical requirements of the HVAC equipment actually furnished on this Project and provide the electrical systems required by that equipment. This coordination effort shall be completed prior to the installation of either the HVAC equipment or the electrical systems serving that equipment. Electrical system revisions required to coordinate with the HVAC equipment actually furnished shall be provided at no additional cost to the Owner.

E. Related Work Specified Elsewhere

1. Utilities five feet beyond building line unless noted otherwise: See Division 33 Utilities
2. Structural steel (except as specified herein): See Division 5 Metals.
3. Grates and railings protecting mechanical shaft and other floor openings: see Division 5 Metals.
4. Miscellaneous lumber and framing work, such as for framing, soffits and support of mechanical materials and equipment. See Division 6 Wood, Plastics, and Composites.
5. Undercutting of doors and door louvers: See Division 8 Openings.
6. Painting (except as specifically indicated): See Division 9 Finishes
7. Fire resistant enclosures around ducts and at fire dampers such as at the bottoms of shafts. See Division 9 Finishes.
8. Electric power, interlock and control wiring, except as specified herein.
9. Installation of starters, contactors, thermal overload switches, and remote push buttons, except as specified herein.
10. Fire alarm initiating devices, control modules, and monitoring modules.
11. Curbs, flashing, and pitch pockets for equipment on roof, except as specified herein.

12. Manhole construction.
13. Louvers and screens, except as specified herein.
14. Concrete equipment pads.

1.3 REFERENCE STANDARDS

A. Reference to codes, standards, specifications and recommendation of technical societies, trade organizations and governmental agencies shall mean that latest edition of such publications adopted and published prior to submittal of the bid. Such codes or standards shall be considered a part of this Specification as though fully repeated herein.

B. Work shall be performed in accordance with all applicable requirements of the latest edition of all governing codes, rules and regulations including but not limited to the following minimum standards, whether statutory or not.

C. Requirements of Regulatory Agencies

1. In accordance with the requirement of Division 1 General Requirements.
2. Nothing in contract documents shall be construed to permit work not conforming to current and applicable laws, ordinances, rules and regulations.
3. Where contract documents exceed requirements of applicable laws, ordinances, rules and regulations, comply with documents establishing the more stringent requirement.
4. It is not the intent of contract documents to repeat requirements of codes except where necessary for completeness or clarity.
5. Comply with the Safety Orders issued by OSHA and any other safety, health or environmental regulations of the State of Mississippi and any districts having jurisdictional authority. Where an omission or conflict appears between OSHA requirements and the Drawings and Specifications, OSHA requirements shall take precedence.
6. Applicable codes as listed below, in addition to others specified in individual sections.

    a. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) – Standard 90.1-2010 “Energy Standard for Buildings Except Low-Rise Residential Buildings”.
    b. International Building Code (IPC) – 2012.
    c. International Mechanical Code (IMC) – 2012.
    d. International Plumbing Code (IPC) - 2012.
    e. NFPA 1 – 2012, Fire Code
    f. NFPA 70 - 2008, National Electric Code
    g. NFPA 90A - 2009, Installation of Air Conditioning and Ventilating Systems

D. Published specifications, standards, tests or recommended method of trade, industry or governmental organizations as listed below apply to all work in Division 23 HVAC, in addition to other standards which may be specified in individual sections.

E. All base material shall meet ASTM and ANSI standards.

F. All Gas Fired Devices: Comply with standards and bear label of AGA.

G. All Pressure Vessels, Relief Valves, Safety Relief Valves and Safety Valves: Comply with standards, ASME stamped.

H. All Electrical Devices and Wiring

    a. Conform to standards of NEC
    b. All devices UL or ETL listed and identified

I. Guidelines and Standards: The latest edition of guidelines and standards published by the following govern the Mechanical Systems and associated support system design. The systems shall be designed to meet or exceed these guidelines and standards.

AABC	Associated Air Balance Council
ADC	Air Diffuser Balance Council
AGA	American Gas Association
AMCA	Air Movement and Control Association, Inc.
ANSI	American National Standards Institute
ARI	Air Conditioning and Refrigeration Institute
ASC	Adhesive and Sealant Council
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASSE	American Society of Sanitary Engineers
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
AWS	American Welding Society
ETL	Interlek Semko (Formerly Electrical Testing Laboratories)
GISO	General Industry Safety Orders
HI	Hydraulic Institute
ICBO	International Conference of Building Officials
IEEE	Institute of Electrical and Electronic Engineers
NBS	National Bureau of Standards
NEBB	National Environmental Balancing Bureau
NEC	National Electric Code
NEMA	National Electrical Manufacturer's Association
NFPA	National Fire Protection Association
OSHA	Occupational Safety and Health Act
PDI	Plumbing and Drainage Institute
SMACNA	Sheet Metal and Air Conditioning Contractors National Association, Inc.
UL	Underwriter's Laboratories, Inc.

1.4 QUALITY ASSURANCE

A. Supply all equipment and accessories in compliance with the applicable standards listed in Paragraph 1.3C and with all applicable national, state and local codes.

B. All equipment and accessories shall be new and the product of a manufacturer regularly engaged in its manufacturer.

C. All items of a given type shall be the products of same manufacturer.

D. Workmanship, material and equipment shall be in accordance with Specifications and Drawings and in some instances the requirements exceed those required by codes and standards. Where not exceeded, the codes and standards shall be considered as absolute minimum requirements.

1.5 SUBMITTALS

A. No work may begin on any segment of this Project until the related submittals have been reviewed for conformance with the design intent and the Contractor has responded to all comments to the satisfaction of the Owner.

B. Submit drawings, product data, samples and certificates of compliance required as hereinafter specified. See also Division 1 – Shop Drawings, Product Data and Samples. Conditions in this Section take precedence over conditions in above referenced Section.

C. Submit no later than 35-days after signing of Contract, or as otherwise indicated by Architect. Submit a schedule indicating the proposed submission date of each submittal specified herein. Schedule shall anticipate the submittal review time, the possible need for resubmittals, and the time required for fabrication, shipping and integration into the construction sequence. Architect will advise of any conflicts in reviewing submittals that the proposed schedule presents.

1. Complete schedule of submittals for equipment and layout shop drawings. Allow 15-working days for review, unless Architect agrees to accelerated schedule.
2. List of all proposed substitutions: See Paragraph 1.7
3. Designate in schedule dates for submission and dates that reviewed shop drawings, product data and samples will be needed.
4. Provide submittals promptly in accordance with schedule and in such sequence as to cause no delay in work or in work of any other division.

D. Submit drawings, product data, samples and certificates of compliance required hereinafter specified.

1. See also Division1 Shop Drawings, Product Data and Samples. Conditions in this Section take precedence over conditions in above referenced Section.
2. Provide submittals promptly in accordance with schedule and in such sequence as to cause no delay in work or in work of any other division.
3. Submittals for each specification section shall be submitted in a single package. However, it is not required (nor desired) for all products to be submitted concurrently. Rather, submittals may be staggered based on schedule and required equipment release dates.
4. Allow 15-working days for review, unless the Architect agrees to accelerated schedule.
5. For substitutions, list any features or characteristics that are not strictly in compliance with specifications. If none are listed with the submittal, Contractor is guaranteeing that substituted product is functionally equivalent to the specified product in accordance with Paragraph 1.7.
6. Submittal reviews by the Architect are intended to assist the Contractor in complying with the design intent and requirements of the drawings and specifications. Reviews do not relieve the Contractor from compliance with these requirements and comments or lack thereof do not constitute approval of changes in these requirements.

E. Submission and Resubmission Procedure

1. Each submittal shall have a unique serial number that includes the associated specification section followed by a number for each sub-part of the submittal for that specification section, such as “SUBMITTAL 23 xx xx-01”.
2. Each resubmittal shall have the original unique serial number plus revision number such as “SUBMITTAL 23 xx xx-01 REVISION 1”.
3. Submit in format specified below. <u>Submissions made in wrong format will be returned without action.</u>

   a. Product Submittals: One copy in word-searchable electronic format per Paragraph 1.7A.4.b. Submit each specification section in a separate file named with unique name and number described above.
   b. Shop Drawings:

      1) One copy in electronic format .dwg, .dwf, or .pdf
      2) Two and only two copies on paper; any additional copies will not be returned without review

   c. Samples: As indicated in each specification section.

4. Architect will return a memo or mark-up of submittal with comments and connections noted where required.
5. Make corrections

    a. Revise initial submittal to resolve review comments and corrections.
    b. Indicate any changes that have been made other than those requested.
    c. Clearly identify resubmittal by original submittal number and revision number.

6. Resubmit revised submittals until no exceptions are taken.
7. Once submittals are accepted and stamped with no exceptions taken, provide

    a. Complete submittal of all accepted products in a single electronic file for each specification section.
    b. Photocopies for coordination with other trades, if and as required by the Contractor or Architect. Photocopies will serve as submittal for record and coordination.

F. Product Data Submittals

1. Contents

    a. Manufacturer's name and model number
    b. All information required to completely describe materials and equipment and to indicate compliance with drawings and specifications, including, but not limited to:

        1) Schedule when more than one of each item is covered by submittal
        2) Physical data, as applicable

            a) Dimensions
            b) Weight
            c) Finishes and colors
            d) Dimensional shop drawings

        3) Performance data, as applicable

            a) Rated capacities
            b) Performance curve
            c) Operating temperature and pressure
            d) Efficiency

        4) Flow and wiring diagrams as applicable
        5) Description of system operation

    c. All other pertinent information requested in individual sections

2. Format

    a. See Division 1 Shop Drawings, Product Data and Samples
    b. Identify clearly if submittal is substitution: Refer to Paragraph 1.8
    c. Reference specification Division, Section, Title, Paragraph and Page number or drawing number as applicable
    d. Use same nomenclature, legend, symbols and abbreviations on submittal material as used in contract documents

G. Coordination Drawings (Layout Shop Drawings)

1. Drawings shall be developed in format compatible with AutoCAD version 2010 or later.
2. Shop fabrication, coordination and installation drawings by the Contractor, are for the Contractor's use and shall be the Contractor's responsibility. These Drawings indicate where the Contractor intends to install the material and equipment as required by the Contract Documents. Do not submit shop fabrication documents unless requested. Use of contract documents or electronic files of contract documents for shop drawings is not sufficient.
3. Prepare and submit Shop Drawings for all Work deviating from that indicated on Contract Drawings. Clearly indicate deviations.
4. Review is not intended to verify dimensions or quantities, or to coordinate items shown on these Drawings. Review is for general conformance with design concept of the Project and general compliance with the information given in the Contract Documents. Contractor is responsible for dimensions, which shall be confirmed and correlated at the Jobsite, for fabrication processes and techniques or construction, for coordination of Work with that of all other trades and the satisfactory performance of Work.
5. Prepare and submit layout drawings, sections and details for following areas, minimum 1/4 inch scale:

    a. Mechanical equipment rooms.
    b. Equipment mezzanines.
    c. Congest areas (ceiling plenums, furrings, shafts, etc.).

6. Prepare layout shop drawings for all other areas; minimum 1/8 inch scale.
7. Layout drawings, as a requirement of Division 23 HVAC, shall indicate, superimposed, Work of all Sections involved in congested area, including ductwork, piping, electrical work, ceiling work, etc. Include all mechanical rooms. Identification of space problems without solutions is not acceptable.
8. Individual coordinated trade layout drawings are to be prepared for all deviations from design documents.
9. Contractor is to assure that each trade has coordinated work with other trades, prior to submittal where submittal is required.

    a. Include stamp on each submittal indicating that layout shop drawing has been coordinated:
    b. No layout shop drawing will be reviewed without stamped and signed coordinated assurance by Contractor.

10. All changes shall be clearly marked on each submitted layout drawing.
11. Drawings shall show work of all trades including but not limited to:

    a. Ductwork
    b. Piping: All Trades, including Fire Sprinklers and electrical installations
    c. Mechanical Equipment

        1) For fire and smoke dampers, tag each damper with a unique tag, starting with the tag on the drawings but adding a 4 digit number: xyzz where

            a) x= AC or AH unit that serves the damper
            b) y= floor
            c) zz= unique consecutive number

    d. Electrical Equipment
    e. Main Electrical conduits and bus ducts
    f. Equipment supports and suspension devices
    g. Structural and architectural constraints
    h. Show location of

1) Valves: manual and automatic
2) Air distribution devices (including sidewall devices with dimensions from finish floor elevation)
3) Exterior wall penetrations (include dimensions from reference elevation)
4) Piping specialties
5) Dampers: fire/smoke, automatic and manual volume, etc.
6) Access doors
7) Control and electrical panels
8) Others as required for clear coordination

12. Drawings shall indicate coordination with work specified in other Divisions which must be coordinated with work specified under Division 23 Mechanical, including, but not limited to:

    a. Irrigation equipment and piping
    b. Elevator equipment
    c. Building vacuum cleaning systems
    d. Pneumatic tube systems
    e. Cable trays
    f. Computer equipment
    g. Others as required

13. Equipment, control devices, dampers, valves, etc. requiring periodic maintenance or adjustment shall be included in coordination drawings. Specifically, the contractor shall verify and coordinate that access is provided to these components via lay-in ceiling or adequately sized access doors in walls, floors, ceilings, etc.
14. Submission of drawings

    a. See Division 1 – Shop Drawings, Product Data and Samples
    b. Submit to other trades for review of space allocated to all trades
    c. Revise drawings to compensate for requirements of existing conditions and conditions created by other trades
    d. Ensure that each trade has coordinated work with other trades
    e. Submit with stamps of General and all other applicable Contractors, initialed and signed certifying

        1) Review of submittal
        2) Verification of products, field measurements and field construction criteria
        3) Coordination of information in submittal with requirements of work of this Division and other divisions of Contract Documents

    f. No layout shop drawing will be reviewed without stamped and signed coordination assurance by the Contractor

1.6 COMPLETION REQUIREMENTS

A. Procedure

1. Until the documents required in this section are submitted and approved, the system will not be considered “accepted”
2. Before requesting acceptance of work, submit one set of Completion Documents for review and approval of Architect
3. After review, furnish quantity of sets indicated below to Owner
4. Format

    a. See Paragraph 1.6H for required format of Completion Documents

b. Paper copies; assemble in chronological order following alpha-numeric system used in specification, in heavy three-ring binder
c. Where electronic copies are called for in Paragraph 1.5H, comply with the following:

1) Provide in word-searchable electronic format; acceptable formats are MS Word, Adobe Acrobat (pdf) and HTML; submit other formats for review and approval prior to submission; scanned paper documents not acceptable
2) For submittals, provide separate file for each type of equipment
3) For Test & Balance report, provide separate files for each air handling system
4) Record drawings shall be in original format

B. Operating and Maintenance (O&M) Manual

1. See O&M Manual requirement herein

C. Record Drawings

1. Keep up-to-date during progress of job one set of Mechanical Drawings indicating the Record installation. In addition to changes made during course of Work, show following by dimension from readily obtained base lines

a. Fully illustrate all revisions made by all crafts in course of work
b. Include all field changes, adjustments, variances, substitutions and deletions, including all Change Orders
c. Exact location, type and function of concealed valves, dampers, controllers, piping, air vents and piping drains
d. Exact size, invert elevations and location of underground and under floor piping and ducts

1) Progress drawing set shall be available for inspection by Architect weekly
2) Update engineering design drawings and shop drawings to reflect revisions and additional data listed above at completion of Project

e. Original engineering design drawings will be provided to Contactor in electronic format compatible with AutoCAD version 2010 or later
f. Both shop and engineering design drawings shall be in format compatible with AutoCAD version 2010 or later
g. Drawings required to be updated if revisions were made

1) Floor plans
2) Shop drawings required by Paragraph 1.5G
3) Sections
4) Riser diagrams

D. Test and Balance Reports

1. See Section 23 05 93 – Testing, Adjusting and Balancing

E. Training Materials

1. See Training Materials requirements herein

F. Miscellaneous Certificates

1. Pressure and Leakage Test documentation/certificates
2. Training/Instruction completion certificates
3. Fire Marshal and Fire Department approvals of system, as required

4. Final inspection certificate signed by governing authorities
5. Warranty period, including start and end period
6. Field test report, including as applicable
7. Start up documents with date and name of technician
8. Piping pressure tests
9. Flex coupled pump alignment verification
10. Duct leakage and pressure tests
11. Drain pan drainage tests
12. Letters from manufacturers certifying their supervision of equipment installation and start-up procedures
13. Machinery vibration test reports
14. Certificates of sterilization/chlorination of plumbing systems
15. Others as specified herein and in other Division 23 – Mechanical sections

G. Format of Completion Documents

1. Provide the type and quantity of media listed in table below
2. Optical media shall be readable on Operator Workstation: See Section 23 09 00 – Energy Management & Control Systems
3. Where indicated in table, the electronic files shall be stored on the EMCS systems' Operator Workstation and hyperlinked to the front-end DDC controls graphics so operators can get the details of a certain device or balance reports by clicking on the link: See Section 23 09 00 – Energy Management & Control Systems

	Document	Paper (Binder or bound)	Electronic	
			Read only optical disk	Loaded Onto Operator Workstation
1	O&M Manuals	3	1	1
2	Record Drawings	2 Full size 2 Half size	1	1
3	Original issue EMCS software & manuals	1	1	1
4	Control sequences	1	1	1
5	Test and Balance Report	5	1	-
6	Miscellaneous Certificates	1	-	-
7	Warranty documents	1	-	-
8	Training materials	1 per trainee	1	1

1.7 SUBSTITUTIONS AND PRODUCT OPTIONS

A. Contractor's Options

1. For products specified only by reference standard, select product meeting that standard, by any manufacturer
2. For products specified by naming one product or manufacturer, submit request for substitutions for any product or manufacturer which is not specifically named in accordance with substitutions clause
3. Wherever catalog numbers and specific brands or trade names are used, they are used to establish standards of quality, utility and appearance required

1.8 DESCRIPTION OF BID DOCUMENTS

A. The Contractor shall be responsible for becoming thoroughly acquainted with all Contract Document contents that affect his work under this contract. Work required under this section includes, but is not limited to, all material, equipment transportation, services and labor required to complete the entire mechanical system as required by the Contract Documents.

B. The Specifications and the associated Drawings are complimentary and any portion of the work described in one shall be provided as if described in both.

C. Specifications

1. Specifications, in general, describe quality and character of materials and equipment.
2. Specifications are of simplified form and include incomplete sentences.
3. Words or phrases such as “The Contractor shall,” “shall be,” “furnish,” “provide,” “a,” “an,” “the,” and “all” have often been omitted from specifications for brevity.

D. Drawings

1. Drawings are diagrammatic in nature and, unless explicitly dimensioned, indicate approximate locations of apparatus, equipment, ductwork and piping. Changes in the location, and offsets, of same which are not shown on the Drawings but are necessary in order to accommodate building conditions and coordination with the work of other trades, shall be made during the preparation of coordination drawings and prior to initial installation, without additional cost to the Owner. Contractor shall install all system components in such a manner as to conform to the structure, avoid obstructions, preserve headroom, keep openings and passageways clear and maintain required servicing clearances without further instructions or additional cost to the Owner.
2. Scaled and figured dimensions are approximate and are for estimating purposes only. Indicated dimensions are limiting dimensions where noted. Duct and piping elevations are indicated for initial coordination; final requirements shall be determined by the Contractor after final coordination with other trades.
3. Before proceeding with work, check and verify all dimensions in field.
4. Assume all responsibility for fitting of materials and equipment to other parts of equipment and structure.
5. Make adjustments that may be necessary or requested in order to resolve space problems, preserve headroom and avoid architectural openings, structural members and work of other trades.
6. It is intended that all mechanical, plumbing and fire protection devices, piping, etc. be located symmetrically with all architectural elements. Refer to Architectural, Structural, Plumbing, Fire Protection, Mechanical and Electrical Specifications and Drawings in completing the required coordination.
7. The Contractor shall fully inform himself regarding any and all peculiarities and limitations of the spaces available for the installation of all work and materials furnished and installed under this Contract. He shall exercise due and particular caution to determine that all parts of his work are made readily accessible.
8. The Contractor shall study all drawings and specifications to determine any conflict with all applicable ordinances and statutes. Any discrepancies shall be reported to the Owner and any changes shall be shown on the as-built drawings with the additional work performed at no cost to the Owner.
9. The submittal of his bid shall indicate the Contractor has examined the site, drawings and specifications and has included all required allowances in his bid. No allowance shall be made for any error or omission resulting from the Contractor’s failure to visit job site and to review drawings and specifications. The Contractor’s bid shall include costs for all required drawings and changes as outlined above at no cost to the Owner.
10. Provide access to equipment and apparatus requiring operation, service or maintenance throughout the life of the system.

E. Do not use equipment exceeding dimensions indicated on drawings or equipment or arrangements that

reduce required clearances or exceed specified maximum dimensions.

F. If any part of Specifications or Drawings appears unclear or contradictory, apply to Architect for an interpretation and decision prior to as early as possible.

1 Do not proceed with work without the decision of the Architect.

1.9 ALTERNATES

A. Refer to Division 01 for possible effect on this Section.

1.10 DEFINITIONS

A. In addition to those defined in Division 1 Specification 01090 – Reference Standards, the following additional definitions shall apply. Definitions of term used in Division 23 HVAC may differ from those given in general and supplementary conditions and take precedence over them.

B. “Provide”: to furnish, supply, install and connect up complete and ready safe and regular operation of particular work referred to unless specifically noted.

C. “Supply”: to purchase, procure, acquire and deliver complete with related accessories.

D. “Work”: includes labor, materials, apparatus, controls, equipment services and all related accessories necessary for the proper and complete installation of complete systems.

E. “Piping”: includes pipe, tube, fittings, flanges, valves, controls, strainers, hangers, supports, unions, traps, drains, insulation and all related accessories.

F. “Wiring”: includes raceway, fittings, wire, boxes and all related accessories.

G. “Concealed”: not in view, installed in masonry or other construction, within furred spaces, double partitions, hung ceiling, trenches, crawl spaces, or enclosures.

H. “Exposed”: in view, not installed underground or “concealed” as defined above. Exposed piping, conduit, or ductwork is that which can be seen when the building is complete without opening or removing access doors or panels or accessible ceiling components.

I. “Control or Actuated Devices”: includes automatic sensing and switching devices such as thermostats, pressure, float, flow, electro-pneumatic switches and electrodes controlling operation of equipment.

J. “Indicated,” “shown” or “noted”: as indicated, shown or noted on drawings or specifications.

K. “Reviewed,” “approved,” or “directed”, as reviewed, approved or directed by or to Owner.

L. “Motor Controllers”: starter, variable speed drives and other devices controlling the operation of motors.

1.11 PROJECT CONDITIONS

A. Examine site related work and surfaces before starting work of any Section.

1 In case of conflict, the most stringent takes precedence.
2 For purposes of clarity and legibility, Drawings are essentially diagrammatic to extent that many

offsets, bends, unions, special fittings, exact locations of items are not indicated, unless specifically dimensioned. Especially note a number of required duct and pipe offsets to coordinate with structure and not shown. Coordinate dimensioned conditions, including invert elevations, with other trades prior to installation by any trade.

3 Exact routing of piping, ductwork, etc. shall be governed by structural conditions and other obstructions. Not all offsets in ductwork or piping are shown on the Drawings. Determine which item to offset or relocate. Maintain required slope in piping. Make use of data in Contract Documents. In addition, Architect reserves right, at no additional cost to the Owner, to make any reasonable change in location of mechanical items, exposed at ceiling or on walls, to group them into orderly relationships or increase their utility. Verify Owner's requirements in this regard prior to rough-in.

4 Take dimensions, location of doors, partitions, similar physical features from Architectural Drawings. Verify at Site under this Division. Consult Architectural Drawings for exact location of outlets to center with Architectural features, panels, etc., at the appropriate location shown on Mechanical Drawings.

5 Mounting heights of brackets, outlets, etc., as required.

6 Report to Architect, in writing, conditions which will prevent proper provision of this work.

7 Beginning work of any Section without reporting unsuitable conditions to Architect constitutes acceptance of conditions by Contractor.

8 Perform any required removal, repair or replacement of this work caused by unsuitable conditions at no additional cost to the Owner.

B. Coordination

1 Work out all "tight" conditions involving Work specified under this Division and work in other Divisions in advance of installation, if necessary, and before Work proceeds in these areas, prepare supplementary Drawings under this Division for review showing all Work in congested area. Provide supplementary Drawings, additional Work necessary to overcome congested conditions, at no additional cost to the Owner.

2 Conflicts: Difference or disputes concerning coordination, interference or extent of Work between sections shall be decided as follows:

a. Install mechanical and electrical systems in the following order of preference (those trades listed below another must reroute to resolve the conflict):

1) Drain piping required by code to be sloped
2) Supply air and exhaust air ductwork connected to fans
3) Electrical conduit 4 inches and larger
4) Domestic water piping
5) Fire sprinkler piping
6) Electrical conduit smaller than 4 inches
7) Transfer ducts and other ductwork not connected to fans
8) Control system piping and wiring

b. Continued disputes shall be decided by Contractor and Contractor's decision, if consistent with Contract Document requirements, shall be final.

3 Supervision: Personally or through an authorized and competent representative, constantly supervise the work from beginning to completion and, within reason, keep the same foreman and workmen on the Project throughout the Project duration.

4 Provide templates, information and instructions to other Divisions to properly locate hides and openings to be cut or provided.

5 The drawings govern in matters of quantity, and the specifications govern in matters of quality. In the event of conflict within the drawings involving quantities, or within the specifications involving quantities, or within the specifications involving quality, the greater quantity and higher quality shall apply. Such discrepancies shall be noted and clarified in the Bid. No additional

allowances will be made because of errors, ambiguities, or omissions that reasonably should have been discovered during the preparation of the Bid.

C. Equipment Rough-in

1 Rough-in locations shown on Mechanical Drawings for equipment furnished by the Owner and for equipment furnished under other Divisions are approximate only. Obtain exact rough-in locations from following sources.

a. From Shop Drawings for equipment provided under this contract
b. From Architect for Owner furnished-Contractor installed equipment
c. From existing equipment where such equipment is relocated under this Contract

2 Verify mechanical characteristics of equipment before starting rough-in. Where conflict exists between equipment and rough-in shown on Drawings obtain clarification from Architect and provide as directed by the Architect at no additional cost to the Owner.
3 Make final connections

1.12 CLEARANCE FROM ELECTRICAL EQUIPMENT

A. Piping, equipment or ductwork

1 Prohibited, except as noted in:

a. Electric rooms and closets over equipment, as restricted by NEC.
b. Telephone rooms and closets
c. Elevator machine rooms
d. Elevator shafts
e. Electrical switchboard room

2 Prohibited, except as noted, over or within 5 feet of:

a. Transformers
b. Substations
c. Switchboards
d. Motor control centers
e. Standby power plant
f. Bus ducts
g. Electrical panels
h. Variable frequency drives
i. Starters

B. Drip pans under piping

1 Where piping is located over any electrical equipment listed above; reroute piping if possible rather than use drip pan
2 28 gage galvanized steel
3 18 gage copper
4 Reinforced and supported
5 Watertight
6 With 1-1/4 inch drain outlet piped to floor drain or service sink

C. Electrical Working Space: Dimensions of the working space shall be a minimum depth of 42" horizontally, the width of the equipment or 30", whichever is greater, and the height of the equipment or 78", whichever is greater. Minimum depth shall be increased to 60" for equipment rated over 600 V.

1.13 PRODUCT DELIVERY, HANDLING AND STORAGE

A. See Division 1 Product Requirements

B. Deliver equipment in its original package to prevent damage or entrance of foreign matter. Provide materials on factory provided shipping skids and lifting lugs if required for handling. Provide protective coverings during construction.

C. Handle and ship in accordance with manufacturer's recommendations

D. Identify materials and equipment delivered to Site to permit check against approved materials list, reviewed with no exceptions taken Shop Drawings

E. Protect from loss or damage. Replace lost or damaged materials and equipment with new at no additional cost to Owner

F. Where necessary, ship in crated sections of size to permit passing through available space

1.14 PROJECT MANAGEMENT AND COORDINATION SERVICES

A. See Division 1 Project Coordination

B. Overview: Provide a project manager/engineer for the duration of the Project to coordinate the Division 23 HVAC work with all other trades. Coordination services, procedures and documentation responsibility shall include, but shall not be limited to the items listed in this section.

C. Review of shop drawings prepared by other subcontractors

1. Obtain copies of all shop drawings for equipment provided by others that require electrical service connections or interface with Division 23 HVAC work.
2. Perform a thorough review of the shop drawings to confirm compliance with the service requirements contained in the Division 23 HVAC contract documents. Document and discrepancy or deviation as follows:

a. Prepare memo summarizing the discrepancy
b. Provide a copy of the specific shop drawing, indicating via cloud, the discrepancy

3. Prepare and maintain a shop drawing review log indicating the following information

a. Shop drawing number and brief description of the system/material
b. Date of you review
c. Indication if follow-up coordination is required

D. Request for information (RFI)

a. See Division 1 Request for Information

1.15 REVIEW OF CONSTRUCTION

A. Work may be reviewed at any time by representatives of the Owner and/or Architect.

B. Advise Owner that work is ready for review at the following times

1. Prior to backfilling buried work.
2. Prior to concealment of work in walls and above ceilings.
3. When all requirements of Contract have been completed.
4. When testing will be performed.

C. Do not backfill or conceal work without Architect's consent.

D. Maintain on site, one set of Specifications and Drawings for use by Owner and/or Architect.

1. Include all change orders

E. Contactor is responsible for construction methods, sequences and safety precautions

1.16 SCHEDULE OF WORK

A. In accordance with Division 1 Contract Schedules and as follows:

1. Arrange work to conform to schedule of construction established or required to comply with Contract Documents
2. In scheduling, anticipate means of installing equipment through available openings in structure

B. Confirm in writing to Architect, within 35-days of signing of contract, anticipated number of days required to perform test, balance, and acceptance testing of mechanical systems. Schedule test balance and acceptance testing of mechanical systems as follows:

1. Submit for review at this time, names and qualifications of test and balancing agencies to be used
2. Test, Adjusting and Balancing must occur after completion of mechanical systems, including all control calibration and adjustment, and requires substantial completion of the building, including closure, ceilings, lighting, partitioning, etc.
3. Allow 21-days after test and balance for life safety testing (where applicable)

1.17 CUTTING AND PATCHING

A. See Division 1 Cutting, Patching and Matching

1.18 UTILITY CONNECTIONS

A. Utilities include but are not limited to, water, sanitary sewer, storm sewer, natural gas, fire protection water, Energy Management and Control System, etc.

B. See above.

C. Connect to utility company mains as required. Include all meters and other ancillary components required by serving utility company.

D. Connect to on-site piping mains

E. Contractor shall be responsible for payment of all service charges

F. Contractor shall be responsible for provisions for temporary utilities

G. (Others as required)

1.19 WARRANTY

A. In accordance with Division 1 Guarantees, Warranties, Bonds, Service & Maintenance Contracts and as follows.

B. Warranty all materials, equipment, apparatus and workmanship to be free of defective materials and faulty workmanship for a period of one year from and after date of acceptance of completed contract.

C. Provide new materials, equipment, apparatus and labor to replace that determined by Architect to be defective or faulty.

D. This guarantee also applies to services including instructions, adjusting, testing, noise, balancing, etc.

E. Furnish Manufacturer's standard Warranties in excess of one year.

F. Refrigerant compressors to have an additional four year parts warranty.

G. Nothing herein intends or implies that guarantee shall apply to work which has been abused or neglected by the Owner or the Owner's successor in interest.

1.20 PERMITS

A. Obtain all permits, certificates of inspections, patent rights and licenses that are required for the performing of this work by all laws, ordinances, rules and regulations or orders of any officer and/or body. Provide all notices necessary in connection therewith, and pay all fees relating thereto and all costs and expenses incurred on account thereof. No work shall be covered before inspection by the jurisdiction authorities and observation by the Architect.

1.21 CONTINUITY OF EXISTING SERVICE AND SYSTEMS

A. Schedule work so existing systems will not be interrupted. Obtain approval from the Owner and Architect at least 14 days prior to any utility interruption or connection.

B. Perform work at such time and in such a manner as to cause minimum inconvenience to the Owner and as approved by the Architect. No allowance will be made for lack of knowledge of existing conditions.

C. Connections to existing work:

1 Install new work and connect to existing work with minimum interference to existing facilities.
2 Connect new work to existing work in neat and acceptable manner. Restore existing disturbed work to original condition.

D. Removal and relocation of existing work.

1 Disconnect, remove or relocate piping, ductwork, conduit, and other work noted or required by

alterations, modifications or changes in existing construction.
2 Plug or cap affected active lines behind or below finished walls and/or floors.
3 Dispose of removed piping and material.

E. Special Traffic Requirements:

1 Maintain emergency and service entrances so they are usable for pedestrian, truck and emergency vehicles at all times.
2 Where trenches are cut, provide adequate bridging for above-mentioned traffic.

1.22 PROCEDURE OF WORK

A. Before any of the work within the scope of this contract is begun, the Contractor shall confer with the Architect and agree on a sequence of procedure for performing the work.

B. The Contractor is hereby cautioned that although he will be permitted to conduct his work during regular working hours (see exceptions below), his work shall be performed in such a manner so as not to interfere with the conduct of regular business unless approval for such interference has been obtained from the Owner and Architect. No reimbursement shall be made to the Contractor for losses sustained due to delays and interruptions of his work to accommodate the operation and business of the Owner.

C. Regular working hours exceptions: Extended utilities shutdowns and/or major equipment changeouts.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Listed “Acceptable Manufacturers” are those considered capable of manufacturing products or equipment conforming to detailed Specifications and Schedules, and as such, are invited to compete provided the offering is comparable in every respect to scheduled or specified products and actually conforms to the detailed Specifications and Schedule requirements. Listing herein as “Acceptable Manufacturers” does not imply “Accepted”, “Approved”, “Prior Approval” or any other connotation. All product offerings must be submitted for approval after Contract Award.

B. Alternate manufacturers as identified in each section will be considered under conditions specified herein.

C. Identify materials, equipment by manufacturer's name, nameplate data. Remove unidentified materials, equipment from Site.

D. Equipment specified by manufacturer's number shall include all accessories, controls, etc., listed in catalog as standard with equipment. Furnish optional or additional accessories as specified.

E. Where no specific make of material or equipment is mentioned, any first class product of reputable manufacturer may be used, provided it conforms to requirements of system and meets with acceptance.

F. Provide an authorized representative to constantly supervise work of this Division, check all materials prior to installation for conformance with Drawings, Specifications, reviewed Submittals and reviewed Shop Drawings.

G. Conform to conditions shown and specified. Coordinate with other trades for best possible assembly of combined Work. Relocate equipment when necessitated by failures to coordinate Work or to advise Architect of conflicts in writing.

H. Material and Equipment-General Requirements

1. New
2. Approved for use by State Fire Marshal and local building inspection department when applicable
3. Testing agency labeled or with other identification wherever standards have been established
4. Architect reserves right to reject items not in accordance with Specification either before or after installation
5. Comprised to render complete and operable systems; provide additional items needed to complete installation to realized design
6. Compatible with space allocated; modifications necessary to adjust items to space limitations at Contractor's expense
7. Installed fully operating and without objectionable noise or vibration
8. Design of mechanical systems is generally based on product of the first named manufacturers cited. Where systems for product installed necessitate modification of systems shown on drawings, Contractor is responsible for installation of systems appropriate to product installed.

I. Electrical Requirements

1. Electrical Work performed under Division 23 – Mechanical shall conform to requirements of Division 26 Electrical
2. Provide weatherproof devices and installation for out-of-doors work

2.2 PAINTING

A. Finish painting (other than factory applied) of mechanical equipment and associated piping and ductwork shall be as specified in Division 09 “Painting” Section(s). Provide touch up painting of prefinished mechanical products.

1 All equipment, ductwork, piping conduit and associated supports, attachments, hardware and connectors exposed to the weather shall be properly coated, painted or otherwise protected from corrosion caused by the elements (sun, wind, rain, snow, ice, etc.).

B. Surfaces shall be left clean, debris shall be removed, and equipment shall be furnished in prime coat finish ready for finish coats.

1 Piping, Ductwork and Equipment: Clean exterior of piping, ductwork and equipment removing rust, plaster and dirt by wire brushing. Remove grease, oil and similar materials by wiping with clean rags and suitable solvents.
2 Motors, Pumps and Other Items with Factory Finish: Remove grease and oil and leave surfaces clean and polished.

C. Cleaning operations may be supplemented by more detailed instructions in various other Sections of this Specification.

D. Paint for high temperature piping and equipment shall be high temperature resistant, designed for the temperatures at which the system will operate.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify that conditions are satisfactory for the installation of materials and equipment. Notify Architect if conditions are not satisfactory and do not commence work until conditions have been corrected.

3.2 INSTALLATION

A. Install materials and equipment in compliance with governing codes.

B. Use printed descriptions, specifications and recommendations of manufacturers as a guide for installation of Work. Follow in all cases where manufacturers' of articles used furnish directions covering points not specified or shown.

C. Equipment

1. See Division 1 – Supporting From Building Structure
2. Assemble equipment which is required to be field assembled under the direct supervision of the manufacturers' agent
3. Prior to the final acceptance submit letters from the manufacturers that equipment has been assembled under the direct supervision of the manufacturers' agent
4. Accurately set and level equipment with supports neatly placed and properly fastened
5. Properly fasten equipment in place with bolts to prevent movement
6. Coordinate the installation of equipment with openings in structure
7. Coordinate and fully dimension steel supports for mechanical equipment where shown on drawings with installing contractor
8. Provide all roof curbs for roof mounted fans, flues, piping and duct penetrations, etc.
9. Concrete

    a. Concrete work, include forming, steel bar reinforcing, cast-in-place concrete, finishing and grouting is specified under Division 3 Concrete
    b. Coordinate and fully dimension concrete housekeeping pads and curbs with installing contractor; dimensions shall be as required for structural requirements, see Section 23 05 48 – Mechanical Sound and Vibration Control
    c. Coordinate inertia base fill with installing contractor

D. Electrical

1. See Division 26 Electrical
2. Install electrical devices with code required clearances and access
3. Assist the electrical contractor in the proper connecting of all electrical wiring and equipment required for mechanical equipment

E. Sleeves, Chases and Concrete Inserts

1. Provide all required sleeves, chases, concrete inserts, anchor bolts, etc.
2. Sleeves, chases are prohibited in structural members, except where shown or as directed by Architect in writing
3. Embed no piping in concrete or masonry

F. Waterproof Construction

1. Comply with Division 7 – Thermal and Moisture Protection
2. Include membrane clamps, sheet metal flashing, counter flashing, caulking and sealant as

required for waterproofing of mechanical penetrations and sealing penetrations in or through fire walls, floors, ceiling slabs and foundation walls

3. All penetrations through vapor barriers at slabs on grade shall be taped and made vapor tight
4. Provide galvanized sheet metal weather protection canopies, hoods or enclosures over all out-of-doors equipment, the operation or maintenance of which would be impaired by rain water; this requirement applies to damper operators and bearing, damper motors, controls and instruments; see other Sections in this Division for application of this requirement to motors, drive, ducts and fans

G. Restoration of Damage

1. Repair or replace, as directed by Architect, materials and parts of premises which become damaged
2. Remove replaced parts from premises at no additional cost to the Owner

H. Review architectural drawings and coordinate with Architect and other contractors to be sure that all architectural shafts, plenums, rated duct enclosures etc. required for mechanical systems are properly located and dimensioned.

I. Access Panels and Doors

1. Product specified under Section 23 05 00 – Basic Mechanical Materials and Methods

   a. Coordinate size requirements and exact location with Contractor who will install access doors
   b. Minimum Sizes: 18 inches by 18 inches unless otherwise shown on Drawings or approved by Architect

2. Provide where shown, or required by Regulatory Agencies, for access of all concealed equipment such as terminal units, valves, fire/smoke dampers, etc., for Mechanical Work:

   a. Equipment shall be located wherever practical over accessible ceilings or rooms to avoid access doors
   b. Access doors shall not be used solely for access to balancing dampers; use instead remote control devices specified under Section 23 33 00 – Duct Accessories

J. Openings

1. Coordinate and fully dimension all openings in walls, floors, roofs and structural elements required for mechanical work
2. Provide all required fire-stopping around pipe, duct and other penetrations required for mechanical work in rated partitions where required by code
3. Fire damper openings: Contractor shall provide damper UL installation requirements to contractor installing partitions to ensure construction complies with listing
4. Air outlet openings

   a. Contractor shall coordinate exact locations of air outlets in floors, walls and ceilings with contractor installing partition
   b. Contractor shall coordinate additional T-bar or spline required to accept air outlets with contractor providing and installing ceiling and associated materials

3.3 PROTECTION OF EQUIPMENT AND MATERIALS DURING CONSTRUCTION

A. See Division 1 – Product Requirements

B. Provide protective covers, skids, plugs or caps to protect equipment and materials from damage or deterioration during construction.

C. Store equipment and material under cover, and off the ground or floors exposed to rain.

D. For outdoor storage, protective covers of 10 mil thick black sheet plastic shall be fitted over equipment and materials. Covers shall be reinforced to withstand wind and precipitation. Set equipment and material on skids or platforms of height to avoid damage or deterioration from spattering and ground water.

E. Protect coils against damage by installing temporary closure panels over exposed coil faces. Panels shall be minimum 24 gauge sheet metal or 0.375" plywood.

F. Completely cover motors and other moving machinery to protect from dirt and water during construction

G. Close open ends of fans, air valves, terminal units, energy recovery units, air handling units, and ductwork with temporary closures of sheet plastic taped in place.

H. Plug ends of pipes when work is stopped to prevent debris from entering the pipes.

I. Provide dust and debris protection for ductwork, coils, fans, equipment, motors, and bearings operated during construction up to date of substantial completion.

J. Cover open ends of exhaust and return ducts with temporary filter media while fan systems are operating.

K. Material, equipment or apparatus damaged because of improper storage or protection will be rejected

1. Remove from site and provide new, duplicate, material, equipment or apparatus in replacement of that rejected
2. Any porous materials, such as duct liner, insulation or flexible ductwork that becomes wet; for example, due to rain shall be replaced; drying is not sufficient (due to possible microbial contamination)

L. Perform Work in manner precluding unnecessary fire hazard

3.4 ADJUSTMENT

A. Preliminary Operation

1. Operate any portion of installation for Owner’s convenience if so requested by Architect. Such operation does not constitute acceptance of Work as complete but does constitute beneficial use, see Paragraph 1.19B. Cost of utilities, such as gas and electrical power, will be borne by the Owner if operation is requested by Owner.

B. Startup Service

1. Prior to startup, ensure that systems are ready, including checking the following: Proper equipment rotation, proper wiring, auxiliary connections, lubrications, venting fan balance, controls and installed and properly set relief and safety valves. See pre-function tests in Division 23 – Mechanical.
2. Start and operate all systems
3. Provide services of factory trained technicians for startup of major equipment and systems including boilers, chillers, fire pumps, etc.

4. Adjusting: See Section 23 05 93 – Testing, Adjusting and Balancing
5. Functional Testing: See Section 23 09 00 – Energy Management & Control Systems
6. Life Safety Testing

    a. Assist Division 26 Electrical contractor in testing fire alarm controls, including control of smoke dampers and shut-off of fan systems
    b. Correct any problems related to equipment supplied under Division 23 – Mechanical
    c. Complete the control matrix with details such as fan tags, FSD tags, etc. based on control matrix provided with Life Safety Report
    d. Assist Life Safety System commissioning agent in testing and commissioning Life Safety System
    e. Provide all tests, air balance and start-up personnel required to start and commissioning the system and for assisting the design/construct team in demonstrating system compliance with the local fire district and building department

C. Noise

1. Cooperate in reducing any objectionable noise or vibration caused by mechanical systems to the extent of adjustments to specified and installed equipment and appurtenances
2. Completely correct noise problems caused by failure to make installation in accordance with Contract Documents, including labor and materials required as a result of such failure, at no additional cost to the Owner

3.5 SPECIAL TOOLS

A. Furnish to Owner at completion of work

1. One set of any special tools required to operate, adjust, dismantle or repair equipment furnished under any section of this Division
2. Pressure gage and temperature sensor for piping test plug

3.6 CLEANING

A. Cleaning

1. See Division 1 – Closeout Procedures, Final Cleaning and Extra Material

B. Thoroughly clean equipment, fans, pumps, motors, piping and other materials under this Division free from all rust, scale and all other dirt before any covering or painting is done, or the systems put in operation; leave in condition satisfactory to Architect

C. At all times keep the premises free from accumulation of waste material and debris caused by his employees. At the completion of the Project, and at other times as Architect may direct, remove refuse from within and around the building. All tools, scaffolding and surplus materials shall also be removed, leaving the Site of his Work clean.

D. Completely cover all plumbing fixtures and all motors and other moving machinery to prevent entry of dirt and water during construction

E. Effectively cap all openings into ducts and pipes to keep moisture and foreign matter out during construction

F. Clean and polish identification plates

G. Clean equipment, ductwork, insulation, piping, conduit, and room surfaces from dust and dirt and maintain in a clean condition from date of substantial completion until final completion of work and corrective work.

3.7 PAINTING

A. Cleaning

1. See Division 1 – Closeout Procedures, Final Cleaning and Extra Material

B. Painting

1. Piping exposed to outdoors and where indicated elsewhere

   a. One coat primer
   b. Two coat alkyd oil paint, UV resistant for PVC piping, color as indicated
   c. Not required for copper, galvanized steel, or insulated piping

2. Steel hangers and supports exposed to outdoors

   a. One coat primer
   b. Not required for galvanized steel

3. Interior of ductwork and duct accessories, including insulation stick pins, at air outlets as far back as visible from occupied spaces

   a. Flat black

4. Marred surfaces of factory painted equipment

   a. Spot coat to match adjacent coat

5. Insulation exposed to sunlight: See Section 23 07 00 – Mechanical Insulation

C. Execution

1. Protect flooring and equipment with drip cloths
2. Paint and materials stored in location where directed
3. Oily rags and waste removed from building every night
4. Wire brush and clean off all oil, dirt and grease areas to be painted before paint if applied
5. Workmanship

   a. No painting or finishing shall be done with

      1) Dust laden air
      2) Unsuitable weather conditions
      3) Space temperature below 60 degrees Fahrenheit

   b. Pipes painted containing no heat and remain cold until paint is dried
   c. Paint spread with uniform and proper film thickness showing no runs, sags, crawls or other defects
   d. Finished surfaces shall be uniform in sheen, color and texture
   e. All coats thoroughly dry before succeeding coats are applied, minimum 24 hours between coats

f. Priming undercoat of slightly different color for inspection purposes

6. Piping continuously painted in all exposed areas

D. Paint

1. High gloss medium or long alkyd paint
2. Best grade for its purpose
3. Deliver in original sealed containers
4. Apply in accordance with manufacturer's instructions

E. Colors

1. Colors as directed by Architect unless specified herein.
2. Interior of ductwork as far back as visible from outside: flat black
3. Uncoated hangers, supports, rods and insets: dip in zinc chromate primer

F. Factory finish

1. Ceiling and wall mounted air outlets in acoustical tile ceilings: Baked white enamel
2. Aluminum air outlets that are not to be painted: anodized
3. Exposed fan coil units: baked enamel
4. Unit ventilators and unit heaters: baked enamel
5. Fans, pumps, compressors, tanks and like items
6. Air handlers, pumps, water heaters and like items where exposed

G. Marred surfaces of prime coated equipment and piping: spot prime coat to match adjacent coat

H. Properly prepare Work under this Division to be finish painted under Division 9 Painting

I. Provide moisture resistant paint for exterior painting and heat resisting paint for hot piping, equipment and materials

J. For the following, provide factory prime coat. Also, provide factory finish painting on each if not specified in Painting Division

1. Other air outlets

K. Paint all equipment out-of-doors and equipment supports with two coats of weather resistant enamel

L. Protect all finished surfaces of fixtures with heavy paper pasted thereon, or by other means, throughout the period of construction

M. Refinish Work supplied with final finish under this Division if damaged under this Division to satisfaction of Architect

3.8 FIELD QUALITY CONTROL

A. See Division 1 – Quality Control

B. Tests

1. Perform as specified in individual sections and as required by authorities having jurisdiction
2. Duration as noted

C. Provide required labor, material, equipment and connections
D. Furnish written report and certification that tests have been satisfactorily completed
E. Repair or replace defective work, as directed by Architect in writing, at no additional cost to the Owner
F. Restore or replace damaged work due to tests as directed by Architect in writing, at no additional cost to the Owner
G. Restore or replace damaged work of others, due to tests, as directed by Architect in writing, at no additional cost to the Owner
H. Remedial work shall be performed to the satisfaction of the Architect, at no additional cost to the Owner, including

    1. Work related to all Division 23 – Mechanical pre-functional tests
    2. Division 23 – Mechanical work related to Section 23 05 93 – Testing, Adjusting and Balancing

I. Remedial work shall include performing any tests related to remedial work an additional time at no additional cost to the Owner

3.9 EXISTING EQUIPMENT AND SYSTEMS

A. Material and equipment which has been removed and not accepted by the Owner shall become the property of the Contractor and shall be removed from the site.

B. Material and equipment which has been removed shall not be used in the new work, except as specified herein.

C. Where existing piping, ductwork and equipment is indicated on the Drawings, its size and location shall be verified.

3.10 EQUIPMENT AND INSTALLATION REQUIREMENTS

A. Air systems shall operate without aerodynamic noise generated from the faulty installation of ductwork or any component of the air distribution system.

B. Equipment shall be installed and connected as specified herein or indicated on the Drawings in accordance with the manufacturers' instructions and recommendations for this Project. Furnish and install auxiliary piping, water seals, valves, and electrical connections recommended by the manufacturer for operation.

C. Provide roughing, fittings, accessories, and connecting piping, and make final connections to all equipment. Coordinate carefully with equipment vendor prior to starting rough-in work.

D. In unfinished areas designated for future build-out, install piping, ductwork, conduit and equipment tight against the structure to maximize future ceiling height.

E. Motor quantities, sizes and equipment wattage ratings specified herein or indicated on the Drawings are the minimum requirements, unless noted otherwise. Motor quantities, sizes and equipment wattage ratings less than those specified herein or indicated on the Drawings are not acceptable. Larger motor sizes and equipment wattage ratings may only be provided if necessary to meet the prescriptive requirements specified herein or indicated on the Drawings. Where multiple motors or motor sizes or equipment wattage ratings larger than specified herein or indicated on the Drawings are furnished, provide and coordinate the corresponding increased number or capacity of feeders and other electrical equipment serving them, at no additional cost to the Owner.

F. Fans, drive sheaves, motors, and pumps shall be statically and dynamically aligned and balanced.

Each shall have steady state radial vibration levels which do not exceed the following:

Equipment	Peak-to-Peak Displacement (mils)
Fans, drive sheaves, and motors	
under 600 rpm	4
600 to 1000 rpm	3
1000 to 2000 rpm	2
over 2000 rpm	1
Pumps and motors	
over 1800 rpm	1
under 1800 rpm	2

G. Field-installed equipment controls or sensor wiring shall be installed in conduit. Low voltage control and sensor wiring shall be installed in conduits separate from line voltage control wiring and power wiring.

H. Where water connection sizes at equipment vary from the pipe size indicated on the Drawings, provide appropriate reducers/increasers directly adjacent to the pipe-equipment unions. Unless otherwise specified herein or indicated on the Drawings, the size of the valves and accessories dedicated to the equipment shall not be less than the pipe size to which they are connected.

I. Install all work so that parts requiring periodic inspection, operation, maintenance and repair are readily accessible and with the manufacturer's minimum required clearances provided. Minor deviations from the drawings may be made to accomplish this, but changes of substantial magnitude shall not be made without written approval.

1 Group concealed valves, controls and equipment requiring access, so as to be freely accessible through access doors.

3.11 EXCAVATION AND BACKFILLING

A. In accordance with the requirements of Division 31 for excavating, trenching, and backfilling.

B. Provide barricades, signs, lanterns, shoring, sheeting and pumping as part of Work in this Division as required to ensure safe conditions. Comply with OSHA requirements

C. Dig trenches straight, true to line and grade with sides and bottoms smoothed of any rock points

1 Excavate 6 inches below grade of pipe
2 Fill with sand properly packed
3 Support pipe for entire length on packed sand
4 Shape or pack bottom of trenches for pipe, duct fittings, hubs, couplings, etc., using templates to fit outside periphery of lower third of piping and ductwork
5 Provide piping outside building with 36-inch minimum cover from top of pipe to finished grade
6 Minimum width 16 inches

D. Dispose of all surplus excavation material and seepage water as directed by the Architect

E. Backfill

1 After piping has been installed, tested and approved, backfill all excavation, tamp and compact by compressed air tampers
2 Backfill to 6-inches above crown of pipe with unwashed sand, with remainder of trench back-

filled and mechanically tamped in 6-inch maximum layers of selected excavated materials, free from organic matter, rocks, etc. Provide 90-percent compaction in accordance with ASTM D 1557-58T; 95-percent compaction for trenches below building slabs.

F. In any asphalt or concrete paved areas, backfill only to subgrade level

G. When piping is installed, prior to backfilling, advise Architect; do not backfill without acceptances of Architect

H. Replace to original condition all paving, curbs, gutters, walks, etc., which become disturbed by trenching

3.12 OPERATION AND MAINTENANCE MANUALS

A. These operation and maintenance manual requirements supplement operation and maintenance manual documentation requirements of other Sections of these specifications.

B. Operation and maintenance documentation, in hardback 3-ring loose-leaf binders except full size drawings and CDs, shall cover the HVAC and building automation systems. Documentation shall include an operations and maintenance documentation directory, emergency information, operating manual, maintenance manual, test reports, and construction documents.

C. Initial Submittal: The operation and maintenance documentation package shall be submitted as one comprehensive package to the Owner 1 month before systems start-up, and shall be updated, revised and completed at completion of construction.

D. Final Submittal: Provide four (4) complete manuals.

1. Correct or modify each manual to comply with Architect’s comments. Submit Final manuals shall be submitted 15 working days prior to demonstration and training of Owner’s personnel. Manuals are to be used in training sessions by Owner’s personnel.

E. Compile and coordinate the documentation for equipment and systems installed. Unless otherwise indicated, organize each manual into a separate section for each system and subsystem and a separate section for each piece of equipment not part of a system. Documentation shall be typewritten and shall contain, at a minimum, the following information.

1. Introduction:

a. Project name, contractors' and subcontractors' names, addresses, telephone numbers, email addresses and facsimile numbers. Indicate the portion of the work for which each subcontractor was responsible.
b. List of Documents
c. List of systems
d. List of equipment
e. Table of Contents.

2. Operations and Maintenance Documentation Directory:

a. Explanation of the identification system used, including lists of systems, equipment, and component identifiers and names. Use the same system, subsystem and equipment designation as used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, “Preparation of Operating and Maintenance Documentation for Building Systems.”

3. Manual Organization: Unless otherwise indicated, organize each manual and into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

    a. Title page
    b. Table of contents
    c. Manual contents

4. Manual Title Page: Enclose title page in transparent plastic sleeve. Include the following information:

    a. Project name, contractors' and subcontractors' names, addresses, telephone numbers, email addresses and facsimile numbers. Indicate the portion of the work for which each subcontractor was responsible.
    b. Subject matter included in manual
    c. Name and address of Project
    d. Name and address of Owner
    e. Date of submittal
    f. Name, address, telephone number, fax number and email address of Contractor
    g. Name and address of Architect and other Architects
    h. Cross-reference to related systems in other operation and maintenance manuals.

5. Manual Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume and cross-referenced to Specification Section number in Project Manual.

    a. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table for all volumes in each volume of the set.

6. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem and equipment. If possible, assemble instructions for subsystems, equipment and components of one system into a single binder.

    a. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2 x 11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

        1) If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
        2) Identify each binder on front and spine, with printed title “OPERATION AND MAINTNANCE MANUAL,” Project title or name, project number and subject matter contents. Indicate volume number for multiple-volume sets and six-digit Section number on bottom of spine.

    b. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the system on each divider, cross-referenced to Specification Section number and title of Project Manual.
    c. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
    d. Supplementary Text: Prepared on 8-1/2 x 11-inch, 20-lb/sq.ft. white bond paper.
    e. Drawings: Attached reinforced, punched binder tabs on drawings and bind with text.

1) If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
2) If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual or reduced drawings. DO NOT USE BINDER POCKETS. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents and drawing locations.

f. Provide color photographs instead of drawings where necessary to demonstrate unusual or complex installations.

7. Emergency Information:

a. Information for technical and nontechnical personnel about actions recommended during emergency situations to protect life and property and to minimize disruption to the building occupants. Emergencies shall, at a minimum, include:

1) Fire.
2) Security breach.
3) Water outage.
4) Power failure.
5) Refrigerant release.
6) Heating failure.
7) Cooling failure.

3.13 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency
2. Emergency instructions
3. Emergency procedures

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment and component:

1. Fire
2. Flood
3. Gas leak
4. Water leak
5. Power failure
6. Water outage
7. System, subsystem or equipment failure
8. Chemical release or spill
9. Sub-freezing weather conditions

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following as applicable:

1. Instructions on stopping
2. Shutdown instructions for each type of emergency
3. Operating instructions for conditions outside normal operating limits

4. Required sequences for electric or electronic systems
5. Special operating instructions and procedures

3.14 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem and equipment descriptions
2. Performance and design criteria if Contractor is delegated design responsibility
3. Operating standards
4. Operating procedures
5. Operating logs
6. Wiring diagrams
7. Control diagrams
8. Piped system diagrams
9. Valve tag lists
10. Precautions against improper use
11. License requirements including inspection and renewal dates

B. Descriptions: Include the following:

1. Product name and model number
2. Manufacturer's name
3. Equipment identification with serial number of each component
4. Equipment function
5. Operating characteristics
6. Limiting conditions
7. Performance curves for pumps, fans and heat exchangers
8. Engineering data and tests
9. Complete nomenclature and number of replacement parts

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures
2. Equipment of system break-in procedures
3. Routine and normal operating instructions
4. Regulation and control procedures
5. Instructions on stopping
6. Normal shutdown instructions
7. Seasonal and weekend operating instructions
8. Required sequences for electric or electronic systems
9. Special operating instructions and procedures

D. Systems and Equipment Controls: Describe the sequence of operation and diagram controls as installed.

E. Piped Systems: Diagram piping as installed and identify color-coding where required for identification.

3.15 PRODUCT MAINTENANCE MANUAL

A. Content: Organize manual into a separate section for each product, material and finish. Include source information, product information, maintenance procedures, repair materials, warranty

information and bond information as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address and telephone number of Installer or supplier and maintenance service agent. Cross-reference Specification Section number and title in Project Manual.

C. Product Information: Include the following as applicable:

1. Product name and model number
2. Manufacturer's name
3. Color, pattern and texture
4. Material and chemical composition
5. Reordering information for specialty manufactured products

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures
2. Types of cleaning agents to be used and methods of cleaning
3. List of cleaning agents and methods of cleaning detrimental to product
4. Schedule of routine cleaning and maintenance
5. Repair instructions

E. Repair Materials and Sources: Include list of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of executed warranties and bonds and lists of circumstances and conditions that would effect validity of warranties and bonds.

1. Include procedures to follow and required notifications for warranty claims.

3.16 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

A. Content: For each system, subsystem and piece of equipment not part of a system, include source information, product information, maintenance procedures, repair materials, warranty information and bond information as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address and telephone number of Installer or supplier and maintenance service agent. Cross-reference Specification Section number and title in Project Manual.

C. Manufacturer's Maintenance Documentation: Manufacturer's maintenance documentation including the following information for each component part or piece of equipment:

1. Standard printed maintenance instructions and bulletins
2. Drawings, diagrams and instructions required for maintenance including disassembly and component removal, replacement and assembly.
3. Identification and nomenclature of parts and components
4. List of items recommended to be stocked as spare parts

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions

2. Troubleshooting guide
3. Precautions against improper maintenance
4. Disassembly: component removal, repair and replacement and reassembly Instructions
5. Aligning, adjusting and checking instructions
6. Manufacturer's demonstration and training videotape or DVD, if available.

E. Maintenance and Service Schedule: Include service and lubrication requirements, list of required lubricants for equipment and separate schedules for preventative and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual and annual frequencies
2. Maintenance and Service Record: Include manufacturer's forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturer's maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of executed warranties and bonds and lists of circumstances and conditions that would effect validity of warranties and bonds.

1. Include procedures to follow and required notifications for warranty claims.

NOTE: Where manuals contain manufacturer's standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data includes more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

3.17 TEST REPORTS AND CERTIFICATIONS

A. Provide copies of tests and certifications performed during manufacture and construction, including but not limited to the following:

1. Results of variable frequency drive burn-in tests.
2. Certification of installation of vibration isolation.
3. Receipt for spare fuses.
4. Receipt for instruction of operating personnel.
5. Certification of EMCS system calibration and testing.
6. Receipt for EMCS system training.
7. Receipt acknowledging no EMCS system failures during test period.
8. Certification of ductwork testing results.
9. Seasonal adjustment reports.
10. Warranty certificates
11. Inspection certificates
12. Test, adjust and balance report

3.18 DIAGRAMS

A. Frame and mount the following information:

Information	Location

HVAC diagrams, start-stop procedures, and valve schedules.	Appropriate mechanical rooms.
Energy Management control diagrams and sequences.	Adjacent to each control panel.
Appropriate control and interface drawings, including a simplified guide to local programming through the digital display unit, a directory of I/O points connected to that panel, and variables which may be displayed.	Posted on the inside cover of each EMCS panel.

B. Diagrams shall be computer generated.

C. Diagrams shall be as-built, and shall include interfaces and interlocks with other equipment.

D. Diagram framing system: 0.125" thick acrylic with satin finish aluminum frames.

3.19 MAINTENANCE

A. Equipment operated prior to the date of substantial completion shall be maintained in accordance with manufacturer's recommendations.

B. Prepare and submit a lubrication chart listing for each piece of equipment:

1. Points requiring lubrication.
2. Recommendations for a single manufacturer's lubricants with brand name and designation.
3. Frequency of lubrication required.

C. Lubricate each item of apparatus requiring lubrication prior to start-up in accordance with the manufacturer's recommendations.

3.20 DEMONSTRATION AND TRAINING FOR MECHANCIAL SYSTEMS AND EQUIPMENT

A. Submittals

1. Instruction Program: Submit to the Architect copies of instructional program outline for demonstration and training, including a schedule of proposed dates, times, length of instruction and instructors' names for each training module. Include learning objective and outline for each training.

    a. At completion of training, submit two (2) complete training manuals for Owner's use.

2. Qualification Data: Include lists of completed projects with project names and addresses, names and addresses of Architects and Owner and other information specified.
3. Attendance Record: For each training module, submit list of participants and length of instruction time.
4. Evaluations: For each participant and each training module, submit results and documentation of performance-based test.
5. Demonstration and Training DVD's: Submit two copies of each DVD within seven (7) days of recording.

    a. Format: Provide high quality color DVDs
    b. Identification: On each DVD, provide an applied label with the following information:

1) Name of project
2) Name and address of photographer
3) Name of Engineer
4) Name of Contractor
5) Date DVD was recorded
6) Description of vantage point, indicating location, direction (by compass point) and elevation or construction story

c. Transcript: Prepared on 8-1/2 x 11" (A4) paper, punched and bound in heavy-duty, 3-ring, vinyl-covered binders. Mark appropriate identification on front and spine of each binder. Include a cover sheet with the same label information as the corresponding DVD. Include name of Project and date of DVD on each page.

B. Quality Assurance

1. Instructor Qualifications: A factory-authorized service representative experienced in operation and maintenance procedures and training.
2. Photographer Qualifications: An individual of established reputation who has been regularly engaged as a professional video photographer for not less than five years.
3. Pre-instruction Conference: Review methods and procedures related to demonstration and training including, but not limited to the following:

a. Inspect and discuss locations and other facilities required for instruction.
b. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment and facilities needed to avoid delays.
c. Review required content of instruction.
d. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

C. Coordination

1. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.
2. Coordinate instructors, including providing notification of dates, times, length of instruction and course content.
3. Coordinate content of training modules with content of approved emergency, operation and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

D. Instruction Program

1. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections and as follows:

a. Heat generation including boiler, pumps and heating water distribution piping.
b. Gas-fired heating equipment.
c. Refrigeration system including chillers, pumps, ice storage tanks and chilled water piping.
d. HVAC system including air-handling equipment, unit heaters, power ventilators, heat exchangers, piping specialties, etc.
e. Building Automation System
f. All control end-devices and sensors
g. Variable Frequency Drives

2. Training Modules (Basis of System Design, Operational Requirements and Criteria): Develop a learning objective and teaching outline for each module. Include a description of specific skills

and knowledge that participants are expected to master. For each module, include instruction for the following (this will be provided through the Architect):

a. System, subsystem and equipment descriptions
b. Performance and design criteria
c. Operating standards
d. Regulatory requirements
e. Equipment function
f. Operating characteristics
g. Limiting conditions
h. Performance curves

3. Training Modules (Documentation): Review the following items in detail:

a. Emergency manuals
b. Operations manuals
c. Maintenance manuals
d. Project record documents
e. Submittal manual
f. Identification systems
g. Warranties and bonds
h. Maintenance service agreements and similar continuing commitments

4. Emergencies: Include the following as applicable:

a. Instructions on meaning of warnings, trouble indications and error messages
b. Instructions on stopping
c. Shutdown instructions for each type of emergency
d. Operating instructions for conditions outside of normal operating limits
e. Sequences for electric or electronic systems
f. Special operating instructions and procedures

5. Operations: Include the following as applicable:

a. Startup procedures
b. Equipment or system break-in procedures
c. Routine and normal operating instructions
d. Regulation and control procedures
e. Control Sequences
f. Safety procedures
g. Instructions on stopping
h. Normal shutdown instructions
i. Operating procedures for emergencies
j. Operating procedures for system, subsystem or equipment failure
k. Seasonal and weekend operating instructions
l. Required sequences for electric or electronic systems
m. Special operating instructions and procedures

6. Adjustments: Include the following:

a. Alignments
b. Checking adjustments
c. Noise and vibration adjustments
d. Economy and efficiency adjustments

7. Troubleshooting: Include the following:

a. Diagnostic instructions
b. Test and inspection procedures

8. Maintenance: Include the following:

a. Inspection procedures
b. Types of cleaning agents to be used and methods of cleaning
c. List of cleaning agents and methods of cleaning detrimental to product
d. Procedures for routine cleaning
e. Procedures for preventative maintenance
f. Procedures for routine maintenance
g. Instructions on use of special tools

9. Repairs: Include the following:

a. Diagnosis instructions
b. Repair instructions
c. Disassembly: component removal, repair and replacement and reassembly instructions
d. Instructions for identifying parts and components
e. Review of spare parts needed for operation and maintenance

E. Instruction

1. Facilitator: The Architect will serve as facilitator to assist the Contractor in preparation of instruction program and training modules, to coordinate instructors and to coordinate between Contractor and Owner for number of participants, instruction times and location.

2. Engage qualified instructors to instruct Owner's personnel to adjust, operate and maintain systems, subsystems and equipment not part of a system.

a. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria and regulatory requirements.
b. Owner will furnish an instructor to describe Owner's operational philosophy.
c. Owner will furnish Contractor with names and positions of participants.

3. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

a. Schedule training with Owner, through Architect, with at least forty-five (45) days advance notice.

4. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a written performance-based test.

5. Demonstration and Training DVD: Record each training module separately. Include classroom instructions and demonstrations, board diagrams and other visual aids, but not student practice.

a. At beginning of each training module, record each chart containing learning objective and lesson outline.

6. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

F. Demonstration and Training DVDs

1. Demonstration and Training DVDs: Record instruction of Owner's personnel in the operation and maintenance of equipment and systems. Edit DVDs to remove non-instructional conversation. Photographer shall select vantage points to best show equipment, systems and procedures demonstrated.

END OF SECTION 23 00 10

SECTION 23 05 00

BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Administrative and Procedural requirements for preparing operation and maintenance manuals, including the following:

1. Temporary operation of mechanical equipment.
2. Wall and ceiling access panels.
3. Roof curbs.
4. Fire, smoke, and sound stopping.
5. Pipe Sleeves.
6. Escutcheons.
7. Dielectric Fittings.
8. Protective drip pans.
9. Non-shrink grout.

B. Related Sections:

1. Section 230010 "Mechanical General Provisions."

1.3 SUBMITTALS

A. See Section 230010 – Mechanical General Provisions.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawings
Wall and ceiling access panels	R			R
Roof curbs	R			R
Fire, smoke and sound stopping	R			R
Pipe sleeves and sleeve seals	R			R
Escutcheons	R			
Dielectric fittings	R			

Protective drain pans	R			R
Non-shrink grout	R			

1.4 QUALITY ASSURANCE

A. Equipment Selection: Equipment of higher electrical characteristics, physical dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. Additional costs shall be paid by this Contractor for these increases. If minimum energy ratings or efficiencies of equipment are specified, equipment must meet minimum requirements.

1.5 TEMPORARY ENVIRONMENTAL CONDITIONING

A. If the Contractor requires temporary heating, cooling, and dehumidification capability prior to the permanent building HVAC system being ready for operation, it shall be the Contractor's responsibly to provide and maintain in working condition the HVAC equipment and system components necessary to meet the recommended indoor environmental conditions. All cost associated with these temporary HVAC systems shall be the Contractor's responsibility and included in their bid.

B. Additionally, if the contractor requires temporary heating, cooling, and dehumidification capability prior to the Architect approving the use of the building mechanical systems, the Contractor shall be responsible for providing and maintaining temporary HVAC systems. All cost associated with these temporary HVAC systems shall be the Contractor's responsibility and included in their bid.

1. See minimum building condition requirements herein for operation of building mechanical equipment and systems.
2. Temporary HVAC systems and controls shall be capable of providing the recommended indoor environmental conditions.

1.6 OPERATION OF BUILDING MECHANICAL EQUIPMENT AND SYSTEMS

A. Temporary operation of the building mechanical equipment and systems shall be provided for this project beginning a minimum of 60 days (or as approved by Architect) prior to the scheduled substantial completion date and maintained until the Owner's final acceptance of the project, or any phase thereof. The beginning of this temporary HVAC period is intended to align with general industry standard construction practice of providing a minimum suitable indoor environment for the installation and curing of millwork, adhesives, finishes, wall covering(s), tile ceiling/floors, etc. This interior space conditioning, includes all areas of the project where the space will be similarly conditioned with heating, cooling, and/or dehumidification capability after the project or any portion/phase thereof is completed.

B. Temporary Operation of Building Mechanical Equipment and Systems Procedure:

1. The Contractor shall notify the Architect in writing fourteen (14) days in advance to request temporary operation of the building HVAC systems.
2. The Professional will schedule a site-visit to observe the site conditions to ensure all the items described below have been met prior to temporary operation.
3. The Contractor shall submit in writing an operation and maintenance plan for temporary use of the building HVAC systems. At a minimum the O&M plan shall address:

   a. Equipment, system, and filter maintenance.
   b. Temporary filter installation locations.
   c. Daily, weekly, monthly, etc. cleaning procedures to ensure indoor cleanliness.

d. Describe in detail how the system will be controlled and indoor conditions monitored. Procedures for shutting down equipment or isolation of areas where dust, dirt, or particulate producing activities occur.

4. At a minimum the following building components and activities shall be completed prior to operation of the building HVAC systems:

   a. Dust or particulate generating construction activities completed.
   b. All dirt, dust, and debris have been removed from the Mechanical Room.
   c. Piping insulation is fully completed and all seams, openings, etc. have been sealed.
   d. All HVAC system equipment utilized for temporary heating and cooling shall have been started up per specifications. All startup and warranty information (including checklists) shall be completed and submitted to the Architect.
   e. All temporary air filters in place of types and installed in locations specified in 234000 “Air Cleaning Devices.” All return air and exhaust air distribution devices and openings shall be covered and protected with filter material specified in 234000 “Air Cleaning Devices.” All temporary filters shall be continually monitored and replaced periodically when required.

5. Upon completion of the Architect’s site visit, review of site conditions and temporary operation plan, the Architect reserves the right to refuse temporary startup and operation if site conditions and plan do not meet specifications. No additional time will be given to the Contractor due to unapproved startup and temporary operation conditions.
6. Additionally, the Architect reserves the right to order the building HVAC systems shut down if the building condition or indoor environmental conditions are found to be unacceptable.

C. The building indoor environmental conditions shall be continuously maintained within the following limits:

1. Maximum indoor temperature: 85 ˚F dry bulb.
2. Minimum indoor temperature: 60 ˚F dry bulb.
3. Maximum indoor relative humidity: 60% RH.

D. Temperature and humidity data loggers shall be installed throughout the facility to record indoor environmental conditions. Data logger quantity and locations shall be approved by Architect. Data from data loggers shall be submitted to the Architect every two weeks for review. Data shall be submitted in .csv format or other format agreed upon by Architect.

E. Contractor shall have either specified or temporary controls in place and fully operational to maintain the specified indoor environmental conditions above. Contractor shall provide all required temporary building services for temporary operation at no additional cost to the Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following listed in this specification.

B. Wall and ceiling access doors.

1. Acudor.
2. Williams Brothers.
3. J.R. Smith.

4. Or equal.

C. Roof curbs.

1. Custom Curb, Inc.
2. Plenums.
3. Thybar.
4. Or equal.

D. Mechanical sleeve seals.

1. Calpico, Inc.
2. Metraflex Co.
3. Thunderline/Link-Seal.
4. Or equal.

2.2 WALL AND CEILING ACCESS DOORS

A. Access panels shall be provided for all concealed valves, controls, dampers, and other mechanical equipment and devices where occasional access for adjustment or repairs will be necessary. Panels shall have cam and cylinder lock with two keys. All locks shall be keyed alike. Label panels as in accordance with Section 230553 “Identification for Mechanical Systems.”

B. Size of panels to be large enough to permit servicing or replacement of devices, controls, valves, etc.; minimum size to be 18"x18". Submit schedule with submittal package indicating location and size.

C. General.

1. Fabricate units of all welded steel construction.
2. The frame and panel assembly for fire rated access panels shall be manufactured under the Factory Inspection Service of Underwriters Laboratories, Inc., and shall bear a label reading: "Frame and Fire Door Assembly, Rating 1-1/2 Hr. (B), Temperature Rise 30 Minutes, 250ºF, Maximum".
3. Access panels used in toilets, kitchens, and other areas expected to experience high relative humidity are to be constructed of stainless steel.

D. Flush Panel Access Panels: Model WB-GP.

1. Frame and door shall be of one piece unit body construction and 14 gauge steel. Body shall be 18 gauge steel with a return edge around door opening.
2. Flange shall be 1-3/4” wide.
3. Hinges shall be concealed, piano type, opening to 175 degrees. Number of hinges will vary with size of door.
4. Locks shall be flush, key operated cylinder lock. Number of locks will vary with size of door.
5. Finishes shall be factory applied with a rust inhibiting phosphated undercoat; finish to be chemically bonded oven baked white enamel.
6. For installation in masonry openings, units shall be furnished with flexible metal anchor straps welded to the body.

E. Flush Access Panel for Drywall or Plaster: Model WB-DW and WB-PL.

1. Body and flange shall be 16 gauge steel. Door shall be 14 gauge steel.
2. Hinges shall be concealed, piano type, opening to 175 degrees. Number of hinges will vary with size of door.

3. Locks shall be flush, key operated cylinder lock. Number of locks will vary with size of door.
4. Finish shall be factory applied oven baked grey enamel with rust inhibiting phosphated undercoat.
5. Plaster models shall have 2-1/2” of 24 gauge galvanized expanded wing casting surrounding door.
6. Drywall models shall have a 1-1/8” perforated drywall bead on all four sides.

F. Fire Rated “B” Label Access Panel: Model WB-FR.

1. Frame and door shall be of one piece unit body construction and 14 gauge steel. Door shall be sandwich type filled with 2" thick thermafiber felt insulation and back enclosure of 22 gauge steel. Body shall be 16 gauge steel.
2. Flange shall be 1-3/4” wide.
3. Hinge shall be continuous steel piano type mounted on long side of doors, opening to 180 degrees and equipped with a spring mechanism for automatic closure.
4. Lock assembly shall be self-latching with key operated cylinder lock and shall have a mechanism to release the latch bolt from the inside.
5. Finish shall be factory applied oven baked grey enamel with rust inhibiting phosphated undercoat.
6. For installation in masonry openings, units may be furnished with flexible metal anchor straps welded to the body.

2.3 ROOF CURBS

A. Contractor shall provide all curbs, adaptor curbs and supports required for roof penetrations and equipment installation; the Contractor shall install and flash.

B. Roof curbs and equipment supports shall be constructed as required such that the top is level and plumb.

C. Minimum of 18 gauge galvanized steel construction, fully mitered, welded corners, 3 inch cant, internal bulkhead reinforcing, 2x4 wood nailer and 18 gauge counter flashing. Equipment supports shall span a minimum of two joists. No load shall be applied to a cantilever section exceeding 1'-0" in length.

D. All curbs, pipe supports, etc. shall be a minimum of 14" high (shall be higher if required). It shall be the Contractor’s responsibility to coordinate the curb and/or support height with roof construction.

E. All exposed roof curbs, equipment supports, and flashing shall be factory or field painted to match roof color. Coordinate color with Architect.

F. Installation shall be in strict accordance with manufacturer’s printed instructions and as detailed on drawings. Curb manufacturer shall coordinate fabrication with Contractor.

2.4 FIRE, SMOKE, AND SOUND STOPPING

A. UL listed penetration sleeve assembly and/or firestop that meets ASTM E-814 E119, and E84, as "3M" systems or equal for the intended applications.

B. All fire, smoke and sound stopping to be done by a licensed and certified Contractor as approved by Architect.

2.5 PIPE SLEEVES AND SLEEVE SEALS

A. Pipe Sleeves.

1. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
2. PVC Pipe Sleeves: Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
3. Galvanized-Steel Sheet Metal Sleeves: Galvanized sheet metal sleeves with lock seam joints and comply with the following minimum thickness:

    a. 24 gauge for 3 inches and smaller.
    b. 22 gauge for 4 inches to 6 inches inclusive.
    c. 20 gauge for sizes over 6 inches.

B. Sleeve Seals: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Stainless steel.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.
4. Link-Seal or equal.

2.6 ESCUTCHEONS (WALL, FLOOR, AND CEILING PLATES)

A. Description.

1. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.
2. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.
3. Split-Casting Brass Type: With polished, chrome-plated rough-brass finish and with concealed hinge and setscrew.
4. Escutcheon thickness: For wall and ceiling plates, not less than 0.025-inches for up to 3-inch pipe and 0.035-inches for larger pipe.
5. Escutcheon thickness: For floor plates, not less than 0.094-inches.

2.7 DIELECTRIC FITTINGS

A. Provide where copper and ferrous metal are jointed.

1. 2 inch and less: Threaded dielectric union.
2. 2-1/2 inch and larger: Flange union with dielectric gasket and bolt sleeves.
3. Temperature Rating: 210 ˚F for water systems.

2.8 PROTECTIVE DRAIN PANS

A. Required at following locations:

1. Fan-coil units with cooling located in attics or above ceilings where required by IMC. Not required if main drain pan includes secondary drain connection for this purpose.

a. Size to capture any overflow from unit condensate drain pan.

2. Fan-coil units with cooling located within rooms housing electrical equipment such as power panels, control panels, transformers, and computer equipment.

a. Size to capture any overflow from unit condensate drain pan and extended to capture drips from control valves, strainers, and unions.

B. Construction:

1. Fabricate pans of 20 gauge galvanized sheet metal or stainless steel minimum two inches deep with rolled top edges.
2. Solder all seams watertight, and cross brace pans to prevent sagging and warping.
3. Provide dielectric union at copper pipe/galvanized pan connection point. Water heater drain pans shall have minimum one inch (1 inch) drain outlet.

2.9 NON-SHRINK GROUT

A. Nonshrink, Nonmetallic Grout: ASTM C 1107, Grade B.

1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psig, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 WALL AND CEILING ACCESS PANEL

A. Coordinate size requirements and exact location with Contractor who will install access doors.

B. Minimum Sizes: 18 inches by 18 inches unless otherwise shown on Drawings or approved by Architect.

C. Provide where shown, or required for access of all concealed equipment such as terminal units, valves, fire/smoke dampers, etc., for Mechanical Work. Where ceiling is constructed with removable tiles or sections, access panels are not required.

1. Equipment shall be located wherever practical over accessible ceilings or rooms to avoid access doors.
2. Access doors shall not be used solely for access to balancing dampers; use instead remote control devices specified under Section 233300 – Air Duct Accessories.

D. Contractor shall provide substantial metal angle frame and support at all ceiling access panels.

3.2 ROOF CURB

A. All roof mounted equipment shall be furnished with a roof curb compatible with both the equipment configuration and roofing system. Curbs shall be installed level by either shimming or sloped curb construction. See detail on Drawings for more information on curb construction requirements.

B. Provide auxiliary support under all roof mounted equipment under curb base and at all penetrations as approved by Architect.

3.3 FIRE, SMOKE, AND SOUND STOPPING

A. Fire and smoke stopping shall be provided and installed at all locations where mechanical Work passes through rated assemblies. This includes all ductwork, piping and controls related conduit.

B. Penetrations in “sound-rated” walls shall be similarly acoustically sealed, both sides of wall with caulk or other approved material. New and existing walls extending to the roof/floor structure above are considered sound walls.

3.4 PIPE SLEEVES AND SLEEVE SEALS

A. Install sleeves for pipes passing through walls, concrete beams, foundations, footings, waterproofed floors, and roof decks.

1. Cut sleeves to length for mounting flush with both surfaces.

    a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Build sleeves into new walls and slabs as work progresses.
3. Install sleeves large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants. Refer to Division 7 Section "Sealants" for materials.

    a. Use Type S, Grade NS, Class 25, Use O, neutral-curing silicone sealant, unless otherwise indicated.

B. Interior wall pipe penetrations.

1. Galvanized-steel sheet metal sleeves.
2. Interior openings shall be caulked tight with fire, smoke or sound stopping material and sealant to prevent the spread of fire, smoke, and sound. Contractor shall coordinate specific requirements to ensure fire, smoke or sound ratings are maintained.

C. Above grade exterior wall, concrete beams, foundations, footings, waterproofed floors and where sleeve is extended above finished floor pipe penetrations: Seal penetrations using silicone sealant specified above.

1. Install galvanized steel or Schedule 40 PVC pipe sleeve.

D. Below grade exterior wall pipe penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install galvanized steel or Schedule 40 PVC pipe sleeve.
2. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.

E. For drilled penetrations in existing floors provide one inch angle ring flange set in silicone sealant and bolted to the floor in lieu of pipe sleeves with one inch extension above floor.

3.5 ESCUTCHEONS

A. Install pipe escutcheons for exposed pipe penetrations of concrete and masonry walls, wall board partitions, suspended ceilings, etc.

B. Inside diameter shall fit around insulation or around pipe when not insulated; outside diameter shall cover sleeve.

C. Use plates that fit tight around insulation or pipes when not insulated.

D. Plates shall cover openings around pipes/insulation and cover the entire pipe sleeve projection. Use deep pattern escutcheons where required to completely conceal protruding fittings and sleeves.

3.6 DIELECTRIC FITTINGS

A. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.

B. Wet Piping Systems: Install dielectric coupling, unions, and nipple fittings to connect piping materials of dissimilar metals.

3.7 PROTECTIVE DRAIN PANS

A. Provide pitched drain pans where shown and required under all concealed fan-coil units with cooling, storage tank type water heaters, and all fluid conducting piping that is over electric switchgear, elevator controllers, busways or electric motor starters or as indicated. Pans shall extend minimum two inches beyond each side of the mechanical equipment, pipe or group of pipes being contained. Pans shall extend six inches beyond electrical equipment below.

B. Pitch pans shall be routed to a drain connection with discharge piped with 3/4-inch or larger copper piping to the nearest available open drain or outside as directed by Architect. Separate drain from main drain pan.

3.8 GROUTING

A. Install nonmetallic, nonshrink, grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, pipe support base plates, and anchors. Mix grout according to manufacturer's written instructions.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Place grout, completely filling equipment bases and pipe support base plates.

E. Place grout around anchors.

F. Cure placed grout according to manufacturer's written instructions.

3.9 CUTTING AND PATCHING

A. Do not cut into any major structural element without written approval of the Architect.

B. Cut required openings through existing masonry or reinforced concrete with diamond core drills. Use of pneumatic hammer type drills, impact type electric drills, and hand or manual hammer type drills, will be permitted only with approval of the Architect. Locate openings that will least affect structural slabs, columns, ribs or beams. Refer to the Architect for determination of proper design for openings through structural sections and opening layouts for approval prior to cutting or drilling into structure. After Architect's approval, carefully cut openings through construction no larger than absolutely necessary for the required installation.

C. Patching:

1. Shall be of quality and appearance matching the existing construction.
2. Contractor shall restore all services and construction that remains in use, to its condition prior to Work performed as part of this contract.

END OF SECTION 23 05 00

SECTION 23 05 13

MOTORS AND CONTROLLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. These heating, ventilating and air conditioning (HVAC) provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.2 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Motors
2. Variable speed drives
3. Motor controllers where provided as part of mechanical equipment

B. Related Sections

1. Section 23 00 10 – Mechanical General Provisions
2. Section 23 00 50 – Basic Mechanical Materials and Methods

1.3 REFERENCE STANDARDS

A. ABMA 9 – Load Ratings and Fatigue Life for Ball Bearings

B. ABMA 11 – Load Ratings and Fatigue Life for Roller Bearings

C. ANSI/IEEE 112 – Test Procedure for Polyphase Induction Motors and Generators

D. ANSI/NEMA MG 1 – Motors and Generators

E. ANSI/NFPA 70 – National Electrical Code

F. IEEE – Standard 519-1992, IEEE Guide for Harmonic Content and Control

G. NEMA – ICS 7.0, AC Adjustable Speed Drives

H. Underwriters laboratories – UL508C

1.4 DEFINITIONS

A. VSD: Variable speed drive

B. ECM: Electrically Commutated Motor

1.5 SUBMITTALS

A. See Section 23 00 10 – Mechanical General Provisions

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. "R" means required.
2. "R2" means required only for products and equipment differing for the specified manufacturer and model and for "or equals" where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Motors	R	R		R
Belts and Drives		R		
Variable Speed Drives	R	R		R
Motor Controllers/Starters	R	R		R

C. Submittals shall include certification from the motor manufacturer certifying compliance with NEMA MG-1, part 31 for motors that are driven by variable speed drives.

D. Submit a site specific harmonic analysis showing total voltage harmonic distortion and total current harmonic distortion is in compliance with IEEE 519. If the analysis indicates that additional external devices or filters are required to meet the power quality requirements of the VSD, provide the devices or filters at no additional cost to the Using Agency. See Paragraph 2.3B.2.

1.6 WARRANTY

A. Special Warranty: VSD warranty shall be 24 months from date of start-up certification including all parts, labor, travel time, and expenses.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Motors

1. MagnaTek
2. Century Electric Co.
3. General Electric
4. Lincoln Electric Co.
5. Gould Inc.
6. Baldor

B. Variable speed drives

1. Yaskawa
2. Trane

3. ABB
4. Danfoss

C. Motor controllers/starters

1. ABB
2. Allen-Bradley
3. Cerus
4. Crouse-Hinds
5. Cutler-Hammer
6. GE
7. Square D
8. Siemens

2.2 MOTORS

A. General

1. In accordance with NEMA, IEEE, and ANSI C50 standards
2. Capacity
    a. Minimum horsepower indicated
    b. To operate driven devices under all conditions without overload
3. Squirrel-cage induction type, NEMA Type "B: insulation class, continuous duty
4. Speed
    a. 1750 RPM, unless otherwise indicated
    b. See schedules on drawings for other speeds
5. NEMA KVA locked rotor CODE LETTER: "G" or better
6. Service factor: 1.15
7. Type unless otherwise scheduled on Drawings
    a. Voltage: As scheduled on Drawings. Contractor shall verify actual site voltage prior to procurement.
    b. 1/2 horsepower and smaller
        (1) Single-phase phase, 60 hertz
        (2) With built-in auto-reset thermal overload protection
    c. 3/4 horsepower and larger
        (1) Three-phase, 60 hertz
        (2) Motors 50 horsepower and over: Reduced voltage start, suitable for star-delta starting or as scheduled on Drawings
    d. Electrically Commutated Motor (ECM)
        (1) Where scheduled on Drawings or equipment Specifications
        (2) Equal to GE ECM version 2.2 or greater
        (3) Programmed with fan curve for “constant airflow”
8. Bearings, unless otherwise scheduled on Drawings or equipment Specifications

a. Provide motors with double shielded, grease lubricated, ball bearings, with grease pockets on each side for regreasing in service. Provide inlet and outlet grease connections in motor housings for each bearing. Provide factory sealed permanently lubricated ball bearings on roof mounted equipment. Similar bearing may be provided on fractional horsepower motors. Provide sleeve bearings where so specified.
b. Ball type, unless otherwise noted
c. Sealed, permanently lubricated, unless otherwise noted or not available in motor size

B. Enclosure

1. Open drip-proof (ODP)

a. Provide ODP motors unless otherwise indicated

2. Totally enclosed (TEFC)

a. Motors outside the building or otherwise exposed to the weather
b. Non-ventilated: under 1/2 horsepower
c. Fan-cooled: 1/2 horsepower and larger

3. See schedules on drawings for other enclosures

C. Belt-connected motors

1. Foundation slide base
2. Shaft as required for aligning pulleys

D. Motors 1 horsepower and larger shall be NEMA Premium labeled and have guaranteed efficiencies equal to or exceeding NEMA Table 12-6D.

E. Multi-speed motors

1. Two speed motors shall be single winding 1800/900 rpm unless otherwise specified or indicated
2. Provide 1800/1200 rpm multi-speed motors of separate winding, variable torque type, unless otherwise specified or indicated.

F. Motors driven by variable frequency drives

1. Shall meet the requirements of NEMA MG-1 part 31.40.4.2
2. Where used for pumps or fans shall be capable of operating at 10 percent speed indefinitely

G. Electrically Commutated Motors (ECMs)

1. Brushless DC type with electronic commutation from 115 volt or 277 volt single phase power to a DC signal
2. Speed controllable from a minimum of 20% or less to 100% of full speed
3. Minimum 80% efficiency at all speeds
4. Provide one of the following as indicated on Drawings or Specifications

a. Where scheduled only: Potentiometer dial mounted on the exterior of the motor housing
b. Unless otherwise noted: 0-10 VDC control signal input and 0-10 VDC speed feedback output with pre-wired contacts. Motor shall shut off when speed signal is below minimum.

2.3 VARIABLE SPEED DRIVES

A. All variable speed drives other than those that are factory packaged with equipment shall be supplied by one manufacturer.

B. Electrical Characteristics

1. Efficiency shall be not less than 97 percent at rated voltage, current, and frequency and fundamental power factor shall not be less than 98 percent at all speeds and loads
2. VSD shall maintain line noise (voltage harmonics) on the input electrical system at or below levels specified in IEEE 519 for a “General System.” Manufacturer shall include in submittals a harmonic distortion analysis (IEEE 519, 3 percent) for this particular jobsite. Provide as a minimum 5% impedance line reactors. The 5% impedance may be from dual (positive and negative DC bus) reactors or 5% AC line reactors. VSDs with only one DC reactor shall include AC line reactors.
3. VSD shall include EMI/RFI filters that allow the VSD assembly to be CE Marked and meet product standard EN 61800-3 for the First Environment restricted level.

C. Features and Accessories

1. Plain language LCD display (code numbers not acceptable); all set-up parameters, indications, faults, warnings, and other information must be displayed in words, not codes
2. Displays and meters for the following: Output voltage, output frequency, motor rpm, motor current, motor watts, speed signal input, last three faults
3. Hand-Off-Auto keyboard function with manual speed control, including bump-less transfer of speed reference when switching between Hand and Auto modes.
4. Input line fuses
5. Adjustable or multiple carrier frequencies up to 12 kHz. Include a carrier frequency control circuit that reduces the carrier frequency based on actual VSD temperature that allows the highest carrier frequency without derating the VSD or operating at high carrier frequency only at low speeds.
6. Isolated 4-20 mA or 0-10 Vdc speed signal input. If the input reference is lost the VSD shall, based on user selectable option, either (1) stopping and displaying a fault, (2) running at a programmable preset speed, (3) hold the speed based on the last good reference received, or (4) cause a warning to be issued.
7. Analog outputs for kW and speed; kW shall be accurate to ±3%
8. Digital outputs for alarm and motor on/off status; latter shall be based on field adjustable motor current that can indicate broken belt or coupling
9. Ability to automatically restart after an over-current, over-voltage, under-voltage, or loss of input signal protective trip. The number of restart attempts, trial time, and time between attempts shall be programmable for each fault type.
10. Controls

a. Provide a minimum of two digital outputs that can be programmed for multiple purposes and also controlled through the DDC network interface device by the DDC system independent of other VSD functions or status. Control sequence possibilities shall include:

(1) Contact to open fan discharge damper either with fan start or independent of fan operation, controlled via the DDC system and wait for the damper end switch to make before starting the drive; this shall function in the normal drive mode, bypass mode, and life safety mode (if part of smoke control system).

b. For fans used as part of IBC smoke control system, include:

(1) Programmable digital input that, when external contact is closed by life safety control system, causes VSD to start and operate at a preset adjustable speed, overriding automatic speed and on/off controls, manual speed settings and all keypad and HOA commands

(2) "Run to destruct" option so that when the digital input is closed, all internal and external safeties that might prevent the VSD from operating at the preset speed will be ignored or overridden

c. Provide built-in PID control loop, allowing connection of a pressure or flow signal to the VSD for closed loop control.
d. Provide factory installed BACnet/MSTP or Modbus RTU network interface that allows all VSD control points to be communicated to EMCS. See Section 23 09 00 Energy Management & Control Systems. At a minimum, the following points shall be provided:

(1) Read only: Speed feedback, output speed, current, % torque, kW power, kilowatt hours (resettable), operating hours (resettable), drive temperature, digital input status, analog input values, all diagnostic warning and fault information, keypad "Hand" or "Auto" selected, deceleration rate, and acceleration rate
(2) Read/write: On/off, output speed, digital output open/close, analog output values, remote fault reset, PID setpoint and gains, force the unit to bypass, maximum speed, and minimum speed

11. Enclosure

a. NEMA 3R enclosure for outdoor installation or unconditioned space
b. NEMA 1 enclosure for indoor installation in conditioned space or indirectly conditioned space such as return air plenum
c. UL Type 12 for wet mechanical rooms.
d. UL listed as plenum rated where located in supply, return, or outdoor air stream.

12. Thermostatically controlled cooling fans shall be provided where required to meet ambient operating conditions. Fans shall be designed for replacement without requiring removal of the VSD from wall mount or removal of circuit boards. Fan sound power shall be no greater than local noise sources where VSD is installed.
13. 3-contactor, constant speed bypass shall be provided to allow the motor to run across the line in the event of VFD shutdown. The transfer from the VFD to the line shall be accomplished manually by means of a selector switch. The bypass circuitry shall be enclosed in a separate well-mounted NEMA 1 cabinet. The bypass cabinet shall include a door interlocked input circuit breaker, a VFD output contactor, and a full voltage starting contactor (both contactors electrically interlocked), a thermal overload relay to provide motor protection, and a control power transformer. Mounted on the cabinet door shall be the bypass selector switch, motor fault light, power ON light, motor on VFD light, and motor on line light.

D. Equipment Protection and Safeties

1. VSDs short-circuit interrupting rating shall equal or exceed that fault current available at the drive.
2. VSD shall protect itself against all normal transients and surges in incoming power line, any grounding or disconnecting of its output power, and any interruption or run away of incoming speed signal without time delay considerations. Protection is defined as normal shutdown with no component damage.
3. The VSD shall be capable of sensing a loss of load (broken belt / broken coupling) and signal the loss of load condition. The VSD shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communications bus. Relay output shall

include programmable time delays that will allow for drive acceleration from zero speed without signaling a false underload condition.

4. VSD shall protect itself against all phase-to-phase or phase-to-ground faults.
5. VSD shall be able to start into a rotating load at all speeds (forward or reverse) without trip.
6. Anti-regeneration circuit shall match the deceleration rate of the drive to that of the motor to prevent high bus voltage shutdown common to high inertia loads, such as fans.
7. VSD shall ride through an input power dip of 3 cycles without trip.
8. VSD shall operate properly at a -35% +30% voltage fluctuation from rated voltage.
9. VSD shall operate properly at a 10 percent frequency variation from rated frequency.
10. VSD shall employ three current limit circuits to provide trip-free operation: slow current regulation, rapid current regulation, and current limit switch-off limit. VSD shall be designed so that overcurrent trip shall be at least 315 percent of the drive's current rating.
11. VSD shall have the ability to set a maximum current available to the motor.
12. VSD shall withstand unlimited switching of the output under full load, without damage to the VSD. Operation of a disconnect switch between the motor and VSD shall not have an adverse effect on the VSD, whether the motor is operating or not. Controls conductors between the disconnect and the VSD shall not be required for the safe and reliable operation of the VSD.
13. The VSD shall withstand switching of the input line power up to 20 times per hour without damage to the VSD.
14. The VSD shall be capable of operating continuously at full load in the following service conditions

    a. Ambient temp: 30 to 104 degrees Fahrenheit
    b. Relative humidity: 0 to 95 percent, non-condensing

E. Warranty shall be 24 months from date of start-up certification including all parts, labor, travel time, and expenses.

2.4 MOTOR CONTROLLERS/STARTERS

A. General:

1. Manual reset, Class 20, thermal type overload protection for each phase, in accordance with NEMA ICS 2-2000 (R2005).
2. NEMA 3R enclosures for exterior application.
3. Equipment furnished with factory-installed starters shall also be equipped with individual motor disconnect and thermal magnetic circuit breakers or fuses as specified herein with lugs sized to receive a feeder as indicated on the Electrical Drawings.
4. 120 V secondary control power transformer with fused primary and secondary circuit in the enclosure.
5. Unused auxiliary contacts (installed on each contactor): 1 normally open and 1 normally closed.

B. Motor starters shall be provided with provisions for interfacing with the Energy Management and Control System (EMCS) or other control and interlocking requirements.

1. For all magnetic starters, a minimum of one set of field reversible auxiliary contacts shall be provided with the starter.

C. For 3-phase motors, unless otherwise specified herein:

1. Combination magnetic type and thermal magnetic circuit breaker with:

a. Circuit breakers having minimum AIC rating as specified in Division 26.
b. External operating handle capable of being locked in the off or open position.
c. Hand-off-automatic switch, except those manually controlled.
d. Starters for motors 50 hp and larger shall be solid-state, reduced-voltage type.

D. For 1-phase, unless otherwise specified herein:

1. Manual starting switch with thermal overload protection and pilot light.
2. Magnetic across-the-line starters with overload protection and Hand-Off-Automatic switch, except for manually controlled equipment.

E. Provide control transformers for equipment with voltage above 240 volts, or as required for complete, operable systems.

F. Coordinate with DIVISION 26: ELECTRICAL

G. Refer to individual equipment sections for factory-provided controllers

1. Installed on equipment by manufacturer
2. Supplied with equipment by manufacturer for field installation

PART 3 - EXECUTION

3.1 INSTALLATION

A. See Section 23 05 48– Mechanical Sound and Vibration Control

B. Coordinate with work of other trades

C. Install in accordance with manufacturer's written installation instructions

D. Drives for packaged equipment shall be mounted and wired by equipment manufacturer

E. Mounting and power wiring of field mounted variable speed drives and other motor controllers is specified under Division 26 Electrical:

1. Where wall space is not available for mounting VSDs or other motor controllers, provide mounting struts securely mounted to the floor, roof, or adjacent structure
2. Where VSD has disconnect switch, locate VSD within sight of equipment served so that switch complies with NEC requirements

F. Set overload devices to suit motors provided in accordance with NEC

3.2 INSPECTION

A. Verify that adequate clearance between motor, controllers and adjacent walls or equipment is available to permit maintenance and repairs.

B. Check that motor and controller are properly supported and allows for proper alignment and tension adjustments as necessary for application.

3.3 PRE-OPERATING CHECKS

A. Before operating motors and controllers

1. Check for proper and sufficient lubrication
2. Check for correct rotation
3. Confirm alignment and re-align if required
4. Check for proper adjustment of vibration isolation.

3.4 STARTUP, TESTING, AND ADJUSTING

A. Start and test motors and controllers in accordance with manufacturers written installation instructions.

B. After starting motors

1. Check for high bearing temperatures
2. Check for motor overload by taking ampere reading at maximum operating conditions, with all valves open and individual motor running
3. Check for objectionable noise or vibration; correct as needed at no additional cost to the Using Agency

C. Variable speed drives

1. Certified factory start-up shall be provided. A certified start-up form shall be filled out for each VSD with a copy to the Professional and a copy kept on file by the manufacturer.
2. See Section 23 09 00 – Energy Management and Control Systems for points to be mapped from the drive controller to the EMCS; coordinate information addresses and other information required with the Section 23 09 00 – Energy Management and Control Systems contractor.
3. Set variable speed ramp-up rates on variable air volume systems slow enough to prevent high pressure trips and/or damage to duct systems. Coordinate with Section 23 09 00 EMCS contractor.
4. Set minimum speed for all applications in accordance with procedure indicated in Section 23 09 Energy Management and Control Systems.
5. Set maximum current limit setpoint to the motor to the motor's full load amps.
6. Set voltage to speed ratio (V/f) to “squared”.
7. For fans such as relief fans and cooling tower fans: Run fan through entire speed range and program out speeds that cause fan vibration.
8. After VSD is fully configured and programmed, all settings shall be documented and included with commissioning documentation in electronic format per Section 23 00 10 Mechanical General Provisions. The intent is to allow replacement drive electronics to be readily configured.

D. Motor Controllers/Starters

1. Provide starters, push buttons, thermal overload switches, and contactors for equipment covered in Division 23 unless otherwise specified herein. Installation of starters, push buttons, and thermal overload switches, not factory installed, is specified under Division 23.
2. Provide 120 V secondary control power transformers for control circuits where equipment is served at 208 V or higher.

E. See Section 23 05 93– Testing, Adjusting, and Balancing

3.5 TRAINING

A. See Section 23 00 10 – Mechanical General Provisions

B. VSD manufacturer to provide one of the following:

1. 8-hours of customer training
2. Interactive Computer based training on VSD installation, start-up, programming, and trouble shooting
3. Professionally produced video cassette on VSD installation, start-up, programming, and trouble shooting in digital format

END OF SECTION 23 05 13

SECTION 232116

HYDRONIC PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Expansion tanks.
2. Storage/buffer tanks.
3. Air separators.
4. Strainers.
5. Suction diffusers.
6. Balancing valves.
7. Pressure reducing valves.
8. Safety valves.
9. Air Vents.
10. Test plugs.
11. Flanges.
12. Flex connectors.

1.3 SUBMITTALS

A. See Section 230010 – Mechanical General Provisions.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Expansion tanks	R	R		R
Storage/buffer tanks	R	R		R
Strainers	R	R		R
Suction diffusers	R	R		R
Balancing valves	R	R		R
Pressure reducing valves	R	R		R

Safety valves	R	R		R
Air vents (manual and automatic)	R	R		R
Air separators	R			R
Test plugs	R			
Flanges	R			
Flexible connectors	R			R

1.4 QUALITY ASSURANCE

A. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

1. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Expansion tanks.

1. Bell & Gossett.
2. John Wood.
3. Wessels
4. Or equal

C. Storage/buffer tanks.

1. Bell & Gossett.
2. John Wood.
3. Wessels
4. Or equal

D. Coalescing air/dirt separators.

1. Spirotherm.
2. Wessels.
3. Wheatley.
4. Or equal.

E. Air vents (manual and automatic).

1. AMTROL.
2. Bell & Gossett.
3. Armstrong.

4. Or equal.

F. Strainers.

1. Mueller.
2. Armstrong.
3. Watts.
4. Sarco.
5. Steamflo.
6. Or equal.

G. Suction diffusers.

1. Bell & Gossett.
2. Weinman
3. Grundfos.
4. Or equal.

H. Balancing valves.

1. Bell & Gossett.
2. Armstrong.
3. Taco.
4. Or equal.

I. Pressure reducing valves.

1. Watts.
2. Bell & Gossett.
3. Armstrong.
4. Or equal.

J. Safety valves.

1. Watts.
2. Bell & Gossett.
3. Armstrong.
4. Or equal.

K. Pressure-temperature test plugs.

1. Peterson-Engineering Company.
2. Taco, Inc.
3. Or equal.

L. Flexible connectors.

1. Flex-Weld.
2. Mason Industries.
3. Metraflex. Co.
4. Or equal.

2.2 EXPANSION TANKS

A. Bladder type.

1. Tank: Welded steel, rated for 125-psig working pressure and 375 deg F maximum operating temperature. Factory test after taps are fabricated and supports installed and are labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Bladder: Securely sealed into tank to separate air charge from system water to maintain required expansion capacity.
3. Air-Charge Fittings: Schrader valve, stainless steel with EPDM seats.
4. Cleaned, prime coated.
5. Precharge as indicated on drawings.
6. Air-Control Tank Fitting: Cast-iron body, copper-plated tube, brass vent tube plug, and stainless-steel ball check, 100-gal. unit only; sized for compression-tank diameter. Provide tank fittings for 125-psig working pressure and 250 deg F maximum operating temperature.
7. Tank Drain Fitting: Brass body, nonferrous internal parts; 125-psig working pressure and 240 deg F maximum operating temperature; constructed to admit air to compression tank, drain water, and close off system.
8. Gage Glass: Full height with dual manual shutoff valves, 3/4-inch- diameter gage glass, and slotted-metal glass guard.

2.3 STORAGE/BUFFER TANKS

A. Designed and built in accordance with the ASME Boiler & Pressure Vessel Code Section VIII, Division 1.

1. Maximum design pressure: 125 psi.
2. Maximum design temperature: 650 ˚F.

B. Construction.

1. Installation: Vertical.
2. Shell: Carbon steel with exterior gray primer finish.
3. Center baffle plate: Carbon steel.
4. Inlet and outlet connections: Flanged.
5. Vent and drain connections: FNPT.
6. Angle legs with 14” minimum clearance from the bottom of the head to the floor/equipment pad.
7. Inspection opening.

2.4 AIR/DIRT SEPARATORS

A. Inline air and dirt separator.

1. Inline air and dirt separator capable of handling the water flow indicated on the Drawings.
2. ASME construction: 125 pounds per square inch operating pressure.
3. Tank: Carbon steel. Painted finish.
4. Copper integral tube bundle.
5. Seal: Viton.
6. O-ring: Viton.
7. Integral float actuated brass air vent.

8. Valved side tap to flush floating dirt and/or liquids.
9. Removable lower head.

B. Spirotherm VDT or equal.

2.5 AIR VENTS

A. Manual Air Vents:

1. Body: Bronze.
2. Internal Parts: Nonferrous.
3. Operator: Screwdriver or thumbscrew.
4. Inlet Connection: NPS 1/2.
5. Discharge Connection: NPS 1/8.
6. CWP Rating: 150 psig.
7. Maximum Operating Temperature: 225 deg F.
8. Bell & Gossett Model 78 or equal.

B. Automatic Air Vents:

1. Body: Bronze or cast iron.
2. Internal Parts: Nonferrous.
3. Operator: Noncorrosive metal float.
4. Inlet Connection: NPS 1/2.
5. Discharge Connection: NPS 1/4.
6. CWP Rating: 150 psig.
7. Maximum Operating Temperature: 240 deg F.
8. Bell & Gossett Model 98 or equal.

2.6 STRAINERS

A. Sizes.

1. Screwed ends: to 2 inch.
2. Flanged 2-1/2 inch and larger.

B. Body.

1. To 100 psi: 125 lb. wsp class, cast iron.
2. 100 psi to 250 psi: 250 lb. wsp class, cast iron.
3. Over 250 psi: 300 lb. wsp class, forged steel or cast steel.

C. Screen.

1. 304, 316 stainless steel or Monel, reinforced.
2. Free area not less than 2-1/2 times inlet area.
3. Perforations.

a. Water.

1) To 8 inch: 1/8 inch.
2) 10 inch and larger: 5/32 inch.

D. Y-Type.

1. Cast iron or bronze body as indicated.
2. Screwed.

a. Faced cap, straight thread and gasket.
b. Mueller Steam Specialty or equal.

1) Steel piping No. 1MFCB.
2) Copper piping No. 35-1/2 M.

3. Flanged.

a. Bolted cover.
b. Mueller Steam Specialty or equal.

1) Steel - 125 psi steam, 200 psi water on gauge (WOG) - No. 751.
2) Steel - 250 psi steam, 500 psi water on gauge (WOG) - No. 752.
3) Copper - 150 psi steam, 225 psi water on gauge (WOG) - No. 851.
4) Copper - 300 psi steam, 500 psi water on gauge (WOG) - No. 852.

E. Basket type.

1. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
2. Mueller Steam Specialty Muessco No. 165 or equal.

2.7 SUCTON DIFFUSER

A. Angle type suction guide fitting.

1. Flanged cast iron body.
2. 125 pounds per square inch.
3. Steel or cast iron guide vanes.
4. Stainless steel orifice cylinder.
5. Bronze start-up strainer.
6. Free area five times cross section area of pump suction opening.
7. Vane length no less than 2-1/2 times pump connection diameter.
8. Adjustable support foot to carry weight of suction.
9. System side connection size same as incoming pipe size.

B. Use product manufactured by associated pump manufacturer if available.

2.8 BALANCING VALVES

A. Calibrated-Balancing Valves:

1. Combination balancing and shut-off valves.
2. Calibrated name plate and adjustable memory stop.
3. Capped read-out valves.
4. Pre-formed insulation.
5. One differential pressure read-out meter for all valves in system.
6. 2 inches and smaller.

a. Brass body.
b. Threaded or soldered ends.
c. Teflon seats.
d. 250 pounds per square inch at 250 deg F.

7. 2-1/2 inches and larger.

a. Ductile or cast iron body.
b. Flanged.
c. 175 pounds per square inch at 250 deg F.

8. Devices using venture type flow meter not acceptable (due to propensity for clogging and ease of putting valve with limited flow range in wrong direction).
9. Devices using Pitot tube or Annubar type flow meter not acceptable (due to propensity for clogging)
10. Devices using other than ball or butterfly valves shall not be used for coil isolation – a separate ball valve or butterfly valve shall be added for isolation (to ensure positive shut-off and to allow 90˚ open-close with memory stop).
11. Bell & Gossett type CB, or equal.

2.9 PRESSURE REDUCING VALVES

A. For water.

1. 2 inches and Smaller.

a. Bronze body, threaded.
b. Watts Model 223 or equal.

2. 2-1/2 inches and Larger.

a. Iron body, flanged.
b. Watts Model 2300 or equal.

2.10 SAFETY AND RELIEF VALVES

A. Use “pressure relief valves” for unheated liquids.

B. Use “safety relief valves” for heated liquids.

C. ASME rated direct spring-loaded type.

1. Lever operated.
2. Non adjustable factory set discharge pressure.

D. Constructed, rated and stamped in accordance with ASME.

1. Relief valves: for unheated liquids.
2. Safety relief valves: for heated liquids.
3. Safety valves for gases and vapors: Including air and steam.

E. Set pressures and ratings.

1. Suitable and rated for system pressure and temperature: For safety relief valves, minimum temperature rating: saturated steam temperature corresponding to pressure 10 percent higher than valve set pressure.
2. Set pressure as indicated on Drawings: Not to exceed pressure rating of protected equipment.

F. Valves to open, under test, at set pressure with following tolerance.

1. Set pressure up to 70 pounds per square inch gage: plus or minus 2 pounds per square inch.
2. Set pressure, above 70 pounds per square inch gage: plus or minus 3 percent.

G. Capacities.

1. Valves shall have capacity to relieve maximum possible generated energy while maintaining pressure in protected equipment at no more than 10 percent above vessel working pressure.
2. Greater than make-up pressure reducing valve capacity.
3. Equipment relief valve capacity to exceed rating of connected equipment.
4. Provide multiple valves if required for capacity even though only one valve may be shown on Drawings.

H. Maintain pressure in protected equipment at not more than following.

1. Low pressure Boilers: 5 pounds per square inch above boiler working pressure.
2. High pressure Boilers: 6 percent above boiler working pressure.
3. Unfired Pressure Vessels: 10 percent above vessel working pressure.

I. Provide multiple valves if required for capacity even though only one valve may be shown on Drawings: Factory manifold.

J. Safety and Relief Valves: Similar to Consolidated.

K. Relief Valves, Water: Equal to Watts.

2.11 PRESSURE/TEMPERATURE TEST PLUG

A. Solid brass with valve core.

B. Valve core: Nordel.

C. Fitted with a color coded and marked cap with gasket.

D. Suitable for 500 pounds per square inch gage and 275ºF for water systems.

E. Pete's Plug: No. 110/100XL with yellow cap or equal.

2.12 FLANGES

A. Convoluted.

B. Carbon steel, cold-formed.

C. Weld-neck and blind flanges in conformance with the design criteria of Section VIII, Division I of the ASME Pressure Valve Code.

D. Flanges drilled and tapped to match ANSI 150.

E. All material to comply with requirements of ASTM A516.

F. Gaskets: Teflon or as recommended by the flange manufacturer and suitable for the service.

G. Slip-on flanges will not be permitted.

H. 150-pound and 300-pound weld-neck and screwed steel flanges on steel lines to conform to ANSI Standard B16.5 for dimensions and ASTM A 181 Material Standard.

2.13 FLEXIBLE CONNECTORS

A. General: Fabricated from materials suitable for system fluid and that will provide flexible pipe connections. Include 125-psig minimum working-pressure rating, unless higher working pressure is indicated, and ends according to the following:

1. 2” and Smaller: Threaded.
2. 2-1/2“ and Larger: Flanged.

B. Stainless-Steel-Hose/Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include steel nipples or flanges, welded to hose.

C. Rubber, Flexible Connectors: CR or EPDM elastomer rubber construction, with multiple plies of NP fabric, molded and cured in hydraulic presses. Include 125-psig minimum working-pressure rating at 220 °F. Units may be straight or elbow type, unless otherwise indicated.

2.14 VENT COCKS

A. Bronze body, 1/4 inch size.

B. Lever handle.

C. 125 pounds per square inch steam working pressure.

D. Weiss LC-14 or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install items in accordance with manufacturer's instructions.

3.2 EXPANSION TANKS

A. Support from structure as indicated.

B. Make piping connections as indicated.

1. Expansion tank connection to the piping main shall be on the side of the pipe (3 o'clock or 9 o'clock).
2. On hot water systems, provide an anti-thermosyphon loop to prevent warm water from migrating to the tank.

C. Connect with ball valve with locked guard.

1. Relief valve shall be located on system-side of expansion tank isolation valve.

3.3 STORAGE/BUFFER TANKS

A. Install on 6" concrete housekeeping pad.

B. Insulate tank per specifications.

C. Provide vent and drain valves.

3.4 AIR/DIRT SEPARATORS

A. Install at lowest pressure, highest temperature point or where indicated on drawings.

B. Provide drain valve.

C. Install automatic vent with cock on top tapping.

3.5 STRAINERS

A. Wye-type: Where shown on drawings and ahead of all automatic flow control valves and pressure regulating valves.

B. Basket-type strainers: Where shown on drawings.

C. Install strainers in horizontal or vertical-down position.

3.6 SUCTION DIFFUSERS

A. Provide on suction side of base mounted centrifugal pumps where indicated.

B. Support with floor mounted pipe and flange supports: From pump isolation base where provided.

3.7 PRESSURE TEMPERATURE TEST PLUGS

A. Provide pressure/temperature test plugs where shown on drawings.

B. Install at all equipment, coil and heat exchanger connections. Install at each VAV terminal unit.

C. Also locate at all temperature/pressure wells for calibration, see Section 23 09 00 – Energy Management & Control Systems.

3.8 VALVE APPLICATIONS

A. Install shutoff-duty valves at each branch connection to supply mains and at supply connection to each piece of equipment.

B. Install calibrated balancing valves at each branch connection to return main.

C. Install calibrated balancing valves in the return pipe of each heating or cooling terminal.

D. Install check valves at each pump discharge and elsewhere as required to control flow direction.

E. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

F. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.

3.9 HYDRONIC SPECIALTIES INSTALLATION

A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

B. Install automatic air vents at high points of system piping in mechanical equipment rooms only. Install manual vents at heat-transfer coils and elsewhere as required for air venting.

3.10 INSPECTION

A. Verify that adequate clearance between piping specialties and adjacent walls or equipment is available to permit maintenance and repairs.

END OF SECTION 23 21 16

SECTION 23 05 23

VALVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Work Included in This Section: Materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Service valves in hydronic and plumbing systems (other than gas and fire sprinkler).
2. Balancing valves.
3. Check valves.
4. Pressure reducing valves.
5. Safety and relief valves.
6. Vent and gas cocks.
7. Manual and automatic air vents.
8. Miscellaneous valves.

B. Related Sections:

1. Section 211300 – Fire Suppression Systems.
2. Section 221116 – Domestic Water Piping.
3. Section 232113 – Heating and Cooling Piping.

1.3 QUALITY ASSURANCE

A. Provide valves with manufacturer's name and pressure rating clearly marked on outside of body.

1.4 SUBMITTALS

A. See Section 230010 Mechanical General Provisions.

B. Submit product data, O&M data, and samples and show item on shop and coordination drawings according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Valves, all types	R	R		R
Valve accessories (handle extensions, operators, etc.)	R			
Manual and automatic air vents	R	R		
Pressure/temperature test plug	R	R		

PART 2 - PRODUCTS

2.1 MANUFACTUERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Ball, gate, and check valves.

1. Nibco Inc.
2. Crane Company.
3. De Zurik Corporation.
4. Or equal.

C. Butterfly valves.

1. Nibco Inc.
2. Crane Company.
3. De Zurik Corporation.
4. Or equal.

D. Balancing valves.

1. ITT Bell and Gossett.
2. Taco Inc.
3. Watts.
4. Or equal.

E. Silent check valves.

1. Nibco Inc.
2. Grinnell.
3. Mueller Steam Specialty.
4. Or equal.

F. Combination check and shut-off valves and Triple duty valves: Not allowed.

G. Pressure reducing valves-air and water. Safety and relief valves.

1. Watts.
2. Consolidated.
3. ITT Bell and Gossett.
4. Or equal.

H. Vent cocks.

1. Weiss.
2. Weksler.
3. Crane Company.
4. Or equal.

I. Automatic air vents.

1. Amtrol.
2. ITT Bell and Gossett.
3. Dole Valve Company.
4. Or equal.

2.2 GENERAL

A. Where possible, provide valves of same manufacturer for all Mechanical Sections per products in this Section.

B. For copper tubing provide solder-joint valves, flare fittings, or IPS-to-copper adaptor, sized for use with tubing and respective valve.

C. For flanged valves, provide streamline companion flanges, ANSI B16.5, 1988 150 class pounds per square inch.

1. 255 pounds per square inch water on gage (WOG) at 150 degree Fahrenheit.
2. 225 pounds per square inch water on gage (WOG) at 250 degree Fahrenheit unless indicated otherwise.

D. Provide valves rated not less than 125 pounds per square inch steam working pressure, unless indicated otherwise.

E. Provide valve materials suitable for service and temperature of respective systems, especially with respect to discs, plugs, balls, linings, gaskets, and lubricants of globe valves, plug cocks, ball valves, etc.

F. Provide chain-operated hand wheels, rustproof chain and chain guide for following valves.

1. Provide chain-operated hand wheels, rustproof chain and chain guide for following valves.
2. As noted.

G. Valves in Insulated Piping: With 2 inch (minimum, greater if insulation thickness is greater than 2 inches) stem extensions and the following features:

1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation and memory stops that are fully adjustable after insulation is applied. Nibco Nib-seal handle extension or equal.
2. Butterfly Valves: With extended neck.

2.3 BALL VALVES

A. 2-1/2 inches and smaller.

1. Two piece body, bronze ASTM B584 C84400.
2. 316 stainless steel stem and ball.
3. PTFE Seat.
4. Full Port 1/2 to 1 inch; Standard Port 1-1/4 and larger.
5. 600 pounds per square inch at 100 degree F, 125 pounds per square inch saturated steam.
6. Infinite throttling handle with memory stop.
7. Nibco 585-70-66 or equal. Nibco 580-70-66 or equal may be used for 1-1/4 inch and larger.

2.4 GATE VALVES

A. General.

1. 2 inches and smaller, Bronze.

a. Class 125 (125 psi steam, 200 psi water).
b. Solid wedge.
c. Union bonnet.
d. Inside screw.
e. Rising screw.
f. Rising stem.
g. Equal to Nibco.

1) Threaded: T-124.
2) Soldered: S-134.

2. 2-1/2 inches and larger.

a. Iron body.
b. Bronze trim.
c. Class 125 (125 psi steam, 200 psi water).
d. Solid wedge.
e. Outside screw and yoke (OS&Y).
f. Flanged.
g. Equal to Nibco

1) 125 pounds per square inch: F-617-O.
2) 250 pounds per square inch: F-667-O.

B. Gate Valves – Hose.

1. Cast Bronze.
2. 200 pounds per square inch water working pressure.
3. Rising stem.
4. Polished chrome plated.
5. Satin chrome.
6. Rough bronze.
7. Polished bronze.
8. NFPA approved.

9. Cap chained to valve body.
10. With escutcheon.
11. Hose threads per requirements of Fire Authority having jurisdiction.
12. Equal to Potter-Roemer.

    a. 2-1/2 x 2-1/2 = 4315.
    b. 2-1/2 x 3 = 4335.

C. Gate Valves – Direct Buried.

1. AWWA C500.
2. Federal Specification WW-V-586, Type II, Class1.
3. Cast iron.
4. Pressure ratings: 2-12 inches - 200 pounds per square inch working, 400 pounds per square inch test; 14 inch and larger - 150 pounds per square inch working, 300 pounds per square inch test.
5. Double disc, parallel seat.
6. Non-rising stem.
7. Joint ends to match piping.
8. Equal to Clow Series F-5062 through F-5085.

D. Valve Indicator Posts.

1. U.L. listed.
2. Two piece.
3. Non-rising stem.
4. Equal to Nibco NIP-1AJ.

E. Lockshield Gate Valves: Same as gate valves, except key operated.

2.5 BUTTERFLY VALVES

A. Flange Type:

1. Iron body.
2. 316 or 416 stainless steel stem, continuous with pinned disc.
3. Disk shall be either:

    a. 316 stainless steel.
    b. Aluminum bronze.
    c. Nickel encapsulated ductile iron.
    d. EPDM encapsulated ductile iron.
    e. Nylon encapsulated ductile iron.

4. Steel seat or cast iron support ring.
5. EPDM body and stem seal.
6. Bronze or copper bushings.
7. Factory tested bubble-tight at 150 pounds per square inch.

B. Type:

1. Lug Type:

    a. Equal to Nibco Series LD-2000.

b. Lugs drilled and tapped to match ANSI 150 flanges.
c. Recommended by manufacturer or dead-end service at full pressure without the need for downstream flanges.
d. Use cap screws both sides.

C. Operator:

1. Infinite throttling handle with memory stop: smaller than 8 inches.
2. Gear operators: 8 inches and larger.

2.6 BALANCING VALVES

A. Calibrated Balancing Valves.

1. Combination balancing and shut-off valves.
2. Calibrated name plate and adjustable memory stop.
3. Capped read-out valves.
4. Pre-formed insulation for chilled water valves.
5. Provide one differential pressure read-out meter for all valves in system.
6. 2-1/2 inches and smaller:

a. Brass body.
b. 304 stainless steel ball.
c. Soldered or threaded ends.
a. Teflon or TFE seats.
b. 250 pounds per square inch at 250 degrees Fahrenheit.

7. 3 inches and larger.

a. Ductile or cast iron body.
b. Flanged.
c. 175 pounds per square inch at 250 degrees Fahrenheit.

8. Devices using venture type flow meter not acceptable (due to propensity for clogging and ease of putting valve with limited flow range in wrong direction).
9. Devices using Pitot tube or Annubar type flow meter not acceptable (due to propensity for clogging).
10. Devices using other than ball or butterfly valves shall not be used for coil isolation – a separate ball valve or butterfly valve shall be added for isolation (to ensure positive shut-off and to allow 90˚ open-close with memory stop) whether shown on schematics or not.
11. Bell & Gossett Circuit-Setter Plus, or equal.

B. Combination shut-off, balancing, and check valve: Not allowed.

2.7 CHECK VALVES

A. Check Valves, General Service.

1. 2 inches and smaller.

a. Swing check.
b. Class 125 (125 psi steam, 200 psi water).
c. Bronze disc.

d. Screw-in cap.
e. Soldered ends.
f. Equal to Nibco S-413-W.

2. 2-1/2 inches and larger.
a. Swing Check.
b. Class 125 (125 psi steam, 200 psi water).
c. Bronze disc and seat ring.
d. Bolted cap.
e. Flanged body.
f. Equal to Nibco F-918-8.

B. Silent Check Valves.

1. For pump discharges:

a. Except sump pumps and sewage ejectors.
b. Variable speed pumps. Check valve pressure drop shall vary roughly as the square of flow rate to near zero flow. Valves that use hydrodynamic profiles (e.g. Victaulic 716 check valve) resulting in high or erratic pressure drop at low flow rates are not acceptable.

2. 2 inches or smaller.

a. Center-guided, silent check.
b. Class 125 (125 psi steam, 200 psi water).
c. Bronze trim.
d. Equal to Nibco 480.

3. 2-1/2 inches or larger.

a. Globe body silent check.
b. Class 125 (125 psi steam, 200 psi water).
c. Bronze trim.
d. Center-guided.
e. Flanged body.
f. Equal to Nibco F-910.

C. Check Valves at Domestic Water Pressure Pumps.

1. 2 inches and smaller.

a. Bronze.
b. 125 pounds per square inch steam, 175 pounds per square inch water on gage (WOG).
c. Diaphragm actuated globe type.
d. Separate opening and closing speed control.
e. Threaded body.
f. Equal to Clayton No. 81-01.

2. 2-1/2 inches and larger.

a. Iron body with bronze trim.
b. 125 pounds per square inch steam, 175 pounds per square inch water on gage (WOG).

c. Diaphragm actuated globe type.
d. Separate opening and closing speed control.
e. Flanged body.
f. Equal to Clayton No. 81-02.

D. Detector Check Valves.

1. Automatic compound lever check valve and bypass bronze disc meter.
2. Flanged galvanized cast iron body.
3. With threaded or flanged bronze IBBM control and check valves.
4. Equal to Hersey Model D.C.

2.8 SAFETY AND RELIEF VALVES

A. General.

1. Constructed, rated and stamped in accordance with Section IV of the ASME Boiler and Pressure Vessel Code.
2. Direct spring-loaded type.
3. Adjustable discharge pressure setting.
4. Bronze body and all wetted parts shall be non-ferrous.
5. Suitable and rated for system pressure and temperatue.

B. Set pressures.

1. Set pressure as indicated on Drawings: Not to exceed pressure rating of protected equipment.
2. Valves to open, under test, at set pressure with following tolerance:

a. Set pressure up to 70 pounds per square inch gage: plus or minus 2 pounds per square inch.
b. Set pressure, above 70 pounds per square inch gage: plus or minus 3 percent.

C. Capacities.

1. Valves shall have capacity to relieve maximum possible generated energy while maintaining pressure in protected equipment at no more than 10 percent above vessel working pressure.
2. Greater than make-up pressure reducing valve capacity.
3. Equipment relief valve capacity to exceed rating of connected equipment.
4. For boiler relief valves, the valve shall have a BTU/h rating in excess of the BTU/h rating of the boiler's heating output.
5. Provide multiple valves if required for capacity even though only one valve may be shown on Drawings.

D. Maintain pressure in protected equipment at not more than the following:

1. Low pressure Boilers: 5 pounds per square inch above boiler working pressure.
2. High pressure Boilers: 6 percent above boiler working pressure.
3. Unfired Pressure Vessels: 10 percent above vessel working pressure.

E. Safety and Relief Valves: Equal to Consolidated.

F. Relief Valves, Water: Equal to Watts.

2.9 VENT AND GAUGE COCKS

A. Bronze body, 1/4 inch size.

B. Lever handle.

C. 125 pounds per square inch steam working pressure.

D. Equal to Weiss LC-14.

2.10 MANUAL AIR VENTS

A. Construction.

1. Vertical.
2. Provide 1/4 inch brass needle valve at top of chamber.
3. To 3 inch pipe: Line size air chamber, 12 inch long.
4. 4 inch to 8 inch: Line size air chamber, 6 inch long.
5. 10 inch and larger: Line size pipe cap.

2.11 AUTOMATIC AIR VENTS

A. Float type.

1. With isolating valve.
2. Brass or semi-steel body.
3. Float copper or stainless steel.
4. Stainless steel valve and valve seat.
5. Suitable for system operating temperature and pressure.
6. Non-opening on negative pressure.
7. Equal to Thrush/Amtrol No. 720.

B. Disc type.

1. All brass with hydroscopic fiber discs.
2. Vent ports.
3. Adjustable cap for manual shut-off.
4. Integral spring loaded ball check valve.
5. Equal to Dole.

C. Threaded vent connection for piping vent to drain.

D. Upstream ball valve for isolation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate with work of other trades.

B. Install valves in accordance with manufacturer’s written installation instructions.

C. Provide valves as shown on drawings, and provide shutoff valves around all equipment whether shown with valves on drawings or not.

D. Provide all valves (except control valves), strainers, and check valves of same size as the pipes in which they are installed unless otherwise indicated.

E. Pressure rating of valves same as piping in which installed.

F. Install valves with stems upright or horizontal, not inverted.

G. Install valves with cast directional arrows in direction of flow.

H. Support line valves at the valve in addition to regularly spaced pipe supports shown and specified.

I. Check valves:

1. Provide silent check valves at discharge of pumps. Triple duty valves shall not be used as a substitution for check and shut-off valve.
2. Install swing checks and gravity closing lift checks in horizontal position.

J. Butterfly valves:

1. Piping adjacent to lug type shall be flange removable while valve is in use.

K. Control valves:

L. See Section 230923 – EMCS Basic Materials and Devices for valve specifications.

M. Install so that actuators, wiring, and tubing connections are accessible for maintenance. Where the actuator top and position indicator are below 5 feet above the floor, install with valve stem axis vertical with actuator side up. Otherwise, valves shall be installed with stem horizontal so that the position indicator is visible from the floor. Do not install valves with stem below horizontal or down.

N. Provide blow-down ball valves and hose adaptors at strainers, air separators, tanks, pipe traps, equipment drains, etc. of same size as strainer blow-off connection.

O. Provide drain valves at main shut-off valves, low points of piping and apparatus.

P. Provide extended valve stems to clear insulation on insulated valves.

Q. Locate wheel handles to clear obstructions with hand.

R. Install valves only in accessible locations.

S. Wherever possible, install valves accessible from floor level. Provide guided chain operators on valves over 7 feet above floor in equipment areas. Extend chains to within 6 feet 6 inches of floor.

T. Locate equipment shut-off valves to be accessible without climbing over equipment.

U. Provide operating handles for all valves and cocks without integral operators, unless otherwise noted. Provide adequate clearance for easy operation.

V. Provide discharge pipe to atmosphere from all relief and safety valves, sized with area equal to sum of outlet areas of all valves connected thereto, unless indicated larger. Extend to over code compliant drain receptacle with airgap.

W. Provide ball valves to isolate shock absorbers.

X. Provide open-ended line valves with plugs or blind flanges.

3.2 VALVE APPLICATIONS

A. Valves shall be limited to the applications listed below. Where this section disagrees with drawings, obtain clarification from Architect and provide as directed by the Architect at no additional cost to the Owner.

B. Ball valves:

1. Throttling and shut-off: water.
2. Use in HVAC, domestic water, and general fire protection piping 2-1/2 inches and smaller.

C. Butterfly valves:

1. Throttling and shut-off: water.
2. Use in HVAC, domestic water, and general fire protection piping 3 inches and larger.

D. Gate Valves:

1. Hose drains.
2. Direct buried.
3. Not used for general shut-off (ball or butterfly only for general shut-off).

3.3 AIR VENTS

A. Manual air vents.

1. Locate:

a. As shown on drawings.
b. At all high points in closed piping systems.
c. At equipment with vents, such as coils.

2. 1/4 inch copper tube discharged into nearest drain or with 180 degree bend to discharge into portable container.
3. Extend tubing or piping as required to make valve accessible.

B. Automatic air vents.

1. Locate:

a. As shown on drawings.

2. Provide manual cock at automatic air vents. Shut after system is free of air.
3. 1/4 inch copper tube discharged into nearest drain.

3.4 FIELD QUALITY CONTROL

A. Test operate valves from closed-to-open-to-closed position while valve is under test pressure.

B. Test automatic valves including solenoid valves, expansion valves, water regulating valves, pressure reducing valves, pressure relief valves, safety valves and temperature and pressure relief valves for proper operation at settings indicated.

C. Insure that valves are field checked for packing and lubricant and that disc is for service intended. Replace leaking packing at no additional cost to the Owner. Service valves which do not operate smoothly and properly with suitable lubricant before placing in operation at no additional cost to the Owner.

3.5 INSPECTION & COMPLETION

A. Verify that adequate clearance between valves and adjacent walls or equipment is available to permit maintenance and repairs.

B. Verify valve set for normal operation.

C. Valves tags: See Section 230553 – Mechanical Identification.

D. See Section 230593 – Testing, Adjusting and Balancing.

END OF SECTION 23 05 23

SECTION 23 05 29

HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Equipment supports.

B. Related Sections:

1. Division 21 – Fire Protection Work.
2. Division 22 – Plumbing Work.

1.3 REFERENCE STANDARDS

A. American Society of Mechanical Engineers: ASME Section VIII – Boiler and Pressure Vessel Code – Pressure Vessels.

B. Pipe Supports: ANSI B31.1, Power Piping.

C. Duct Hangers: SMACNA Duct Manuals.

1.4 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, “Guidelines on Terminology for Pipe Hangers and Supports”.

1.5 SUBMITTALS

A. See Section 230010 – Mechanical General Provisions.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. "R" means required.
2. "R2" means required only for products and equipment differing for the specified manufacturer and model and for "or equals" where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Pipe hangers and supports	R	R		R
Structural attachments	R			R
Pipe protection and thermal hanger shields	R	R		R
Equipment supports	R			R
Expansion shields	R			
Welding certificates	R			

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Hangers, Inserts and Supports.

1. Unistrut.
2. Superstrut.
3. B-Line Systems.
4. Or equal.

C. Pipe Protection and Thermal Hanger Shields.

1. Pipe Shields, Inc.
2. Elcen Metal Products Company
3. Superstrut.
4. Or equal.

D. Expansion Shields.

1. Hilti Fastening Systems.
2. ITT Phillips Drill Co.: Red Head.
3. Omark Industries, Inc.
4. Or equal.

E. Pipe Stand Supports.

1. B-Line Systems, Inc.
2. Grinnell Corp.
3. PHD Manufacturing, Inc.
4. Or equal.

F. Powder-Actuated Fastener Systems.

1. Hilti Fastening Systems.
2. ITW Ramset/Red Head.
3. Masterset Fastening Systems, Inc.
4. Or equal.

G. Insulation Protectors.

1. B-Line Systems, Inc.
2. ITT Grinnell Corporation.
3. PHD Manufacturing, Inc.
4. Or equal.

H. Roof Pipe Supports.

1. MiFab.
2. B-Line Systems, Inc.
3. Miro.
4. Or equal

I. Miscellaneous Devices.

1. Kopty.
2. Wejit.
3. Or equal.

2.2 PIPE HANGERS AND SUPPORTS

A. Model numbers are Superstrut, unless otherwise indicated.

B. Provide electro-chromate, galvanized or factory painted finish; no plain, "black" hangers allowed.

C. Dielectric Isolators: All uninsulated copper tubing systems; Superstrut isolators or equal, Cush-A-Strip or Cush-A-Clamp on all pipe clamps; for individual hangers, use felt lined hangers.

D. Individual Pipe Hangers.

1. Cold pipe all sizes: Clevis hanger, No. C710.
2. Hot pipe sizes up to 4 in: Clevis hanger, No. C710.
3. Hot pipe sizes above 6 in: Adjustable steel yoke and cast iron roll No. C729.

E. Multiple or Trapeze Hangers.

1. Factory channel.

a. 12 gauge thick steel.
b. Single or double section.
c. Electro-chromate finish.
d. Strutnuts: Series A-100 or CM-100.
e. Straps: Series 702.
f. No. A-1200 or A-1202.

2. Hot pipe sizes 6 in and larger: cast iron roll and stand; C728 or CR728.

F. Wall Supports.

1. Pipe sizes up to 3 in: Steel bracket No. C738.
2. Pipe sizes 4 in and larger: Welded steel bracket C-735.
3. Hot pipe sizes 6 inches and larger.

    a. Welded steel bracket No. C739.
    b. Adjustable steel yoke and cast iron roller No.C729.

G. Vertical Support.

1. Riser clamp Series C-720.

H. Floor Support.

1. Hot pipe sizes up to 4 in; cold pipe, all sizes.

    a. Adjustable cast iron saddle No. R786.
    b. Locknut nipple.
    c. Floor flange.

2. Hot pipe sizes 6 in and larger: Adjustable cast iron roll and stand No. R-730-C.

I. Thermal Hanger Shields (for insulated pipe supports).

1. 180 degree high density insert.

    a. 100 psi waterproofed cellular glass, asbestos-free, K=0.38, encased in a 360-degree galvanized sheet metal shield, ASTM A653.
    b. See Section 230719 Piping Insulation.
    c. Same thickness as adjoining pipe insulation.

2. 180 degree galvanized sheet metal shield (inverted saddle).

    a. Shield length and gauges.

Pipe Size	Shield Length	Minimum Gauge
1/2-1 1/2	4	26
2 - 6	6	20
8 - 10	9	16

3. Insert to extend one inch beyond metal shield ends on insulated piping.
4. Use double layer shield on bearing surface for:

    a. Roller hangers.
    b. Support spacing exceeding 10 feet.

J. Pipe Isolators.

1. Hanger with felt padding.
2. Tolco Fig. 3F or equal felt lined hangers.

K. Anchors and Guides: Provide anchors and guides where indicated on the Drawings and as required. Structural inserts shall be high density cellular glass. Guide slide pads shall be Teflon. Ensure that slide accommodates pipe movement over full range of service and out-of-service temperatures. Guides shall be Pipe Shields, Inc. Model #B3000 or equal. Anchors shall be Pipe Shields, Inc. Model #C4000 or equal. See Section 230719 HVAC Piping Insulation.

L. Insulated Pipe Strap.

1. 1/2 in to 1 in plumbing piping in wood frame construction.
2. Felt insulated.
3. Kopty or equal.

M. Escutcheons: See Section 230500 – Basic Mechanical Materials and Methods.

N. Flashing and Sleeves.

1. Flashings.

a. See Division 7 – Thermal and Moisture Protection.
b. Flash and counter flash watertight all pipe and duct penetrations of roofs and exterior walls.
c. Flash pipes through roofs with ITW Buildex Dektite or equal.
d. Flash vents through roofs with.

1) Minimum 24 gage soldered roof jack for flat surface roofs.
2) Minimum 4 pound lead soldered roof jack for roofs other than flat surface roofs.
3) Vandal caps.
4) Provide counter-flashing sleeves and storm collars.
5) Caulk counter-flashing and storm collar weather tight.
6) Other flashings shall be minimum 24-gage galvanized sheet metal.

2. Sleeves.

a. See 230500 – Basic Mechanical Materials and Methods.

b. For insulated piping, sleeve diameter shall not be less than diameter of insulation.

c. Terminate sleeves flush with walls, and ceiling.

d. For exposed vertical pipe, extend sleeves 1 inch above finished floor except where escutcheons are required.

e. Packing through fire rated partitions on of following.

1) 3M Penetration Sealing Systems (PSS 7909) and 3M Fire Barrier Caulk and Putty.
2) Dow-Corning LTV Silicone foam.
3) Or equal.

3. Separate piping through walls, other than concrete walls, from contact with wall construction materials; use non-hardening caulking.

4. Install insulation on piping in walls which require insulation at time of installation.

2.3 DUCT HANGERS AND SUPPORTS

A. See Section 233113 – Ducts.

2.4 DUCT AND PIPE SUPPORT AT ROOF LEVEL

A. The Contractor shall coordinate pipe work and ductwork to provide access to all equipment. The services at roof level indicated on the details provide the minimum clearance required for pipe work and ductwork for maintenance of the roof. The plans indicate higher elevations where necessary for access. Where pipe work and ductwork cross over at the same point, the pipe work shall run underneath the ductwork. The Contractor may propose a combined structure, for approval, to support the pipes and ducts at roof level. The contractor shall provide calculations by a certified licensed engineer in the state of Mississippi once the conceptual support has been approved. The main path of egress shall be maintained clear at 7’-6”.

2.5 STRUCTURAL ATTACHMENTS

A. Model Numbers are Superstrut, unless otherwise indicated.

B. All components shall have galvanized or equal finish.

C. Anchor Bolts: Size as specified for hanger rods.

D. Concrete Inserts.

1. Malleable iron.
2. Place reinforcing steel through insert as recommended by manufacturer for recommended loads.
3. No. 452 or equal.

E. Beam Clamps.

1. All with U-568 safety strap.
2. All with locknuts on.

    a. Set Screw.
    b. Hanger rod.

3. Bottom flange attachment.

    a. Loading 150 pound and less: U-563.
    b. Loading 150 pound to 300 pound: U-562.
    c. Loading more than 300 pound: U-560.

4. Top flange attachment.

    a. Permitted only when bottom flange attachment cannot be used.
    b. Loading 400 pound and less: M-777.
    c. Loading more than 400 pound: M-778.

F. Welded Beam Attachments: No. C-780 or equal.

G. Side Beam Attachments: No. 542 or equal.

H. Hanger Rods.

1. ASTM A575 Hot rolled steel, galvanized.
2. ANSI B1.1 Unified Inch Screw Treads.
3. Threaded both ends, threaded one end, or continuous threaded.

I. Hanger Rod Fixtures.

1. Turnbuckles: No. F-112 or equal.
2. Linked Eye Rod.
    a. Rod swivel.
    b. No. E-131 or equal.
3. Clevis: No. F-111 or equal.

J. Powder or Gas Actuated Anchors.

1. Not allowed on initial building construction; allowed only for revisions made after initial construction and with approval of Owner.
2. Hardened steel stud with threaded shank; size of shank to match hanger rod size.
3. Use only with non-shock loads.
4. Maximum load safety factors:
    a. Maximum anchor load: 100 pounds.
    b. Static loads – 5.
    c. Vibratory loads - 8-10.
5. For concrete and steel; not to be used for light weight concrete, brick or concrete block.
6. 10% testing rate required, testing by contractor.
7. Omark Drivit or equal.

K. Expansion Shields.

1. Carbon-steel anchors, zinc coated.
2. Stainless steel for corrosive atmospheres.
3. For normal concrete use.
    a. Self-drilling anchor.
    b. Sleeve anchor.
    c. Stud anchor.
4. For thin concrete use: wedge anchor.
5. For brick or concrete block use: sleeve anchor.
6. Maximum load safety factors.
    a. Static loads – 4.
    b. Vibratory loads - 8 – 10.
    c. Shock loads - 8 – 10.
7. Size to suit hanger rods.
8. ITT Phillips Red Head or equal.

L. Steel Deck Inserts.

1. Factory stud with.

    a. Clip.
    b. Spring.
    c. Coupling.

2. ITT Phillips Red-Head or equal.

M. Miscellaneous Metal.

1. Steel plate, shapes and bars: ASTM A36.
2. Steel pipe columns: ASTM A53, Schedule 40, black.
3. Bolts and nuts: regular hexagon-head type, ASTM A307, Grade A.
4. Lag bolts: square head type, Fed. Spec. FF-B-561.
5. Plain washers: round, carbon steel, Fed. Spec. FF-W.92.

2.6 ROOF PIPE SUPPORTS

A. All piping HVAC, plumbing, gas, etc. located above the roof (and supported by the roof) shall be supported utilizing the following roof supports.

B. Rubber support base with 1-5/8-inch galvanized steel channel.

C. Materials:

1. Base: 100% recycled rubber, UV resistant.
2. Channel: 14 gauge galvanized steel (1-5/8-inch wide x 1-5/8-inch high).

D. Maximum load: 750 lbs for each 9.6-inch long support.

E. Include strut clamp.

F. Mifab C6 Series or equal. Sized appropriately for the quantity of piping being supported.

2.7 MISCELLANEOUS MATERIALS

A. Powder-Actuated Drive-Pin Fasteners: Powder-actuated-type, drive-pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

C. Structural Steel: ASTM A36/A36M, steel plates, shapes, and bars, black and galvanized.

D. Concrete: Normal weight concrete (145 pcf) using Type I Portland Cement, 1" maximum size coarse aggregate to provide a minimum 28 day compressive strength of 3000 psi.

E. Grout: ASTM C1107, Grade B, factory-mixed and -packaged, nonshrink and nonmetallic, dry, hydraulic-cement grout.

1. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
2. Properties: Nonstaining, noncorrosive, and nongaseous.

3. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 PIPE HANGERS, SUPPORTS AND GUIDES

A. General.

1. Assure adequate support for pipe and contents.
2. Provide adjustable hangers for all pipes complete with inserts, adjusters, bolts, nuts, swivels, all-thread rods, etc., except where specified otherwise.
3. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping and do not support piping from other piping.
4. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.
5. Install all cast iron piping in accordance with Cast Iron Soil Pipe Industry (CISPI) Standards.
6. Support all piping within 2 feet of each change of direction on both sides of fitting.
7. Thermal hanger shields shall be provided at hangers and supports where piping is insulated.
8. Prevent vibration or swaying.
9. Provide for expansion and contraction.
10. Supports of wire, rope, wood, chain, strap perforated bar or any other makeshift device not permitted.
11. Comply with applicable requirements at ANSI B31.1 and B31.2 for piping.
12. Support piping independently so that equipment is not stressed by piping weight of expansion.
13. Hangers and supports shall have minimum safety factor of five (5), based on ultimate tensile or compressive strength, as applicable, of material used; base calculations on equipment's heaviest operating weight and pipes full of water.
14. Install additional supports or braces if, during normal operation, piping should sway, crawl or vibrate. Piping shall be immobile.
15. Install thrust blocks as required to prevent sway.

B. Horizontal piping, except as noted.

1. Adjustable clevis type and rod; all services at or below 250 degrees F.
2. Rollers or slide bases: not required.
3. Trapeze hangers; guide individual pipes on trapezes with 1/4 inch U-bolt or Superstrut 702 pipe clamp.

    a. Install thermal hanger shield at each support point.

4. Galvanized sheet metal shields between hangers and PVC piping.
5. Threaded steel rods.

    a. 2 in vertical adjustment with 2 nuts each end for positioning and locking.
    b. Size to 12 in inside pipe size (IPS).

Pipe, IPS	Rod
to 2 inch	3/8 inch
2-1/2 inch and 3 inch	1/2 inch
4 inch	5/8 inch
6 inch and 8 inch	3/4 inch
10 inch and 12 inch	7/8 inch
14 inch and 18 inch	1 inch
20 inch and 30 inch	1-1/4 inch

c. Size above 12 inch IPS and multiple pipe standards: safety factor of 5 on ultimate strength on area.
d. For double rod hangers: 1 size smaller than above.

C. Vertical piping.

1. Base support.

a. Base elbow or welded equivalent.
b. Bearing plate on structural support.

2. Guides.

a. At every third floor but not to exceed.

1) 25 feet for piping to 2 inch.
2) 36 feet for piping 2-1/2 inch to 12 inch.
3) 50 feet for piping 14 inch and larger.

b. Or as otherwise designed by the Vibration Isolation vendor.

3. Top support.

a. Special hanger or saddle in horizontal connection.
b. Provisions for expansion.

4. Intermediate supports: steel pipe clamp at floor.

a. Bolted and welded to pipe.
b. Extension ends bearing on structural steel or bearing plates.

5. For multiple pipes: coordinate guides, bearing plates and accessory steel.

D. Horizontal insulated piping.

1. Install saddles for rollers or slide bases.
2. Install thermal hanger shields for all other types of supports.
3. See Section 230719 HVAC Piping Insulation for insulation connection to shields.

E. Vertical insulated piping.

1. Install thermal hanger shields at guides.
2. See Section 230719 HVAC Piping Insulation for insulation connection to shields.

F. Install Pipe Isolators between hangers and piping for all uninsulated copper tubing.

G. Miscellaneous Steel.

1. Provide miscellaneous steel members, beams, brackets, etc., for support of work in this division unless specifically included in other divisions.

H. Fire-stopping.

1. At pipe penetrations through rated assemblies.
2. Commercial pipe sleeve assemblies that are UL listed and that have been approved by the fire marshal for this purpose.

I. Roof pipe supports shall be installed per manufacturer's recommendations in coordination with the roofing system and company holding the roof warranty.

3.2 PIPE SUPPORT SPACING

A. Maximum spacing for horizontal piping.

Type of Pipe	Size	MAXIMUM SPACING
Steel	1-1/2 inch and smaller	7 feet
	2 inch and larger	10 feet
Copper	3/4 inch and smaller	5 feet
	1- 1-1/4 inch	6 feet
	1-1/2 - 3 inch	8 feet
	4 inch and larger	10 feet
Plastic	3/4 inch and smaller	3 feet

B. Spacing Notes: Additional supports at:

1. Changes in direction.
2. Branch piping and runouts over 5 feet.
3. Concentrated loads due to valves, strainers and other similar items.
4. At valves 4 inch and larger in horizontal piping, support piping on each side of valve.

C. Parallel piping on trapezes.

1. Maximum spacing to be that of pipe requiring closest spacing.

3.3 ATTACHMENT TO STRUCTURE

A. Concrete.

1. Use inserts for suspending hangers from reinforced concrete slabs, walls and sides of reinforced concrete beams wherever practicable.
2. Set inserts in position in advance of concrete work.
3. Provide reinforcement rod in concrete for inserts carrying.

    a. Pipe over 4 inch.
    b. Ducts over 60 inches wide.

4. Where concrete slabs form finished ceiling, finish inserts flush with slab surface.
5. Where inserts are omitted, install hangers with expansion shields.
6. Through-deck support.

    a. Drill through concrete slab from below.
    b. Provide rod with recessed square steel plate and nut above slab.

7. Where permitted by Owner and only for revisions made after initial construction, powder actuated anchors or expansion shields may be used in lieu of inserts.

    a. In bottom of thick slabs.
    b. In thin slab construction, only in sides of beams.

8. Pre-Cast Concrete.

    a. Use pre-set inserts.
    b. Where inserts are not available, field drill through beam or joists at locations as directed by Architect.
    c. Through bolt side beam bracket to beam or joist.

9. Poured-In-Place Concrete.

    a. With metal form or underdeck.
    b. Before concrete is poured.

        1) Field drill hole through metal deck.
        2) Provide bearing plate, nut and locknut on rod; or install factory-made steel deck inserts specified hereinbefore.

    c. After concrete is poured.

        1) Install hangers with expansion shields.

B. Steel Beam Anchors.

1. Beam or channel clamps.
2. Do not cut or weld to structural steel without permission of structural engineer.

C. Steel Deck Anchors.

1. Concrete filled: as specified above.
2. Decking without concrete.

    a. Through rod Support.

        1) Weld to square plate, 1/4 in thick.
        2) Plate to distribute load over minimum of two full cells.
        3) Coordinate with floor layouts to clear cells with wiring.

D. Side Wall Supports.

1. Concrete walls: As specified for hangers.
2. Stud Walls.

    a. Toggle bolts.

b. Stud welded to structural studs.

E. Support Spreaders.

1. Install spreaders spanning between structural members when hangers fall between them, and hanger load is too great for slab or deck attachment.
2. Spreaders may be one of methods listed below, or combination of both as required.

a. Fabricated from structural channel.

1) End fittings bolted or welded.
2) Secure to structural members.

a) As required by construction.
b) As reviewed by Structural Engineer.

b. Formed channels with fittings, Superstrut or equal.

1) Submit manufacturer's calculations for installation.

3.4 DUCT HANGERS AND SUPPORTS

1. See Section 233113 Ducts.

3.5 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure above or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and floor pipe supports. Finish shall provide a smooth bearing surface.

3.6 METAL FABRICATION

A. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.

B. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.7 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.8 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 23 05 29

SECTION 23 05 33

HEAT TRACING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes heat tracing for HVAC piping with the following electric heating cables:

1. Self-regulating, parallel resistance.

B. Related Requirements:

1. Section 230010 Mechanical General Provisions.

1.3 SUBMITTALS

A. See Section 230010 – Mechanical General Provisions.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Heat tracing	R	R		R
Accessories	R			
Controls	R			

1.4 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace electric heating cable that fails in materials or workmanship within specified warranty period.

1. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SELF-REGULATING, PARALLEL-RESISTANCE HEATING CABLES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Chromalox, Inc.
2. Raychem; Tyco Thermal Controls.
3. Thermon Americas Inc.
4. Or equal.

B. Comply with IEEE 515.1.

C. Heating Element: Pair of parallel No. 16 AWG, tinned, stranded copper bus wires embedded in crosslinked conductive polymer core, which varies heat output in response to temperature along its length. Terminate with waterproof, factory-assembled, nonheating leads with connectors at one end, and seal the opposite end watertight. Cable shall be capable of crossing over itself once without overheating.

D. Electrical Insulating Jacket: Flame-retardant polyolefin.

E. Cable Cover: Tinned-copper braid and polyolefin outer jacket with ultraviolet inhibitor.

F. Maximum Operating Temperature (Power On): 150 deg F.

G. Maximum Exposure Temperature (Power Off): 185 deg F.

H. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

I. Heating cable capacity shall be based on freeze protection for metallic piping and a low ambient temperature of 0 °F.

2.2 CONTROLS

A. Snap action; open-on-rise, single-pole switch with minimum current rating adequate for connected cable.

B. Thermostat: Ambient sensing, U.L. listed thermostat with a variable setpoint and a SP-DT switch in a NEMA 4X enclosure. Sensing element shall be stainless steel; setpoint range shall be -15 °F to 140 °F. Control shall meet ASHRAE Standard 90.1-2010.

C. Corrosion-resistant, waterproof control enclosure.

2.3 ACCESSORIES

A. Cable Installation Accessories: Fiberglass tape, heat-conductive putty, cable ties, silicone end seals and splice kits, and installation clips all furnished by manufacturer, or as recommended in writing by manufacturer.

B. Warning Labels: Refer to Section 230553 Mechanical Identification.

C. Warning Tape: Continuously printed "Electrical Tracing"; vinyl, at least 3 mils thick, and with pressure-sensitive, permanent, waterproof, self-adhesive back.

1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches: 3/4 inch minimum.
2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches or Larger: 1-1/2 inches minimum.

PART 3 - EXECUTION

3.1 HEATING TRACING APPLICATIONS

A. Provide heating capacity, as recommended by the manufacturer, to keep the pipe surface temperature at a minimum of 36 ˚F at an outdoor air temperature of 10 ˚F, but not less than the following:

1. 3-inch pipe and smaller: 4 Watts per linear foot of pipe.
2. 4-inch pipe and larger: 8 Watts per linear foot of pipe.

3.2 EXAMINATION

A. Examine surfaces and substrates to receive electric heating cables for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Ensure surfaces and pipes in contact with electric heating cables are free of burrs and sharp protrusions.
2. Ensure pipe testing is complete.
3. Ensure surfaces and substrates are level and plumb.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Test cables for electrical continuity before installing.

D. Test cables for insulation resistance before installing.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. Install electric heating cable across expansion joints according to manufacturer's written instructions; use slack cable to allow movement without damage to cable.

B. Install electric heating cables after piping has been tested and before insulation is installed.

C. Install electric heating cables according to IEEE 515.1.

D. Install insulation over piping with electric cables according to Section 230719 Mechanical Insulation.

E. Install warning tape on piping insulation where piping is equipped with electric heating cables.

F. Set field-adjustable switches and circuit-breaker trip ranges.

3.4 CONNECTIONS

A. Electrical installation requirements are specified in Division 26 Sections. Drawings indicate general arrangement of wiring, conduit, and specialties.

B. Connect heating cables and other components to wiring systems.

C. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections[with the assistance of a factory-authorized service representative]:

1. Perform tests after cable installation but before application of coverings such as insulation, wall or ceiling construction, or concrete.
2. Test cables for electrical continuity and insulation integrity before energizing.
3. Test cables to verify rating and power input. Energize and measure voltage and current simultaneously.

B. Repeat tests for continuity, insulation resistance, and input power after applying thermal insulation on pipe-mounted cables.

C. Cables will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.6 ADJUSTING

A. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

3.7 PROTECTION

A. Protect installed heating cables, including nonheating leads, from damage during construction.

B. Remove and replace damaged heat-tracing cables.

END OF SECTION 23 05 33

SECTION 23 05 48

MECHANICAL SOUND AND VIBRATION CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Work Included in This Section: Materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Vibration isolators for equipment
2. Vibration isolators for piping systems
3. Equipment bases
4. Inertia bases

B. Related Sections

1. Section 23 00 10 – Mechanical General Provisions
2. Section 23 05 00 – Basic Mechanical Materials and Methods
3. Duct sound attenuators, see Section 23 33 00 – Duct Accessories
4. Section 23 05 16 – Piping Specialties

1.3 REFERENCE STANDARDS

A. AFBMA – Anti-Friction Bearing Manufacturer's Association

B. ASHRAE – American Society of Heating, Refrigerating and Air Conditioning Engineers

C. NEMA – National Electrical Manufacturer's Association

D. Underwriters' Laboratories, Inc.: UL 778 – Motor Operated Water Pumps

E. American Society of Mechanical Engineers: ASME Section VIII – Boiler and Pressure Vessel Code – Pressure Vessels

F. Published specifications standards, tests or recommended methods of trade, industry or governmental organizations apply to work in this section where cited below

1. Mason Industries “Seismic Restraint Guidelines for Suspended Piping, Ductwork, and Electrical Systems”
2. SMACNA and PPIC “Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Piping Systems”.

G. Publication references below are basic industry standards; however, regulatory requirements may reference, modify or supersede:

1. American Institute of Steel Construction (AISC) publications

    a. Specification for the Design, Fabrication and Erection of Structural Steel Buildings (Eighth Edition)

2. American National Standards Institute (ANSI) Standard

    a. B027.2-965 – Plain Washers

3. American Society for Testing and Materials (ASTM) Specifications

    a. A 6 – General Requirements for Delivery and Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use
    b. A 36 – Structural Steel
    c. A 53 – Welded and Seamless Steel Pipe
    d. B633 – Electrodeposited Coatings of Zinc on Steel
    e. A 307 – Carbon Steel Externally and Internally Threaded Standard Fasteners
    f. A 500 – Cold-Formed Welded and Seamless Carbon Steel Structural Tubing
    g. A1011 – Hot Rolled Carbon Steel Sheet and Strip

4. American Society for Testing and Materials (ASTM) Specifications

    a. A 6 – General Requirements for Delivery and Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use
    b. A 36 – Structural Steel
    c. A 53 – Welded and Seamless Steel Pipe
    d. B633 – Electrodeposited Coatings of Zinc on Steel
    e. A 307 – Carbon Steel Externally and Internally Threaded Standard Fasteners
    f. A 500 – Cold-Formed Welded and Seamless Carbon Steel Structural Tubing
    g. A1011 – Hot Rolled Carbon Steel Sheet and Strip

5. American Welding Society (AWS) Publication

    a. D 1.1 – Structural Welding Code

1.4 QUALITY ASSURANCE

A. Qualifications

1. Manufacturer

    a. All equipment and accessories to be the product of a manufacturer regularly engaged in its manufacture for not less than five years

B. Manufacturer or manufacturer's representative of vibration isolation equipment shall have the following responsibilities

1. Determine vibration isolator sizes and locations
2. Provide piping and equipment isolation systems as scheduled or specified
3. Guarantee specified isolation system static deflection under installed actual load.
4. Provide installation instructions, drawings and field supervision to assure proper installation, adjustment and performance

C. The installation of all vibration isolation units and associated hangers and bases shall be as directed by the vibration isolation manufacturer's representative.

D. It is the objective of this Specification to provide the necessary design for the control of excessive noise and vibration in the building due to the operation of machinery or equipment, and due to interconnected piping, ductwork or conduit

1. All vibration isolators shall have either known undeflected heights or calibration markings so that, after adjustment, when carrying their load, the deflection under load can be verified, thus determining that the load is within the proper range of the device and that the correct degree of vibration isolation is being provided according to the design.
2. All isolators shall operate in the linear portion of their load versus deflection curve. Load versus deflection curves shall be furnished by the manufacturer and must be linear over a deflection range of not less than 50 percent greater than the design deflection.
3. The theoretical vertical natural frequency for each support point, based upon load per isolator and isolator stiffness, shall not differ from the design objectives for the equipment as a whole by more than ±10 percent.
4. All neoprene mountings shall have a Shore hardness of 30 to 60 ±5, after minimum aging of 20 days or corresponding oven-aging.

E. Acoustical Testing

1. The contractor shall cooperate with regard to sound tests (ARI 575, ANSI S1.13) which may be conducted by Professional to verify that noise criteria are met.
2. The contractor shall notify the Professional of any changes which will affect the acoustical performance.

1.5 SUBMITTALS

A. See Section 23 00 10 – Mechanical General Provisions

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Vibration isolation devices: catalog cuts, static deflections, quantity, load per isolator, mounting details, etc.	R	R		
Concrete and steel details for equipment pads				R
Weld or anchor bolt locations				R
Reinforcing and template steel locations and details				R
Inertia and equipment bases	R	R		R
Anchors, inserts and fasteners and fastening details	R	R		R
Flexible pipe connectors	R	R		R
Flexible duct connectors	R	R		R

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Vibration Isolation

1. Mason Industries, Inc.
2. Kinetics Noise Control, Inc.
3. M.L. Saussé & Co. (Vibrex)
4. Amber-Booth
5. Or equal.

2.2 VIBRATION ISOLATOR TYPES

A. Spring type

1. Spring isolators shall incorporate following

a. All springs to be single coil steel with minimum spring coil outer diameter 0.8 of loaded operating height
b. Horizontal spring stiffness within 0.8 to 1.25 times rated vertical spring stiffness
c. Corrosion resistance

(1) Where exposed to corrosive environment including but not limited to:

a) Outdoors
b) Exposed to outdoor air within 5 feet of outdoor air intake

(2) Corrosion protection: painted with outdoor paint
(3) Springs neoprene coated
(4) Hardware cadmium plated
(5) All other metal parts hot dip galvanized

d. Reserve deflection (from loaded to solid height) of 50 percent of rated deflection
e. Designed and installed so that ends of springs remain parallel; neoprene cups not acceptable
f. Noise pads of ½ inch or 1 inch thickness below the spring base to reduce the chance that the springs shall be resonant with equipment forcing frequencies or support structure natural frequencies. See Table in Paragraph 3.4B.
g. Leveling device
h. Where operating weight differs from installed weight provide built-in adjustable limit stops to prevent equipment rising when weight is removed. Stops shall not be in contact during normal operation.

2. Type "A": Similar to Mason Type SLF
3. Type "B": same as Type "A" except

a. Provide built-in resilient vertical limit stops
b. Tapped holes in top plate for bolting to equipment

c. Capable of supporting equipment at fixed elevation during equipment erection
d. Mason Type SLRS or equal for 1 inch and 2 inch deflection, Type SLR Series 100 for 3 inch to 5 inch deflection

4. Type "C": spring hanger rod isolators shall incorporate the following

a. Spring element seated on steel washer within neoprene cup
b. Steel retainer box encasing spring and neoprene cup
c. Minimum 1/2 inch clearance between retainer box and spring hanger rod
d. Minimum 15 degrees angular clearance between rod and retainer box
e. Double deflection neoprene element at top of hanger box
f. Mason 30N or equal

B. Elastomer mounting types

1. Type "D": Double deflecting type incorporating following

a. Bolt holes for bolting to equipment base
b. Bottom steel plates for bolting to sub-base as required
c. Unit type design molded in black oil-resistant neoprene
d. Neoprene compounded to meet following:

(1) Not greater than 50 durometer
(2) Minimum tensile strength 2000 pounds per square inch
(3) Minimum elongation 300 percent
(4) Maximum compression set of 25 percent of the original deflection

e. Mason Type ND or equal
f. Mason Type BR or equal

2. Type "E": Elastomer hanger rod isolators shall incorporate following

a. Molded unit type neoprene element
b. Compounding described in Type "D" above
c. Steel retainer box encasing neoprene mounting.
d. Minimum 1/2 inch box
e. Mason Type HD or equal

3. Type "F": pad type elastomer mountings to incorporate following

a. 5/16 to 3/8 inch minimum thickness per layer
b. 50 psi maximum loading
c. Ribbed or waffled design
d. 1/16 inch galvanized steel plate between multiple layers of pad thickness
e. 1/16 inch deflection per pad thickness
f. Suitable bearing plate to distribute load
g. Bolts through equipment and pad shall be oversized and provided with resilient washers, bushings and lock nuts
h. Mason Type W Series or equal

4. Type "G": Pad type elastomer mountings to incorporate following

a. High quality bridge bearing neoprene
b. Maximum loading 800 psi
c. Suitable bearing plate to distribute load

d. Minimum thickness 2 inch
e. Mason Type BBP or equal

5. Type "H": Combination spring/elastomer hanger rod isolators to incorporate following

a. Spring and neoprene isolator elements in steel box retainer
b. Characteristics of spring and neoprene as described in Type "C" and Type "E" hanger isolators
c. Factory preloading to 75 percent of rated load
d. Mason PC30N or equal

2.3 EQUIPMENT BASES

A. Integral structural steel bases, Type "B-1"

1. Reinforced as required to prevent base flexure at start-up and misalignment of drive and driven units
2. Fan bases complete with motor slide rails
3. Drilled for drive and driven unit mounting template
4. Mason Type WFSL or equal

B. Concrete inertia base, Type "B-2"

1. Formed in structural steel frame
2. Structural base reinforced as required to prevent flexure, misalignment of drive and driven unit or stress transferal into equipment
3. Minimum thickness of the inertia base shall be 6 inches or greater if required to meet weight ratio specified below
4. Fan bases complete with motor slide rails
5. Pump bases shall be large enough to support suction and discharge elbows and suction diffusers
6. Bases complete with

a. Height saving brackets
b. Reinforcing
c. Equipment bolting provisions
d. Isolators provided by vibration control supplier, type as scheduled

7. Base ready for concrete pour
8. Inertia Base Weights

a. Centrifugal Fans, except as noted: Minimum 1.0 times weight of fan, motor and drive
b. Air handling Units, except as noted: Minimum 1.0 times weight of fan and coil cabinet, coils, fan, motor and drive
c. Pumps: Minimum 1.5 times weight of pump, motor and base

(1) Base to be sized to support suction diffuser when used

d. Air compressors

(1) Minimum 2 times weight of compressor, motor and base
(2) Weight can be reduced by weight of tank when tank mounted unit is provided

9. Mason Type KSL/BMK or equal

2.4 ANCHORS, INSERTS AND FASTENERS

A. All anchors and inserts shall be installed according to the ICBO standards

B. Do not use any anchor or insert in concrete which does not have a signed structurally engineered design value based on its installed application and one of the following

1. ICBO evaluation report
2. Lab test report verifying compliance

C. Do not use powder driven and power driven (Shoot-In) fasteners, expansion nails or friction spring clips

D. All over-head concrete anchors or inserts shall be selected to comply with the ICBO report table for the anchor or insert

E. Torque testing of anchors shall be allowed to verify compliance of anchor installation. However, torque testing shall not justify usability of anchor. Only load or pull testing shall be allowed to justify usability of anchors. Failure of torque shall constitute failure of anchor.

F. Bolts and nuts

1. Bolts and heavy hexagon nuts: ANSI B18.2.1 and ASTM A307 or A576
2. Bolts, underground: ASTM A325
3. Expansion anchors: Federal Specification A-A-1922

2.5 FLEXIBLE PIPE CONNECTORS

A. Piping Connections for Vibration Isolation

1. Molded twin-sphere type connectors made of peroxide cured EPDM and Kevlar tire cord reinforcement
2. Connectors up to 2 inch diameter may have threaded ends
3. Connectors 2-1/2 inch diameter and larger to have floating steel flanges recessed to lock the connector's neoprene flanges
4. Connectors rated a minimum of 150 pounds per square inch at 220 degrees Fahrenheit without control rods or cables
5. Mason SAFEFLEX Type SFDEJ or equal

2.6 FLEXIBLE DUCT CONNECTORS

A. See Section 23 31 13 – Ducts

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install isolators in accordance with manufacturer's written instructions.

B. Vibration isolators must not cause any change of position of equipment or piping resulting in piping

stresses or misalignment.

C. Make no rigid connections between equipment and building structure that degrade noise and vibration isolation system herein specified.

1. Electrical conduit connections to isolated equipment shall be flexible liquid tight conduit of sufficient length to incorporate a right angle bend, an offset of not less than 8 inches or a loop to allow free motion of isolated equipment.
2. The HVAC Sub-contractor shall not install any equipment, piping or conduit which makes rigid contact with the building unless permitted in this Specification; building includes, but is not limited to, slabs, beams, columns, studs and walls.
3. Coordinate work with other trades to avoid rigid contact with the building. Inform other trades following work, such as plastering or electrical, to avoid any contact which would reduce the vibration isolation.

D. Do not use isolator leveling bolts as jacking screws.

E. Verify that all installed isolators and mounting systems permit equipment motion in all directions.

3.2 FLOOR MOUNTED EQUIPMENT

A. Concrete housekeeping pads

1. Isolation supplier to determine dimensions and thickness required.

a. Minimum thickness: 5.5 inches

2. Support all vibration isolation devices and bases.
3. Key with stirrups as required, integral with structural slab.

3.3 EQUIPMENT ISOLATION

A. General

1. Provide 1 inch operating clearance between equipment or structural bases and housekeeping pad

a. 1 inch minimum clearance for inertia bases over 96 inches in any dimension

2. Position equipment, structural base and concrete bases on blocks or wedges at proper operating height
3. Provide operating load conditions prior to transferring base isolator loads to springs and removing wedges
4. Adjust or provide additional resilient restraints to flexibly limit start-up equipment lateral motion to 1/4 inch
5. Prior to start-up, clean out all foreign matter between bases and equipment
6. Verify that there are no isolation short circuits in the base, isolators, or conduit, pipe and duct connections
7. Locate spring hanger boxes directly adjacent to the structural support element above, as opposed to down at the location of the supported equipment
8. Where isolator base pad is called for in Vibration Isolator Schedule, install pad between the isolator base and structure
9. For isolator pads penetrated by anchors to the structure, to prevent short-circuiting, provide neoprene grommet between the anchor and isolator. Hand-tighten nut so that grommet is not

compressed then secure with lock nut.

B. Vibration Isolator Schedule

Equipment	Base Type	Isolator Type	Isolater Static Deflection	Thickness
Floor-mounted Pumps				
10 HP and larger	B-2	A	2 inch	1 inch
5 HP to 7.5 HP	B-2	A	1.5 inch	1/2 inch
<5 HP	B-2	A	1 inch	1/2 inch–
Floor-mounted AHUs (internally isolated)	None	F	1/4 inch	–
Suspended fan-coils, AC, HP	None	C	1 inch	–
Floor-mounted fans <10 HP	B-1	A	1 inch	1/2 inch
Floor-mounted fans > 10 HP				
<300 RPM	B-1 (B-2 if 50 HP or larger	A	3.5 inch	1/2 inch
300-450 RPM	ditto	A	3 inch	1/2 inch
451-600 RPM	ditto	A	2.5 inch	1/2 inch
601-750 RPM	ditto	A	2 inch	1/2 inch
751-850 RPM	ditto	A	1.5 inch	1/2 inch
>850 RPM	ditto	A	1 inch	1/2 inch
Suspended fans direct drive	None	E	0.2 inch	–
Suspended fans belt drive	None	C	As for floor mounted fans plus 1/4 inch	As for floor mounted fans
Wall mounted propeller fans				
1 HP and larger	None	F	1/4 - inch	–
<1 HP	None	–	–	–

3.4 PIPING AND DUCTWORK ISOLATION

A. See Section 23 21 12 – Heating and Cooling Piping and Section 23 31 13 – Ducts

B. Ductwork

1. No vibration isolation required

C. Piping other than risers

1. No vibration isolation required

D. Pipe Risers

1. For pipe risers less than 75 feet, vertical risers shall be laterally supported with a riser clamp at each floor set on a Type F isolation pad, ¼" deflection.
2. For pipe risers greater than 75 feet, riser supports shall be engineered by the vibration isolation vendor as follows

a. All vertical risers shall be supported by spring isolators designed to support the riser filled with water. Assigned loads must be within the building design limits at the support points.
b. Neutral central resilient anchors close to the center of the run shall direct movement up and down. The anchors shall be capable of holding an upward force equal to the water weight when the system is drained. If one level cannot accommodate this force, anchors can be located on 2 or 3 adjacent floors. Anchors shall be Mason ADA or equal.
c. Resilient guides shall be spaced and sized properly depending on the pipe diameter. Guides shall be Mason VSG Vertical Sliding Guides or equal.
d. Support spring mountings shall be Type A. The initial spring deflection shall be a minimum of 0.75 inches or four times the thermal movement at the isolator location, whichever is greater.
e. Submittals must include the initial load, initial deflection, change in deflection, final load and change in load at all spring and anchor support locations, as well as guide spacing. Calculations shall include pipe stress at end conditions and branch off locations and the manufacturer must include installation instructions. Submittal must be stamped and signed by a licensed professional engineer in the employ of the vibration isolator vendor.

E. Wall and Floor Penetrations

1. All piping and ductwork to be vibration isolated, and all piping and ductwork passing through acoustically rated partitions, shall freely pass through walls and floors without rigid contacts or connections. Penetration points shall be sleeved or otherwise formed to allow passage of piping or ductwork, and maintain 0.75 inches to 1.25 inches clearance around the pipe or duct outside surfaces.

   a. For installations through air plenum partitions and through acoustically rated partitions, clearance space shall be tightly packed with fiberglass, and caulked airtight after installation of piping or ductwork
   b. For installation in rated walls, see Section 23 21 12 – Heating and Cooling Piping and Section 23 31 13 – Ducts

2. Provide sleeves and escutcheons as specified in Section 23 21 12 – Heating and Cooling Piping and Section 23 31 13 – Ducts.

3.5 FIELD QUALITY CONTROL

A. Inspection by manufacturer's representative of all vibration isolating devices

1. After installation of all devices
2. Provide written report by manufacturer regarding

   a. Installation errors
   b. Improper selection of devices
   c. Other fault that could affect performance of system

B. Submit written report to Professional

1. Include manufacturer's report indicating required corrections
2. Include report on steps to properly complete isolation work

C. See Section 23 08 00 – Mechanical Commissioning

END OF SECTION 23 05 48

SECTION 23 05 53

MECHANICAL SYSTEM IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Equipment nameplates.
2. Access panel and door markers.
3. Pipe markers.
4. Duct markers.
5. Valve tags.
6. Valve schedules.
7. Warning tags.

1.3 REFERENCE STANDARDS

A. Pipe marker shall comply with ANSI A13-1.

1.4 SUBMITTALS

A. See Section 230010 – Mechanical General Provisions.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Pipe markers	R		R	
Duct markers	R		R	
Equipment tags	R		R	
Valve tags	R		R	
Concealed equipment markers	R		R	
Equipment label and valve tag schedule		R		
Valve numbering scheme		R		

Item	Product Data	O&M Manual	Samples	Shop Drawing
Valve schedules	R	R	R	

1.5 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

1.6 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with location of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

1. Brimar Industries, Inc.
2. Seton Identification Products.
3. Marking Services, Inc.

2.2 EQUIPMENT IDENTIFICATION DEVICES

A. Equipment Labels:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Black.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: Principal lettering shall be 1/2 inch. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.3 ACCESS PANEL AND DOOR MARKERS

A. Access panel and access door markers:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Red.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: Principal lettering shall be 3/4 inch. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label access panels and access doors identifying “Fire Damper, Fire/Smoke Damper”, etc.

2.4 WARNING SIGNS AND LABELS

A. Warning signs and labels:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Red.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: Principal lettering shall be 1/2 inch. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include caution and warning information plus emergency notification instructions.

2.5 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction according to ASME A13.1.

1. Colors: Comply with ASME A13.1, unless otherwise indicated.

2. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
3. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers extending 360 degrees around pipe at each location.
4. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or shaped pipe markers at least three times letter height and of length required for label.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Shaped Pipe Markers: Preformed semirigid plastic formed to partially cover circumference of pipe and to attach to pipe with mechanical fasteners that do not penetrate insulation vapor barrier.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

2.6 DUCT LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

1. Letter Color: White.
2. Background Color: Blue.
3. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
5. Minimum Letter Size: Principal lettering shall be 1/2 inch. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
6. Fasteners: Stainless-steel rivets or self-tapping screws.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings; also include duct size and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions or as separate unit on each duct label to indicate flow direction.

2.7 VALVE TAGS

A. Valve Tags: Numbering scheme approved by Architect.

1. General: Identify valves with metal tags, legends to be stamped or embossed. It shall indicate the function of the valve and its normal operating position; such as:

a. “56 HW” (NUMBER AND CONTENT OF PIPE)

b. "ISOLATION" (VALVE FUNCTION)
c. "NC" (NORMALLY CLOSED)

B. Description: 2-inch diameter, stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass beaded chain or S-hook.
3. Automatic Valves and Regulating Valves: Use 1/16-inch thick laminated 3-ply plastic, center ply white, outer ply red, "lamicoid" or equal. Form letters by exposing center ply.
4. Valve Tag Directory: Include tag number, location, exposed or concealed, service, valve size, valve manufacturer, valve model number, tag material, and normal operating position of valve.

C. Valve Schedules: For each piping system, on plastic laminated, standard-size bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Include floor plan location drawing with all valves indicated with the valve tag assigned to each valve. Mark valves for emergency shutoff and similar special uses.

1. Valve-Schedule and Valve Floor Plan Frames: Glazed display frame for removable mounting on masonry walls for each page of valve schedule. Include mounting screws.
2. Frame: Extruded aluminum.
3. Glazing: ASTM C 1036, Type I, Class 1, Glazing Quality B, 2.5-mm, single-thickness glass.

2.8 EQUIPMENT LOCATOR TACKS

A. 7/8" diameter tack for pushing into ceiling tile near closest equipment access point. Colors to be as specified.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment (including motor starters, VFDs, control panels, etc.)

B. Locate equipment labels where accessible and visible.

C. Install access panel markers with screws on equipment access panels.

3.4 PIPE LABEL INSTALLATION

A. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Within 18” of each valve, valve assembly and control device.
2. Within 3’ of each 90 degree elbow, connection to equipment or vessel and where pipe enters shafts and penetrates outside walls, floors, ceilings and nonaccessible enclosures.
3. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
4. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
5. At access doors, manholes, and similar access points that permit view of concealed piping.
6. Near major equipment items and other points of origination and termination.
7. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
8. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

B. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

C. Pipe Label Color Schedule:

Service	Pipe marker	Background col-or	Lettering
Chilled water	Chilled water supply	Green	White
	Chilled water return	Green	White
Heating water	Heating water supply	Yellow	Black
	Heating water return	Yellow	Black
Refrigerant Suction/Gas	Refrigerant Suction/Gas	Orange	Black
Refrigerant Liquid	Refrigerant Liquid	Orange	Black
Natural gas	Natural gas	Yellow	Black
Wet-Pipe sprinkler water	Wet-pipe fire protection water	Red	White
Dry-Pipe sprinkler water	Dry-pipe fire protection water	Red	White
Clean-agent piping	Clean agent fire protection	Red	White
Fire suppression standpipe	Standpipe fire protection water	Red	White
Cold water	Domestic cold water	Green	White
Hot water	Domestic hot water supply	Yellow	White
	Domestic hot water return	Yellow	White
Sanitary waste	Sanitary waste	Green	White
Storm drain	Storm drain	Green	White
Condensate drain	Condensate drain	Green	White

Service	Pipe marker	Background color	Lettering
Vent	Vent	Green	White

3.5 DUCT LABEL INSTALLATION

A. Install plastic-laminated duct labels with permanent adhesive on air ducts in the following color codes:

1. Blue: For cold-air supply ducts.
2. Yellow: For hot-air supply ducts.
3. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.

B. Locate labels near points where ducts enter into and exit from concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.6 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape: 1-1/2 inches, round.
2. Valve-Tag Colors:

a. Toxic and Corrosive Fluids: Black letters on a safety-orange background.
b. Flammable Fluids: Black letters on a safety-yellow background.
c. Combustible Fluids: White letters on a safety-brown background.
d. Potable and Chilled Water: White letters on a safety-green background.
e. Hot and Heating Water: White letters on a safety-orange background.
f. Compressed Air: White letters on a safety-blue background.
g. Defined by User: White letters on a safety-purple background, black letters on a safety-white background, white letters on a safety-gray background, and white letters on a safety-black background

3.7 VALVE SCHEDULE INSTALLATION

A. Mount valve schedule on wall in accessible location in each major equipment room.

3.8 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

3.9 EQUIPMENT LOCATOR TACKS

A. Install tacks into the ceiling tile or insulation at the closest access point to the device.

B. Install tacks to locate above ceiling equipment and devices as follows:

1. Fire dampers (red).
2. Manual volume dampers (orange).
3. Motorized control dampers (yellow).
4. HVAC equipment (black).
5. Hydronic system valves (green).
6. Control system devices (light blue).
7. Cold water (blue).
8. Hot water (red).

3.10 ADJUSTING

A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

3.11 CLEANING

A. Clean faces of mechanical identification devices and glass frames of valve schedules.

END OF SECTION 23 05 53

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

a. Operational testing and adjusting of air handling equipment.
b. Balancing of air distribution systems.
c. Testing and adjustment of air terminal devices.

2. Balancing Hydronic Piping Systems:

a. Flow testing and adjusting of hydronic systems.

3. Duct leakage tests.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. BAS: Building automation systems.

C. NEBB: National Environmental Balancing Bureau.

D. TAB: Testing, adjusting, and balancing.

E. TAB Specialist: An independent entity meeting qualifications to perform TAB work.

F. TDH: Total dynamic head.

1.4 SUBMITTALS

A. See Section 230010 – Mechanical General Provisions.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.

2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
AABC or NEBB certification	R			
Report forms	R			
List of instrumentation	R			
Final air balancing report		R		
Final water balancing report		R		

C. Final Test & Balance Report.

1. At least 15 days prior to Contractor’s request for final inspection, submit electronic copy of final reports on approved reporting forms for review and approval by Architect. Once approved, provide required quantity of paper and electronic copies per 230010 “Mechanical General Provisions.”
2. Form of final reports.

   a. Fully completed report forms for all systems specified to be tested and balanced including at a minimum all data specified herein to be recorded.
   b. Each individual final reporting form must bear:
   c. Identify instruments of all types that were used and last date of calibration of each.

1.5 QUALITY ASSURANCE

A. TAB Specialists Qualifications: Certified by AABC or NEBB.

1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC or NEBB.

B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

C. Prior to start of testing, adjusting, and balancing, verify that required Project conditions are met:

1. System and control system installation is complete and in full operation.
2. All pre-functional tests have been performed.
3. Equipment has been started and tested in accordance with manufacturer’s installation instructions.
4. Doors and windows are in place and closed or under normal traffic conditions.

D. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

E. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.6 PROJECT REVIEW

A. Construction Review.

1. Make on-site visits during progress of construction: Number of visits to be as required to perform the functions specified below.
2. Purpose of review.

    a. Identify potential problem for performing total system balance.
    b. Identify modifications that will affect air total system balance.
    c. Schedule and coordinate total system balance with other work.
    d. Identify conditions that could create hazardous environment for building occupants.

3. Typical activities.

    a. Check that necessary balancing and measuring hardware is:

        1) In place.
        2) Located properly and accessibly.
        3) Installed correctly.

    b. Identify and evaluate variations from system design.
    c. Record data from equipment nameplates.
    d. Identify and report possible restrictions in systems; such as:

        1) Closed fire dampers.
        2) Long runs of flexible duct.
        3) Poorly designed duct fittings.
        4) Questionable piping connections.
        5) Others as may arise or based on Agency's experience.

    e. Verify that construction progress will not delay total system balance.
    f. Identify best location for duct Pitot tube traverses.
    g. Identify scaffolding needs.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified herein. If not otherwise noted, the following minimum requirements apply.

1. Volt-meter: plus or minus 1 percent scale.
2. Ammeter: plus or minus 1 percent scale.
3. Ohmmeter: plus or minus 0.1 percent scale for calibrating plus or minus 0.4 degrees Fahrenheit resistance temperature sensors, plus or minus 0.25 percent scale for calibrating plus or minus 1 degrees Fahrenheit temperature sensors, plus or minus 1 percent scale for measuring motor current.
4. Ultrasonic time-of-travel strap-on flow sensor: plus or minus 5 percent of reading.
5. Other flow sensors: plus or minus 2 percent of reading.
6. Water pressure gauge: plus or minus1/2 percent scale, ASME Grade 2A.
7. Watt meter, plus or minus1/2 percent scale: 3 phase split core current transducers.
8. Temperature: plus or minus 0.4 degrees Fahrenheit.

B. All equipment shall be calibrated within 6 months of use, or according to the manufacturer's recommended interval, whichever is shorter, and when dropped or damaged. Calibration tags shall be affixed or certificates readily available and proof of calibration shall be included reports.

PART 3 - EXECUTION

3.1 GENERAL

A. Coordinate with work of other trades.

B. Report to Professional any discrepancies or items not installed in accordance with the Contract Drawings pertaining to proper balance and operation of air and water distribution systems.

C. Perform testing, adjusting and balancing in accordance with AABC or NEBB standards.

D. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to Section 230713 "Duct Insulation" and Section 230719 "HVAC Piping Insulation.".

E. Mark equipment settings with paint or other suitable, permanent identification material, including damper control positions, valve indicators, and similar controls and devices, to show final settings.

3.2 CONTROL SYSTEM COORDINATION

A. See Section 230900 "Energy Management & Control Systems (EMCS)."

B. System balance techniques in this Section rely on the operation of the EMCS. Test and balance agency shall coordinate schedule of work with EMCS installer to ensure test and balance work can be executed and completed in a timely manner.

C. Cooperate with EMCS installer in determining operating conditions and setpoints, as indicated in this Section.

D. Cooperate with EMCS installer in calibrating all airflow measuring devices.

E. Obtain and receive training for required software from controls system vendor for setting calibration constants in terminal devices.

3.3 AIR SYSTEMS BALANCING

A. General.

1. Do not operate fan systems for test or balance until spaces served have been cleaned of dust and debris, to avoid contamination of supply air or return air paths and equipment.
2. Filters.

    a. Check that filters are installed, oriented in the proper airflow direction, free of bypass, and clean.

b. Make no adjustment for dirty filters, fans were selected for clean filters at design airflow.

3. In cooperation with EMCS installer, set adjustments of automatically operated dampers and valves to operate as indicated.
4. Balance hydronic systems prior to air balance and have operational during air balance for air temperature measurements.

B. Air Outlets.

1. Adjust diffusers' throw pattern, grilles and registers to pattern indicated on the Drawings. Review manufacturer's instructions for proper diffuser blade or weir gate positions to provide this throw pattern as it is not always intuitive. It is TAB agency's responsibility to adjust throw patterns for all adjustable throw diffusers. If diffuser has a fixed throw pattern and is incorrectly installed, HVAC contractor shall correct pattern prior to balance.

   a. Ceiling diffusers: As indicated on the Drawings.

      1) Star pattern diffuser deflectors shall be adjusted for corner blow pattern unless otherwise indicated on Drawings.

   b. Double-deflection grilles: Adjust rear blades horizontal 22 degree upward and splay front blades in 45 degree pattern at each end gradually rotating to almost straight at blades in center of grille.
   c. Floor grilles: Not applicable.

2. Test and adjust each diffuser, grille and register to within plus or minus 10 percent of design requirements.

   a. Start with all dampers wide open.
   b. Adjust dampers, starting with nearest to terminal unit or fan. Make adjustments using duct mounted volume dampers rather than dampers at diffuser face (if any) unless absolutely required.
   c. At least one damper shall remain wide open at end of balance.

3. Plenum return air grilles or slots in lights: No balance required.
4. Report.

   a. Tag each grille, diffuser and register and mark tag on copy of floor plan.
   b. For each grille, diffuser and register, indicate tag, size, type, and effective area (where applicable).
   c. Required velocity/cubic feet per minute.
   d. Initially tested velocity/cubic feet per minute.
   e. Finally tested cubic feet per minute after adjustments.

C. Terminal Boxes.

1. Balancing Agency shall provide laptop computer or other device for communicating with EMCS system, using software provided by EMCS installer. Cooperate with EMCS installer to learn how to use software to calibrate EMCS zone controller.
2. Terminal box calibration procedure listed below may be modified based on specific features or limitations of digital controller and recommendations of the controller manufacturer. Submit revised procedure for approval by Architect.
3. Use EMCS terminal "commissioning" software where available and record all calibration and test data through the EMCS.

4. Zero transmitter prior to each test.
5. Adjust EMCS calibration constants so that the VAV box controller and measured air flow rate at air outlets matches EMCS reading within range listed at all of the following conditions at a minimum:

    a. Zero airflow.
    b. Maximum airflow setpoint, ±5%.
    c. Minimum airlflow setpoint, ±10%.

        1) If EMCS can only calibrate to one point, adjust VAV box controller minimum volume setpoint so that measured air flow rate at air outlets equals desired minimum, even though this will cause EMCS to read improperly.

6. Report:

    a. Tag, manufacturer, and model.
    b. VAV maximum cooling flow rate, design, and measured.
    c. VAV minimum flow rate, design, and measured.
    d. EMCS calibration coefficients at all calibration points.

D. EMCS airflow measuring stations (AFMS).

1. Measure and report airflow and concurrent EMCS AFMS readings at a minimum of three conditions.

2. For factory calibrated AFMS: if measured airflow and EMCS readings differ by more than 10%, consult with Architect for recalibration instructions. Do not change factory calibration without written direction.

3. For field calibrated AFMS: Work with EMCS installer to adjust calibration coefficients. Report coefficients in air balance report.

E. Air Handling Units, Fan Coil Units, Packaged Equipment Air Flow Rate Readings.

1. Total supply air quantities shall be determined at all of the following where applicable:

    a. Pitot traverse in the supply duct downstream, positive pressure side of the fan.
    b. Pitot traverse at coil or filter bank.
    c. Totaling the readings of individual air outlets.
    d. Totaling the readings of individual terminals as read through the EMCS.

2. Total return air quantities shall be determined at all of the following where applicable:

    a. Pitot traverse in the return air duct or damper entering air handler.
    b. Totaling the readings of individual air outlets, if ducted return system.
    c. Totaling reading of each return air shaft inlet, if multi-story plenum return system.

3. Outside air quantities shall be determined by all of the following where applicable:

    a. Subtracting pitot traverses of supply and return ducts.
    b. Pitot traverse of outdoor air intake duct.
    c. Outdoor airflow sensor reading as read through the EMCS.
    d. Note: Balance by measurement of return air, outside air, and mixed air temperatures shall not be used due to inherent inaccuracy.

4. For systems with airflow measuring stations, measure airflow and coordinate with EMCS installer to calibrate airflow stations at a minimum of three conditions:

    a. Design air flow.
    b. 50 percent of design air flow.
    c. Minimum air flow.

F. Variable Air Volume Air Handling Equipment.

1. Adjust fan speed using manual adjustment of variable speed drive for testing only. Do not change or adjust sheaves.
2. Supply fan DP Setpoint.

    a. Establish minimum static pressure setpoint (DPmax) in conjunction with the EMCS installer as follows. All adjustments made via the EMCS, not field measurements except as noted.
    b. Test conditions.

        1) Set all boxes to operate at maximum airflow setpoints: allow controls to stabilize.
        2) For cooling systems only to account for diversity: Shut off boxes, starting with boxes whose dampers are the most closed, as indicated by the EMCS, and upstream of the DP sensor, until the airflow equals scheduled design airflow rate.

    c. Procedure.

        1) Manually lower fan speed slowly while observing VAV box airflow rates downstream of the static pressure sensor. Stop lowering speed when one or more VAV box airflow rates drops 10 percent below maximum airflow rate setpoint.
        2) Once flow condition in previous step is achieved, note the EMCS system static pressure reading at the duct static pressure sensor.

            a) This reading becomes the maximum static pressure setpoint.
            b) Using pressure taps at differential pressure sensor and handheld digital pressure sensor, verify accuracy of EMCS reading.

    d. Convey to the EMCS installer.

        1) Static pressure setpoints.
        2) Any discrepancy between EMCS differential pressure reading and handheld measurement.

    e. Report.

        1) Static pressure setpoint and concurrent reading of handheld measurement: Initials of EMCS installer to indicate that the information was transmitted to them.
        2) Tag of VAV boxes that dropped below design maximum airflow rate in tests above. These are the critical boxes, those requiring the largest static pressure.
        3) Concurrent fan data.

            a) Volts and amps.

b) Amps and kilowatts from VFD.
c) VFD speed in hertz.
d) Entering and leaving fan static pressure.
e) Flow rate, summed from EMCS terminals.
f) Fan airflow sensor reading from EMCS, where applicable.

3. Relief fans.

a. Test conditions.

1) Economizer in 100% outdoor air position.
2) Supply fan at design supply air rate.
3) All doors and windows closed in area served by air handler.
4) All exhaust fans on in area served by air handler.

b. Procedure.

1) Measure building pressure using EMCS sensor.
2) Manually adjust fan speed at variable speed drive to achieve 0.05" building pressure.

a) Fan speed may exceed 60Hz if necessary. Do not change or adjust sheaves.
b) If required fan speed 60 Hz, convey maximum speed to EMCS contractor.

3) At the above design conditions, measure fan inlet and outlet pressures and measure total relief air quantities with pitot tube traverse of main ducts near the fan inlet or outlet where possible.

c. Report.

1) Amps and kilowatts from VFD.
2) VFD speed in Hertz.
3) Entering and leaving fan static pressure.
4) Building static pressure.

4. Minimum outside air flow.

a. Supply air fan and return air fan (if any) shall first be operating at design airflow. For VAV systems with diversity, close enough boxes close to fan to reduce supply airflow to scheduled design condition.

1) Note differential pressure across the outdoor air damper. This value becomes the minimum outdoor air differential pressure setpoint in the EMCS. Convey this setpoint to EMCS installer and note on air balance report.
2) For systems with CO_2 demand-controlled ventilation.

a) With the system at the minimum outdoor air position, reduce supply air fan speed until the outdoor air rate is equal to [0.15 cfm/ft^2 of floor area served by the system] [the absolute minimum outdoor air rate on AHU schedule].
b) Note differential pressure across the outdoor air damper. This value becomes the absolute minimum outdoor air differential pressure

setpoint in the EMCS. Convey this setpoint to EMCS installer and note on air balance report.

b. For systems with outdoor airflow measuring stations:

1) See EMCS AFMS paragraph herein.

5. Test with system operating at design fan and minimum outside air flow conditions described above and record the following on a schematic of the system:

a. Tags of all equipment.
b. Manufacturer and model of fan and motor.
c. Motor horsepower, rpm, volts, phase, full load amps.
d. Sheave data at motor and fan; belt data.
e. Fan airflow rate at all locations measured, as listed above.
f. Final measured fan speed and amps.
g. Amps and kilowatts, from VFDs.
h. VFD speed in hertz.
i. Static pressures measured at:

1) Return air plenum.
2) Mixed air plenum.
3) Downstream of relief fan (where applicable).
4) Downstream of filter.
5) Downstream of coil.
6) Discharge of supply fans.
7) At static pressure sensor.

j. Concurrent airflow rate readings from EMCS airflow sensors, including sum of VAV box airflow rates.
k. Minimum EMCS outdoor air control setpoints and signals, where applicable.

G. Constant Volume Air Handling Units, Fan Coil Units, Package Equipment.

1. Total air quantities shall be obtained within 10 percent of design by adjustment of fan speed.

a. Adjust sheaves on fans with adjustable sheaves.
b. Change sheaves on fans with fixed sheaves.
c. Adjust speed potentiometer for EC motors.
d. Adjust SCR for direct drive PSC motors.

2. Test and adjust minimum outdoor air flow.

a. Supply air fan shall first be operating at design airflow.
b. For systems with economizers.

1) Open return air damper fully.
2) Adjust the outdoor air damper signal through the EMCS until the minimum outdoor airflow rate is achieved.
3) Convey this minimum signal to EMCS installer and note on air balance report.

c. For systems without economizers.

1) Adjust minimum outdoor air or return air damper balancing damper position or linkage to deliver design minimum outdoor airflow rate.
2) Clearly mark minimum damper position on damper housing.

3. Test with system operating at minimum outside air flow condition described above and record the following on a schematic of the system.

a. Tag.
b. Manufacturer and model of fan and motor.
c. Sheave data at motor and fan; belt data.
d. Motor horsepower, rpm, volts, phase, FLA.
e. Fan airflow rate at all locations measured, as listed above.
f. Final measured amps.
g. Static pressure measured at:

1) Return air plenum.
2) Mixed air plenum.
3) Downstream of filter.
4) Downstream of coil.
5) Discharge of fans.

h. Concurrent airflow rate readings from EMCS airflow sensors, where applicable.
i. Minimum EMCS outdoor air control signal, where applicable.

H. Constant Volume & Variable Volume Exhaust Fans.

1. See herein for air outlet balancing.
2. Total air quantities for fan shall be determined by both:

a. Pitot tube traverse of main ducts near the fan inlet, and.
b. Totaling the readings of individual air outlets (or inlets).

3. Total air quantities shall be obtained within 10 percent of design by adjustment of fan speed.

a. Constant speed fans:

1) Adjust sheaves on fans with adjustable sheaves.
2) Change sheaves on fans with fixed sheaves.
3) Adjust speed potentiometer for EC motors.

b. Variable speed fans:

1) Adjust maximum fan speed at ECM or VFD.

4. Report.

a. Tag.
b. Manufacturer and model of fan and motor.
c. Sheave data at motor and fan; belt data.
d. Motor horsepower, rpm, volts, phase, full load amps.
e. Fan airflow rate at all locations measured, as listed above.
f. Final measured amps.
g. Inlet and outlet static pressure.

3.4 WATER SYSTEMS BALANCING

A. Prepare water systems for balancing in following manner.

1. Verify the following conditions:

a. Piping systems have been flushed and treated in accordance with Section 232113 “Hydronic Piping.”
b. Strainers have been cleaned.
c. Piping systems are completely full of water, all air properly vented.
d. All coil and heat exchanger isolation shut-off and balance valves are fully open.

2. Check Pump.

a. Rotation.
b. Pump factory impeller trimming by comparing shut-off heads with pump curves from approved submittals.

1) Note that impellers on variable speed pumps should not be trimmed to design flow and head conditions. See 232123 “Hydronic Pumps.”
2) Report discrepancy in shut-off head to Architect and if impeller does not appear to be properly trimmed, wait for direction before proceeding with pump test and balance.

3. EMCS and Central Plant Operability.

a. Do not proceed with any of the following balancing procedures until the EMCS is capable of operating equipment such as fans, pumps, VAV boxes, control valves, and the like, in manual and automatic modes and capable of reading sensors such as differential pressure, flow rates, temperatures, and the like, of air and hydronic systems to be tested and adjusted.
b. Do not proceed with air handler and fan-coil testing until chilled and hot water at design temperatures are available from the central plant.

B. Pumps.

1. Test and report for each pump at test conditions indicated in Paragraphs below.

a. Tag.
b. Manufacturer and model of pump and motor.
c. Motor horsepower, volts, phase, full load amps.
d. Pump shut-off head from curves, measured shut-off head, and resulting impeller diameter from pump curve.
e. At test condition specified.

1) Volts and amps.
2) Calculated brake horsepower.
3) Entering and leaving gauge pressure and difference in feet.
4) Flow rate deduced from pump curve.
5) For pump with VFD:

a) Speed (Hz).
b) Kilowatts.

C. Heating Water and Chilled Water Distribution System.

1. Coil Test & Balance.

    a. System is self-balancing. Two-way control valves at coils prevent each coil from being over-supplied with water, other than minor excursions during transients such as cool-down or warm-up. Conventional balancing (throttling of balancing valves) will increase pump energy use by not allowing aggressive differential pressure setpoint reset. Hence, do not adjust any valves on any coil or pump, except temporary adjustements where noted. Calibrated balancing valves may be provided for flow measurement and diagnostics but they shall not be modulated for flow balancing. All manual valves at coils and pumps shall be wide open when test and balance work is complete.
    b. Report with all control valves open to coil and all pumps (except standby pumps, where applicable) operating at full speed.

        1) See Air Balance below for coil temperature data.
        2) See Pump test data above for pump data.
        3) Coils with modulating two-way or three-way control valves.

            a) Terminal tag.
            b) Control valve model number and serial number.
            c) Pressure drop across coil.
            d) Flow as measured by calibrated balancing valve (where applicable).

2. Variable Speed Drive Setpoint Determination.

    a. For systems with VFD, determine maximum differential pressure setpoint (DPmax) in conjunction with the EMCS installer as follows:

        1) Fully open all control valves serving coils that are located downstream of the differential pressure sensor.
        2) Fully close all control valves serving coils that are located upstream of the differential pressure sensor.
        3) Start pump(s). Manually adjust speed slowly until design flow (or design pressure drop, for coils without calibrated balance valves) is just achieved through all open coils without modulating any balance valves. One coil should be just at design flow, while others should be at or above design flow.
        4) Once flow condition in previous step is achieved, note the EMCS system differential pressure reading at the differential pressure sensor. This reading becomes the differential pressure setpoint. Using pressure taps at differential pressure sensor and handheld digital pressure sensor, verify accuracy of EMCS reading.
        5) If there are multiple differential pressure sensors, repeat steps above for each sensor.

    b. Convey to the EMCS installer.

        1) Differential pressure setpoint.
        2) Any discrepancy between EMCS differential pressure reading and handheld measurement.

    c. Report at condition described above.

1) Differential pressure setpoint and concurrent reading of handheld measurement. Initials of EMCS contractor to indicate that the information was transmitted to them.
2) Tag of coils downstream of differential pressure sensor, along with the following for each:

a) Design flow rate and pressure drop.
b) Tested flow rate and pressure drop with differential pressure at setpoint determined above.

3) Water flow rate through flow meter (where applicable), through EMCS.
4) See Pump test data above for pump data.

3. Control Valve Shut-Off Test.

a. Close all control valves in the system through the EMCS. Close bypass balance valves of 3-way valves (where applicable). Run all pumps (except stand-by pump, if any) at full speed:

1) Verify that all control valves remain shut with no measurable flow, as indicated by pump differential pressure, flow meters, and any temperature rise across coils.
2) Do not run pumps deadheaded for more than 5-minutes at any one time.
3) After test, return 3-way valve balance valves to prior position and release control valves to automatic operation through the EMCS.

b. Report at condition described above.

1) Tag of coils where flow is detected. Initials of EMCS contractor to indicate that this information was transmitted to them.
2) Measured pump inlet and outlet pressures, and difference converted to feet.
3) Differential pressure reading at all differential pressure sensors, through EMCS.
4) Water flow rate from flow meter, through EMCS.

D. Hot Water Plant.

1. Boiler Balancing.

a. Test and proportionally balance flow to boilers:

1) Start with all balance valves at boilers wide open.
2) Open all coil control valves through EMCS.
3) Run all pumps (except stand-by pump, if any).
4) Adjust balance valves at boilers, starting with nearest to pump, to provide flow rates proportional to design rates (deduced from pressure drop or calibrated balance valve) through each. At least one boiler balance valve shall remain wide open at end of balance.

b. Report at condition described above.

1) Design and final flow rate at each boiler.
2) Design and final inlet and outlet pressure at each boiler.
3) Balance valve position (% open).

2. Boiler Firing Test.

    a. Ensure that no gas fired equipment other than the boilers is in operation.
    b. Start with the system cold enough so the system does not heat to setpoint within test period.
    c. Verify gas manifold pressure downstream of gas valves meets boiler manufacturer's requirements.
    d. Open all heating coil control valves.
    e. Run all hot water pumps (except stand-by pump, if any).
    f. Run each boiler, one at a time, at high fire by raising the HW supply temperature setpoint.
    g. Clock the gas meter for a minimum of 10 minutes.
    h. Concurrently record natural gas flow meter reading from EMCS (if applicable).
    i. Measure the gas pressure at inlet to meter.
    j. Determine conversion factor of (Btu per cubic foot) from gas pressure chart, and then calculate the boiler firing rate in Btu/h.
    k. Determine boiler flow rate from calibrated balancing valve at boiler or EMCS flow meter.
    l. Use flow and temperature rise across each boiler to calculate heat transferred to water ($Q = 490*GPM*\triangle T$).
    m. Report.

        1) Gas meter test start and stop readings.
        2) Boiler input gas rate in cubic feet per hour calculated from gas meter and measured by EMCS.
        3) Each boiler.

            a) Boiler firing input rate in Btu/h, design and calculated from utility gas meter and from EMCS gas meter.
            b) Hot water return temperature.
            c) Hot water supply temperature.
            d) Flow rate.
            e) Calculated heating energy transferred to water Btu/h.
            f) Calculated efficiency, heat transferred to water divided by gas energy input.

E. Bypass Balancing at 3-way Valves.

1. At all 3-way valves serving coils with a design coil pressure drop exceeding 2 feet, adjust balance valve in bypass leg as required to make pressure drop across the coil-valve assembly when valve is in full-bypass position equal to that when control valve is in through-coil position.
2. Report.

    a. Differential pressure across coil-valve assembly when control valve is in full-bypass position.
    b. Differential pressure across coil-valve assembly when control valve is in through-coil position.
    c. Position of bypass valve (% open).

3.5 DUCT LEAKAGE TESTS

A. See specification Section 233113 "Ducts."

3.6 ADDITIONAL COST

A. Fans: If drives are not capable of being adjusted to meet required performance, inform Architect and replace sheaves as required.

B. Pumps: Do not trim pump impellers. Adjust flow with pump speed via VFD.

3.7 SPOT CHECKING

A. Spot checks shall take place after test and balance work is complete and reports have been prepared and approved.

B. Spot checks shall be witnessed by an Professional. Schedule spot checks with Professional at least 1 week prior to proposed test date.

C. Professional shall select subsets of any tested and balanced air or hydronic system to be spot-checked on the day of tests without prior notice to the Contractor.

1. Spot-checking will not require more than one working day.
2. If additional spot checks are requested by the Professional causing the time limit above to be exceeded, inform Professional and indicate added price to perform the additional tests. Do not include additional tests in initial bid.

D. Discrepancies.

1. If any of the spot-check measurements differ more than 25 percent from those documented in test and balance reports, the Agency shall completely rebalance the associated system. For balance discrepancies at or downstream of a VAV box, rebalance only is required at or downstream of that box.
2. If discrepancies as described above are found on more than 25 percent of the spot-checks for air systems, all air systems shall be rebalanced.
3. If discrepancies as described above are found on more than 25 percent of the spot-checks for hydronic systems, all hydronic systems shall be rebalanced.
4. Rebalance work shall be witnessed by the Architect at the option of the Architect.
5. All rebalance work shall be documented and documentation shall be resubmitted as specified above.
6. All rebalance work shall be provided at no additional cost to the Owner.

3.8 TRAINING OWNER PERSONNEL

A. Go over the final Testing, Adjusting and Balancing Report, explaining the layout and the meanings of each data type.

B. Discuss any outstanding deficient items in control, ducting, piping or design that may affect the delivery of air or water.

C. Identify and discuss any systems or system components that are not meeting their design capacities.

D. Discuss any temporary settings and steps to finalize them for any areas that are not finished or fully occupied.

E. Any other appropriate points that may be helpful for facilities operations, relative to testing, adjusting and balancing or the mechanical systems.

END OF SECTION 23 05 93

SECTION 23 07 13

DUCT INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes insulating the following duct services:

1. Ducts and plenums, thermal insulation.
2. Ducts and plenums, acoustic insulation.
3. Ducts and plenums, fire rated insulation.
4. Duct liner.

B. Related Sections:

1. Section 230719 "HVAC Piping and Equipment Insulation."

1.3 REFERENCE STANDARDS

A. ASTM B209 – Aluminum and Aluminum-Alloy Sheet and Plate.

B. ASTM C177 – Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.

C. ASTM C335 – Steady-State Heat Transfer Properties of Horizontal Pipe Insulation.

D. ASTM C585 – Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe.

E. ASTM C921 – Properties of Jacketing Materials for Thermal Insulation.

F. ASTM E84 – Surface Burning Characteristics of Building Materials.

G. ASTM E96 – Water Vapor Transmission of Materials.

H. NFPA 255 – Surface Burning Characteristics of Building Materials.

I. SMACNA – HVAC Duct Construction Standards - Metal and Flexible.

J. UL 723 – Surface Burning Characteristics of Building Materials.

K. ASTM E 814 – Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

1.4 DEFINITIONS

A. Duct Dimensions.

1. Duct sizes indicated on Drawings shall be clear inside dimensions unless duct size is specifically indicated as outside dimensions (OD).

1.5 QUALITY ASSURANCE

A. Source Quality Control.

1. Service: Use insulation specifically manufactured for service specified.
2. Labeling: Insulation labeled or stamped with brand name and number.

B. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

C. Mockups: Before installing insulation, build mockups for each type of insulation and finish listed below to demonstrate quality of insulation application and finishes. Build mockups in the location indicated or, if not indicated, as directed by Architect. Use materials indicated for the completed Work.

1. Ductwork Mockups:

a. One 10-foot section each of rectangular and round straight duct.
b. One each of a 90-degree mitered round and rectangular elbow, and one each of a 90-degree radius round and rectangular elbow.
c. One rectangular branch takeoff and one round branch takeoff from a rectangular duct. One round tee fitting.
d. One rectangular and round transition fitting.
e. Four support hangers for round and rectangular ductwork.
f. Each type of damper and specialty.

2. For each mockup, fabricate cutaway sections to allow observation of application details for insulation materials, adhesives, mastics, attachments, and jackets.
3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
4. Obtain Architect's approval of mockups before starting insulation application.
5. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Demolish and remove mockups when directed.

1.6 SUBMITTALS

A. See Section 230010 – Mechanical General Provisions.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. "R" means required.
2. "R2" means required only for products and equipment differing for the specified manufacturer and model and for "or equals" where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Duct insulation, wrap and liner	R			
Jackets	R			
Adhesives and coatings	R			
Mechanical fasteners	R			
Installer qualifications	R			

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Insulation: fiberglass.

1. Owens-Corning Fiberglass Corporation.
2. Johns Manville.
3. Certainteed Corporation.
4. Knauf.
5. Or equal.

C. Adhesives.

1. Childers Brand; H. B. Fuller Construction Products.
2. Foster Brand; H. B. Fuller Construction Products.
3. Mon-Eco Industries, Inc.
4. Or equal.

D. Mechanical Fasteners.

1. AGM Industries, Inc.
2. Miracle Adhesives Corporation.
3. Grip-Nail.
4. Or equal.

2.2 GENERAL

A. Energy Codes: The current versions of ASHRAE 90.1 shall govern where requirements for thickness exceeds thickness specified.

B. All insulation materials, including jackets, facings, adhesives, coatings, and accessories are to be fire hazard rated and listed by Underwriters' Laboratories, Inc., using Standard UL 723 (ASTM E-84), (NFPA-255), (ASA A2.5-1963).

1. Flamespread: maximum 25.
2. Fuel contributed and smoke developed: maximum 50.
3. Flameproofing treatments subject to deterioration from moisture or humidity are not acceptable.

C. Insulation and accessories shall not provide any nutritional or bodily use to fungi, bacteria, insects, rats, mice, or other vermin, shall not react corrosively with equipment, piping or ductwork, and shall be asbestos free: Duct lining shall meet ASTM C1136 and ASTM C665 for biological growth in insulation

2.3 MATERIALS

A. Duct Wrap with Vapor Barrier, Type DW-V.

1. Insulation: ASTM C553 and C612; flexible, noncombustible blanket.

   a. 'K' ('Ksi') value: ASTM C518, 0.24 at 75 degrees Fahrenheit.
   b. Maximum service temperature: 350 degrees Fahrenheit.
   c. Maximum moisture absorption: 0.20 percent by volume.

2. Vapor Barrier Jacket - factory installed. (FSK).

   a. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
   b. Moisture vapor transmission: ASTM E96 Procedure E; 0.02 perm.
   c. Secure with pressure sensitive tape.

3. Vapor Barrier Tape: Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

   a. Flexible fiberglass wrap. 1-1/2 pounds per cubic foot.
   b. Installed conductance: 0.30 BTU-inch/hr/square foot/degree Fahrenheit.
   c. Factory applied jacket.

      1) Foil-scrim-kraft laminate: Aluminum foil facing.
      2) Glass scrim reinforcing.
      3) Kraft paper backing.

   d. Maximum vapor permeance: 0.02 perms,

4. Owens-Corning All Service Faced Duct-Wrap or equal.

B. Duct Board with Vapor Barrier, Type DB-V

1. Insulation: ASTM C612; rigid, noncombustible board.

   a. 'K' ('Ksi') value: ASTM C518, 0.23 at 75 degrees Fahrenheit.
   b. Maximum service temperature: 350 degrees Fahrenheit.
   c. Maximum moisture absorption: 0.20 percent by volume.

2. Vapor Barrier Jacket - factory installed (FSK).

   a. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
   b. Moisture vapor transmission: ASTM E96 Procedure E; 0.02 perm.
   c. Secure with pressure sensitive tape.

3. Vapor Barrier Tape: Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.
4. Installed conductance: 0.23 BTU-inch/hr/square foot/degree Fahrenheit.
5. Thickness per Duct Insulation Type and Thickness Schedule.
6. Factory applied jacket.

    a. Foil-scrim-kraft laminate.

        1) Aluminum foil facing.
        2) Glass scrim reinforcing.

C. Rectangular Duct Liner, Type AL.

1. Material.

    a. Insulation: ASTM C423.
    b. 'K': ASTM C518, 0.23 at 75 degrees Fahrenheit.
    c. Maximum service temperature: 350 degrees Fahrenheit.
    d. Maximum moisture absorption: 0.20 percent by volume.
    e. Thickness per Duct Insulation Type and Thickness Schedule.
    f. 1-1/2 pounds per cubic foot unless shown otherwise to be 3 pounds per cubic foot.
    g. Installed conductance: 0.25 BTU-inch/hr/square foot/degree Fahrenheit.

2. Interior air side surface.

    a. Smooth black neoprene or matte facing overlay on air side. Coating shall conform to NFPA 90A, ASTM C665, ASTM G21.
    b. Suitable for velocity up to 4000 feet per minute.
    c. Meet erosion test method described in UL publication No. 181.
    d. Durable and mechanically cleanable.
    e. EPA registered anti-microbial agent.
    f. Certainteed Toughgard Duct Liner or equal.
    g. Adhesives.

        1) Duct Insulation, Internal: Foster 85-60 or equal.
        2) Weld Pins: Duro-Dyne CP or equal.

D. Round Duct Liner, Type RAL.

1. Same material as Type AL.
2. Interior air-side surfaces same as Type AL.
3. Self-supporting, slide-in installation.
4. Schuller Permacote Spiracoustic or equal.
5. Small diameter ducts which cannot be insulated internally using duct lining materials shall be pre-fabricated. Insulation material shall be fixed between outer duct metal and a perforated metal liner. United McGill k27 series or equal. Fittings shall be insulated to same standard and shall be by same manufacturer.

E. Plenum Liner, Type PL

1. Material.

    a. Heavy-density mat-faced Plenum Liner: Comply with ASTM C 1071.
    b. 'K': ASTM C518, 0.23 at 75 degrees Fahrenheit.
    c. Maximum service temperature: 350 degrees Fahrenheit.

d. Maximum moisture absorption: 0.20 percent by volume.
e. Thickness per Duct Insulation Type and Thickness Schedule.
f. 1-1/2 pounds per cubic foot unless shown otherwise to be 3 pounds per cubic foot.
g. Installed conductance: 0.25 BTU-inch/hr/square foot/degree Fahrenheit.

2. Interior air side surface.

a. Smooth black neoprene or matte facing overlay on air side. Coating shall conform to NFPA 90A, ASTM C665, ASTM G21.
b. Suitable for velocity up to 4000 feet per minute.
c. Meet erosion test method described in UL publication No. 181.
d. Durable and mechanically cleanable.
e. EPA registered anti-microbial agent.
f. Knauf Insulation Rigid Plenum Liner or equal.
g. Adhesives.

1) Duct Insulation, Internal: Foster 85-60 or equal.
2) Weld Pins: Duro-Dyne CP or equal.

F. Aluminum Jacket (for outdoor duct).

1. ASTM B209.
2. Use for weatherproof jacket.
3. Thickness: 0.016 inch sheet.
4. Finish: Embossed.
5. Joining: Longitudinal slip joints and 2 inch laps.
6. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum or 0.010 inch thick stainless steel.

PART 3 - EXECUTION

3.1 DUCT & PLENUM INSULATION

A. Duct Insulation Type and Thickness Schedule.

Location	Cooling or Heat/Cool Supply	Return/Outdoor Air	Exhaust
Outdoors	1 inch 1.5 pounds per Cubic foot AL 1 inch 3.0 pounds per cu-bic foot DB-V with outdoor duct jacket	1 inch 1.5 pounds per Cubic foot AL 1 inch 3.0 pounds per cu-bic foot DB-V with outdoor duct jacket	-
Concealed in ceiling or return air ple-num	2.33 inches DW-V	1-1/2 inches DW-V	1-1/2 inches DW-V
Concealed in unconditioned spaces	2.33 inches DW-V	1-1/2 inches DW-V	1-1/2 inches DW-V
Exposed within mechanical rooms	2.33 inches 3.0 pounds Per cubic foot DW-V	1-1/2 inches 3.0 pounds Per cubic foot DW-V	1-1/2 inches DW-V

Location	Cooling or Heat/Cool Supply	Return/Outdoor Air	Exhaust
Exposed within conditioned space	–	–	-
Lined duct on drawings at risers	2 inches 1.5 pounds per Cubic foot AL	2 inches 1.5 pounds per Cubic foot AL	2 inches 1.5 pounds per Cubic foot AL
Lined duct on drawings (unless other-wise noted)	1 inch 1.5 pounds per Cubic foot AL or RAL	1 inch 1.5 pounds per Cubic foot AL or RAL	1 inch 1.5 pounds per Cubic foot AL or RAL
Transfer air ducts	1 inch 1.5 pounds per Cubic foot AL or RAL	1 inch 1.5 pounds per Cubic foot AL or RAL	1 inch 1.5 pounds per Cubic foot AL or RAL
Terminal cans	0.5 inches 1.5 pounds per cubic foot AL	0.5 inches 1.5 pounds per cubic foot AL	-
Flex duct	By manufacturer	By manufacturer	-
Double wall duct	1 inch 1-1/2 pounds Per cubic foot DW	-	-
Air distribution devices, not factory in-sulated (backpans of grilles, registers, and diffusers)	2 inches DW-V	-	-

3.2 NON-INSULATED DUCTWORK

A. No insulation required for ducts so indicated in Duct Insulation Type and Thickness Schedule, and the following:

1. Factory-insulated flexible ducts.
2. Factory-insulated plenums and casings.
3. Flexible connectors.
4. Vibration-control devices.
5. Factory-insulated access panels and doors.

B. Do not line ducts:

1. Where prohibited by codes.
2. Food service exhaust.
3. Dishwasher exhaust.
4. Shower exhaust.
5. Ten feet downstream from humidifiers.

3.3 DUCT INSULATION INSTALLATION

A. General.

1. Ensure that insulation is continuous through all walls.

2. Finish insulation neatly at hangers, supports and other protrusions.
3. Locate insulation joints or cover seams in least visible locations.
4. Where ducts run in groups too close to be individually insulated and finished.

    a. Completely fill all spaces between ducts with rigid or flexible insulating material.
    b. Insulate and finish exterior surfaces of group as specified for particular service.

5. Where ducts cannot be insulated after erection, insulate prior to installation.
6. Where specified thickness of insulation and/or lining exceeds available thickness in single layer, provide insulation and/or lining in 2 or more layers with joints staggered.
7. Preparation:

    a. Do not install covering before ductwork and equipment has been tested and reviewed.
    b. Ensure surface is clean and dry prior to installation.
    c. Ensure insulation is dry before and during application.

8. Mechanical fasteners:

    a. Use spot weld anchors in all shop fabricated internally lined ducts.
    b. Adhered anchors.
    c. Clip off pin penetrations flush with insulation surface or facing.
    d. Seal pins and washers where pins penetrate vapor barriers.

        1) With 4 inch square pieces of vapor barrier material to match facing.
        2) Adhere with vaporseal adhesive.

    e. Spacing on rectangular ducts.

        1) Typical of horizontal and vertical, unless otherwise specified.
        2) Duct board.

            a) 3 inches in from edges.
            b) Intermediate fasteners: 12 inches on counter maximum spacing all directions.
            c) Not less than four pins per surface.

        3) Duct Wrap.

Side Dimension	Maximum Spacing
24 inches and under	None required.
25 to 32 inches	Horizontal - none. Vertical: 1 row centered, 12 inches on center
33 to 48 inches	2 rows, 12 inches on center.
49 to 60 inches	3 rows, 12 inches on center.
61 inches and over	16 inches on center, all directions.

        4) Duct wrap spacing applicable to flat surfaces of flat oval ducts.

9. Provide 24 gauge sheet metal Z section frames over edges of duct and plenum lining.

    a. At access openings and doors.
    b. Along edges exposed to air flow.

B. Rectangular Duct Wrap.

1. Vapor barrier and sealing continuous without breaks. Vapor proof seal around supports and bracing.
2. 2 inches lap strip at one end.
3. Peel insulation for 2 inch lap strip along longitudinal joints.
4. Seal lap strips with vaporseal adhesive; Foster's 85-60 or equal.

C. Round Duct Wrap.

1. Adhere flexible insulation to ductwork with adhesive applied in 6 inch wide strips on 16 inch centers.
2. Provide 16 gauge annealed tie wire tied, spiral wound or half hitched at 16 inch centers.
3. Overlap insulation 2 inches and seal joints and breaks with 2 inch lap of foil adhered over joint.
4. Apply duct wrap with vapor barrier as specified above for rectangular ducts.

D. Duct Board.

1. Comply with published recommendations of manufacturer.
2. Secure on top, sides and bottom of duct with mechanical fasteners, spacing as scheduled.
3. Secure with 4 inch strips of adhesive, 8 inch on center.

E. Rectangular Duct and Plenum Lining.

1. Comply with SMACNA Duct Liner Application Standard, published recommendations of manufacturer, and following:
2. Apply adhesive over 100 percent of surfaces to be lined.
3. The coated surface shall face air stream.
4. Surface adjacent to air flow, including at joints, to be uniformly flat.
5. Insulation on floors of plenums and large ducts where access is required shall be protected by wire mesh so that lining is not damaged when walked or crawled on.
6. Blank-Off Panels: Insulation, enclosed with sheet metal on all sides; all joints with vapor barrier mastic and taped.
7. Volume Dampers: Where volume dampers do not allow for continuous insulation, terminate insulation clear of handle sweep and finish edges to maintain vapor barrier and to prevent damage to the insulation.
8. Seal butt joints and exposed edges of liner to prevent erosion.
9. Edges at terminal points shall be provided with metal beading and heavily coated with adhesive.
10. Damaged areas replaced or heavily coated with adhesive.
11. Mechanical fasteners.

    a. Use weld pins.
    b. Install mechanical fasteners.

        1) Weld pins flush with liner surface. Weld pins spaced maximum of 12-inch on center in both directions and within 2 inches of all corners and joints, except where SMACNA Standard requires closer spacing.
        2) Within 2 inches of all edges.
        3) Minimum 4 pins per side.
        4) For field alterations of lined ducts, install adhesive and glued pins with washers. Clip-off pins after washers installed. Field installed pins shall be

used for unusual conditions only and shall not exceed 1 percent of total pins.

3.4 OUTDOOR DUCT INSULATION INSTALLATION

A. Install duct board and duct liner as described herein.

B. Cover duct board with aluminum jacket.

C. Caulk all seams at flanges and joints. Locate longitudinal seams of bottom side of horizontal duct sections.

D. Jacket installation shall be neat with a smooth finish.

3.5 PENETRATION THROUGH RATED WALLS

A. Refer to drawings for penetrations of rated assemblies.

B. Install per manufacturer's installation and listing requirements.

3.6 FIELD QUALITY CONTROL

A. Repair separation of joints or cracking of insulation due to thermal movement or poor workmanship.

B. All vapor barriers shall be continuous; tears, holes, staples, etc. shall be coated with vapor barrier mastic and patch with facing or tape.

C. See Section 233113 – Metal Ducts for protection of lined duct during construction.

END OF SECTION 23 07 13

SECTION 23 07 19

PIPING AND EQUPMENT INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Work Included in This Section: Materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Piping insulation.
2. Pipe insulation jacket.
3. Equipment insulation.

1.3 REFERENCE STANDARDS

A. ASTM B209 – Aluminum and Aluminum-Alloy Sheet and Plate.

B. ASTM C177 – Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.

C. ASTM C335 – Steady-State Heat Transfer Properties of Horizontal Pipe Insulation.

D. ASTM C585 – Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe.

E. ASTM C921 – Properties of Jacketing Materials for Thermal Insulation.

F. ASTM E84 – Surface Burning Characteristics of Building Materials.

G. ASTM E96 – Water Vapor Transmission of Materials.

H. NFPA 255 – Surface Burning Characteristics of Building Materials.

I. SMACNA – HVAC Duct Construction Standards - Metal and Flexible.

J. UL 723 – Surface Burning Characteristics of Building Materials.

K. ASTM E 814 – Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

1.4 QUALITY ASSURANCE

A. Source Quality Control.

1. Service: Use insulation specifically manufactured for service specified.
2. Labeling: Insulation labeled or stamped with brand name and number.

B. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

C. Mockups: Before installing insulation, build mockups for each type of insulation and finish listed below to demonstrate quality of insulation application and finishes. Build mockups in the location indicated or, if not indicated, as directed by Architect. Use materials indicated for the completed Work.

1. Piping Mockups:

a. One 10-foot section of NPS 2 straight pipe.
b. One each of a 90-degree threaded, welded, and flanged elbow.
c. One each of a threaded, welded, and flanged tee fitting.
d. One NPS 2 or smaller valve, and one NPS 2-1/2 or larger valve.
e. Four support hangers including hanger shield and insert.
f. One threaded strainer and one flanged strainer with removable portion of insulation.
g. One threaded reducer and one welded reducer.
h. One pressure temperature tap.
i. One mechanical coupling.

2. For each mockup, fabricate cutaway sections to allow observation of application details for insulation materials, adhesives, mastics, attachments, and jackets.
3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
4. Obtain Architect's approval of mockups before starting insulation application.
5. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Demolish and remove mockups when directed.

1.5 SUBMITTALS

A. See Section 230010 – Mechanical General Provisions.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Piping insulation	R			
Jackets	R			
Adhesives and coatings	R			

Mechanical fasteners	R			
Installer qualifications	R			

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Insulation: Cellular glass.

1. Pittsburg-Corning
2. Or equal.

C. Insulation: fiberglass.

1. Owens-Corning Fiberglass Corporation.
2. Manville.
3. Certainteed Corporation.
4. Knauf.
5. Or equal.

D. Insulation: Elastomeric Closed Cell.

1. Armstrong World Industries, Inc.
2. Rubatex Corporation.
3. Or equal.

E. Weatherproof Aluminum Jacket.

1. Childers Products Company.
2. Insul-Coustic/Birma Corporation.
3. Or equal.

F. Pre-molded pipe fitting covers and Jacketing.

1. Manville: Zeston.
2. Childers Products Company.
3. Proto Corporation.
4. Insul-Coustic/Birma Corporation.
5. Or equal.

G. Adhesives.

1. Foster Div. Amchem Products Inc.
2. Childers Products Company.
3. Epolux Mfg. Corporation.
4. Insul-Coustic/Birma Corporation.
5. Armstrong 520 Adhesive.
6. Or equal.

H. Mechanical Fasteners.

1. AGM Industries, Inc.
2. Miracle Adhesives Corporation.
3. Grip-Nail.
4. Or equal.

2.2 GENERAL

A. Energy Codes: The current versions of ASHRAE 90.1 shall govern where requirements for thickness exceeds thickness specified.

B. All insulation materials, including jackets, facings, adhesives, coatings, and accessories are to be fire hazard rated and listed by Underwriters' Laboratories, Inc., using Standard UL 723 (ASTM E-84), (NFPA-255), (ASA A2.5-1963).

1. Flamespread: maximum 25.
2. Fuel contributed and smoke developed: maximum 50.
3. Flameproofing treatments subject to deterioration from moisture or humidity are not acceptable.

C. Insulation and accessories shall not provide any nutritional or bodily use to fungi, bacteria, insects, rats, mice, or other vermin, shall not react corrosively with equipment, piping or ductwork, and shall be asbestos free: Duct lining shall meet ASTM C1136 and ASTM C665 for biological growth in insulation.

D. Provide a continuous vapor seal for any service piping that carries liquid below 60 degrees Fahrenheit.

2.3 PIPE INSULATION

A. Cellular Glass.

1. Insulation (without jacket) ASTM C 552, Type II, Class 1.
2. Insulation (with jacket) ASTM C552, Class 2.
3. Sectional.
4. 0.32 maximum K-factor at 75 degrees Fahrenheit mean temperature.
5. Pittsburg-Corning or equal.

B. Fiberglass.

1. Molded: one piece, with factory-applied, all purpose, vapor retarder jacket, maximum 0.26 K factor at 75 degrees Fahrenheit mean temperature: Owens-Corning ASJ/SSL-II Pipe Insulation or equal.

C. Flexible, closed cell elastomeric thermal insulation.

1. Insulation ASTM C534.
2. Service rating of 220 degrees Fahrenheit.
3. Density 6.0 pounds per cubic foot.
4. Closed cell foam: Vapor permeability ASTM E96 0.2 perm.
5. Max moisture absorption: 1.0 percent by volume, 10 percent by weight.
6. Molded pipe insulation.

a. Maximum 0.27 K factor at 75 degrees Fahrenheit mean temperature
b. Maximum water vapor transmission rating of 0.17 perm-inches,

7. Sheet insulation.

a. Maximum 0.28 K factor at 75 degrees Fahrenheit mean temperature.
b. Maximum water vapor transmission rating of 0.17 perm-inches.

8. Seal with Rubatex adhesive or equal: Armstrong Armaflex II or equal.

D. Underground pipe insulation: See Section 232112 – Hydronic Piping.

2.4 EQUIPMENT INSULATION

A. Flexible, closed cell elastomeric thermal insulation.

1. Insulation ASTM C534, Type II sheet material.
2. Service rating of 220 degrees Fahrenheit.
3. Density 6.0 pounds per cubic foot.
4. Closed cell foam: Vapor permeability ASTM E96 0.2 perm.
5. Max moisture absorption: 1.0 percent by volume, 10 percent by weight.
6. Sheet insulation.

a. Maximum 0.28 K factor at 75 degrees Fahrenheit mean temperature.
b. Maximum water vapor transmission rating of 0.17 perm-inches.

7. Seal with Rubatex adhesive or equal: Armstrong Armaflex II or equal.

2.5 JACKETS

A. Factory Applied Vapor Barrier All Service Jacket (ASJ).

1. ASTM C921, White kraft paper bonded to aluminum foil and reinforced with glass fiber yarn.
2. Moisture Vapor Transmission: ASTM E96; 0.02 perm inches.
3. Secure with self sealing longitudinal laps and butt strips.
4. Secure vapor barrier mastic.
5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum or 0.010 inch thick stainless steel.
6. Vapor Barrier Lap Adhesive: Compatible with insulation.

B. Aluminum Jacket: ASTM B209.
1. Use for weatherproof jacket.
2. Thickness: 0.016 inch sheet.
3. Finish: Embossed.
4. Joining: Longitudinal slip joints and 2 inch laps.
5. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
6. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum or 0.010 inch thick stainless steel.

C. Preformed PVC.

1. Polyvinylchloride covers similar to Manville Zeston.

2. Colors:

a. Chilled Water: Blue.
b. Condenser Water: Light blue.
c. Heating Water: Red.
d. Domestic Cold Water: Green.
e. Domestic Hot Water: Orange.

D. Equipment insulation facings: Foil-scrim-kraft laminate of aluminum foil facing, glass scrim reinforcing, kraft paper backing.

E. Preformed Pipe Fitting Covers:

1. Aluminum.

a. Factory fabricated formed covers.
b. General Aluminum Supply Corporation GASCO or equal.

2. PVC.

a. Factory fabricated formed covers.
b. Manville Zeston or equal.

2.6 ADHESIVES AND COATINGS

A. Foster product names and figure numbers or equal.

1. Lagging adhesive: 30-36.
2. Fiberglass: Zeston Z-Glu.
3. Vapor barrier coating: Tite-fit 30-80, UP Label, comply with MIL-C-19565C, Type II; fire and water resistant.
4. Vaporseal adhesive: 85-60.
5. Cellular glass bedding and sealing compound adhesive: Foamseal 30-45.
6. Outdoor mastic: 30-90.
7. Asphalt mastic: C.I. Mastic 60-25.
8. For elastomeric insulation: 520 contact adhesive.

2.7 WIRE, BANDING AND FASTENING DEVICES

A. Wire: minimum 16 gauge copper clad annealed steel wire

B. Bands: 3/4 inches nominal width with wing seals, of minimum thickness as follows:

1. Aluminum: 0.007 inches. Except where exposed to weather, 0.020 inches.
2. Stainless steel: 0.010 inches.

C. Staples: outward clinching type of corrosion resistant steel.

2.8 MECHANICAL FASTENERS

A. Mild steel, copper plated.

B. AGM Industries Power Base insulation pins or equal.

C. Insulation washers:

1. Galvanized steel.
2. 1-1/2 inch diameter.
3. AGM Industries SLW-1 or equal.

2.9 PRE-INSULATED PIPE SUPPORT AND SHIELDS

A. Provide insulated pipe supports for all insulated pipe and tubing. Insulated pipe supports shall be Pipe Shields, Inc. or equal.

B. All insulated pipe supports shall be load rated. Load ratings shall be established by pipe support manufacturer based upon testing and analysis in conformance with the latest edition of the following codes: ASME B31.1, MSS SP-58, MSS SP-69 and MSS SP-89.

C. All insulated pipe supports shall have cellular glass insulation and galvanized steel jackets. Pipe supports for use on flat surfaces shall have integral load distribution plates coated with zinc primer minimum 3 mils thick.

D. See Section 230529 – Hangers and Supports.

E. Hangers and supports shall fit outside of all pipe insulation and insulation inserts. Provide pre-insulated pipe supports as specified and install per manufacturer's installation instructions. Shield lengths and gauges shall also be per manufacturer's recommendations.

F. Tape all butt joints where pipe insulation butts up against hanger shield.

1. On hot pipe, apply three inch wide vapor barrier tape or band over the butt joint.
2. On chilled water piping, apply a wet coat vapor barrier lap cement on all butt joints and seal the joints with a minimum of three inch wide vapor tape or band.

2.10 FIRE-STOPPING

A. At pipe penetrations through rated assemblies.

B. Commercial pipe sleeve assemblies that are UL listed and that have been approved by the fire marshal for this purpose.

C. Insulation shall be continuous through penetration.

2.11 ACCESSORIES

A. Insulation Protection Saddles: 12-inch long, 16 gauge steel.

B. Paint: Ultraviolet resistant latex paint with special adherence capabilities to the fitting covers, elastomeric, aluminum facing, Kraft paper, tapes and adhesives.

PART 3 - EXECUTION

3.1 PIPE & EQUIPMENT INSULATION SCHEDULE

A. Type P-1.

1. Molded fiberglass.
2. All-service jacket (ASJ).
3. Vapor sealed.

B. Type P-1A.

1. Molded fiberglass.
2. All-service jacket (ASJ).
3. Vapor sealed.
4. PVC jacket.

C. Type P-1B.

1. Molded fiberglass.
2. All-service jacket (ASJ).
3. Vapor sealed.
4. Metal jacket.

D. Type P-2.

1. Flexible elastomeric insulation.

E. Type P-3.

1. Cellular glass insulation.
2. All service jacket (ASJ).
3. Vapor sealed.

F. Type P-3A.

1. Cellular glass insulation.
2. All service jacket (ASJ).
3. Vapor sealed.
4. PVC jacket.

G. Type P-3B.

1. Cellular glass insulation.
2. All service jacket (ASJ).
3. Vapor sealed.
4. Metal jacket.

H. Type E-1.

1. Flexible elastomeric insulation.

I. Application Schedule.

Piping Systems	Location	Type	Pipe Size	Insulation Thickness	Freeze Protection
Chilled Water	Interior concealed	P-3	4" and Smaller	1-1/2”	-
			6" and Larger	2"	-
	Interior exposed	P-3A	4” and Smaller	1-1/2”	-
			6” and Larger	2"	-
	Exterior	P-3B	4” and Smaller	2”	Yes
			6” and Larger	3-1/2”	Yes
Heating Water (Max 180 ˚F)	Interior concealed	P-1	2-1/2” and Smaller	1-1/2”	-
			3" and Larger	2-1/2”	-
	Interior exposed	P-1A	2-1/2” and Smaller	1-1/2”	-
			3" and Larger	2-1/2”	-
	Exterior	P-1B	2-1/2” and Smaller	2”	Yes
			3" and Larger	3-1/2”	Yes
Floor Drain Bodies and related horizontal and vertical Sanitary Drain Lines above floor that receive cold condensate drainage.	Interior	P-2	4” and smaller	3/4"	-
Cold Condensate Drain Lines	Interior	P-2	All Sizes	3/4"	-
Refrigerant suction	All	P-2	All Sizes	3/4"	-
Refrigerant hot gas (VRF systems)	All	P-2	All Sizes	3/4"	-
Chilled water pumps	All	E-1	-	1-1/2”	-
Chilled water air separators, expansion tanks, and storage tanks, equipment supports as required	All	E-1	-	1-1/2”	-
Chillers (evaporators, evaporator heads, all cold services)	All	E-1	-	1-1/2”	-
Hot water pumps	All	E-1	-	1-1/2”	-
Hot water air separators and storage tanks	All	E-1	-	1-1/2”	-
Hot water coil frame and tube bends	All	E-1 or DW-V	-	1-1/2”	-
Condensate, and sanitary sewer waste/vent piping receiving condensate (horizontal piping and first three feet of vertical piping, Underside of floor drain bodies receiving condensate)	Interior	P-2	All Sizes	3/4"	
Domestic cold water	Interior concealed	P-1	1-1/2” and smaller	1/2"	-
			2” and larger	3/4"	-
	Interior exposed	P-1B	1-1/2” and smaller	1/2"	-
			2” and larger	3/4"	-
	Exterior exposed	P-1A	All Sizes	3/4"	Yes
Domestic hot water (includes recirculation piping)	Interior concealed	P-1	1-1/2” and smaller	3/4"	-
			2” and larger	1"	-
	Interior exposed	P-1B	1-1/2” and smaller	3/4"	-
			2” and larger	1"	-
	Exterior exposed	P-1A	All Sizes	1”	Yes
Roof drains (horizontal piping	All	P-1	All Sizes	3/4"	-

Piping Systems	Location	Type	Pipe Size	Insulation Thickness	Freeze Protection
and first three feet of vertical piping)		P-2	All Sizes	1”	-
Roof drains (underside of roof drain bodies/bowl)	All	E-1	All Sizes	3/4"	-

K. Non-insulated piping and equipment.

1. Pneumatic tubing.
2. Hot water expansion tanks and piping to them other than the first 3 feet from the point of connection at piping mains.
3. Pot feeders and piping to them other than the first 3 feet from the point of connection at piping mains.
4. Vent, overflow, drain and relief, except as noted otherwise.
5. Hot water control valves. (Note: this exclusion applies only to the valves themselves; all other hot water piping and accessories, including that between isolation valves and coils, shall be insulated.)

3.2 INSTALLATION

A. Install materials in accordance with manufacturer’s instructions.

B. Coordinate with work of other trades.

C. Deliver material to job site in original non-broken factory packaging, labeled with manufacturer’s density and thickness.

D. Install insulation where it cannot become wet. If insulation becomes wet, remove and dispose of properly and replace with new, dry insulation. Wetted insulation is not acceptable. Ensure insulation is dry before and during installation.

E. Insulate all piping, valves, fittings, flanges and accessories.

F. On piping exposed to public view, locate insulation and cover seams in least visible locations.

G. Insulate fittings, joints and valves with insulation of same material and thickness as adjoining pipe. Use pre-molded fiberglass fittings. For strainers, expansion joints, fittings and accessories requiring servicing or inspection insulation shall be removable and replaceable without damage. Enclose within two-piece no. 15 gauge aluminum covers fastened with cadmium-plated bolts and nuts.

H. Insulate flanges with insulation sleeve of same material as pipe insulation to cover flange and overlap insulation on adjacent piping.

I. Continue insulation through walls, sleeves, pipe hangers and other pipe penetrations.

J. Finish insulation at supports, protrusions and interruptions. No hangers or supports shall be embedded in insulation. Do not insulate expansion bellows.

K. Fiberglass insulation.

1. Provide insulation with factory applied vapor barrier jackets.
2. Butt edges neatly. ASJ with 3 inch minimum butt strips.

3. Longitudinal overlaps: Minimum 2 inch self sealing, double adhesive.
4. Apply additional jacket as specified.
5. For insulation with factory-applied jackets, secure laps with aluminum or stainless steel bands at 18 inches o.c.
6. For piping conveying fluids below ambient temperature finish with vapor barrier adhesive.

L. Cellular glass insulation.

1. Provide insulation with factory applied vapor barrier jackets.
2. Butt edges neatly. Seal longitudinal and transverse joints with adhesive to maintain minimum vapor permeance. Adhesive shall be selected and applied in accordance with insulation manufacturer's recommendations.
3. Secure insulation sections with bands without deforming insulation materials.
4. Build up coating of insulating and finishing cement.
5. For insulation with factory-applied jackets, secure laps with aluminum or stainless steel bands at 18 inches o.c.
6. For piping conveying fluids below ambient temperature finish with vapor barrier adhesive.
7. Apply additional jacket as specified. If no additional jacket specified apply skim coat of finishing cement to smooth out surface of fitting insulation.

M. Elastomeric Tubing.

1. Butt edges neatly. Seal longitudinal and transverse joints with adhesive to maintain minimum vapor permeance. Adhesive shall be selected and applied in accordance with insulation manufacturer's recommendations.
2. Apply additional jacket as specified.

N. For all pipe systems exposed in the mechanical equipment rooms, finish with an all service PVC jacket.

O. For exterior applications, provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

P. For buried piping, provide factory fabricated assembly with inner all-purpose service jacket with self sealing lap, and asphalt impregnated open mesh glass fabric, with one mil thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with a polyester film.

Q. Perform work at ambient and equipment temperatures as recommended by adhesive manufacturer.

R. Protection: Protect against dirt, water, chemical, or mechanical damage before, during, and after installation. Repair or replace damaged insulation at no additional cost.

S. Paint all insulation exposed to ultraviolet light (sunlight).

T. All vapor barriers shall be continuous. Tears, holes, staples, etc. shall be coated with vapor barrier mastic and patch with facing or tape.

U. Joints between insulation and access shall be sealed with vapor barrier mastic.

3.3 PIPE INSULATION APPLICATION

A. General.

1. Before applying insulation.

a. Test piping for tightness and obtain approval.
b. Dry pipe thoroughly.
c. Clean surfaces to be insulated of dust, grease and foreign matter.

2. Butt edges neatly.
3. Fill voids with insulating cement.
4. Longitudinal overlaps.

a. 2 inches minimum.
b. For exposed work: toward ceiling or wall.
c. For weatherproof aluminum jackets: on side to shed water.

5. Circumferential overlaps on weatherproof aluminum jackets: 2 inches minimum.
6. Continuous insulation passing through sleeves or other openings.
7. Oversize insulation to accommodate heat tracing on piping.

B. Valves, fittings, flanges and accessory insulation.

1. Unless otherwise noted, insulate:

a. Valves including bonnets.
b. Flanges.
c. Fittings.
d. Strainers.
e. Expansion joints.
f. Specialties.

2. Insulation for strainers, expansion joints, fittings and accessories requiring servicing or inspection.

a. Insulation removable and replaceable without damage.
b. Enclosed within two piece, No. 18 gauge aluminum covers fastened with cadmium plated bolts and nuts.

3. Insulation of same thickness as adjacent piping insulation.
4. For piping systems insulated with fiberglass.

a. Apply premolded insulation sections of the same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.
b. Cover fittings with heavy PVC fitting covers. Overlap PVC covers on pipe insulation jackets at least 1 inch at each end. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

5. For piping systems insulated with cellular glass.

a. Apply premolded insulation sections of the same material as straight segments of pipe when available. Secure according to manufacturer’s written instructions.

b. When premolded insulation elbows and fittings are not available, apply mitered sections of pipe insulation (blanket insulation is not acceptable) to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire, tape, or bands.
c. Cover fittings with heavy PVC fitting covers. Overlap PVC covers on pipe insulation jackets at least 1 inch at each end. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

6. For piping systems insulated with elastomeric thermal insulation.

a. Apply mitered sections of pipe insulation.
b. Secure insulation materials and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

7. Flanges.

a. Apply preformed pipe insulation to outer diameter of pipe flange.
b. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
c. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with the same insulation material as adjacent piping insulation.
d. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch, and seal joints with vapor-retarder mastic.

8. Finish for outdoor locations only: weatherproof aluminum jacket compatible with weatherproof jacket on adjoining pipe insulation.

C. At pipe hangers.

1. Insulation protection shields specified in Section 230529 – Hangers and Supports.
2. Butt insulation to shields.
3. Cold piping: Wet coat of vapor barrier lap cement on all butt joints.

D. Jackets and facings.

1. Vapor-sealed types: continuous; staples not permitted.
2. Adhere longitudinal laps: Adhere 3 inches wide joint strip, of same material as facing, at center of each butt joint.
3. Adhesives.

a. Vapor-sealed insulation: vapor-seal adhesive.
b. Heating service insulation: vapor-seal adhesive.
c. Weatherproof aluminum jacket: sealing compound.
d. PVC jacket: welding compound.
e. Underground asphalt felt jacket: asphalt mastic

E. Wiring, banding and fastening devices: Secure insulation to piping and equipment in accordance with following minimum requirements.

1. Piping insulation section 3 foot long.

a. Concealed vapor-sealed insulation banded at ends and center.

b. Other concealed insulation banded at ends and center.

2. Pipe fitting insulation.

a. Loops of wire to secure mitered segments of insulation.
b. Wire spiraled on from end to end on blanket insulation

3. Outdoor piping weatherproof aluminum jackets banded at circumferential joints and center of each section: Lap joint at bottom.

3.4 EQUIPMENT INSULATION

A. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Secure insulation to equipment with bands, welded-on anchors, ties or adhesive. Where access to equipment is required for testing or maintenance the insulation shall be installed so that it is removable and so that the vapor barrier can be remade after access.

B. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor barrier cement.

C. For cold equipment or equipment containing fluids below ambient temperature.

1. Insulate entire system.
2. Provide vapor barrier jackets, factory applied or field applied.
3. Finish with glass cloth and vapor barrier adhesive.
4. Cover with aluminum jacket where specified.

D. For equipment containing fluids above ambient temperature.

1. Insulate entire system.
2. Provide standard jackets, with or without vapor barrier, factory applied or field applied.
3. Finish with glass cloth and adhesive.
4. Cover with aluminum jacket where specified.
5. For hot equipment containing fluids 140 degrees Fahrenheit or less, do not insulate flanges and unions, but bevel and seal ends of insulation.
6. For hot equipment containing fluids over 140 degrees Fahrenheit, insulate flanges and unions with removable sections and jackets.

E. Finish insulation at supports, protrusions, and interruptions.

F. For equipment in mechanical equipment rooms or in finished spaces, finish with aluminum jacket.

G. Do not insulate over nameplate or ASME stamps; bevel and seal insulation around such.

H. General.

1. Apply insulation with edges tightly butted.

a. Joints staggered and secured in place by steel bands.
b. Where necessary weld on suitable anchors.

2. Seal with 520 adhesive.

I. Special considerations.

1. Chiller heads: removable and replaceable covers to allow tube removal.
2. Strainers and suction diffusers: removable and replaceable covers to allow strainer removal.
3. Pumps: removable and replaceable covers to allow impeller replacement.
4. Provide sufficient clearance around openings for normal operation of equipment.

3.5 PENETRATION THROUGH RATED WALLS

A. Refer to drawings for penetrations of rated assemblies.

B. Install per manufacturer’s installation and listing requirements.

3.6 FIELD QUALITY CONTROL

A. Repair separation of joints or cracking of insulation due to thermal movement or poor workmanship.

B. All vapor barriers shall be continuous; tears, holes, staples, etc. shall be coated with vapor barrier mastic and patch with facing or tape.

END OF SECTION 230719

SECTION 23 09 00

ENERGY MANAGEMENT AND CONTROL SYSTEM - GENERAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. These heating, ventilating and air conditioning (HVAC) provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.2 WORK INCLUDED

A. Contractor shall furnish and install a direct digital control and Energy Management and Control System (EMCS).

B. The systems to be controlled under work of this Section include but are not limited to the following:

1. HVAC Systems

1.3 RELATED WORK AND REQUIREMENTS

A. Other EMCS Sections:

1. Section 23 09 13 EMCS Basic Materials and Devices
2. Section 23 09 16 EMCS Operator Interfaces
3. Section 23 09 19 EMCS Field Panels
4. Section 23 09 23 EMCS Communication Devices
5. Section 23 09 26 EMCS Software and Programming
6. Section 23 09 29 EMCS Points and Sequence of Operation
7. Section 23 09 33 EMCS Commissioning

B. Coordination with other Divisions. The table in specification 23 00 10 paragraph 1.2-B shall be used to determine scope of work between Division 23 and other Divisions including Divisions 23 and 26. All work not specified to be a part of the EMCS scope of work shall be provided by General Contractor and associated subcontractors for each building and the infrastructure.

C. Testing and Commissioning

1. Section 23 05 93 Testing, Adjusting and Balancing
2. Section 23 09 33 EMCS Commissioning

D. Communications

1. Connection to Owner IT WAN/LAN and terminations to wall jack shall be by Division 23C Contractor. Coordinate connection location of IT WAN/LAN and terminations with Owner. This connection shall also provide access to Internet through Owner’s firewall to Internet Services Provider procured by Owner.
2. Telephone lines: none required.

1.4 REFERENCE STANDARDS

A. Nothing in Contract Documents shall be construed to permit Work not conforming to applicable laws, ordinances, rules, and regulations. When Contract Documents differ from requirements of applicable laws, ordinances, rules and regulations, EMCS contractor shall comply with documents establishing the more stringent requirement.

B. The latest published or effective editions, including approved addenda or amendments, of the following codes and standard shall apply to the EMCS design and installation as applicable.

C. State and Local Codes:

1. Local City and County Codes

D. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

1. ASHRAE 135: BACnet - A Data Communication Protocol for Building Automation and Control Networks.

E. Electronics Industries Alliance

1. EIA-232: Interface Between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange.
2. EIA-458: Standard Optical Fiber Material Classes and Preferred Sizes
3. EIA-485: Standard for Electrical Characteristics of Generator and Receivers for use in Balanced Digital Multipoint Systems.

F. Underwriters Laboratories

1. UL 916: Energy Management Systems.

G. NEMA Compliance

1. NEMA 250: Enclosure for Electrical Equipment
2. NEMA ICS 1: General Standards for Industrial Controls.

H. NFPA Compliance

1. NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems" where applicable to controls and control sequences.

I. Institute of Electrical and Electronics Engineers (IEEE)

1. IEEE 142: Recommended Practice for Grounding of Industrial and Commercial Power Systems
2. IEEE 802.3: CSMA/CD (Ethernet – Based) LAN
3. IEEE 802.4: Token Bus Working Group (ARCNET – Based) LAN

1.5 DEFINITIONS

A. Acronyms

AAC	Advanced Application Controller
AH	Air Handler

AHU	Air Handling Unit
AI	Analog Input
ANSI	American National Standards Institute
AO	Analog Output
APDU	Application Protocol Data Unit
ASC	Application Specific Controllers
ASCII	American Standard Code for Information Interchange
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers.
ASME	American Society of Mechanical Engineers.
ASTM	American Society for Testing and Materials.
A-to-D	Analog-to-Digital
BACnet	Data Communications Protocol for Building Automation and Control Systems
BC	Building Controller
BIBB	BACnet Interoperability Building Blocks
BMA	BACnet Manufacturers Association \
CAD	Computer Aided Drafting
CHW	Chilled Water
CHWR	Chilled Water Return
CHWS	Chilled Water Supply
COV	Change of Value
CSS	Control Systems Server
CU	Controller or Control Unit
CV	Constant Volume
CW	Condenser Water
CWR	Condenser Water Return
CWS	Condenser Water Supply
DCS	Digital Control Stations
DBMS	Database Management System
DDC	Direct Digital Control
DHW	Domestic Hot Water
DI	Digital Input
DO	Digital Output
D-to-A	Digital-to-Analog
EMCS	Energy Management and Control System
EMT	Electrical Metallic Tubing
EP	Electro-Pneumatic
ETL	Edison Testing Laboratories.
GUI	Graphical User Interface
HOA	Hand-Off-Automatic
HVAC	Heating, Ventilating and Air-Conditioning'
HTTP	Hyper-Text Transfer Protocol
I/O	Input/output
IEEE	Institute of Electrical and Electronics Engineers
ISO	International Organization for Standardization
LAN	Local Area Network
LANID	LAN Interface Device
LCP	Lighting Control Panel
MAC	Medium Access Control
MHz	Megahertz
MS/TP	Master-Slave/Token-Passing

NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association.
NIST	National Institute of Standards and Technology
ODBC	Open Database Connectivity
OI	Operator Interface
OWS	Operator Workstation
P	Proportional
PC	Personal Computer
PI	Proportional-Integral
PICS	Protocol Implementation Conformance Statement
PID	Proportional-Integral-Derivative
POT	Portable Operators Terminal
PTP	Point-to-Point
RAM	Random Access Memory
SOO	Sequence of Operation
SQL	Standardized Query Language
SSL	Secure Socket Layers
TAB	Test, Adjust, and Balance
TDR	Time Delay Relay
THS	Trend Historian Server
UL	Underwriters' Laboratories, Inc.
XML	Extensible Markup Language

B. Terms

Term	Definition
Accessible	Locations that can be reached with no more than a ladder to assist access and without having to remove permanent partitions or materials. Examples include inside mechanical rooms, mechanical equipment enclosures, instrument panels, and above suspended ceilings with removable tiles.
Advanced Application Controller	A device with limited resources relative to the Building Controller. It may support a level of programming and may also be intended for application specific applications.
Application Protocol Data Unit	A unit of data specified in an application protocol and consisting of application protocol control information and possible application user data (ISO 9545).
Application Specific Controller	A device with limited resources relative to the Advanced Application Controller. It may support a level of programming and may also be intended for application-specific applications. .
BACnet Interoperability Building Blocks	A BIBB defines a small portion of BACnet functionality that is needed to perform a particular task. BIBBs are combined to build the BACnet functional requirements for a device in a specification.
BACnet/BACnet Standard	BACnet communication requirements as defined by the latest version of ASHRAE/ANSI 135 and approved addenda.
Building Controller	A fully programmable device capable of carrying out a number of tasks including control and monitoring via direct digital control of specific systems, acting as a communications router between the LAN backbone and sub-LANs, and data storage for trend information, time schedules, and alarm data.
Change of Value	An event that occurs when a digital point changes value or an analog value changes by a predefined amount

Client	A device that is the requestor of services from a server. A client device makes requests of and receives responses from a server device.
Concealed	Embedded in masonry or other construction, installed in furred spaces, within double partitions or hung ceilings, in trenches, in crawl spaces, or in enclosures.
Continuous Monitoring	A sampling and recording of a variable based on time or change of state (e.g. trending an analog value, monitoring a binary change of state).
Contract Documents	Specifications, drawings, and other materials provided with request for bids.
Contractor, EMCS Contractor, or Division 23C Contractor	The Contractor retained by Owner to execute the work defined in Division 23C and associated design documents
Control Systems Server	A computer (or computers) that maintains the systems configuration and programming database.
Controller or Control Unit	Intelligent stand-alone control panel. Controller is a generic reference and shall include BCs, AACs, and ASCs as appropriate.
Digital Control Stations	One or more EMCS control panels
Direct Digital Control	Microprocessor-based control including Analog/Digital conversion and program logic
Energy Management and Control System	The entire integrated management and control system
Equal	Approximately equal in material types, weight, size, design, quality, and efficiency of specified product.
Exposed	Not installed underground or concealed.
Extensible Markup Language	A specification developed by the World Wide Web Consortium. XML is a pared-down version of SGML, designed especially for Web documents. It allows designers to create their own customized tags, enabling the definition, transmission, validation, and interpretation of data between applications and between organizations.
Functional Profile	A collection of variables required to define a the key parameters for a standard application. As this applies to the HVAC industry, this would include applications like VAV terminal, fan coil units, and the like.
Gateway	Bi-directional protocol translator connecting control systems that use different communication protocols
Hand Held Device	Manufacturer's microprocessor based device for direct connection to a Controller.
Inaccessible	Locations that do not meet the definition of accessible. Examples include inside furred walls, pipe chases and shafts, or above ceilings without removable tiles.
Indicated, shown or noted	As indicated, shown or noted on drawings or specifications.
Install	To erect, mount and connect complete with related accessories.
Instrumentation	Gauges, thermometers and other devices mounted in ductwork or piping that are not a part of the automatic temperature control system
IT LAN	Reference to the facility's Information Technology network, used for normal business-related e-mail and Internet communication.
LAN Interface Device	Device or function used to facilitate communication and sharing of data throughout the EMCS
Local Area Network	General term for a network segment within the architecture.
Supervisory LAN	Ethernet-based LAN connecting Primary Controller LANs with

	each other and OWSs, CSS, and THS. See System Architecture below.
Master-Slave/Token Passing	Data link protocol as defined by the BACnet standard.
Motor Controllers	Manual or magnetic starters (with or without switches), individual pushbuttons or hand-off-automatic (HOA) switches controlling the operation of motors.
Open Database Connectivity	An open standard application-programming interface for accessing a database developed. ODBC compliant systems make it possible to access any data from any application, regardless of which database management system is handling the data.
Operator Interface	A device used by the operator to manage the EMCS including OWSs, POTs, and HHDs.
Operator Workstation	The user's interface with the EMCS system. As the EMCS network devices are stand-alone, the OWS is not required for communications to occur.
Piping	Pipe, tube, fittings, flanges, valves, controls, strainers, hangers, supports, unions, traps, drains, insulation, and related items.
Points	All physical I/O points, virtual points, and all application program parameters.
Point-to-Point	Serial communication as defined in the BACnet standard.
Portable Operators Terminal	Laptop PC used both for direct connection to a controller and for remote dial up connection.
Primary Controlling LAN	High speed, peer-to-peer controller LAN connecting BCs and optionally AACs and ASCs. Refer to System Architecture below.
Protocol Implementation Conformance Statement	A written document, created by the manufacturer of a device, which identifies the particular options specified by BACnet that are implemented in the device (ASHRAE/ANSI 135).
Provide	To supply, install and connect up complete and ready safe and regular operation of particular work referred to unless specifically noted.
Reviewed, approved, or directed	As reviewed, approved, or directed by the Owner.
Router	A device that connects two or more networks at the network layer.
Secondary Controlling LAN	LAN connecting AACs and ASCs. Generally lower speed and less reliable than the Primary Controlling LAN. Refer to System Architecture below.
Server	A device that is a provider of services to a client. A client device makes requests of and receives responses from a server device.
Smart Device	A control I/O device such as a sensor or actuator that can directly communicate with the controller network to which it is connected. This differs from an ASC in that it typically deals only with one variable.
Standardized Query Language	A standardized means for requesting information from a database.
Supply	To purchase, procure, acquire and deliver complete with related accessories.
Trend Historian Server	A computer (or computers) that maintains the database of recorded trend logs.
Owner	Owner, University, Institution and/or its designated representatives.
Wiring	Raceway, fittings, wire, boxes and related items.
Work	Labor, materials, equipment, apparatus, controls, accessories,

	and other items required for proper and complete installation.

1.6 QUALITY ASSURANCE

A. Materials and Equipment

1. Manufacturer's Qualifications: See 2.01 for approved manufacturer.
2. Product Line Demonstrated History: The direct digital control equipment product line being proposed for the project must have an installed history of demonstrated satisfactory operation for a length of one year since date of final completion in at least 10 installations of comparative size and complexity.
3. All products used in this project installation shall be new, currently under manufacture, and shall have been available from the manufacturer for a minimum of 6 months prior to date of proposal and previously installed and proven effective in installations of similar nature, not including test sites. This installation shall not be used as a test site for any new products unless explicitly approved by the Owner in writing. Spare parts shall be available for at least five years after completion of this contract.
4. All BACnet devices must either be certified as complaint with BACnet through the BACnet Manufacturers Association or the vendor must supply proof of having submitted the device for testing by BMA.
5. The EMCS and components shall be listed by Underwriters Laboratories UL 916 as an Energy Management System.

B. Installer

1. EMS Contractor's Project Manager Qualifications: Individual shall specialize in and be experienced with direct digital control system installation for not less than 3 years. Project Manager shall have experience with the installation of the proposed direct digital control equipment product line for not less than 2 projects of similar size and complexity. Project Manager must have proof of having successfully completed the most advanced training offered by the manufacturer of the proposed product line.
2. EMS Contractor's Programmer Qualifications: Individual(s) shall specialize in and be experienced with direct digital control system programming for not less than 3 years and with the proposed direct digital control equipment product line for not less than 1.5 years. Programmers must show proof of having successfully completed the most advanced programming training offered by the vendor of the programming application on the proposed product line.
3. EMS Contractor's Service Qualifications: The installer must be experienced in control system operation, maintenance and service. EMS Contractor must document a minimum 5-year history of servicing installations of similar size and complexity. Installer must also document at least a 1-year history of servicing the proposed product line.
4. Installer’s Response Time and Proximity

    a. Installer must maintain a fully capable service facility within Mississippi. Service facility shall manage the emergency service dispatches and maintain the inventory of spare parts.
    b. Installer must demonstrate the ability to meet the emergency response times listed in paragraph 1.12B.2.

5. Electrical installation shall be by manufacturer-trained electricians.

    a. Exception: Roughing in wiring/conduit and mounting panels may be subcontracted to any licensed electrician.

1.7 SUBMITTALS

A. No work may begin on any segment of this project until the related submittals have been reviewed for conformity with the design intent and the Contractor has responded to all comments to the satisfaction of the resentative.

B. Submit drawings, product data, samples and certificates of compliance required as hereinafter specified. See also Division 1 Shop Drawings, Product Data and Samples. Conditions in this Section take precedence over conditions in above referenced Section.

C. Submittal Schedule: Submittal schedule shall be as follows unless otherwise directed by the Owner:

1. Allow 10 working days for approval, unless Architect agrees to accelerated schedule.
2. Submittal Package 1 (Hardware and Shop Drawings) shall be submitted in accordance with schedule established by the Owner in bid documents.
3. Submittal Package 2 (Programming and Graphics) and shall be submitted no less than 30 days before software is to be installed in field devices.
4. Submittal Package 3 (Functional Testing) shall be submitted no less than 30 days prior to conducting tests.
5. Submittal Package 4 (Training Materials) shall be submitted no less than 14 days prior to conducting first training class.
6. Submittal Package 5 (Post-Construction Trend Logs) shall be submitted after demonstration tests are accepted and systems are in full automatic operation. The list of points to be trended shall be submitted for approval 14 days prior to the start of the trend collection period.
7. Submittal Package 6 (End-of-Warranty Trend Logs) shall be submitted 30 days prior to the end of the warranty period.

D. Submission and Resubmission Procedure:

1. Each submittal shall have a unique serial number that includes the associated specification section followed by a number for each sub-part of the submitted for that specification section, such as SUBMITTAL 230900-01.
2. Each resubmittal shall have the original unique serial number plus unique revision number such as SUBMITTAL 230900-01 REVISION 1.
3. Submit one copy of submittal in electronic format specified under each submittal package below. Submissions made in the wrong format will be returned without action.
4. Submit two (2) and only two hardcopies copies of submittals to Architect for review. Any additional copies will be returned without review.
5. Architect will return one copy with comments and corrections noted where required.
6. Make corrections:

    a. Revise initial drawings or data.
    b. Indicate any changes that have been made other than those requested.
    c. Clearly identify resubmittal by original submittal number and revision number.

7. Resubmit two (2) and only two copies of revised submittals to Architect for review until no exceptions are taken.
8. Once submittals are accepted and stamped with no exceptions taken, Contactor shall make photocopies for coordination with other trades, as required by the General Contractor. Photocopies will serve as submittal for record and coordination.

E. Submittals Packages

1. Submittal Package 1 (Hardware and Shop Drawings)

a. Provide Installer and Key personnel qualifications as specified.
b. Hardware

(1) Organize by specification section and device tags as tagged in these specifications.
(2) Do not submit products that are not used even if included in specifications.
(3) Include a summary table of contents listing for every submitted device:

a) Tab of submittal file/binder where submittal is located
b) Device tag as tagged in these specifications (such as TS-1A, FM-1)
c) Specification section number (down to the lowest applicable heading number)
d) Whether device is per specifications and a listed product or a substitution
e) Manufacturer
f) Model Number
g) Device accuracy (where applicable)
h) Accuracy as installed including wiring and A/D conversion effects (where applicable)

(4) Submittal shall include manufacturer's description and technical data, such as performance data, product specification sheets, and installation instructions for all control devices and software.
(5) When manufacturer's cut-sheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Each submitted piece of literature and drawings shall clearly reference the specification and/or drawing that the submittal is to cover. General catalogs shall not be accepted as cut sheets to fulfill submittal requirements.
(6) A BACnet_ Protocol Implementation Conformance Statement (PICS) for each type of controller and operator interface shall be included submittals.
(7) Format: Electronic word-searchable format.

c. Shop Drawings

(1) Format:

a) Sheets shall be consecutively numbered.
b) Each sheet shall have a title indicating the type of information included and the mechanical/electrical system controlled.
c) Table of Contents listing sheet titles and sheet numbers.
d) Legend and list of abbreviations.
e) Schematics

1) AutoCAD or Visio compatible format.
2) 21 inch x 15 inch or 17 inch x 11 inch.

f) Floor plans: None required

(2) System architecture one-line diagram indicating schematic location of all control units, workstations, LAN interface devices, gateways, etc. Indicate address and type for each control unit. Indicate media, protocol, baud rate, and type of each LAN.
(3) Schematic flow diagram of each air and water system showing fans, coils, dampers, valves, pumps, heat exchange equipment and control devices. The schematics provided with bid package shall be the basis on the EMCS Contractor's schematics with respect to control points, but EMCS Contractor may

use alternative graphics format.

(4) All physical points on the schematic flow diagram shall be indicated with names, descriptors, and point addresses identified as listed in the point summary table.

(5) With each schematic, provide a point summary table listing building number and abbreviation, system type, equipment type, full point name, point description, Ethernet backbone network number, network number, device ID, object ID (object type, instance number). See Section 23 09 26 - Part 3 for additional requirements.

(6) Label each control device with setting or adjustable range of control.

(7) Label each input and output with the appropriate range.

(8) Device table (Bill of Materials). With each schematic, provide a table of all materials and equipment including:

a) Device tag as indicated in the schematic and actual field labeling (use tag as indicated in these specifications where applicable and practical)
b) Device tag as indicated in these specifications where applicable and if it differs from schematic device tag
c) Description
d) Quantity
e) Proposed manufacturer and model number
f) Range

(9) With each schematic or on separate valve sheet, provide valve and actuator information including size, C_v, design flow, target pressure drop, actual design pressure drop, manufacturer, model number, close off rating, etc. Indicate normal positions of spring return valves and dampers.

(10) Indicate all required electrical wiring. Electrical wiring diagrams shall include both ladder logic type diagram for motor starter, control, and safety circuits and detailed digital interface panel point termination diagrams with all wire numbers and terminal block numbers identified. Provide panel termination drawings on separate drawings. Ladder diagrams shall appear on system schematic. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

(11) Details of control panels, including controls, instruments, and labeling shown in plan or elevation indicating the installed locations.

d. Do not include sequence of controls on shop drawings or equipment submittals; they are included in Submittal Package 2.

e. Submit along with shop drawings but under separate cover memory allocation projections and calculated and guaranteed response times of the most heavily loaded LAN in the system.

2. Submittal Package 2 (Programming and Graphics)

a. A detailed description of point naming convention conforming to Section 23 09 26 to be used for all software and hardware points, integrated with existing database convention.

b. A list of all hardware and software points identifying their text names, device addresses and descriptions.

c. Control Logic Documentation

(1) Submit control logic program listings (graphical programming) consistent with specified English-language Sequences of Operation for all control units.

(2) Control logic shall be annotated to describe how it accomplishes the sequence of operation. Annotations shall be sufficient to allow an operator to relate each program component (block or line) to corresponding portions of the specified

Sequence of Operation.

(3) Include specified English-language Sequences of Operation of each control sequence updated to reflect any suggested changes made by the Contractor to clarify or improve the sequences. Changes shall be clearly marked. SOO shall be fully consistent with the graphical programming. (An electronic version of the sequences of controls in Section 23 09 29 will be provided to the Contractor upon request.)

(4) Include control settings, setpoints, throttling ranges, reset schedules, adjustable parameters and limits.

(5) Submit one complete set of programming and operating manuals for all digital controllers concurrently with control logic documentation. This set will count toward the required number of Operation and Maintenance materials specified below.

d. Graphic screens of all required graphics, provided in final colors, one 11” x 8.5” page per screen.

e. Format

(1) Points list: Word-searchable format per Paragraph 1.8C.3.

(2) Programming: Native electronic file if interpreter is available, otherwise provide pdf files of screen shots.

(3) Programming and operating manual: Word-searchable format per Paragraph 1.8C.3.

(4) Graphics: Graphical electronic format (pdf, png, etc.).

3. Submittal Package 3 (Functional Testing)

a. Provide pre-functional test forms as required by Section 23 09 33.
b. Provide functional test forms as required by Section 23 09 33.
c. Format: Word-searchable format per Paragraph 1.8C.3.

4. Submittal Package 4 (Training Materials)

a. Provide training materials as required by Section 23 09 33.
b. Format: Word-searchable format per Paragraph 1.8C.3.

5. Submittal Package 5 and 6 (Trend Logs)

a. Provide a list of points being trended along with trend interval or change-of-value per Section 23 09 29.
b. Provide trend logs as required by Section 23 09 29.
c. Format: See Section 23 09 26.

1.8 COMPLETION REQUIREMENTS

A. Procedure.

1. Until the documents required in this section are submitted and approved, the system will not be considered “accepted” and final payment to EMCS Contractor will not be made.
2. Before requesting acceptance of work, submit one set of completion documents for review and approval of Owner.
3. After review, furnish quantity of sets indicated below to Owner.

B. Completion Documents:

1. Operation and Maintenance (O & M) Manuals. Provide in both paper and electronic format per paragraph 1.8C.

    a. Include all submittals (product data, shop drawings, control logic documentation, hardware manuals, software manuals, installation guides or manuals, maintenance instructions and spare parts lists) in maintenance manual; in accordance with requirements of Division 1.
    b. As-built versions of the submittal product data. Submittal data shall be located in tabs along with associated maintenance information.
    c. Engineering, Installation, and Maintenance Manual(s) that explain how to design and install new points, panels, and other hardware; preventive maintenance and calibration procedures; how to debug hardware problems; and how to repair or replace hardware.
    d. Complete original issue documentation, installation, and maintenance information for all third-party hardware and software provided, including computer equipment and sensors.
    e. A list of recommended spare parts with part numbers and suppliers.
    f. Operators Manual with procedures for operating the control systems, including logging on/off, alarm handling, producing point reports, trending data, overriding computer control, and changing set points and other variables.
    g. Programming Manuals with a description of the programming language, control block descriptions (including algorithms and calculations used), point database creation and modification, program creation and modification, and use of the programming editor.
    h. Recommended preventive maintenance procedures for all system components, including a schedule of tasks (inspection, cleaning, calibration, etc.), time between tasks, and task descriptions.
    i. A listing and documentation of all custom software for the project created using the programming language, including the set points, tuning parameters, and point and object database.
    j. English language control sequences updated to reflect final programming installed in the EMCS at the time of system acceptance.

2. Complete original issue diskettes/CDs for all software provided, including operating systems, programming language, operator workstation software, and graphics software.
3. Project Record Drawings.

    a. “As-built” versions of the submittal drawings in reproducible paper and electronic format per paragraph 1.8C.
    b. Provide as-built network architecture drawings showing all BACnet nodes including a description field with specific controller/device identification, description and location information.
    c. Record floor plans with controller locations with all interconnecting wiring routing including space sensors, LAN wiring, power wiring, low voltage power wiring. Indicate device instance, address and drawing reference number.

4. Commissioning Reports. Completed versions of all Pre-functional, Functional, and Demonstration Commissioning Test reports, calibration logs, etc., per Section 23 09 33.
5. Copy of inspection certificates provided by the local code authorities.
6. Written guarantee and warranty documents for all equipment and systems, including the start and end date for each.
7. Training materials as required by Section 23 09 33.
8. Contact information. Names, addresses, and 24-hour telephone numbers of contractors installing equipment, and the control systems and service representatives of each.

C. Format of Completion Documents

1. Provide the type and quantity of media listed in table below.

2. Documents such as manuals and control sequences shall be in word-searchable electronic format such as MS Word, Adobe Acrobat (pdf), and HTML and broken into separate files for each type of equipment. Record drawings shall be in original format per paragraph 1.06F.
3. Optical media shall be readable on Operator Workstations.

	Document	Paper (binder or bound)	Electronic	
			Read only optical disk	Loaded onto OWSs and POTs
1.	O&M Manual	5	1	1
2.	Original issue software	–	1 per workstation	1
3.	Project Record Drawings	5	1	1
4.	Control sequences	1	1	1
5.	Commissioning Reports	5	–	–
6.	Inspection Certificates	1	–	–
7.	Warranty documents	1	–	–
8.	Training materials	1 per trainee	–	–
9.	Contact information	1	–	1

D. Permanent On-site Documentation:

1. In panels, provide point list of all points in panel in sufficiently permanent manner that list cannot be easily removed (and lost).
2. Mount half size drawings of primary system schematics and network architecture in glass covered frame. The number of drawings will depend on the complexity of the system; compressed or abridged versions of shop drawings are acceptable provided all control points are shown. Mount the drawings in space available in mechanical rooms. Drawings may be mounted in different locations, e.g. air handler schematic may be in fan room, chiller schematic in chiller room, etc.

1.9 SYSTEM ARCHITECTURE

A. General

1. The system provided shall incorporate hardware resources sufficient to meet the functional requirements of these Specifications. The Contractor shall include all items not specifically itemized in these Specifications that are necessary to implement, maintain, and operate the system in compliance with the functional intent of these Specifications.
2. The control system shall consist of a high-speed, peer-to-peer network of DDC controllers, a control system server, and an operator workstation capable of expansion as specified herein.
3. System software shall be based on a server/thin-client architecture, designed around the open standards of web technology. The control system server shall be accessed using a Web browser over the control system network, the Owner's local area network, and remotely over the Internet (through the Owner's LAN).
4. The intent of the thin-client architecture is to provide operators complete access to the control system via a Web browser. No special software other than a Web browser shall be required to access graphics, point displays, and trends, configure trends, configure points and controllers, or to edit programming.
5. Performance Monitoring. The EMCS will provide the specified performance monitoring functionality, including required monitoring points and performance metrics, improved through system accuracy, data acquisition and data management capabilities, and required graphical and data displays.

6. Event Response. The EMCS will provide the specified operational changes based on event response from the energy service provider.
7. All control products provided for this project shall comprise an interoperable fully-native BACnet system, including all communication media, connectors, repeaters, hubs, and routers necessary for the network. All control products provided for this project shall conform to ANSI/ASHRAE Standard 135.

B. EMCS network architecture.

1. Supervisory LAN: The LAN shall be an Ethernet-based, 100/1000 Mbps network connecting the control system servers and OWSs to routers in each building. Contractor shall utilize the Owner's Enterprise IT LAN/WAN for this purpose. This network shall be BACnet/IP as defined in Addendum A (Annex J) of the BACnet standard, and shall share a common network number for the Ethernet backbone, as defined in BACnet.
2. Primary Controller LAN (Primary LAN): High-speed, peer-to-peer communicating LAN used to connect AACs, ASCs and BCs and communicate exclusively control information. Acceptable technologies include:

    a. Ethernet (IEEE 802.3)

3. Secondary Controller LAN (Secondary LAN or sub LAN): Network used to connect AACs and ASCs. These can be Master Slave/ Token Passing or polling, in addition to those allowed for Primary Controller LANs. Network speed vs. the number of controllers on the LAN shall be dictated by the response time and trending requirements.

C. Operator Interfaces and Servers:

1. Control Systems Server (CSS). This shall be a server upon which the systems configuration and programming databases are maintained and serves as web server for operator interface. It shall hold the backup files of the information downloaded into the individual controllers and as such support uploading and downloading that information directly to/from the controllers. It shall also act as a control information server to non-control system based programs. It shall allow secure multiple-access to the control information.
2. The Operator Workstations and Portable Operator Terminals shall provide for overall system supervision, graphical user interface, management report generation, and alarm annunciation.
3. Remote monitoring and control shall be through use of a web browser through the Owner's IT LAN and via the internet through the Owner's IT LAN.
4. The operator interface and server already exist. Modify existing hardware and software as needed for the project.

D. Controllers. The BCs, AACs, and ASCs shall monitor, control, and provide the field interface for all points specified. Each BC, AAC, or ASC shall be capable of performing all specified energy management functions, and all DDC functions, independent of other BCs, AACs, or ASCs and operator interface devices.

E. Gateways:

1. Gateways shall be provided only as required for connection to the following:

    a. Variable Refrigerant Flow System
    b. Variable Speed Drive Controls

2. Where gateways are used, critical points shall be hard-wired from the DDC system to the controlled device, rather than using the gateway, to avoid problems with gateway failures, currently a common problem. Critical points are those that are essential for proper operation

and are listed in points list as separate points. Where listed, these points shall be hard-wired even when available through gateway.

1.10 SYSTEM PERFORMANCE

A. The communication speed between the controllers, LAN interface devices, and operator interface devices shall be sufficient to ensure fast system response time under any loading condition. This includes when system is collecting trend data for commissioning and for long term monitoring. (See Section 23 09 33.) In no case shall delay times between an event, request, or command initiation and its completion be greater than those listed herein, assuming no other simultaneous operator activity. Contractor shall reconfigure LAN as necessary to accomplish these performance requirements. This does not apply to gateways and their interaction with non-EMCS-vendor equipment.

1. Object Command. The maximum time between an operator command via the operator interface to change an analog or binary point and the subsequent change in the controller shall be less than 5 seconds.
2. Object Scan. All changes of state and change of analog values will be transmitted over the network such that any data used or displayed at a controller or workstation will have been current within the previous 10 seconds.
3. Graphics Scan. The maximum time between an operator's selection of a graphic and it completely painting the screen and updating at least 10 points shall be less than 10 seconds.
4. Alarm Response Time. The maximum time from when an object goes into alarm to when it is annunciated at the workstation or broadcast to pager (where so programmed) shall not exceed 10 seconds for a Level 1 or 2 alarm, 20 seconds for alarm levels 2 and 3, and 30 seconds for alarm levels 4 and 5. All workstations on the onsite network must receive alarms within 5 seconds of each other.
5. Program Execution Frequency. Custom and standard applications shall be capable of running as often as once every 5 seconds. The EMCS Contractor shall be responsible for selecting execution times consistent with the mechanical process under control.
6. Control Loop Performance. Programmable controllers shall be able to execute DDC PID control loops at a selectable frequency of at least once per second. The controller shall scan and update the process value and output generated by this calculation at this same frequency.

1.11 OWNERSHIP OF PROPRIETARY MATERIAL

A. All project-developed software and documentation shall become the property of the Owner. These include, but are not limited to:

1. Project graphic images
2. Record drawings
3. Project database
4. Project-specific application programming code
5. All documentation

1.12 WARRANTY

A. In accordance with Division 1 Guarantees, Warranties, Bonds, Service & Maintenance Contracts, and as follows.

B. At the successful completion of the final testing, commissioning, and demonstration phase in accordance with the terms of this specification, if equipment and systems are operating

satisfactorily to the Owner and if all completion requirements per paragraph 1.07 have been fulfilled, the Owner shall certify in writing that the control system has been accepted. The date of acceptance shall be the start of the warranty period.

C. Guarantee all materials, equipment, apparatus and workmanship (including programming) to be free of defective materials and faulty workmanship for period of one year from date of acceptance.

1. Valve and damper actuators shall carry a manufacturer's 5-year warranty.

D. Provide new materials, equipment, apparatus and labor to replace that determined by Owner to be defective or faulty.

E. Control system failures during the warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to the Owner. The EMCS Contractor shall respond to the Owner's request for warranty service within 24 hours during normal business hours.

F. Operator workstation software, project-specific software, graphic software, database software, and firmware updates that resolve known software deficiencies as identified by the EMCS Contractor shall be provided at no charge during the warranty period. Software bugs (both due to programming misinterpretations and sequence errors) shall be corrected and any reasonable control sequence changes required to provide proper system operation shall also be provided at no additional cost during this period.

1.13 WARRANTY MAINTENANCE

A. The Owner reserves the right to make changes to the EMCS during the warranty period. Such changes do not constitute a waiver of warranty. The Contractor shall warrant parts and installation work regardless of any such changes made by the Owner, unless the Contractor provides clear and convincing evidence that a specific problem is the result of such changes to the EMCS.

B. At no cost to the Owner, during the warranty period, the Contractor shall provide maintenance services for software and hardware components as specified below:

1. Maintenance services shall be provided for all devices and hardware specified in Division 23C. Service all equipment per the manufacturer's recommendations.
2. Emergency Service: Any malfunction, failure, or defect in any hardware component or failure of any control programming that would result in property damage or loss of comfort control shall be corrected and repaired following telephonic notification by the Owner to the Contractor.

    a. Response by telephone or via internet connection to the EMCS to any request for service shall be provided within two hours of the Owner's initial telephone request for service.
    b. In the event that the malfunction, failure, or defect is not corrected through the telephonic communication, at least one hardware and software technician, trained in the system to be serviced, shall be dispatched to the Owner's site within eight hours of the Owner's initial telephone request for such services, as specified.

3. Normal Service: Any malfunction, failure, or defect in any hardware component or failure of any control programming that would not result in property damage or loss of comfort control shall be corrected and repaired following telephonic notification by the Owner to the Contractor.

    a. Response by telephone to any request for service shall be provided within eight working hours (contractor specified 40 hr per week normal working period) of the

Owner's initial telephone request for service.

b. In the event that the malfunction, failure, or defect is not corrected through the telephonic communication, at least one hardware and software technician, trained in the system to be serviced, shall be dispatched to the Owner's site within three working days of the Owner's initial telephone request for such services, as specified.

4. Owner’s Telephonic Request for Service: Contractor shall specify a maximum of three telephone numbers for Owner to call in the event of a need for service. At least one of the lines shall be attended continuously (24/7). Alternatively, pagers can be used for technicians trained in system to be serviced. One of the three paged technicians shall respond to every call within 15 minutes.
5. Technical Support: Contractor shall provide technical support by telephone throughout the warranty period.
6. Preventive maintenance shall be provided throughout the warranty period in accordance with the hardware component manufacturer's requirements.
7. Record drawings and software documentation shall be updated as required to reflect any and all changes made to the system or programming during the warranty period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS (PRODUCT LINE)

A. Johnson Controls (Facilities Explorer w/Enterprise System)

B. Trane (Tracer ES)

C. Siemens (Desigo)

D. Schneider Electric (SmartStruxture)

2.2 MATERIALS AND EQUIPMENT

A. Materials shall be new, the best of their respective kinds without imperfections or blemishes and shall not be damaged in any way.

B. To the extent practical, all equipment of the same type serving the same function shall be identical and from the same manufacturer

PART 3 - EXECUTION

3.1 COORDINATION

A. The Contractor shall coordinate work schedule with Architect to complete project on schedule without disruption or delays.

B. The Contractor shall coordinate work with other trades prior to construction.

C. Examine areas and conditions under which control systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION

A. Install systems and materials in accordance with manufacturer's instructions, roughing-in drawings and details shown on drawings.

B. Refer to additional requirements in other Sections of this specification.

3.3 DIGITAL CONTROL STATIONS

A. Individual Digital Control Stations referenced on drawings to indicate allocation of points to each DCS and DCS location. Digital control stations shall consist of one or multiple controllers to meet requirements of this specification. It is the Contractor's responsibility to provide enough controllers to ensure a completely functioning system, according to the point list and sequence of operations.

B. Where a DCS is referenced, Contractor shall provide at least one (1) controller, and additional controllers as required, in sufficient quantity to meet the requirements of this Specification. Restrictions in applying controllers are specified in Section 23 09 19 - EMCS Field Panels.

C. Contractor is responsible for ensuring DCSs do not interfere with other requirements of the project and maintain adequate clearance for maintenance access.

D. DCSs have not been located. The Contractor shall locate DCSs in electrical rooms, mechanical rooms, and adjacent to rooftop equipment where space is available.

E. Contractor is responsible for ensuring DCSs do not interfere with other requirements of the project and maintain adequate clearance for maintenance access.

3.4 CONTROL POWER

A. Division 23C Contractor shall extend power to all EMCS devices, including 120V power to panels, from an acceptable power panel.

1. See Division 26 Electrical drawings for power locations pre-allocated for EMCS system.
2. Where no power source is shown, for bid purposes only, assume a dedicated circuit is available within an average of 50 feet of panel location. If this is not the case, request additional cost prior to submission of shop drawings or no additional costs will be reimbursed.
3. Coordinate with Division 26 during shop drawing development for final connection location.

B. General requirements for obtaining power include the following:

1. Obtain power from a source that feeds the equipment being controlled such that both the control component and the equipment are powered from the same panel. Where equipment is powered from a 460V source, obtain power from the electrically most proximate 120v source fed from a common origin.
2. Where control equipment is located inside a new equipment enclosure, coordinate with the equipment manufacturer and feed the control with the same source as the equipment. If the equipment’s control transformer is large enough and of the correct voltage to supply the controls, it may be used. If the equipment’s control transformer is not large enough or of the correct voltage to supply the controls, the Contractor shall provide separate transformer(s).
3. Where a controller controls multiple systems on varying levels of power reliability (normal, emergency, and/or interruptible), the controller shall be powered by the highest level of reliability served.
4. Standalone Functionality: Refer to Section 23 09 19.

C. Power line filtering. Provide transient voltage and surge suppression for all workstations and

controllers either internally or as an external component.

3.5 DELIVERY, STORAGE, AND HANDLING

A. Provide factory-shipping cartons for each piece of equipment and control device. Maintain cartons during shipping, storage and handling as required to prevent equipment damage, and to eliminate dirt and moisture from equipment.

B. Store equipment and materials inside and protect from weather.

3.6 IDENTIFICATION

A. General:

1. Manufacturers' nameplates and UL or CSA labels to be visible and legible after equipment is installed.
2. Identifiers shall match record documents.
3. All plug-in components shall be labeled such that removal of the component does not remove the label.

B. Wiring and Tubing:

1. All wiring and cabling, including that within factory-fabricated panels, shall be labeled at each end within 2" of termination with the DDC address or termination number.
2. Permanently label or code each point of field terminal strips to show the instrument or item served.
3. All pneumatic tubing shall be labeled at each end within 2" of termination with a descriptive identifier.

C. Equipment and Devices:

1. Valve and damper actuators: Provide 2" diameter brass tags and brass chains. Lettering shall be ½" high, stamped and painted black. Indicate unique valve or damper identifier from record drawings.
2. Sensors: Provide 1"x 3"x 1/8” black micarta or lamacoid labels with engraved white lettering, ¼" high. Indicate sensor identifier and function (e.g. “CHWS temp”).
3. Panels: Provide 2"x 5" 1/8” black micarta or lamacoid labels with engraved white lettering, ½" high. Indicate panel identifier and service.
4. Identify room sensors relating to terminal box or valves with indelible marker on sensor hidden by cover.

3.7 CUTTING, CORING, PATCHING & PAINTING

A. The EMCS Contractor shall provide canning for openings in concrete walls and floors and other structural elements prior to their construction. Should any openings be missed, the EMCS Contractor shall be responsible for all cutting, coring, and patching that may be required for Division 23C work. Structural elements shall not be cut without the written consent of Owner.

B. Penetrations through rated walls or floors shall be filled with an approved material to provide a code compliant fire-stop.

C. All damage to and openings in ductwork, piping insulation, and other materials and equipment resulting from Division 23C work shall be properly sealed, repaired, and/or re-insulated by

experienced mechanics of the trade involved. Repair insulation to maintain integrity of insulation and vapor barrier jacket. Use hydraulic insulating cement to fill voids and finish with material matching or compatible with adjacent jacket material.

D. At the completion of work, all equipment furnished under this section shall be checked for paint damage, and any factory-finished paint that has been damaged shall be repaired and repainted to original finish.

3.8 CLEANING

A. The EMCS Contractor shall clean up all debris resulting from its activities daily. The EMCS Contractor shall remove all cartons, containers, crates, etc., under its control as soon as their contents have been removed. Waste shall be collected and legally disposed of by EMCS Contractor.

B. Materials stored on-site shall be stored in an orderly manner, neatly stacked, or piled in the designated area assigned by the Architect.

C. At the completion of work in any area, the EMCS Contractor shall clean all of its work, equipment, etc., keeping it free from dust, dirt, and debris, etc.

D. The EMCS Contractor shall use only cleaning materials recommended by the manufacturer of the surfaces to be cleaned and on surfaces recommended by the cleaning material manufacturer.

3.9 FIELD QUALITY CONTROL

A. See Division1 Quality Control.

B. Perform tests as required by authorities having jurisdiction.

C. Repair or replace defective work, as directed by Architect in writing, at no additional cost to the Owner.

D. Restore or replace damaged work due to tests as directed by Architect in writing, at no additional cost to the Owner.

E. Restore or replace damaged work of others, due to tests, as directed by Architect in writing, at no additional cost to the Owner.

F. Remedial work shall be performed to the satisfaction of the Architect, at no additional cost to the Owner, including:

1. Work related to all Division 23C pre-functional, functional, and demonstration tests.
2. Division 23C work related to Section 23 05 93 Testing, Adjusting and Balancing.

G. Remedial work shall include performing any commissioning or other tests related to remedial work an additional time at no additional cost to the Owner.

END OF SECTION 23 09 00

SECTION 23 09 13

EMCS BASIC MATERIALS AND DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 WORK INCLUDED

A. Provide and install the following:

1. Field devices including control valves, control dampers, sensors, etc.

B. Refer to Section 230900 for general requirements.

C. Refer to Section 230929 for points list and specific device requirements.

1.3 RELATED WORK AND REQUIREMENTS

A. Other EMCS Sections:

1. Section 230900 Energy Management and Control System (EMCS) - General
2. Section 230916 EMCS Operator Interfaces
3. Section 230919 EMCS Field Panels
4. Section 230923 EMCS Communication Devices
5. Section 230926 EMCS Software and Programming
6. Section 230929 EMCS Points and Sequence of Operation
7. Section 230933 EMCS Commissioning

1.4 GENERAL

A. Sensor selection, wiring method, use of transmitters, A-to-D conversion bits, etc. shall be selected and adjusted to provide end-to-end (fluid to display) accuracy at or better than those listed in the following table.

Measured Variable	Reported Accuracy
Space dry bulb temperature	±1ºF
Ducted air dry bulb temperature	±0.5ºF
Mixed air dry bulb temperature	±1ºF
Outside air dry bulb temperature	±0.5ºF
Chilled and condenser water temperature at central plant mains only	±0.2ºF
Chilled and condenser water temperature - general	±0.5ºF

Measured Variable	Reported Accuracy
Hot water temperature	±1ºF
Chilled water delta-t (supply to return) at central plant main supply or return only	±0.15ºF
Relative humidity – general	±5% RH
Relative humidity – outdoor air	±3% RH
Water and gas flow	±1% of full scale
Airflow (terminal)	±10% of reading
Airflow (measuring stations)	±5% of full scale
Air pressure (ducts)	±0.05 inches
Air pressure (space)	±0.01 inches
Water pressure	±2% of full scale
Electrical power	1% of reading
Carbon Dioxide (CO_2)	±75 ppm

B. The listing of several sensors or devices in each section of Part 2 does not imply that any may be used. Refer to points list in Section 230929 for device specification. Only where two or more devices are specifically listed in points list (e.g. “FM-1 or FM-4”) may the contractor supply any of the listed products.

PART 2 - PRODUCTS

2.1 AIR TUBING

A. Seamless copper tubing, Type L-ACR, ASTM B 88; with cast-bronze solder joint fittings, ANSI B1.18; or wrought-copper solder joint fittings, ANSI B16.22; except brass compression-type fittings at connections to equipment. Solder shall be 95/5 tin antimony, or other suitable lead free composition solder.

B. Virgin polyethylene non-metallic tubing type FR, ASTM D 2737, and with flame-retardant harness for multiple tubing. Use compression or push-on brass fittings.

2.2 ELECTRIC WIRING AND DEVICES

A. General. All electrical work shall comply with Division 26.

B. Power Wiring.

1. Power wiring and wiring connections required for EMCS shall be provided under this section unless specifically shown on drawings or specified to be under Division 26. See Coordination section in Section 230900.
2. See Control Power section of 230900.

C. Communication Wiring.

1. Contractor shall supply all communication wiring between Building Controllers, Routers, Gateways, AAC’s, ASC’s and local and remote peripherals (e.g., operator workstations, printers, and modems).
2. Supervisory LAN: For any portions of this network required under this section of the specification, contractor shall use Fiber or Category 5 of standard TIA/EIA 68 (10baseT). Network shall be run with no splices and separate from any wiring over thirty (30) volts.

3. Primary and Secondary Controller LANs: Communication wiring shall be individually 100% shielded pairs per manufacturers recommendations for distances installed, with overall PVC cover, Class 2, plenum-rated run with no splices and separate from any wiring over thirty (30) volts. Shield shall be terminated and wiring shall be grounded as recommended by BC manufacturer.

D. Signal Wiring.

1. Signal wiring to all field devices, including, but not limited to, all sensors, transducers, transmitters, switches, etc. shall be twisted, 100% shielded pair, minimum 18-gauge wire, with PVC cover. Signal wiring shall be run with no splices and separate from any wiring above thirty (30) volts.
2. Signal wiring shield shall be grounded at controller end only unless otherwise recommended by the controller manufacturer.

E. Low Voltage Analog Output Wiring.

1. Low voltage control wiring shall be minimum 16-gauge, twisted pair, 100% shielded, with PVC cover, Class 2 plenum-rated. Low voltage control wiring shall be run with no splices separate from any wiring above thirty (30) volts.

2.3 CONTROL CABINETS

A. All control cabinets shall be fully enclosed with hinged door, key-lock latch. A single key shall be common to all field panels and sub-panels within each building. Provide 3 keys.

B. Construction.

1. Indoor: NEMA-1.
2. Outdoor: NEMA 4.

C. Interconnections between internal and face-mounted devices shall be pre-wired with color-coded stranded conductors neatly installed in plastic troughs and/or tie-wrapped. Terminals for field connections shall be UL Listed for service, individually identified per control/interlock drawings, with adequate clearance for field wiring. All control tubing and wiring shall be run neatly and orderly in open slot wiring duct with cover. Control terminations for field connection shall be individually identified per control drawings.

D. Provide ON/OFF power switch with over-current protection for control power sources to each local panel.

E. Provide with:

1. Framed, plastic-encased point list for all points in cabinet.
2. Nameplates for all devices on face.

2.4 CONTROL VALVES

A. Manufacturers:

1. Belimo
2. Siemens

3. Johnson Controls
4. Invensys
5. Delta
6. Or equal

B. Plug-Type Globe Pattern for Water Service:

1. Valves shall have cage-type trim, providing seating and guiding surfaces for plug on 'top-and-bottom' guided plugs.
2. Temperature Rating: 25˚F minimum, 250˚F maximum.
3. Body:

    a. Bronze, screwed for 1/2" to 2".
    b. Cast Iron, flanged for 2-1/2" and larger.

4. Valve Trim: Bronze; Stem: Polished stainless steel.
5. Packing: Spring Loaded Teflon or Synthetic Elastomer U-cups, self-adjusting.
6. Plug: Brass, bronze or stainless steel, Seat: Brass.
7. Disc: Replaceable Composition or Stainless Steel Filled PTFE.
8. Ambient Operating Temperature Limits: -10 to 150˚F.

C. Butterfly Type:

1. Body: Extended neck epoxy coated cast or ductile iron with full lug pattern, ANSI Class bolt pattern to match specified flanges.
2. Seat: EPDM replaceable, non-collapsible, phenolic backed.
3. Disc: Polished aluminum bronze or stainless steel, pinned or mechanically locked to shaft. Sanded castings are not acceptable.
4. Bearings: Bronze or stainless steel.
5. Shaft: 416 stainless steel supported at three locations with PTFE bushings for positive shaft alignment.
6. Close Off: Bubble-tight shutoff at rated differential pressure.
7. Operation: Valve and actuator operation shall be smooth both seating and unseating. Should more than 2 psi deadband be required to seat/unseat the valve, valve shall be replaced at no additional cost to the Owner.
8. Manufacturers in Addition to those listed above:

    a. Jamesbury
    b. Keystone
    c. Dezurik
    d. Or equal

D. Characterized Ball Type:

1. Valves shall be specifically designed for modulating duty in control application with guaranteed average leak-free life span over 200,000 full stroke cycles.
2. Maximum size: 3 inch.
3. Industrial quality with nickel plated forged brass bronze bodies and female NPT threads.
4. Blowout proof stem design, glass-reinforced Teflon thrust seal washer and stuffing box ring with minimum 600 PSI rating (two way valves) or 400 PSI rating (three way valves). The stem packing shall consist of 2 lubricated O-rings designed for on-off, floating, or modulating service and requiring no maintenance.
5. Valves suitable for water or low-pressure steam shall incorporate an anti-condensation cap thermal break in stem design.
6. Ball: stainless steel.

7. Stem: stainless steel.
8. Port: Segmented design with characterizing disk held securely by a keyed ring.

E. Valve assembly pressure ratings:

1. Chilled water: 125 psi at 60˚F.
2. Hot water: 125 psi at 200˚F.
3. Condenser water. 125 psi at 60˚F.

F. Valve Selection:

1. Valve type:

a. Modulating 2-way or 3-way valves: globe or characterized ball type. Butterfly valves may also be used for applications requiring low valve authority (pressure drop 1 psi and less) such as cooling tower bypass and boiler bypass. Valves (in conjunction with actuator) shall have minimum rangeability of 100 to 1.

1) 3 inch and less: characterized ball type.
2) 4 inch and greater: globe type.

b. Two-position: butterfly or ball valves.

2. Valve Characteristic:

a. 2-way valves: equal percentage or modified equal percentage.
b. 3-way valves controlling cooling coils and condenser water heat exchangers: linear.
c. 3-way valves controlling heating coils: equal percentage or modified equal percentage.
d. Two-position valves: not applicable.

3. Valve Sizing:

a. Modulating Water: Size valve to achieve the following full-open pressure drop:

1) Minimum pressure drop: equal to pressure drop of coil or exchanger.
2) Maximum pressure drop:

a) Hot and chilled water at bridge connection: 2 psi.
b) Hot water at coils: 2 psi.
c) Chilled water at coils: 5 psi.
d) Tower bypass: 1 psi.
e) Boiler bypass: 1 psi.

3) Three-way valves shall be selected for near minimum pressure drop. Two-way valves shall be selected near maximum pressure drop.
4) Flow coefficient (C_v) shall not be less than 1.0 (to avoid clogging).

b. Modulating Steam:

1) The outlet pressure of valves for converters shall be no less than the inlet pressure required for the converters as given in plans for project.
2) As limited above, size modulating valves for applications of 15 psig or less for 80% of inlet gage pressure unless otherwise indicated.

3) As limited above, modulating valves for applications of greater than 15 psig shall be sized for 42% of inlet absolute pressure unless otherwise indicated.

c. Two-position valves: Line size unless otherwise indicated.

2.5 CONTROL DAMPERS

A. See Section 233300 Air Duct Accessories.

2.6 ACTUATORS

A. Manufacturers:

1. Belimo
2. Siemens
3. Johnson Controls
4. Delta
5. Invensys
6. Or equal

B. Warranty: Valve and damper actuators shall carry a manufacturer's 5-year warranty.

C. Electric Actuators.

1. Entire actuator shall be UL or CSA approved by a National Recognized Testing Laboratory.
2. Dampers. The actuator shall be direct coupled over the shaft, enabling it to be mounted directly to the damper shaft without the need for connecting linkage. The clamp shall be steel of a "V" bolt design with associated "V" shaped, toothed cradle attaching to the shaft for maximum strength and eliminating slippage via cold weld attachment. Single bolt or set screw type fasteners are not acceptable. Aluminum clamps are unacceptable.
3. Valves. Actuators shall be specifically designed for integral mounting to valves without external couplings.
4. Actuator shall have microprocessor based motor controller providing electronic cut off at full open so that no noise can be generated while holding open. Holding noise level shall be inaudible.
5. Actuators shall provide protection against actuator burnout using an internal current limiting circuit or digital motor rotation sensing circuit. Circuit shall insure that actuators cannot burn out due to stalled damper or mechanical and electrical paralleling. End switches to deactivate the actuator at the end of rotation or use of magnetic clutches are not acceptable.
6. Modulating actuators:

   a. General: Actuators shall accept a 0 to 10 VDC or 0 to 20 mA control signal and provide a 2 to 10 VDC or 4 to 20 mA operating range. Actuators shall have positive positioning circuit so that controlled device is at same position for a given signal regardless of operating differential pressure.

7. Where shown on Drawings or Points List, actuators shall include:

   a. 2 to 10 VDC position feedback signal.
   b. Limit (end) position switches.

8. All 24 VAC/DC actuators shall operate on Class 2 wiring and shall not require more than 10 VA for AC. Actuators operating on 120 VAC power shall not require more than 10 VA. Actuators operating on 230 VAC power shall not require more than 11 VA.
9. All modulating actuators shall have an external, built-in switch to allow the reversing of direction of rotation.
10. Actuators shall be provided with a conduit fitting an a minimum three-foot electrical cable and shall be pre-wired to eliminate the necessity of opening the actuator housing to make electrical connections.
11. Where fail-open or fail-closed position is required, an internal mechanical, spring return mechanism shall be built into the actuator housing. Non-mechanical forms of fail-safe are not acceptable. All spring return actuators shall be capable of both clockwise or counterclockwise spring return operation by simply changing the mounting orientation.
12. Actuators shall be capable of being mechanically and electrically paralleled to increase torque where required.
13. All non-spring return actuators shall have an external manual gear release to allow manual positioning of the damper when the actuator is not powered. Spring return actuators with more than 60 in-lb torque capacity shall have a manual crank for this purpose.
14. Actuators shall be designed for a minimum of 60,000 full cycles at full torque and be UL 873 listed.
15. Provide limit (end) position switches where indicated on schematics.

D. Electric Actuators for Large Butterfly Valves.

1. Entire actuator shall be UL or CSA approved by a National Recognized Testing Laboratory.
2. The valve actuator shall consist of a capacitor-type reversible electric motor, gear train, limit switches and terminal block, all contained in a die cast aluminum enclosure.
3. Enclosure shall meet NEMA 4 weatherproof requirements for outdoor applications. Unless NEMA-3R indicated elsewhere.
4. Output shaft shall be electroless nickel plated to prevent corrosion.
5. Actuator shall have a motor rated for minimum 75% duty cycle. Duty cycle shall be defined as running time / Installed time at maximum torque.
6. Actuator shall be suitable for operation in ambient temperature ranging from -22˚F to +150˚F.
7. A pre-wired cable shall bring wiring outside enclosure to avoid necessity of opening cover.
8. Gears shall be hardened alloy steel, permanently lubricated. A self-locking gear assembly or a brake shall be supplied.
9. Actuator shall be equipped with a hand wheel for manual override to permit operation of the valve in the event of electrical power failure or system malfunction. Hand wheel must be permanently attached to the actuator. When in manual operation electrical power to the actuator will be permanently interrupted.
10. The hand wheel will not rotate while the actuator is electrically driven.
11. Actuator shall have heater and thermostat to minimize condensation within the actuator housing.
12. Provide limit (end) position switches where indicated on schematics.

E. Normal Position. Actuators shall be spring return to the normal position, unless non-spring style is specifically listed as acceptable in table below. Except as specified otherwise, “normal” positions of control devices shall be as follows:

Device	Normal Position	Spring Return Required
Outside air damper	CLOSED	Yes
Return air damper	OPEN	Yes
Exhaust/relief air damper	CLOSED	Yes
AHU heating coil valves	OPEN	
AHU cooling coil valves	CLOSED	

Equipment isolation valves:	OPEN	
Hot water reheat coil valves	CLOSED	
Fan coil HW and CHW valves	CLOSED	
VAV box dampers	OPEN	

F. Valve Actuator Selection:

1. Modulating actuators for valves shall have minimum rangeability of 50 to 1.
2. Water:

a. Two way and two-position valves:

1) Tight closing against 125 percent of system pump shut-off head.
2) Modulating duty against 90 percent of system pump shut-off head.

b. Three-way shall have close-off against twice the full open differential pressure for which they are sized.

G. Damper Actuator Selection:

1. Actuators shall be direct coupled. For multiple sections, provide one actuator for each section; linking or jack-shafting damper sections shall not be allowed.
2. Provide sufficient torque as velocity, static, or side seals require per damper manufacturer's recommendations and the following.

a. Torque shall be a minimum 5 in-lb. per sq. ft. for opposed blade dampers and 7 in-lb. per sq. ft. for parallel blade dampers.
b. The total damper area operated by an actuator shall not exceed 80% of the manufacturer's maximum area rating.

2.7 GENERAL FIELD DEVICES

A. Provide field devices for input and output of digital (binary) and analog signals into controllers (BCs, AACs, ASCs). Provide signal conditioning for all field devices as recommended by field device manufacturers, and as required for proper operation in the system.

B. It shall be the Contractor's responsibility to assure that all field devices are compatible with controller hardware and software.

C. Field devices specified herein are generally ‘two-wire’ type transmitters, with power for the device to be supplied from the respective controller. If the controller provided is not equipped to provide this power, or is not designed to work with ‘two-wire’ type transmitters, or if field device is to serve as input to more than one controller, or where the length of wire to the controller will unacceptably affect the accuracy, the Contractor shall provide ‘four-wire’ type equal transmitter and necessary regulated DC power supply or 120 VAC power supply, as required.

D. For field devices specified hereinafter that require signal conditioners, signal boosters, signal repeaters, or other devices for proper interface to controllers, Contractor shall furnish and install proper device, including 120V power as required. Such devices shall have accuracy equal to, or better than, the accuracy listed for respective field devices.

E. Accuracy: As used in this Section, accuracy shall include combined effects of nonlinearity, nonrepeatability and hysteresis. Sensor accuracy shall be at or better than both that specifically listed for a device and as required herein.

2.8 TEMPERATURE SENSORS (TS)

A. General:

1. Unless otherwise noted, sensors may be platinum RTD, thermistor, or other device that is commonly used for temperature sensing and that meets accuracy, stability, and resolution requirements.
2. When matched with A/D converter of BC, AAC, or ASC, sensor range shall provide a resolution of no worse than 0.3°F (unless noted otherwise).
3. Sensors shall drift no more than 0.3˚F and shall not require calibration over a five-year period.
4. Manufacturers:

    a. Mamac.
    b. Kele Associates
    c. Building Automation Products
    d. Or equal

B. Duct temperature sensors. Shall consist of sensing element, junction box for wiring connections and gasket to prevent air leakage or vibration noise. Sensor probe shall be 316 stainless steel.

1. TS-1A. Single point (use where not specifically called out to be averaging in points list).
2. TS-1B. Averaging. Sensor length shall be at least 1 linear foot for each 3 square feet of face area up to 25 feet maximum.

C. Water temperature sensors.

1. TS-2A: Immersion sensors. All piping immersion sensors shall be in brass or stainless steel wells that allow removal from operating system, with lagging extension equal to insulation thickness where installed in insulated piping. Wells shall be rated for maximum system operating pressure, temperature and fluid velocity. The well shall penetrate the pipe by the lesser of half the pipe diameter or four inches. The use of direct immersion or strap-on type sensors is not acceptable.
2. TS-2B. Same as TS-2A except provide matched temperature sensors for differential temperature measurement, e.g. chilled water supply and return temperature.
3. TS-2C. Same as TS-2A or TS-2B (matched pair) with the following added requirements (for extremely high accuracy and stability at central plant main supply/return chilled water temperature sensors): Each assembly shall consist of a 100 Ohm platinum RTD and a solid-state 4-wire, 4-20mA transmitter contained in a housing suitable for pipe mounting, spring-loaded probe to ensure good thermal contact between the sensor and the well. Manufacturer must be certified as meeting the requirements of ISO 9001. RTD shall conform to the DIN 437601980 standards (Ultra precision DIN RTD). 2 Year NIST traceable guarantee. Manufacturer: Accutech AI-2000, or equal.

D. Room sensors: Shall be an element contained within a ventilated cover, suitable for wall mounting, with insulated base.

1. TS-3A.

    a. Thermistor in enclosure with blank cover.

b. Include a USB port for connection of portable Operator Interface.

2. TS-3B. Same as TS-3A except.

a. Setpoints shall be adjustable at wall mounted sensor with setpoint knobs with software limits.
b. Override button capable of being programmed to start system during unscheduled hours.

3. TS-3C. Same as TS-3B except.

a. Integral LCD display of space temperature and active setpoint.

4. Unless otherwise indicated in points list, locate sensors as follows:

a. Lobbies, corridors, break rooms, and other public spaces: TS-3B.
b. Equipment rooms: TS-3A
c. Offices and other spaces not listed above: TS-3C.
d. Others not listed: Confirm with Architect through RFI.

E. TS-4. Outdoor air sensors shall have a sun shield, utility box, and watertight gasket to prevent water seepage.

F. Temperature Transmitters. Where required by Controller, or to meet specified end-to-end accuracy requirements, sensors as specified above shall be matched with transmitters outputting 4-20 mA linearly across the specified temperature range. Transmitters shall have zero and span adjustments, an accuracy of 0.1˚F when applied to the sensor range.

2.9 HUMIDITY TRANSMITTERS (HT)

A. General:

1. Suitable for duct, wall (room) or outdoor mounting as indicated in points list and Construction Drawings.
2. Two-wire transmitter utilizing bulk polymer resistance change or thin film capacitance change humidity sensor producing a continuous 4-20 mA output proportional to percent relative humidity (%RH).
3. Input Range: 0 to 100% RH.
4. Accuracy (%RH), NIST Traceable and certified at 77˚F over 20-95% RH including hysteresis, linearity and repeatability:

a. HT-1: ±2%
b. HT-2: ±3%

5. Sensor Operating Range:

a. Humidity: 0-99%, non-condensing, sensor.
b. Temperature: 32˚F to 122˚F

6. Temperature Effect: Less than 0.06% per ˚F at baseline of 77˚F.
7. Sensitivity: 0.1% RH.
8. Repeatability: 0.5 RH.
9. Hysteresis: Less than 1%.

10. Long Term Stability: Less than 2% drift per 5 years.
11. Manufacturer:

    a. Vaisala HM Series
    b. Automation Components Inc. RH Series
    c. Or equal

2.10 CO_2 SENSORS/TRANSMITTERS (CO2)

A. CO2-1. Wall mounted.

1. Non-dispersive infrared sensor with dual beam technology where a reference channel is used to maintain sensor calibration.
2. Detachable base with all field wiring terminations on base.
3. Accuracy: ±50 ppm or 5% of reading from 0 to 1500 ppm at temperatures from 60°F to 90°F.
4. Factory calibrated and set to 0-2000 ppm range (equals 4-20 mA or 0-10 V).
5. Include elevation adjustment.
6. The sensor shall not require recalibration for a minimum of 5 years, guaranteed. If sensor is found to be out of calibration, supplier shall recalibrate at no additional cost to the Owner within 5 years of purchase date.
7. LCD display.
8. Manufacturers:

    a. Telaire 8102
    b. Vaisala GMV21
    c. AirTest EE80-2CT
    d. Or equal

B. CO2-2. Same as CO2-1 except duct mounted.

2.11 DIFFERENTIAL PRESSURE TRANSMITTERS (DPT)

A. DPT-1. Water, General Purpose.

1. Fast-response capacitance sensor.
2. Two-wire transmitter, 4-20 mA output with zero and span adjustments.
3. Accuracy.

    a. Overall Accuracy (at constant temp) ±0.25% full scale (FS).
    b. Non-Linearity, BFSL ±0.20% FS.
    c. Hysteresis 0.10% FS.
    d. Non-Repeatability 0.05% FS.

4. Long Term Stability 0.5% FS per year.
5. Only 316 stainless steel in contact with fluid.
6. Pressure limits.

    a. 0 to 100 psid range: 250 psig maximum static pressure rating, 250 psig maximum overpressure rating.
    b. 100 to 300 psid range: 450 psig maximum static pressure rating, 450 psig maximum overpressure rating.

7. Include brass 3-valve assembly. See sensor installation specifications below.

8. Manufacturers:

    a. Setra 230
    b. Modus W30
    c. Or equal

B. DPT-2. Air, Duct Pressure:

1. General: Loop powered two-wire differential capacitance cell-type transmitter.
2. Output: two wire 4-20 mA output with zero adjustment.
3. Overall Accuracy: ±1% scale.
4. Minimum Range: 0.5 in. w.c.
5. Maximum Range: 10 inches w.c.
6. Housing: Polymer housing suitable for surface mounting.
7. Static Sensing Element: Pitot-type static pressure sensing tips similar to Dwyer model A-301, Davis Instruments, or equal and connecting tubing.
8. Range: Select as specified in points list or, if not listed for specified setpoint to be between 25% and 75% full-scale.
9. DPT-2A: Include LCD display of reading.
10. Manufacturers:

    a. Veris
    b. Setra
    c. Modus
    d. Invensys
    e. Dwyer
    f. Or equal

C. DPT-3. Air, Low Differential Pressure (space pressure).

1. General: Loop powered, two-wire differential capacitance cell type transmitter.
2. Output: Two-wire 4-20 mA output with zero adjustment.
3. Overall Accuracy:

    a. General ±1% FS.
    b. Minimum outdoor air damper DP used for minimum outdoor airflow: ±0.25% FS.

4. Range:

    a. Non-switch selectable.
    b. Minimum Range: 0, -0.1, -0.25, or -0.5 inches w.c.
    c. Maximum Range: +0.1, 0.25, or 0.5 inches w.c.
    d. Range shall be as specified in points list or, if not listed, selected such that specified setpoint is between 25% and 75% full-scale.

5. Housing: Polymer housing suitable for surface mounting.
6. Static Sensing Element:

    a. Ambient sensor: Dwyer A-306.
    b. Space sensor: Kele SPS, BAPI ZPS-ACC-01, Dwyer A-417 or 465, or equal wall plate sensor.
    c. Filter or duct pressure sensor: Dwyer A-301 or equal.
    d. Plenum pressure sensor: Dwyer A-421 or equal..

7. DPT-3A: Include LCD display of reading.

8. Manufacturers:

    a. Setra 267
    b. Air Monitor
    c. Paragon
    d. Or equal

D. DPT-4. VAV Velocity Pressure:

1. General: Loop powered two-wire differential capacitance cell type transmitter.
2. Output: Two-wire, 4-20 mA output with zero adjustment.
3. Flow transducer (including impact of A-to-D conversion) shall be capable of stably controlling to a setpoint of 0.004" differential pressure or lower, shall be capable of sensing 0.002" differential pressure or lower, and shall have a ±0.001" or lower resolution across the entire scale.
4. Minimum Range: 0 in. w.c.
5. Maximum Range: 1.5 inch w.c.
6. Housing: Polymer housing suitable for surface mounting.
7. Manufacturer:

    a. Trane
    b. Johnson Controls
    c. Siemens
    d. Veris
    e. Or equal

2.12 DIFFERENTIAL PRESSURE SWITCHES (DPS)

A. DPS-1. Water: Diaphragm with adjustable setpoint, 2 psig or adjustable differential, and snap-acting Form C contacts rated for the application. 60 psid minimum pressure differential range. 0˚F to 160˚F operating temperature range.

B. DPS-2. Air: Diaphragm with adjustable setpoint and differential and snap acting form C contacts rated for the application. Provide manufacturer's recommended static pressure sensing tips and connecting tubing.

2.13 WATER LEAK DETECTOR (WLD)

A. WLD-1:

1. Gold plated adjustable sensing probes to detect water from 0 to 1/8 inch above surface.
2. All electronic circuitry encapsulated in epoxy to protect from dirt, fungus and short term immersion in water.
3. DPDT (2 form C) relay contact outputs rated at 1 amp @ 28 VDC.
4. Powered with 12-24 VAC or VDC from EMCS panel. Battery not acceptable.
5. 5 year warranty minimum.
6. Manufacturer:

    a. Dorlen Water Alert SS-4'
    b. Or equal

2.14 CURRENT SWITCHES (CS)

A. CS-1

1. Clamp-on or solid-core
2. Range: 1.5 to 150 amps (or as required by application).
3. Trip Point: Adjustable.
4. Switch: Solid state, normally open, 1 to 135 Vac or Vdc, 0.3 Amps. Zero off state leakage.
5. Lower Frequency Limit: 6 Hz.
6. Trip Indication: LED
7. Approvals: UL, CSA
8. May be combined with relay for start/stop.
9. Where used for single-phase devices, provide the CS/CR in a self-contained unit in a housing with override switch. Kele RIBX, Veris H500, or equal.
10. Manufacturers:

    a. Veris Industries H-608/708/808/908; Inc.
    b. RE Technologies SCS1150A-LED
    c. Or equal

2.15 CURRENT TRANSFORMER (CT)

A. Clamp-On Design Current Transformer (for Motor Current Sensing)

1. Range: 1-10 amps minimum, 20-200 amps maximum.
2. Trip Point: Adjustable.
3. Output: 0-5 VDC.
4. Accuracy: ±0.2% from 20 to 100 Hz.
5. Manufacturers:

    a. Kele SC100
    b. Veris 722
    c. Or equal

2.16 FLOW METER (FM)

A. FM-1. Magnetic Insertion Type Flow Meters for Water Service.

1. Magnetic Faraday point velocity measuring device.
2. Insertion type complete with ‘hot-tap’ isolation valves to enable sensor removal without water supply system shutdown.
3. 4-20 mA transmitter proportional to flow or velocity.
4. Accuracy: ± 1% of reading from 0.25 to 20 fps.
5. Flow range: 0.25 to 20 fps, bidirectional.
6. Each sensor shall be individually calibrated and tagged accordingly against the manufacturer’s primary standards which must be accurate to within 0.1% and traceable to the U.S. National Institute Standards and Technology (NIST).
7. Manufacturers:

    a. Onicon F-3500
    b. FloCat YD20-A
    c. Marsh McBirney MultiMag 284
    d. SeaMetrics 100/200 Series

B. FM-2: Displacement Gas Meter.

1. Positive displacement, rotary type gas meter designed for volumetric measurement of widely varying flow rates of low pressure natural gas.
2. Permanent, non-adjustable calibration, not affected by low or varying line pressure and independent of the gas specific gravity, temperature, and pressure.
3. Manufactured in accordance with ANSI B109.3 for Rotary Type Gas Displacement Meters.
4. Operating temperature range: -40 ˚F to +140 ˚F.
5. Temperature compensating with a corrected reading for temperatures ranging from -20 ˚F to +120 ˚F.
6. Low frequency pulse output.
7. Rangeability at ±1% accuracy: Minimum 40 to 1.
8. Glass enclosed 8 digit totalizer, re-zeroed with on-board device.
9. Manufacturers:

    a. Dresser Roots B3
    b. Or equal

C. FM-3. Compound-type cold water meter.

1. Shall consist of a combination of a turbine-type, mainline meter for measuring high rates of flow and a bypass meter of an appropriate size for measuring low rates of flow. The compound meter shall have an automatic valve mechanism for diverting low rates of flow through the bypass meter.
2. Comply or exceed the latest revision of AWWA C702.
3. Maximum operating pressure of 150 psi and maximum operating temperature of 120 ˚F continuous.
4. Shall provide a pulse output scaled to a selectable unit of measurement; i.e., 1 pulse per gallon. The pulse output needs to retain the lowest flow rate and the accuracy that the meter is capable of. A 3-wire pulse output is required for connection to EMCS. The 3-wires are ground, pulse output, and an optional output voltage. The pulse output shall not require the EMCS to supply power to the meter Pulse Encoder system.
5. Shall have permanently sealed, straight reading local register indicating in gallons, including a center-sweep test hand, a low flow indicator, totalizer, and a glass lens. The registers shall be serviceable without interruption of the meter's operation.
6. Separate magnetic-drive registers shall record the flow of the turbine and disc meters and their total will be the registration of the compound meter. A single pulse output denoting the total high and low flow will be required.
7. Operating characteristics: Shall comply with the operating characteristics shown below:

Size	Normal Operating Range @100% +/- 1.5% accuracy (gpm)	Maximum Continuous Flow (gpm)	Maximum Loss of Head at Max Cont Flow (psi)	Maximum Intermittent Flow (gpm)	Lowest Flow @ 95% accuracy (gpm)	Minimum Accuracy at Crossover (%)
2"	1/2 - 200	160	8	200	1/4	97
3"	1/2 - 450	350	8	450	1/4	97
4"	1 - 1000	700	11	1000	3/8	97
6"	1 1/2 - 2000	1400	10	2000	3/8	95

8. Size: the size shall be determined by: a) Laying Length: nominal size (in inches) of the opening in the inlet and outlet flanges and b) Total Height: nominal size (in inches) from the lowest point of the meter installed for horizontal flow to the highest point. The size of meters shall not exceed:

Meter Size	Laying Length (in)	Total Height (in)
2″	15 1/4	11
3″	17	12
4″	20	16
6″	24	17

9. Materials: The main case wetted parts shall be cast from an ANSI/NSF 61 certified no lead high copper alloy. A test plug shall be located in the main case or the cover for the purpose of field testing of the meter. Casing bolts shall be made of stainless steel.
10. Manufacturers:

    a. Badger Recordall Compound Meter, Bronze Housing with Pulse Output (two RTR registers and summator/converter)
    b. Or equal

2.17 AIRFLOW MEASURING STATIONS (AFMS)

A. AFMS-1. Airflow measurement in ducts, plenums and fan inlets.

1. The AFMS shall be an array of sensors mounted across the entire area of the duct, plenum, and fan inlet in which the AFMS is mounted.
2. Include electronic devices or transducers to provide a 4-20 mA or 0-10 Vdc signal proportional to airflow or velocity with specified accuracy over entire range. Additionally, include one isolated RS-485 network connection to communicate with a BACnet MS/TP network.
3. LCD display.
4. Performance:

    a. Sensors shall be calibrated to NIST-traceable standards for airflow/velocity.
    b. Factory tested prior to shipment and shall not require calibration or adjustment over the life of the equipment, when installed in accordance to manufacturer's guidelines.
    c. The installed total accuracy for airflow shall be better than ±3% of reading over the sensor probe operating ranges when installed in accordance with manufacturers' guidelines. Installed accuracy shall include the probe itself plus the electronics for converting probe signal to an electronic signal proportional to airflow and shall be demonstrated at both maximum and minimum airflow rates of operating range.
    d. Operating Range: 50 to 4,000 FPM.

5. Duct & Plenum Mounted Sensor Probes:

    a. Sensor probes shall be constructed of anodized aluminum alloy tube with stainless steel mounting brackets. Probes shall be constructed to provide insertion, internal, or standoff mounting, depending on the applications and field installation requirements.
    b. Probe Sensor Density. The number of independent sensing points shall be distributed per duct face area, at a minimum quantity as indicated below.

Area (ft^2)	Sensors
<= 1	2

Area (ft^2)	Sensors
>1 to <4	4
4 to <8	6
8 to <12	8
12 to <16	12
>=16	16

c. Pressure drop: The maximum allowable unrecovered pressure drop caused by the probes shall not exceed .025" at 2000 FPM, or .085" at 4000 FPM.

6. Fan Inlet Mounted Sensor Probes:

a. Sensor probes shall be constructed of anodized aluminum alloy tube with stainless steel mounting brackets. Probes shall be constructed to provide insertion, internal, or standoff mounting, depending on the applications and field installation requirements.
b. Fan inlet probe size per manufacturer's recommendations.

7. Manufacturers:

a. Ebtron Gold Series
b. Ruskin EAMP
c. Or equal

2.18 POWER METERS

A. (PM-1) 3-Phase kWh/Demand Meter.

1. Power measurement device shall include current and potential (voltage) transformers on each leg and shall be certified under UL-3111.
2. Accuracy: Comply with ANSI 12.16 – 1% / IEC-692053-21 or ANSI 12.20 – 0.5% / IEC-62053-22.
3. The transducer range shall be selected such that the maximum value shall be 150% of the nominal value being monitored.
4. Power output signal shall be any of the following: pulse output, 4-20 mA, or 0-10 Vdc output.
5. Manufacturers:

a. E-mon D-mon series 2000 with P2 pulse accessory or D/A converter accessory.
b. Or equal.

B. (PM-2) Power meter with BACnet Communication.

1. Electronic with multi-line backlit LCD display indicating measured parameters as well as alarm functions and pulse output.

2. Include the following measurements:

a. Accumulated Real Energy (kWh) for each phase and total of all phases.

b. Accumulated Reactive Energy (kVARh) and Apparent Energy (kVAh) totals for all phases.
c. Net Present Demand for Real (kW), Reactive (kVAR) and Apparent (kVA) Power over a user-specified interval (block or sliding window).
d. Maximum (Peak) Real (kW), Reactive (kVAR) and Apparent (kVA) Demand Intervals.
e. Instantaneous Real (kW), Reactive (kVAR) and Apparent Power (kVA), by phase and in total.
f. Current (amps) for each phase and average of all phases.
g. Phase-to-phase voltage for each phase and average of all phase pairs.
h. Phase-to-neutral voltage for each phase pair and average of all phases.
i. Power factor for each phase and average of all phases.
j. AC frequency.

3. BACnet MS/TP communication protocol.
4. UL/CUL listed.
5. Accuracy: Meet both ANSI C12.20 .5% and IEC 62053-22 Class .5S real power and energy accuracy specifications.
6. Phase Loss Alarm contacts with a user configurable phase loss threshold.
7. Manufacturers:

a. Veris E50H2.
b. Or equal.

2.19 ELECTRONIC CONTROL COMPONENTS

A. Limit Switches (LS): Limit switches shall be UL listed, SPDT or DPDT type, with adjustable trim arm. Limit switches shall be as manufactured by Square D, Allen Bradley, or equal.

B. Line-Voltage Wall Thermostat: Wall-mounted thermostat shall consist of SPDT contacts rated for 120V and current as required for application, temperature setpoint range of 50 to 95 ☐ F, and a adjustable 2-10 ☐F setpoint differential.

C. Low Temperature Detector (Freeze-stat) (LLT-1): Low temperature detector shall consist of a cold spot element that responds only to the lowest temperature along any one foot of entire element, minimum bulb size of 1/8 inch x 20 feet, junction box for wiring connections and gasket to prevent air leakage or vibration noise, DPST (4 wire 2 circuit) with manual reset, Temperature range 15 to 55˚F, factory set at 38˚F.

D. Control Relays: All control relays shall be UL listed, with contacts rated for the application, and mounted in minimum NEMA-1 enclosure for indoor locations, NEMA-4 for outdoor locations.

1. Control relays for use on electrical systems of 120 volts or less shall have, as a minimum, the following:

a. AC coil pull-in voltage range of +10%, -15% or nominal voltage.
b. Coil sealed volt-amperes (VA) not greater than four (4) VA.
c. Silver cadmium Form C (SPDT) contacts in a dustproof enclosure, with 8 or 11 pin type plug.
d. Pilot light indication of power-to-coil and coil retainer clips.

2. Relays used for across-the-line control (start/stop) of 120V motors, 1/4 HP, and 1/3 HP, shall be rated to break minimum 10 Amps inductive load.
3. Relays used for stop/start control shall have low voltage coils (30 VAC or less), and shall be provided with transient and surge suppression devices at the controller interface.

E. General Purpose Power Contactors: NEMA ICS 2, AC general-purpose magnetic contactor. ANSI/NEMA ICS 6, NEMA type 1enclosure. Manufacturer shall be Square 'D', Cutler-Hammer, or equal.

F. Control Transformers and Power Supplies:

1. Control transformers shall be UL Listed. Furnish Class 2 current-limiting type, or furnish over-current protection in both primary and secondary circuits for Class 2 service per NEC requirements. Mount in minimum NEMA-1 enclosure.
2. Transformer shall be proper size for application. Limit connected loads to 80% of rated capacity.
3. DC power supply output shall match output current and voltage requirements. Unit shall be full-wave rectifier type with output ripple of 5.0 mV maximum peak-to-peak. Regulation shall be 1.0% line and load combined, with 100 microsecond response time for 50% load changes. Unit shall have built-in over-voltage and over-current protection, and shall be able to withstand a 150% current overload for at least 3 seconds without trip-out or failure.
4. Unit shall operate between 0°C and 50°C [32°F and 120°F]. EM/RF shall meet FCC Class B and VDE 0871 for Class B, and MIL-STD 810C for shock and vibration.
5. Line voltage units shall be UL Recognized and CSA Approved.

G. Electric Push Button Switch: Switch shall be momentary contact, oil tight, push button, with number of N.O. and/or N.C. contacts as required. Contacts shall be snap-action type, and rated for minimum 120 Vac operation. Switch shall be 800T type, as manufactured by Allen Bradley, Kele, or equal.

H. Alarm Horn: Panel-mounted audible alarm horn shall be continuous tone, 120 Vac Sonalert solid-state electronic signal, as manufactured by Mallory, Kele, or equal.

I. Electric Selector Switch (SS): Switch shall be maintained contact, NEMA ICS 2, oil-tight selector switch with contact arrangement, as required. Contacts shall be rated for minimum 120 Vac operation. Switch shall be 800T type, as manufactured by Allen-Bradley, Kele, or equal.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which control systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION

A. General: Install systems and materials in accordance with manufacturer's instructions, roughing-in drawings and details shown on drawings. Install electrical components and use electrical products complying with requirements of National Electric Code and all local codes.

3.3 ELECTRICAL INSTALLATION

A. Wiring.

1. Comply with Division 26.

2. All NEC Class 1 (line voltage) wiring shall be UL Listed in approved raceway per NEC requirements and shall be installed by a licensed electrician.
3. All low-voltage wiring shall meet NEC Class 2 requirements. (Low-voltage power circuits shall be sub-fused when required to meet Class 2 current-limit.) Class 2 wiring shall be installed in UL Listed approved raceway, except where wires are in concealed in accessible locations, approved cables not in raceway may be used, provided that cables are UL Listed for the intended application. For example, cables used in ceiling return plenums shall be UL Listed specifically for that purpose.
4. Do not install Class 2 wiring in raceway containing Class 1 wiring. Boxes and panels containing high-voltage wiring and equipment may not be used for low-voltage wiring except for the purpose of interfacing the two (e.g., relays and transformers).
5. Do not install wiring in raceway containing tubing.
6. Where Class 2 wiring is used without raceway, it shall be supported from or anchored to structural members neatly tied at 10 foot intervals. Cables shall not be supported by or anchored to ductwork, electrical raceways, piping, or ceiling suspension systems and at least 1 foot above ceiling tiles and light fixtures.
7. All wire-to-device connections shall be made at a terminal block or terminal strip. All wire-to-wire connections shall be at a terminal block.
8. All field wiring shall be properly labeled at each end, with self-laminating typed labels indicating device address, for easy reference to the identification schematic. All power wiring shall be neatly labeled to indicate service, voltage, and breaker source.
9. Use coded conductors throughout with different colored conductors.
10. All wiring within enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals.
11. Maximum allowable voltage for control wiring shall be 120 V. If only higher voltages are available, the Contractor shall provide step-down transformers.
12. All wiring shall be installed as continuous lengths, with no splices permitted between termination points.
13. Install plenum wiring in sleeves where it passes through walls and floors. Maintain fire rating at all penetrations.
14. Size of raceway and size and type of wire shall be the responsibility of the Contractor, in keeping with the manufacturer's recommendation and NEC requirements.
15. Include one pull string in each raceway 1 inch or larger.
16. Control and status relays are to be located in designated enclosures only. These enclosures include packaged equipment control panel enclosures unless they also contain Class 1 starters.
17. Conceal all raceways, except within mechanical, electrical, or service rooms. Install raceway to maintain a minimum clearance of 6” from high-temperature equipment (e.g., steam pipes or flues).
18. Secure raceways with raceway clamps fastened to the structure and spaced according to code requirements. Raceways and pull boxes may not be hung on flexible duct strap or tie rods. Raceways may not be run on or attached to ductwork.
19. Install insulated bushings on all raceway ends and openings to enclosures. Seal top end of all vertical raceways.
20. The EMCS Contractor shall terminate all control and/or interlock wiring, and shall maintain updated (as-built) wiring diagrams with terminations identified at the job site.
21. Flexible metal raceways and liquid-tight, flexible metal raceways shall not exceed 3 feet in length and shall be supported at each end. Flexible metal raceway less than ½” electrical trade size shall not be used. In areas exposed to moisture liquid-tight, flexible metal raceways shall be used.
22. Raceway must be rigidly installed, adequately supported, properly reamed at both ends, and left clean and free of obstructions. Raceway sections shall be joined with couplings (per code). Terminations must be made with fittings at boxes, and ends not terminating in boxes shall have bushings installed.

23. Electrical service to controls panels and control devices shall be provided by isolated circuits, with no other loads attached to the circuit, clearly marked at its source. The location of the breaker shall be clearly identified in each panel served by it. If a spare breaker is not available within an electrical panel, the EMCS Contractor shall be responsible for providing any and all equipment and labor necessary to supply an isolated circuit. Controllers controlling only packaged air conditioning equipment may be powered directly from the packaged units control circuit.
24. Wire digital outputs to either the normally-closed or normally-open contacts of binary output depending on desired action in case of system failure. Unless otherwise indicated, wire to the NO contact except the following shall be wired to the NC contact:

    a. Hot water pumps.
    b. Coil recirc' pumps provided for freeze protection.

25. Hardwire Interlocks.

    a. The devices referenced in this section are hardwire interlocked to ensure equipment shutdown occurs even if control systems are down. Do not use software (alone) for these interlocks.
    b. Hardwire device NC contact to air handler fan starter upstream of HOA switch, or to VFD enable contact.
    c. Where multiple fans (or DDC DI) are controlled off of one device and the device does not have sufficient contacts, provide a relay at the device to provide the required number of contacts.
    d. Provide for the following devices where shown on plans:

        1) Duct smoke detector.
        2) High discharge static pressure.
        3) Low mixing plenum pressure.
        4) Freeze-stats.

B. Communication Wiring.

1. The EMCS Contractor shall adhere to the requirements of paragraph 3.3A in addition to this section.
2. Communication and signal wiring may be run without conduit in concealed, accessible locations as permitted by paragraph 3.3A only if noise immunity is ensured. Contractor will be fully responsible for noise immunity and rewire in conduit if electrical or RF noise affects performance.
3. All cabling shall be installed in a neat and workmanlike manner. Follow all manufacturers' installation recommendations for all communication cabling. Use shielded wiring if recommended by manufacturer.
4. Do not install communication wiring in raceway and enclosures containing Class 1 or other Class 2 wiring.
5. Maximum pulling, tension, and bend radius for cable installation as specified by the cable manufacturer shall not be exceeded during installation.
6. EMCS Contractor shall verify the integrity of the entire network following the cable installation. Use appropriate test measures for each particular cable.
7. All runs of communication wiring shall be unspliced length when that length is commercially available.
8. All communication wiring shall be labeled to indicate origination and destination data.
9. Grounding of coaxial cable shall be in accordance with NEC regulations Article on Communications Circuits, Cable and Protector Grounding.
10. Shielded cable shield shall be grounded only at one end.
11. Power-line carrier signal communication/transmission is not acceptable.

3.4 INSTALLATION OF SENSORS

A. Install sensors in accordance with the manufacturer's recommendations.

B. Mount sensors rigidly and adequately for the environment within which the sensor operates.

C. Temperature Sensors.

1. Room temperature sensors/thermostats shall be installed on concealed junction boxes properly supported by the wall framing.
2. All wires attached to sensors shall be air sealed in their raceways or in the wall to stop air transmitted from other areas affecting sensor readings.
3. Averaging sensors shall be installed in a serpentine manner vertically across duct. Each bend shall be supported with a capillary clip. Where located in front of filters (e.g. mixed air sensors), access for filter removal shall be maintained.
4. For sensors specified to be calibrated using a dry well bath (see points list), install sensors with a sufficient wiring/flexible conduit lead that sensor may removed from well or duct and placed in an ice bath or dry well for calibration. The spare wiring/flexible conduit shall be no less than 3’ in length.
5. All pipe-mounted temperature sensors shall be installed in wells. Install the sensor in the well with a thermal-conducting grease or mastic. Use a closed-cell insulation patch that is integrated into the pipe insulation system to isolate the top of the well from ambient conditions but allow easy access to the sensor. Install a test plug adjacent to all wells for testing and calibration.
6. Unless otherwise noted, temperature sensors/thermostats, humidity sensors/humidistats, CO_2 sensors, and other room wall mounted sensors shall be installed at same centerline as adjacent electrical switches, 4’-0” above the finished floor where there are no adjacent electrical switches, and within ADA limitations.
7. Unless otherwise noted, install outdoor air temperature sensors on north wall, complete with sun shield, where they will not be influenced by building exhaust, exfiltration, or solar insolation. Do not install near intake or exhaust air louvers.

D. Differential Pressure Sensors.

1. Supply Duct Static Pressure: Locate transmitter in temperature control panel near or in DDC panel to which it is wired. Connect the low-pressure port to tee in building pressure (high) signal of the building static pressure transmitter. Pipe the high-pressure tap to the duct using a static pressure tip. Locate static pressure tip as shown on drawings; if no location is shown, locate at end of duct riser or main as far out in the system as possible but upstream of all smoke and fire dampers. Install pressure tips securely fastened with tip facing upstream in accordance with manufacturer’s installation instructions.
2. Filter Differential Pressure:

    a. Install static-pressure tips upstream and downstream of filters with tips oriented in direction of flow.
    b. Mount transmitter on outside of filter housing or filter plenum in an accessible position with LCD display clearly visible. This sensor is used in lieu of an analog gauge and thus must be readily viewable.

3. Building Static Pressure:

    a. Low pressure port of the pressure sensor:

1) Pipe to the ambient static pressure probe located on the outside and at high point of the building through a high-volume accumulator or otherwise protected from wind fluctuations.

b. High-pressure port of the pressure sensor:

1) Pipe to either:

a) Behind a DDC temperature sensor cover in an interior zone.
b) Bosco or Dwyer plate sensor mounted in ceiling.

2) Do not locate near elevators, exterior doors, atria, or (for ceiling sensor applications) near diffusers.

4. All pressure transducers, other than those controlling VAV boxes, shall be located where accessible for service without use of ladders or special equipment. If required, locate in field device panels and pipe to the equipment monitored or ductwork.
5. The piping to the pressure ports on all pressure transducers (both air and water) shall contain a capped test port located adjacent to the transducer.
6. Piping differential pressure transducers shall have three valve manifold, two valves to allow removal of sensor without disrupting the hydronic system plus an equalizing valve to allow the sensor to be zeroed and to prevent sensor from experiencing full static (as opposed to differential) pressure, plus test plugs on each connection (also used as vents).
7. Copper tubing shall be installed in a neat manner (parallel and perpendicular to the building structure, equipment, piping, etc. from which it is supported) and shall be properly supported. Changes to copper tubing installation resulting from failure to comply with this requirement shall be made at the discretion of the Architect at no additional cost to the Owner.

E. Relative Humidity Sensors: Provide element guard as recommended by manufacturer for high velocity installations. For high limit sensors, position remote enough to allow full moisture absorption into the air stream before reaching the sensor.

F. Flow Switches: Install in a straight run of pipe at least 10 diameters in length to minimize false indications.

G. Current Switches for Motor Status Monitoring: Adjust so that setpoint is below minimum operating current and above motor no load current.

H. Airflow Measuring Stations: Install per manufacturer’s recommendations in an unobstructed straight length of duct both upstream and downstream of sensor, except those installations specifically designed for installation in fan inlet. For installations in fan inlets, provide on both inlets of double inlet fans and provide inlet cone adapter as recommended by AFMS manufacturer.

I. Fluid Flow Sensors: Install per manufacturer’s recommendations in an unobstructed straight length of pipe both upstream and downstream of sensor.

3.5 ACTUATORS

A. Type.

1. Actuators for two-position valves may be pneumatic or electric at the option of the Division 23C contractor.
2. Actuators for high pressure (125 psig) steam, both modulating and two-position, shall be pneumatic.

3. Except where listed above, actuators shall be electric.

B. Mount and link control damper actuators per manufacturer's instructions.

C. Dampers:

1. To compress seals when spring-return actuators are used on normally closed dampers, power actuator to approximately 5° open position, manually close the damper, and then tighten the linkage, or follow manufacturer's instructions to achieve same effect.
2. Check operation of damper/actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.
3. Provide all mounting hardware and linkages for actuator installation.

D. Control Valves: Install so that actuators, wiring, and tubing connections are accessible for maintenance. Where possible, install with valve stem axis vertical, with operator side up. Where vertical stem position is not possible, or would result in poor access, valves may be installed with stem horizontal. Do not install valves with stem below horizontal, or down.

END OF SECTION 23 09 13

SECTION 23 09 16

EMCS OPERATOR INTERFACES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 WORK INCLUDED

A. Provide and install the following:

1. Operator Workstation(s)
2. Servers
3. Portable Operator Terminal
4. Uninterruptible Power Supply
5. Backup Device
6. Printers

B. Refer to Section 230900 for general requirements.

1.3 RELATED WORK AND REQUIREMENTS

A. Other EMCS Sections:

1. Section 230900 Energy Management and Control System (EMCS) - General
2. Section 230913 EMCS Basic Materials and Devices
3. Section 230919 EMCS Field Panels
4. Section 230923 EMCS Communication Devices
5. Section 230926 EMCS Software and Programming
6. Section 230929 EMCS Points and Sequence of Operation
7. Section 230933 EMCS Commissioning

PART 2 - PRODUCTS

2.1 OPERATOR WORKSTATION (OWS)

A. Hardware:

1. 3.2 GHz (minimum)
2. 4 GB SDRAM (minimum)
3. 8X DVD +/- RW Drive
4. 250 GB hard disk (minimum)
5. Ethernet 100 GB internal network card (for connection to Supervisory LAN)
6. 24” LED HD color, 1920 x 1080 pixel display monitor

7. 3-button optical USB mouse
8. USB Keyboard
9. Internal speakers
10. Energy Star configured
11. One spare serial port and one spare USB port in addition to those needed for specified peripherals.
12. 24x7 dedicated technical support service that delivers reduced hold time, direct access to advanced level technicians, and reduced time to resolution, minimum 1 year.

B. Software:

1. By PC Supplier (factory installed):

   a. Operating system: Microsoft Windows 8 Professional.
   b. Browser: Microsoft Internet Explorer.
   c. Office Suite: Microsoft Office Professional.
   d. CD Burner Software: Standard software provided by computer supplier.
   e. All software shall be at least the latest version available as of the date of purchase.

2. By EMCS Contractor:

   a. See Section 230926.

2.2 CONTROL SYSTEM SERVER (CSS)

A. Hardware:

1. Dual Processor 3.2 GHz (minimum)
2. 4 GB DDRAM (minimum)
3. 4 Bay (1x4) Hot Plug SCSI Hard Drive Backplane with dual 500 GB (minimum) SCSI hard disks connected to on-board 128MB Battery Backed Cache, 2 Internal Ch- Embedded RAID controllers
4. 24X (minimum) CD ROM drive
5. One Ethernet 100 GB internal network card (for connection to Supervisory LAN)
6. One Ethernet 1000 Gigabit NIC-Fiber network card (for connection to Owner's WAN)
7. Redundant AC power supplies
8. 19" color , 1280 x 1024 pixel display
9. 3-button optical USB mouse
10. USB Keyboard
11. Energy Star configured
12. One spare serial port and one spare USB port in addition to those needed for specified peripherals.
13. 24x7 dedicated technical support service that delivers reduced hold time, direct access to advanced level technicians, and reduced time to resolution, minimum 1 year.

B. Software:

1. By PC Supplier (factory installed):

   a. Operating system: Microsoft Windows Server 2012.
   b. Browser: Microsoft Internet Explorer.
   c. All software shall be at least the latest version available as of the date of purchase.

2. By EMCS Contractor:

a. See Section 230926.

C. CSS shall be configured to secure it to the extent practical inside the Supervisory LAN with firewall software provided by the Contractor.

2.3 PORTBLE OPERATORS TERMINAL (POT)

A. Portable Operators Terminal shall support system management by connection to the controllers, by connection via the Supervisory LAN, Owner's Intranet, or Internet; or by dial-up communications.

B. Hardware:

1. 1.6 GHz (minimum)
2. 4 GB SDRAM (minimum)
3. 250 GB hard disk (minimum)
4. 24X (minimum) CD ROM drive (built-in)
5. Ethernet 100 GB internal network card (for connection to Supervisory LAN)
6. 15.6" color, 1366x768 Anti-Glare WLED-Backlit display
7. Touch pad
8. Rechargeable battery, spare battery and 110V power supply/charger
9. Internal speakers
10. Parallel, Serial and USB port
11. Vinyl carry-bag
12. IEEE 802.11b (DSSS) 2.4GHz-Compliant wireless PCMCIA card (compatible with wireless router; see Section 230923).
13. 24x7 dedicated technical support service that delivers reduced hold time, direct access to advanced level technicians, and reduced time to resolution, minimum 1 year.

C. Software:

1. By PC Supplier (factory installed):

a. Operating system: Microsoft Windows 7 Professional.
b. Browser: Microsoft Internet Explorer
c. Office Suite: Microsoft Office Professional
d. CD burner software: Standard software provided by computer supplier.
e. All software shall be at least the latest version available as of the date of purchase.

2. By EMCS Contractor

a. See Section 230926.

2.4 UNINTERRUPTIBLE POWER SUPPLY (UPS)

A. Back-UPS ES battery backup and surge protection.

B. EMI/RFI filtering to FCC Class B.

C. Lightning and surge protection for all outlets.

D. Stepped sine wave output.

E. Wide input voltage range.

F. Automatic battery testing.

G. Continuous battery monitoring.

H. Continuous overload monitoring.

I. Sufficient to power all EMCS devices in Central Plant/Mechanical Room at full load for 5 minutes after power failure.

2.5 BACKUP DEVICES

A. Network Laser Printer:

1. Print Quality: 1200 x 1200 dpi resolution.
2. Speed: 25 pages per minute; print time of less than 9 seconds to first page.
3. Cartridge / Printhead Duty Cycle: 5000 pages.
4. Paper Size: 8.5x11.
5. Ethernet Network hardware and software with remote management (configure, monitor and manage printer via network).
6. Compliant Standards:

    a. Energy Star configured.
    b. IEEE 802.3-LAN, IEEE 802.3U-LAN.

B. Color Ink Jet Printer:

1. Print Quality (Color): 1440 x 720 dpi resolution.
2. Speed: 5 pages per minute (color).
3. Cartridge / Printhead Duty Cycle: 300 pages.
4. Paper Size: 11x17, 8.5x11.

PART 3 - EXECUTION

3.1 DEVICE REQUIREMENTS

A. Provide the following Equipment in the Control Room or at location designated by the Owner.

Device	Quantity
Operator Workstation	1
Control System Server	1
Portable Operator's Terminal	2
Interruptible Power Supply	As required
Backup device	1
Network Laser Printer	0
Color Inkjet Printer	1

3.2 INSTALLATION

A. Install all servers and other devices available in a location coordinated with the Owner and Architect.

B. Install all hardware and software and configure all devices in accordance with manufacturer's instructions.

C. Provide all licenses, keys, etc. and all documentation and information required to install, configure, operate, diagnose and maintain the system shall be provided.

D. Network connections:

1. See System Architecture in Section 230900.
2. Connect OWSs and CSS to Supervisory LAN.
3. Connect OWSs and CSS to Owner's IT WAN/LAN. Contractor shall coordinate with the Owner's IT representative to establish IP addresses and communications parameters to assure proper operation.

E. Printers:

1. Connect network laser printer to Supervisory LAN.
2. Connect other printers to an OWS and configure to share with other OWSs.

F. Backup:

1. After completion and acceptance of installation, create a backup of all OWSs and server database and configuration files for permanent record of initial installation.
2. Configure backup software to provide automatic backup of OWS and CSS on a weekly basis.
3. All other backup configuration shall be by the Owner.

G. Anti-virus software and installation shall be by the Owner.

END OF SECTION 23 09 16

SECTION 23 09 19

EMCS FIELD PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 WORK INCLUDED

A. Provide and install the following:

1. Building Controller (BC)
2. Advance Application Specific Controller (AAC)
3. Application Specific Controller (ASC)

B. Refer to Section 230900 for general requirements.

1.3 RELATED WORK AND REQUIREMENTS

A. Other EMCS Sections:

1. Section 230900 Energy Management and Control System (EMCS) - General
2. Section 230913 EMCS Basic Materials and Devices
3. Section 230916 EMCS Operator Interfaces
4. Section 230923 EMCS Communication Devices
5. Section 230926 EMCS Software and Programming
6. Section 230929 EMCS Points and Sequence of Operation
7. Section 230933 EMCS Commissioning

PART 2 - PRODUCTS

2.1 GENERAL

A. Point information from any controller (including BCs, AACs, and ASCs) and from any gateway shall be capable of being used in a control sequence in any other panel. The use of OWS or CSS to serve as a communications server between control panels and gateways is not acceptable.

B. For all controllers, operating configuration and software shall be retained in the event of a power outage without requiring a download from upper level controllers by one or a combination of the following:

1. Volatile RAM shall have a replaceable battery backup using a lithium battery with a rated service life of 10,000 hours continuous, and a rated shelf life of at least 7 years.

2. Volatile RAM shall have a automatically rechargeable battery backup using a lithium battery with a rated service life of 50 hours continuous, and a rated shelf life of at least 10 years.
3. EEPROM, EPROM, or NOVROM non-volatile memory.

C. Controllers shall allow independent operation regardless of the status of the other controllers or OWS or CSS. All energy management logic shall reside in field hardware and shall not be dependent on the OWS or CSS for operation.

D. Each controller shall continually check the status of its processor and memory circuits. If an abnormal operation is detected, the controller shall:

1. Assume a predetermined failure mode.
2. Generate an alarm notification to the master controller and/or Operator Workstation.

E. All input points and output points shall be protected such that shorting of the point to itself — to another point, or to ground — will cause no damage to the controller. All input and output points shall be protected from voltage up to 24V of any duration, such that contact with this voltage will cause no damage to the controller.

F. Controller hardware shall be suitable for the anticipated ambient conditions.

1. Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures, and shall be rated for operation at 0°F to 150°F.
2. Controllers used in conditioned space shall be mounted in dust--resistant enclosures, and shall be rated for operation at 32°F to 120°F.

G. Programmability. All controllers, including BCs, AACs, and ASCs, shall be fully user programmable. See Section 23 09 26. Configurable pre-programmed logic shall not be acceptable in any controller. (This is required due to non-standard control sequences at AHUs and VAV terminal units.)

2.2 STAND-ALONE FUNCTIONALITY

A. General: These requirements clarify the requirement for stand-alone functionality relative to packaging I/O devices with a controller. Stand-alone functionality is specified with the controller and for each Application Category specified in Part 3. This item refers to acceptable paradigms for associating the points with the processor.

B. Functional Boundary: Provide controllers so that all points associated with and common to one unit or other complete system/equipment shall reside within a single control unit. The boundaries of a standalone system shall be as dictated in the contract documents. Generally systems specified for the Application Category will dictate the boundary of the standalone control functionality. See related restrictions below. When referring to the controller as pertains to the standalone functionality, reference is specifically made to the processor. One processor shall execute all the related I/O control logic via one operating system that uses a common programming and configuration tool.

C. The following configurations are considered acceptable with reference to a controller's standalone functionality:

1. Points packaged as integral to the controller such that the point configuration is listed as an essential piece of information for ordering the controller (having a unique ordering number).
2. Controllers with processors and modular back planes that allow plug in point modules as an integral part of the controller.

3. I/O point expander boards, plugged directly into the main controller board to expand the point capacity of the controller.

D. The following configurations are considered unacceptable with reference to a controller's standalone functionality:

1. Multiple controllers enclosed in the same control panel to accomplish the point requirement.

2.3 BUILDING CONTROLLER (BC)

A. General Requirements:

1. BCs shall be peer-to-peer devices connected to the Primary Controller LAN.
2. Each BC shall be capable of standalone direct digital operation utilizing its own microprocessor, internal RAM, non-volatile memory, input/output, wiring terminal strips, A/D converters, real-time clock/calendar and voltage transient and lightning protection devices, battery backup, regulated power supply, power conditioning equipment, ports for connection of operating interface devices, and control enclosure.. Refer to standalone functionality specified above.
3. The BC(s) shall provide fully distributed control independent of the operational status of the OWSs and CSS. All necessary calculations required to achieve control shall be executed within the BC independent of any other device.
4. BCs shall perform overall system coordination, accept control programs, perform automated HVAC functions, control peripheral devices and perform all necessary mathematical and logical functions. BCs shall share information with the entire network of BCs and AACs/ASCs for full global control. Each controller shall permit multi-user operation from multiple workstations and portable operator terminals connected either locally or over the Primary Controller LAN.
5. BC shall contain sufficient memory for all specified global control strategies, user defined reports and trending, communication programs, and central alarming.
6. The BC may provide for point mix flexibility and expandability. This requirement may be met via either a family of expander boards, modular input/output configuration, or a combination thereof. Refer to stand alone functionality specified above.
7. All BC point data, algorithms and application software shall be configurable, and all control strategies performed by the BC shall be both operator definable and modifiable, from Operator Interfaces. The point database and all application programs shall be stored in non-volatile or battery backed volatile memory within the BC and will be able to upload/download to/from the OWS and/or CSS.
8. BC shall provide buffer for holding alarms, messages, trends etc.
9. Each BC shall include self-test diagnostics, which allow the BC to automatically alarm any malfunctions, or alarm conditions that exceed desired parameters as determined by programming input.
10. Each BC shall contain software to perform full DDC/PID control loops.
11. Memory:

    a. Memory for data trending shall reside in BCs; the Operator Workstation shall not need to be connected for data trending to occur. Memory shall be large enough to record 256 records of each hardware point on the panel and an equal number of software points, each record to include both data value and time of occurrence. (See Section 230926 for trending software requirements.)
    b. Provide sufficient internal memory for the specified sequences of operation and trend logging. There shall be a minimum of approximately 25% of available memory free for future programming changes.
    c. Provide an additional BC if needed to comply with this section.

12. For systems requiring end-of-line resistors those resistors shall be located in the BC.
13. Input-Output Processing:

    a. Digital Outputs (DO): Outputs shall be rated for a minimum 24 Vac or Vdc, 0.5 amp maximum current. Each shall be configurable as normally open or normally closed. Each output shall have an LED to indicate the operating mode of the output and a supervised manual hand off or auto (HOA) switch to allow for override. HOA override switches shall be monitored via additional input channels to provide dynamic indication of the switch status at any Operator Interface. Each DO shall be discrete outputs from the BC's board (multiplexing to a separate manufacturer's board is unacceptable). Provide suppression to limit transients to acceptable levels.
    b. Analog Inputs (AI): AI shall be 0-5 Vdc, 0-10 Vdc, and 0-20 mA. Provide signal conditioning, and zero and span calibration for each input. Each input shall be a discrete input to the BC's board (multiplexing to a separate manufacturers board is unacceptable unless specifically indicated otherwise). A/D converters shall have a minimum resolution of 12 bits.
    c. Digital Inputs (DI): Monitor dry contact closures. Accept pulsed inputs of at least one per second. Source voltage for sensing shall be supplied by the BC and shall be isolated from the main board. Software multiplexing of an AI and resistors is unacceptable.
    d. Universal Inputs (UI-AI or DI): To serve as either AI or DI as specified above.
    e. Electronic Analog Outputs (AO): Voltage mode: 0-5 Vdc and 0-10 Vdc; Current mode: 4-20 mA. Provide zero and span calibration and circuit protection. Pulse Width Modulated (PWM) analog is not acceptable. D/A converters shall have a minimum resolution of 8 bits. Each output shall have an LED to indicate the operating mode of the output and a supervised manual hand off or auto (HOA) switch and trim potentiometer to allow for override and manual positioning of the output from 0 to 100%. HOA override switches shall be monitored via additional input channels to provide dynamic indication of the switch status at any Operator Interface.
    f. Analog Output Pneumatic (AOP), 0-20 psi: Pneumatic outputs via an I/ or V/P transducer. Multiplexed digital to pneumatic transducers are acceptable provided they are supplied as a standard product and part of the BC and provide individual feedback. Multiplexed pneumatic outputs of a separate manufacturer are unacceptable.
    g. Pulsed Inputs: Capable of counting up to 8 pulses per second with buffer to accumulate pulse count. Pulses shall be counted at all times.

14. A communication port for operator interface through a terminal shall be provided in each BC. It shall be possible to perform all program and database back-up, system monitoring, control functions, and BC diagnostics through this port. Standalone BC panels shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems, printers, or workstations.
15. Each BC shall be equipped with loop tuning algorithm for precise proportional, integral, derivative (PID) control. Loop tuning tools provided with the Operator Workstation software is acceptable. In any case, tools to support loop tuning must be provided such that P, I, and D gains are automatically calculated.
16. All analog output points shall have a selectable failure setpoint. The BC shall be capable of maintaining this failure setpoint in the event of a system malfunction, which causes loss of BC control, or loss of output signal, as long as power is available at the BC. The failure setpoint shall be selectable on a per point basis.
17. Slope intercepts and gain adjustments shall be available on a per-point basis.
18. BC Power Loss:

    a. Upon a loss of power to any BC, the other units on the primary controlling network shall not in any way be affected.
    b. Upon a loss of power, all software, database parameters, and data (except trend data) shall be protected from memory loss as described herein.

c. Upon restoration of power within the specified battery backup period, the BC shall resume full operation without operator intervention. The BC shall automatically reset its clock such that proper operation of any time dependent function is possible without manual reset of the clock. All monitored functions shall be updated.
d. Should the duration of a loss of power exceed the specified battery back-up period or BC panel memory be lost for any reason, the panel shall automatically report, or CSS shall automatically determine, the condition (upon resumption of power) and be capable of receiving a download via the network, and connected computer. In addition, the Owner shall be able to upload the most current versions of all energy management control programs, Direct Digital Control programs, database parameters, and all other data and programs in the memory of each BC to the operator workstation via the local area network, or via the telephone line dial-up modem where applicable, or to the laptop PC via the local RS-232C port.

19. BC Failure:

a. Controller LAN Data Transmission Failure: BC shall continue to operate in stand-alone mode. BC shall store loss of communication alarm along with the time of the event. All control functions shall continue with the global values programmable to either last value or a specified value.
b. BC Hardware Failure: BC shall cease operation and terminate communication with other devices. All outputs shall go to their specified fail position.

20. Each BC shall be equipped with firmware resident or software self-diagnostics for sensors and be capable of assessing an open or shorted sensor circuit and taking an appropriate control action (close valve, damper, etc.).
21. BCs may include LAN communications interface functions for controlling s\Secondary controlling LANs Refer to Section 230923 - EMCS System Communications Devices for requirements if this function is packaged with the BC.
22. BCs shall be mounted on equipment, in packaged equipment enclosures, or locking wall mounted in a NEMA 1 enclosure, as specified elsewhere.

B. BACnet Building Controller Requirements:

1. The BC(s) shall support all BIBBs defined in the BACnet Building Controller (B-BC) device profile as defined in the BACnet standard.
2. Each BC shall be connected to the BACnet Primary Controller LAN communicating to/from other BCs.

2.4 ADVANCED APPLICATION SPECIFIC CONTROLLER (AAC) AND APPLICATION SPECIFIC CONTROLLER (ASC)

A. General Requirements:

1. AACs and ASCs shall be connected to the Primary or Secondary Controller LAN.
2. AACs and ASCs shall provide intelligent, standalone control of HVAC equipment. Each unit shall have its own internal RAM, non-volatile memory and will continue to operate all local control functions in the event of a loss of communications on the Secondary LAN. Refer to standalone requirements by application specified in Part 3 of this section. In addition, it shall be able to share information with every other BC and AAC /ASC on the entire network.
3. Each AAC and ASC shall include self-test diagnostics that allow the AAC /ASC to automatically relay to the BC, LAN Interface Device or workstation, any malfunctions or abnormal conditions within the AAC /ASC or alarm conditions of inputs that exceed desired parameters as determined by programming input.

4. AACs and ASCs shall include sufficient memory to perform the specific control functions required for its application and to communicate with other devices.
5. Each AAC and ASC must be capable of stand-alone direct digital operation utilizing its own processor, non-volatile memory, input/output, voltage transient and lightning protection devices.
6. All point data; algorithms and application software within an AAC /ASC shall be modifiable from Operator Interfaces.
7. Memory:

    a. Memory for data trending is not required for AACs and ASCs. If not provided in controller, memory for trend data shall reside in BCs connected to the same Network.
    b. Provide sufficient internal memory for the specified sequences of operation. For AACs, there shall be a minimum of approximately 25% of available memory free for future programming changes. Provide additional AACs or a BC if needed to comply with this requirement.

8. AAC Input-Output Processing. Same as BCs (paragraph 2.3A.13) except A/D converters may be 10 bit.
9. ASC Input-Output Processing:

    a. Digital Outputs (DO): Outputs shall be rated for a minimum 24 Vac or Vdc, 0.5 amp maximum current. Each shall be configurable as normally open or normally closed. Each output shall have an LED to indicate the operating mode of the output. Each DO shall be discrete outputs from the ASC's board (multiplexing to a separate manufacturer's board is unacceptable). Provide suppression to limit transients to acceptable levels.
    b. Analog Inputs (AI): AI shall be 0-5 Vdc or direct thermistor connection. Provide signal conditioning, and zero and span calibration for each input. Each input shall be a discrete input to the ASC's board (multiplexing to a separate manufacturers board is unacceptable unless specifically indicated otherwise). A/D converters shall have a minimum resolution of 10 bits.
    c. Digital Inputs (DI): Monitor dry contact closures. Accept pulsed inputs of at least one per second. Source voltage for sensing shall be supplied by the ASC and shall be isolated from the main board. Software multiplexing of an AI and resistors may only be done in non-critical applications and only with prior approval of the Owner.
    d. Universal Inputs (UI-AI or DI): To serve as either AI or DI as specified above.
    e. Electronic Analog Outputs (AO): Voltage mode: 0-5 Vdc and 0-10 Vdc; Current mode: 4-20 mA. Provide zero and span calibration and circuit protection. Pulse Width Modulated (PWM) analog is not acceptable. D/A converters shall have a minimum resolution of 8 bits.
    f. Analog Output Pneumatic (AOP), 0-20 psi: Pneumatic outputs via an I/ or V/P transducer. Multiplexed digital to pneumatic transducers are acceptable provided they are supplied as a standard product and part of the ASC and provide individual feedback. Multiplexed pneumatic outputs of a separate manufacturer are unacceptable.

B. BACnet AAC(s) and ASC(s) Requirements:

1. The AAC(s) and ASC(s) shall support all BIBBs defined in the BACnet Building Controller (B-AAC and B-ASC) device profile as defined in the BACnet standard.
2. AAC(s) and ASC(s) shall communicate over the BACnet Primary Controller LAN or the Secondary LAN.

PART 3 - EXECUTION

3.1 GENERAL

A. Install systems and materials in accordance with manufacturer's instructions, specifications roughing-in drawings and details shown on drawings.

3.2 HARDWARE APPLICATION REQUIREMENTS

A. General: The functional intent of this specification is to allow cost effective application of manufacturers standard products while maintain the integrity and reliability of the control functions. A BC as specified above is generally fully featured and customizable whereas the AAC/ASC refers to a more cost-effective unit designed for lower-end applications. Specific requirements indicated below are required for the respective application. Manufacturer may apply the most cost-effective unit that meets the requirement of that application.

B. Software Capability: Regardless of application category listed below, each Control Unit shall be capable of performing the specified sequence of operation for the associated equipment. All physical point data and calculated values required to accomplish the sequence of operation shall originate within the associated CU with only the exceptions enumerated below. Refer to requirements herein above for physical limitations of standalone functionality. Listed below are functional point data and calculated values that shall be allowed to be obtained from or stored by other CUs via LAN.

1. Remote pressure sensors. To meet the requirements of this section, differential pressure sensors controlling fans and pumps shall either be home-run wired back to the CU controlling the fan/pump VFD; or install another DP sensor (not shown in points list) near the fan/pump and connected to the CU controlling the pump, connect remote sensors to remote CUs, and use cascading control loops (remote sensor loops reset setpoint for local sensor loop via the network, and local sensor loop controls the pump/fan).

C. Where associated control functions involve functions from different categories identified below, the requirements for the most restrictive category shall be met.

D. Application Category 0 (Distributed Monitoring).

1. Applications in this category include the following:

   a. Monitoring of variables that are not used in a control loop, sequence logic, or safety. Examples include status of sump pumps or associated float switches, temperatures in monitored electrical rooms.

2. Applicable Controllers: Available points on conveniently located BCs, AACs, and ASCs may be used in these applications.
3. Contractor shall verify and document that the network bandwidth is acceptable to accept specified trends of monitored points.

E. Application Category 1 (Application Specific Controller).

1. Applications in this category include the following:

   a. Fan Coil Units.
   b. Terminal Units (e.g. VAV and Constant Volume Boxes).

c. Miscellaneous heaters.
d. Constant speed exhaust fans and pumps.
e. Unitary single zone units with self contained controls (Package Terminal AC Units, Package Terminal Heat Pumps, Split-System AC Units, Split-System Heat Pumps, Water-Source Heat Pumps, Computer Room AC units).

2. Applicable Controllers: ASCs may be used in these applications.
3. Standalone Capability: Provide capability to execute control functions for the application for a given setpoint or mode, which shall generally be occupied mode control. Only the following data (as applicable) may be acquired from other controllers via LANs. In the event of a loss of communications with any other controller, or any fault in any system hardware that interrupts the acquisition of any of these values, the ASC shall use the last value obtained before the fault occurred. If such fault has not been corrected after the specified default delay time, specified default value(s) shall then be substituted until such fault has been corrected.

Physical/Virtual Point	Default Value
Time of day	Occupied
Scheduling Mode	Occupied
Morning Warm-Up	Off (cold discharge air)
Load Shed	Off (no shedding)
Trend Data	N/A

4. Mounting:

a. ASCs that control equipment located above accessible ceilings shall be mounted on the equipment in an accessible enclosure and shall be rated for plenum use if ceiling attic is used as a return air plenum.
b. ASCs that control equipment mounted in a mechanical room may either be mounted in/on the equipment, or on the wall of the mechanical room at an adjacent, accessible location.
c. ASCs that control equipment mounted outside or in occupied spaces shall either be located in the unit or in a proximate mechanical/utility space.

5. Mounting: LAN Restrictions: Limit the number of nodes on the network to the maximum recommended by the manufacturer.
6. Trending Restrictions: BCs connected to same Network shall be capable of storing trend data for points associated with ASCs and must still meet the requirement of paragraph 2.3A.11, or special purpose trend storage devices meeting the requirement of paragraph 2.3A.11 for ASC points must be added for this purpose.

F. Application Category 2 (Advanced Application Controller).

1. Applications in this category include the following:

a. Unitary VAV AC Unit with self contained controls.
b. Single Zone Air Handling Units.
c. Constant or variable speed pump station.
d. DHW Converter control/monitoring.

2. Applicable Controllers:

   a. BCs may be used in these applications.
   b. AACs may be used in these applications provided the AAC meets all requirements specified below and all control functions and physical I/O associated with a given unit resides in one AAC.

3. Standalone Capability: Only the following data (as applicable) may be acquired from other AACs or BCs via LANs. In the event of a loss of communications with any other AACs, or any fault in any system hardware that interrupts the acquisition of any of these values, the AAC shall use the last value obtained before the fault occurred. If such fault has not been corrected after the specified default delay time, specified default value(s) shall then be substituted until such fault has been corrected.

Physical/Virtual Point	Default Delay Time	Default Value
Outside Air Temperature	3 minutes	80˚F
Trend Data		N/A

4. Trending Restrictions for AACs: BCs connected to same Network shall be capable of storing trend data for points associated with AACs that do not have on-board trend storage capability, and must still meet the requirement of paragraph 2.3A.11, or special purpose trend storage devices meeting the requirement of paragraph 2.3A.11 for AAC points must be added for this purpose.
5. Mounting:

   a. AACs/BCs that control equipment located above accessible ceilings shall be mounted in a NEMA 1, locking enclosure and shall be rated for plenum use if ceiling attic is used as a return air plenum.
   b. AACs/BCs that control equipment located in occupied spaces or outside shall either be mounted within the equipment enclosure (responsibility for physical fit remains with the Contractor) or in a proximate mechanical/utility room in which case it shall be enclosed in a NEMA 1, locking enclosure.

G. Application Category 3 (Building Controller)

1. Applications in this category include the following:

   a. VAV Air Handlers.
   b. Central Cooling Plant.
   c. Central Heating Plant.

2. Applicable Controllers: BCs shall be used in these applications.
3. Mounting: See 3.2F.5

3.3 CONTROL POWER

A. Refer to Section 230900 for power to control panels.

END OF SECTION 23 09 19

SECTION 23 09 23

EMCS COMMUNICATION DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 WORK INCLUDED

A. Provide and install the following:

1. LAN Interface Devices/Routers
2. BACnet Gateways
3. Electrical Power System Gateway

B. Refer to Section 230900 for general requirements.

1.3 RELATED WORK AND REQUIREMENTS

A. Other EMCS Sections:

1. Section 230900 Energy Management and Control System (EMCS) - General
2. Section 230913 EMCS Basic Materials and Devices
3. Section 230916 EMCS Operator Interfaces
4. Section 230919 EMCS Field Panels
5. Section 230926 EMCS Software and Programming
6. Section 230929 EMCS Points and Sequence of Operation
7. Section 230933 EMCS Commissioning

PART 2 - PRODUCTS

2.1 CONTROLLER LOCAL AREA NETWORK INTERFACE DEVICES (LANID)

A. The Controller LANID shall be a microprocessor-based communications device which acts as a gateway/router between the Primary LAN, Secondary LAN, an operator interface, modem to support remote operator interface, or printer. These may be provided within a BC or as a separate device.

B. The LANID shall perform information translation between the Primary LAN and the Secondary LAN, supervise communications on a polling secondary LAN, and shall be applicable to systems in which the same functionality is not provided in the BC. In systems where the LANID is a separate device, it shall contain its own microprocessor, RAM, battery, real-time clock, communication ports, and power supply as specified for a BC in Section 230919. Each LANID shall be mounted in a lockable enclosure.

C. Each LANID shall support interrogation, full control, and all utilities associated with all BCs on the Primary LAN, all AACs and ASCs connected to all secondary LANs under the Primary Controller LAN, and all points connected to those PCUs and SCUs.

D. Upon loss of power to a LANID, the battery shall provide for minimum 100-hour backup of all programs and data in RAM. The battery shall be sealed and self-charging.

E. The LANID shall be transparent to control functions and shall not be required to control information routing on the Primary LAN.

2.2 SUPERVISORY LAN ROUTERS

A. The Supervisory Router shall be a microprocessor-based communications device that acts as a router between the Supervisory LAN CSSs or OWS and the Primary LAN.

B. The Supervisory Router shall not perform information translation. Both Primary LAN and the Supervisory LAN shall use BACnet.

C. The Supervisory Router shall contain its own microprocessor, RAM, communication ports, and power supply. Each Supervisory Router shall be mounted in a lockable enclosure.

D. The Supervisory Router shall allow centralized overall system supervision, operator interface, management report generation, alarm annunciation, acquisition of trend data, and communication with control units. It shall allow system operators to perform the following functions from the CSS, OWSs, and POTs:

1. Configure systems.
2. Monitor and supervise control of all points.
3. Change control setpoints.
4. Override input values.
5. Override output values.
6. Enter programmed start/stop time schedules.
7. View and acknowledge alarms and messages.
8. Receive, store and display trend logs and management reports.
9. Upload/Download programs, database, etc. as specified.

E. Upon loss of power to the Supervisory Router, the battery shall provide for minimum 100-hour backup of all programs and data in RAM. The battery shall be sealed and self-charging.

F. The Supervisory Router shall be transparent to control functions and shall not be required to control information routing on the Primary LAN.

2.3 BACnet BROADCAST MESSAGE ROUTING

A. To allow BACnet broadcast messages to be relayed from remote nodes communicating via the internet and connecting to the Supervisory Router through IP protocol, a BACnet/IP Broadcast Management Device (BBMD) shall be provided which conforms to the Annex J definition of the BACnet standard for two-hop distribution. Multicast messaging or one-hop distribution requiring configuration of IP routers which are not part of the EMCS vendor’s cope in not acceptable.

2.4 BACNET GATEWAYS

A. Gateways shall be provided to link non-BACnet control products to the BACnet inter-network. All of the functionality described in this section is to be provided by using the BACnet capabilities. Each Gateway shall have the ability to expand the number of BACnet objects of each type supported by 20% to accommodate future system changes.

B. Each Gateway shall provide values for all points on the non-BACnet side of the Gateway to BACnet devices as if the values were originating from BACnet objects. The Gateway shall also provide a way for BACnet devices to modify (write) all points specified by the AOC using standard BACnet services. All points are required to be writable for each site.

C. The Gateway shall implement BACnet schedule objects and permit both read and write access to the schedules from the workstation.

D. Each Gateway shall provide a way to collect and archive or trend (time, value) data pairs.

E. Each Gateway and any devices that the Gateway represents which have time-of-day information shall respond to workstation requests to synchronize the date and time. Each Gateway and any devices that the Gateway represents shall support dynamic device binding and dynamic object binding.

F. All points in the system shall be made network visible through the use of standard BACnet objects or through proprietary BACnet extensions that the workstation also supports. All points shall be writable using standard BACnet services.

G. All devices have a Device Object instance number that is unique throughout the entire inter-network. All BACnet devices shall be configured with a Device Object instance number that is based on the format specified (shown in decimal notation). This includes all physical devices as well as any logical BACnet devices that are physically represented by Gateways.

H. All BACnet Interoperability Building Blocks (BIBBs) are required to be supported for each native BACnet device or Gateway. The Gateway shall support all BIBBs defined in the BACnet Gateway’s device profile as defined in the BACnet standard.

I. Upon loss of power to a Gateway, the battery shall provide for minimum 1000-hour backup of all programs and data in RAM. The battery shall be sealed and self-charging.

J. UL 916 CE FCC part 15 Subpart B – Class A with surge and transient protection circuitry for power and communications.

PART 3 - EXECUTION

3.1 GENERAL

A. Install systems and materials in accordance with manufacturer's instructions, specifications roughing-in drawings and details shown on drawings.

B. Contractor shall provide all interface devices and software to provide an integrated system.

C. See Control Power in Section 230900 for device power options and requirements.

3.2 LANID AND LAN ROUTERS

A. Provide as required. See System Architecture in Section 230900.

B. At each building, connect Supervisory LAN to Owner's IT/LAN or dedicated EMCS network (whichever is applicable).

C. Connect networks to both sides of device.

D. Thoroughly test to ensure proper operation.

E. Interruptions or fault at any point on any Primary Controller LAN shall not interrupt communications between other nodes on the network. If a LAN is severed, two separate networks shall be formed and communications within each network shall continue uninterrupted. The system shall automatically monitor the operation of all network devices and annunciate any device that goes off-line because it is failing to communicate.

3.3 GATEWAYS

A. General.

1. Wire to networks on both sides of device.
2. Map across all monitoring and control points listed in Section 230929.
3. Thoroughly test each point to ensure that mapping is accurate.
4. Initiate trends of points as indication in Section 230929.

END OF SECTION 23 09 23

SECTION 23 09 19

EMCS SOFTWARE AND PROGRAMMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 WORK INCLUDED

A. Provide and install the following:

1. System Software
2. Programming Software
3. Graphical User Interface Software

B. Refer to Section 230900 for general requirements.

1.3 RELATED WORK AND REQUIREMENTS

A. Other EMCS Sections:

1. Section 230900 Energy Management and Control System (EMCS) - General
2. Section 230913 EMCS Basic Materials and Devices
3. Section 230916 EMCS Operator Interfaces
4. Section 230919 EMCS Field Panels
5. Section 230923 EMCS Communication Devices
6. Section 230929 EMCS Points and Sequence of Operation
7. Section 230933 EMCS Commissioning

1.4 GENERAL

A. System software shall be based on server/thin-client architecture, designed around the open standards of web technology. Servers shall be accessed using a web browser over the control system Supervisory LAN, the Owner intranet, and remotely over the Internet (through the Owner IT WAN/LAN).

B. The intent of the thin-client architecture is to provide operators complete access to the EMCS via a web browser GUI. No special software other than a web browser (including active-x components or fat java clients) shall be required to be installed on OIs used to access the EMCS graphics, point displays, trends, and trend configuration. Additional software other than a browser may be used to configure or modify the EMCS and programming.

C. The Contractor shall furnish and install all software and programming necessary to provide a complete and functioning system as specified. The Contractor shall include all software and

programming not specifically itemized in these specifications that is necessary to implement, maintain, operate, and diagnose the system in compliance with these specifications.

D. Software Components: All software components of the BAS system software shall be installed and completed in accordance with the specification. BAS system components shall include:

1. Server Software, Database and Web Browser Graphical User Interface
2. System Configuration Utilities for future modifications to the system.
3. Graphical Programming.
4. Direct digital control software.
5. Application Software.

E. Database Open Connectivity: The BAS server database shall be Java DataBase Connectivity (JDBC) compatible, allowing real time access of data via XML/SOAP.

1.5 LICENSING

A. Include licensing and hardware keys for all software packages at all workstations (OWSs and POTs) and servers.

B. Within the limitations of the servers, any number of users shall have web access to the CSS at any given time.

C. All operator interface, programming environment, networking, database management and any other software used by the Contractor to install the system or needed to operate the system to its full capabilities shall be licensed and provided to the Owner.

D. All operator software, including that for programming and configuration, shall be available on all workstations. Hardware and software keys to provide all rights shall be installed on all workstations.

PART 2 - PRODUCTS

2.1 CONTROLLER SOFTWARE

A. BC Software Residency: Each BC shall be capable of control and monitoring of all points physically connected to it. All software including the following shall reside and execute at the BC:

1. Real-Time Operating System software.
2. Real-Time Clock/Calendar and network time synchronization.
3. BC diagnostic software.
4. LAN Communication software/firmware.
5. Direct Digital Control software.
6. Alarm Processing and Buffering software.
7. Energy Management software.
8. Data Trending, Reporting, and Buffering software.
9. I/O (physical and virtual) database.
10. Remote Communication software.

B. AAC/ASC Software Residency: Each AAC/ASC shall be capable of control and monitoring of all points physically connected to it. As a minimum, software including the following shall reside and execute at the AAC/ASC. Other software to support other required functions of the AAC/ASC may

reside at the BC or LAN interface device (specified in Section 230923) with the restrictions/exceptions per application provided in Section 230919:

1. Real-Time Operating System software.
2. AAC/ASC diagnostic software.
3. LAN Communication software.
4. Control software applicable to the unit it serves that will support a single mode of operation.
5. I/O (physical and virtual) database to support one mode of operation.

C. Stand Alone Capability: BC shall continue to perform all functions independent of a failure in other BC/AAC/ASC or other communication links to other BCs/AACs/ASCs. Trends and runtime totalization shall be retained in memory. Runtime totalization shall be available on all digital input points that monitor electric motor status. Refer also to Section 230919 for other aspects of stand alone functionality.

D. Operating System: Controllers shall include a real-time operating system resident in ROM or EEPROM. This software shall execute independently from any other devices in the system. It shall support all specified functions. It shall provide a command prioritization scheme to allow functional override of control functions. Refer also to Section 230919 for other aspects of the controller's operating system.

E. Network Communications: Each controller shall include software/firmware that supports the networking of CUs on a common communications trunk that forms the respective LAN. Network support shall include the following:

1. Building Controller/Primary LAN shall be a high-speed network designed and optimized for control system communication. If a Primary LAN communications trunk is severed, BCs shall reconfigure into two separate LANs and continue operations without interruption or Operator intervention.
2. Controller communication software shall include error detection, correction, and re-transmission to ensure data integrity.
3. Operator/System communication software shall facilitate communications between other BCs, all subordinate AACs/ASCs, Gateways and LAN Interface Devices or Operator Workstations. Software shall allow point interrogation, adjustment, addition/deletion, and programming while the controller is on line and functioning without disruption to unaffected points. The software architecture shall allow networked controllers to share selected physical and virtual point information throughout the entire system.

F. Diagnostic Software: Controller software shall include diagnostic software that checks memory and communications and reports any malfunctions.

G. Alarm/Messaging Software: Controller software shall support alarm/message processing and buffering software as specified below.

H. Application Programs: CUs shall support and execute application programs specified.

I. Updating/Storing Application Data: Site-specific programming residing in volatile memory shall be uploadable/downloadable from an OWS or CSS using BACnet services connected locally, to the Primary LAN, to the Local Supervisory LAN and remotely via modem and telephone lines as applicable but all must be available. Initiation of an upload or download shall include all of the following methods; Manually, Scheduled, and Automatically upon detection of a loss or change.

J. Power Loss and Restart: System software shall provide for orderly shutdown upon loss of power. Volatile memory shall be retained. Outputs shall go to programmed fail position, which as a default shall be set to their position in unoccupied mode. Equipment restart shall be automatic upon power

restoration and shall include a user definable time delay on each piece of equipment to stagger the restart. Loss of power shall be alarmed at operator interface indicating date and time.

K. Time Synchronization: Operators shall be able to set the time and date in any device on the network that supports time-of-day functionality. The operator shall be able to select to set the time and date for an individual device, devices on a single network, or all devices simultaneously. Automatic time synchronization shall be provided using BACnet services.

L. Anti-dithering. In order to improve the life expectancy of modulating electronic actuators, software shall limit the number of re-positions. This can be accomplished by providing anti-dithering software, a small deadband for fully proportioning actuators, and by ensuring that floating actuators do not receive control pulses of excessively short duration.

2.2 GRAPHICAL USER INTERFACE SOFTWARE

A. A web browser installed on each OWS, POT, and server (see Section 230916) shall serve as the graphical user interface to the EMCS. Communication between the web server GUI and EMCS server shall be encrypted using 128-bit encryption technology within Secure Socket Layers. Communication protocol shall be Hyper-Text Transfer Protocol.

B. The GUI shall provide a comprehensive user interface. Using a collection of web pages, it shall be constructed to “feel” like a single application, and provide a complete and intuitive mouse/menu driven operator interface. It shall be possible to navigate through the system using a web browser to accomplish all features specified in this section.

C. The GUI shall (as a minimum) provide a Navigation Pane for navigation, and a Action Pane for display of animated graphics, schedules, alarms/events, live graphic programs, active graphic setpoint controls, configuration menus for operator access, reports, and reporting actions for events.

D. Login. Upon launching the web browser and selecting the appropriate domain name or IP address, the operator shall be presented with a login page that will require a login name and password. Navigation in the system shall be dependent on the operator’s role privileges, and geographic area of responsibility. See Security Access below.

E. Navigation Pane

1. The Navigation Pane shall comprise a Navigation Tree which defines a geographic hierarchy of the EMCS system. Navigation through the GUI shall be accomplished by clicking on appropriate level of a navigation tree (consisting of expandable and collapsible tree control like Microsoft’s Explorer program), and/or by selecting dynamic links to other system graphics. Both the navigation tree and action pane defined below shall be displayed simultaneously, enabling the operator to select a specific system or equipment, and view the corresponding graphic. The navigation tree shall as a minimum provide the following views:

    a. Geographic View shall display a logical geographic hierarchy of the system including: cities, sites, buildings, building systems, floors, equipment and BACnet objects.
    b. Network View shall display the hierarchy of the actual BACnet IP Intranet network. This can include: Systems, Site, Networks, Routers, Half-Routers, Devices, Equipment and all the BACnet Objects in a device.
    c. Groups View shall display Scheduled Groups and custom reports.
    d. Configuration View shall display all the configuration categories (Operators, Schedule, Event, Reporting and Roles).

2. Alternative interface structures will also be accepted if they provide similar ease of navigation through the system hierarchy.

F. Action Pane. The Action Pane shall provide several functional views for each HVAC or mechanical/electrical subsystem specified. A functional view shall be accessed by clicking on the corresponding button:

1. Graphics: Using animated gifs or other graphical format suitable for display in a web browser, graphics shall include aerial building/campus views, color building floor-plans, equipment drawings, active graphic setpoint controls, web content, and other valid HTML elements. The data on each graphic page shall automatically refresh as frequently as 6 updates per minute.
2. Properties: Shall include graphic controls and text for the following: Locking or overriding BACnet objects, demand strategies, and any other valid data required for setup. Changes made to the properties pages shall require the operator to depress a 'accept/cancel' button.
3. Schedules: Shall be used to create, modify/edit and view schedules based on the systems geographical hierarchy and in compliance with paragraph 2.2H.
4. Events: Shall be used to view alarm event information geographically (using the navigation tree), acknowledge events, sort events by category, actions and verify reporting actions.
5. Trends: Shall be used to display associated trend and historical data, modify colors, date range, axis and scaling.
6. Logic - Live Graphic Programs: Shall be used to display a 'live' graphic programs of the control algorithm for the mechanical/electrical system selected in the navigation tree.

G. Graphics:

1. The GUI shall make extensive use of color in the graphic pane to communicate information related to setpoints and comfort. Animated graphics and active setpoint graphic controls shall be used to enhance usability.
2. Graphics tools used to create Web Browser graphics shall be non-proprietary and provided and installed on each OWS.
3. Graphical display shall be 1280 x 1024 pixels or denser, 256 color minimum.
4. Links:

    a. Graphics shall include hyperlinks which when selected (i.e. clicked on with mouse) launch applications, initiate other graphics etc.
    b. Screen Penetration: Links shall be provided to allow user to navigate graphics logically without having to navigate back to the home graphic. See additional discussion in Paragraph 3.5.
    c. Informational Links:

        1) On each MEP system and subsystem graphic, provide links to display in a new window the information listed below.

            a) English-language control sequence associated with the system. See Section 230929.
            b) O&M and submittal information for the devices on the graphic. See Section 230900 and Section 230010.

        2) The display shall identify the target of the link by file name/address.
        3) Information shall be displayed in electronic format that is text searchable.
        4) Window shall include software tools so that text, model numbers, or point names may be found. Source documents shall be read-only (not be editable) with this software, however.

5. Point Override Feature:

a. Every real output or virtual point displayed on a graphic shall be capable of being overridden by the user (subject to security level access) by mouse point-and-click from the graphic without having to open another program or view.
b. When the point is selected to be commanded:

1) Dialog box opens to allow user to override the point (place in “operator mode”) or release the point (“automatic mode”). Operator mode will override automatic control of the point from normal control programs.
2) Dialog box shall have buttons (for digital points) or a text box and/or slide bar (for analog points) to allow user to set the point’s value when in operator mode. These are grayed out when in automatic mode.
3) When dialog box is closed, mode and value are sent to controller.
4) Graphic is updated upon next upload scan of the actual point value.

c. A list of points that are currently in an operator mode shall be available through menu selection.

6. Point override status (if a digital point is overridden by the supervised manual override per Section 230919 or if a point is in operator mode per 2.2G.5) shall be clearly displayed for each point, e.g. by changing color or flag.
7. The color of symbols representing equipment shall change color or become animated based on status of binary point to graphically represent on/off status.
8. On floor plan displays of spaces, temperature shall be graphically displayed by coloring the zone area in accordance with or similar to the following:

a. Red: space temperature above cooling setpoint by 2°F (adj.) or more. This condition can be programmed to generate an alarm.
b. Yellow: space temperature between cooling setpoint and 2°F (adj.) above setpoint.
c. Green: space temperature between cooling and heating setpoints and space is in occupied mode.
d. Gray: space temperature between cooling and heating setpoints and space is in unoccupied mode.
e. Light blue: space temperature between heating setpoint and 2°F (adj.) below setpoint.
f. Dark blue: space temperature below heating setpoint by 2°F (adj.) or more. This condition can be programmed to generate an alarm.

9. On floor plan displays of spaces, lighting shall be graphically displayed by coloring the lighting zone area in accordance with or similar to the following:

a. Yellow: lights on by timed override.
b. Red: lights on by manual override in lighting panel.
c. Green: lights on by schedule.
d. Gray: lights off.

10. Floor plans shall include final room names and room numbers as confirmed by the Owner. Room names and room numbers included in Construction Documents are not necessarily the final room names and room numbers. Division 23C Contractor shall be responsible for obtaining and confirming the final room names and room numbers from Owner. Changes to floor plan graphics resulting from wrong room names and room numbers shall be made at no additional charge to the Owner.

H. Graphics Development Package:

1. Graphic development and generation software shall be provided to allow the user to add, modify, or delete system graphic displays.

2. Provide capability to store graphic symbols in a symbol directory and incorporate these symbols into graphics.
3. Provide libraries of pre-engineered screens and symbols depicting standard air handling unit components (e.g. fans, cooling coils, filters, dampers, etc.), mechanical system components (e.g., pumps, chillers, cooling towers, boilers, etc.), complete mechanical subsystems (e.g. VAV reheat zone, etc.) and electrical symbols.
4. The Graphic Development Package shall use a mouse or similar pointing device to allow the user to perform the following:

    a. Define symbols.
    b. Position items on graphic screens.
    c. Attach physical or virtual points to a graphic.
    d. Define background screens.
    e. Define connecting lines and curves.
    f. Locate, orient and size descriptive text.
    g. Define and display colors for all elements.
    h. Establish correlation between symbols or text and associated system points or other displays.
    i. Create hot spots or link triggers to other graphic displays or other functions in the software.

5. A single graphic file shall be used for common control applications (e.g. VAV box) so that any updates to the graphic may be done once and automatically applied to all applications. Displayed points shall be automatically populated based on “wild card” entry of point name in graphic definition.

I. Time and Schedules:

1. Provide a time master that is installed and configured to synchronize the clocks of all BACnet devices supporting time synchronization. Synchronization shall be done using Coordinated Universal Time. All trend sample times shall be able to be synchronized. The frequency of time synchronization message transmission shall be selectable by the operator.
2. System shall automatically change time/date for Daylight Savings Time and leap years.
3. An operator (with password access) shall be able to define a Normal, Holiday or Override schedule for an individual piece of equipment or room, or choose to apply a hierarchical schedule to the entire system, site or floor “isolation” area. For example, Independence Day ‘Holiday’ for every level in the system would be created by clicking at the top of the geographic hierarchy defined in the Navigation Tree. No further operator intervention would be required and every control module in the system with would be automatically downloaded with the ‘Independence Day’ Holiday.
4. All schedules that affect the system/area/equipment highlighted in the Navigation Tree shall be shown in a summary schedule table and graph.
5. Schedules shall comply with the BACnet standard, (Schedule Object, Calendar Object, Weekly Schedule property and Exception Schedule property) and shall allow events to be scheduled based on:

    a. Types of schedule shall be Normal, Holiday or Override.
    b. A specific date.
    c. A range of dates.
    d. Any combination of Month of Year (1-12, any), Week of Month (1-5, last, any), Day of Week (M-Sun, Any).
    e. Wildcard (example, allow combinations like second Tuesday of every month).

6. Schedule Categories: The system shall allow operators to define and edit scheduling categories (different types of “things” to be scheduled; for example, lighting, HVAC

occupancy, etc.). The categories shall include: name, description, icon (to display in the hierarchy tree when icon option is selected) and type of value to be scheduled.

7. Schedule Groups: In addition to hierarchical scheduling, operators shall be able to define functional Schedule Groups, comprised of an arbitrary group of areas/rooms/equipment scattered throughout the facility and site. For example, the operator shall be able to define an 'individual tenant' group – who may occupy different areas within a building or buildings. Schedules applied to the 'tenant group' shall automatically be downloaded to control modules affecting spaces occupied by the 'tenant group'.
8. Partial Day Exceptions: Schedule events shall be able to accommodate a time range specified by the operator (example: board meeting from 6 pm to 9 pm overrides Normal schedule for conference room).
9. Schedule Summary Graph: The schedule summary graph shall clearly show Normal versus Holiday versus Override Schedules, and the net operating schedule that results from all contributing schedules. Note: In case of priority conflict between schedules at the different geographic hierarchy, the schedule for the more detailed geographic level shall apply.
10. Schedule Distribution: For reliability and performance, instead of maintaining a single schedule in a field device that writes over the network to notify other devices when a scheduled event occurs, field devices will only keep their part of the schedule locally. The EMCS server software shall determine which nodes a hierarchical schedule applies to and will create/modify the necessary schedule objects in each field device as necessary.

J. Events and Alarms:

1. Events and alarms associated with a specific system, area, or equipment selected in the Navigation Tree, shall be displayed in the Action Pane by selecting an 'Events' view.
2. Events View: Each event shall display an Event Category (using a different icon for each event category), date/time of occurrence, current status, and event report. An operator shall be able to sort events, edit event templates and categories, acknowledge or force a return to normal in the Events View as specified in this section.
3. Event Categories (Alarm Levels): The operator shall be able to create, edit or delete event categories (alarm level). An icon shall be associated with each Event category, enabling the operator to easily sort through multiple events displayed. Alarm levels shall be initially configured by the Contractor as follows:

    a. Level 1: Critical/life safety.
    b. Level 2: Significant equipment failure.
    c. Level 3: Non-critical equipment failure/operation.
    d. Level 4: Energy conservation monitor.
    e. Level 5: Maintenance indication, notification.

4. BACnet Event Templates: BACnet Event template shall define different types of alarms and their associated properties. As a minimum, properties shall include a reference name, verbose description, severity of event, acknowledgement requirements, high/low limit and out of range information.
5. Event Areas (Actions): Each Event Categories (Alarm Level) shall be configured to specific Event Reporting Actions. For example, it shall be possible for an operator to assign all HVAC Maintenance events on the 1st floor of a building to email the technician responsible for maintenance. The Navigation Tree shall be used to setup Event Areas in the Graphic Pane. For initial setup, contractor shall configure events as follows:

    a. Levels 1 and 2: Print to alarm printer and call/text two engineers.
    b. Level 3: Print to alarm printer and email engineer responsible for building/system.
    c. Levels 4 and 5: Email engineer responsible for building/system

6. Event Reporting Actions: Event Reporting Actions specified shall be automatically launched (under certain conditions) after an event is received by the EMCS server software. Operators shall be able to define these Reporting Actions using the Navigation Tree and Graphic Pane through the GUI. Reporting Actions shall be as follows:

    a. GUI dialog box: Provide visual and optional audible alarm indication. The alarm dialog box shall always become the top dialog box upon receipt of an alarm irrespective of the foreground application.
    b. Print: Alarm/Event information shall be printed to the any network accessible printer.
    c. Email: Alarm/Event information shall be via email to a POP3 address on the Owner's intranet or through this intranet to the internet.
    d. Call/Text: Alarm/Event information shall be sent via alphanumeric call/text via email to internet alphanumeric call/text services.
    e. File Write: The ASCII File write reporting action shall enable the operator to append operator defined alarm information to any alarm through a text file. The alarm information that is written to the file shall be completely definable by the operator. The operator may enter text or attach other data point information (such as AHU discharge temperature and fan condition upon a high room temperature alarm).
    f. Write Property: The write property reporting action updates a property value in a hardware module.
    g. Run External Program: The Run External Program reporting action launches specified program in response to an event.

7. Event Time/Date Stamp: All events shall be generated at the DDC control module level and comprise the Time/Date Stamp using the standalone control module time and date.
8. Event Configuration: Operators shall be able to define the type of events generated per BACnet object. A 'network' view of the Navigation Tree shall expose all BACnet objects and their respective Event Configuration. Configuration shall include assignment of event, alarm, type of Acknowledgement and notification for return to normal or fault status.
9. Event Summary Counter: The view of events in the Graphic Pane shall provide a numeric counter, indicating how many events are active (in alarm), require acknowledgement, and total number of events in the EMCS Server database.
10. Event Auto-Deletion: Events that are acknowledged and closed, shall be auto-deleted from the database and archived to a text file after an operator defined period. The file shall be stored in file on the CSS with no limit to quantity or age of alarms, other than limitations of hard disk. The file can be archived to tape and deleted by operator to clear disk space.
11. Data Format. The system shall allow for external systems to access the event instance data. Event data shall be stored and queried in the database in a relational manner. At a minimum, the fields to be stored in the database are:

    a. Event Source.
    b. Event Generation Tie.
    c. Acknowledge Required Flag.
    d. Delivery Priority.
    e. BACnet Event Type.
    f. Event Message Text.
    g. BACnet Event Parameter.
    h. Classification of Event.
    i. Event Acknowledgement Time.
    j. Return to Normal Time.
    k. Operator Comments.
    l. Who Acknowledged the Event.

12. Event Simulator: The GUI user shall provide an Event Simulator to test assigned Reporting Actions. The operator shall have the option of using current time or scheduling a specific time

to generate the Event. Utilizing the Navigation Tree and drop-down menus in the Graphic Pane, the operator shall be able to select the Event Type, Status, Notification, Priority, Message, and whether acknowledgement is required.

K. Trends:

1. Trending and trend analysis capabilities are considered critical to system performance. The system shall be designed to upload and record large amounts of point data without causing network bottlenecks or affecting proper system operation. A separate server (Historical Trend Server) shall be provided (see Section 230916) in order to reduce network traffic to and disk activity on the CSS. The system as a whole shall be designed to comply with the trending capability test defined in Section 230933.
2. Every point, both real and virtual, shall be available for data trending.
3. Trending software shall be capable of recording point values and time on a user specified regular time step and on a change-of-value (COV) basis (data is recorded when point changes by a specified amount for analog points or by changes of state for binary points), at the user's option. Sampling intervals shall be as small as one second. Each trended point shall have the ability to be trended at a different sampling interval.
4. Trend data shall be sampled and stored in control panel memory (see Section 230919). If historical trending is enabled for the BACnet object, trend data shall be uploaded from control panels to the THS on a user-defined interval, manual command, or automatically when the trend buffer becomes full.. There shall be no limit to the amount of trend data stored at the THS other than hard disk limitations.
5. Trends shall conform to the BACnet Trend Log Object specification. Trends shall both be displayed and user configurable through the GUI. Trend logs may comprise analog, digital or calculated points simultaneously. A trend log's properties shall be editable using the Navigation Tree and Graphic Pane.
6. Viewing Trends:

    a. Trend data shall be displayed graphically by the GUI. This shall be a capability internal to the workstation software and not a capability resulting from download of trend data on a third-party spreadsheet program unless such transfer is automatic and transparent to the operation and the third-party software is included with the workstation software package.
    b. The software shall be capable of dynamically graphing the trend logged object data by creating two-axis (x, y) graphs that simultaneously display values relative to time for at least eight objects in different colors, even if objects have been trended at different time intervals. Where trended values are COV, software shall automatically fill the trend samples between COV entries. A graph legend shall identify each variable plotted.
    c. Multiple scales shall be possible, one for each object, with range set automatically by the software but capable of being manually adjusted by the operator.
    d. Trend format, displayed points, etc. shall be capable of being saved as a template for future trend displays.
    e. Trends shall be able to dynamically update at operator-defined intervals, including on a 1 second interval for loop tuning.
    f. It shall be possible to zoom-in on a particular section of a trend for more detailed examination and 'pan through' historical data by simply scrolling the mouse.
    g. It shall be possible to pick (or float mouse over) any sample on a trend and have the numerical value displayed.
    h. The operator shall have the ability to pan through a historical trend and copy the data viewed to the clipboard using standard Windows keystrokes.

7. Trend Data Storage

a. The database shall allow applications to access the data while the database is running. The database shall not require shutting down in order to provide read-write access to the data. Data shall be able to be read from the database without interrupting the continuous storage of trend data being carried by the EMCS.
b. Provide a single licensed copy of Microsoft SQL Server and install on the OWS.
c. Data shall be accessible to off-site SQL compliant database software through the Owner's intranet and/or internet.

L. Security Access:

1. Security access from the GUI to EMCS servers shall require a Login Name and Password.
2. Access to different areas of the EMCS shall be defined in terms of roles and geographic area of responsibility as specified.
3. Roles shall reflect the actual roles of different types of operators. Roles shall be defined in terms of View, Edit and Function Privileges.

    a. View Privileges: Navigation, Network, and Configuration Trees, Operators, Roles and Privileges, Alarm/Event Template and Reporting Action.
    b. Edit Privileges: Setpoint, Tuning and Logic, Manual Override, and Point Assignment Parameters.
    c. Function Privileges: Alarm/Event Acknowledgement, Control Module Configuration, Memory Download, and Upload, Schedules, Schedule Groups, Manual Commands, Print, and Alarm/Event Maintenance.

4. Roles shall be geographically assigned using a similar expandable/collapsible navigation tree. For example, it shall be possible to assign two HVAC Technicians with similar competencies (and the same operator defined HVAC Role) to different areas of the system.
5. Each operator shall automatically be logged off of the system if no keyboard or mouse activity is detected for an adjustable period of time. This auto logoff time shall be set individually per operator.
6. Provide an audit trail of actions taken by any user, including the user name and time. Store in secure file in database format on the CSS. Provide software to view and print audit trail.

M. Report Software:

1. Provide software to create standard and custom reports of point status, alarms, etc. Report format, displayed points, time period (daily, weekly, monthly, or annual), etc. shall be capable of being saved as a template for future reports. Reports shall be time and date stamped and shall contain a report title editable by the user.
2. Reports shall be capable of being sent to a printer or export to Word or ASCII format to a file, and shall be capable of being generated automatically based on date and time of day.
3. Standard reports. Prepare the following standard reports for each building and the Owner as a whole, accessible automatically without requiring definition by user:

    a. Tenant after-hour usage. System must be capable of monitoring tenant override requests and generating a monthly report showing the daily total time in hours that each tenant has requested after-hours HVAC services.
    b. Monthly and annual energy usage and cost. See Utility cost calculation in Section 230929.
    c. Alarm events and status.
    d. Points in "hand" (operator override) via Workstation command (including name of operator who made the command) or via supervised HOA switch at output, including date and time.
    e. Position reset: Where zones or system valve or damper positions are used to reset supply air/water temperature or differential pressure setpoints:

1) EMCS shall record the following on an hourly basis: the descriptors of the zones/systems that have dampers/valves at the highest cooling/heating position, i.e. the control point that is being used in the reset loop. The information shall be accumulated in a report format for periodic printing upon operator command.
2) Configure a tabular report using real-time or trend data with the following column headings: ZONE [SYSTEM] DESCRIPTION, VALVE [DAMPER] POSITION (0 to 100%), LOOP OUTPUT %, [CHWST, CHWDP, SAT, etc.] SETPOINT. At the top of the table, list building number, floor or area description if applicable, air handling unit or HW/CHW pump system designation.

2.3 CONTROL PROGRAMMING SOFTWARE

A. Points:

1. Provide templates customized for point type, to support input of individual point information using standard BACnet Objects, including long-name field.
2. All real and virtual points shall be accessible to any control panel for use in any control sequences regardless of physical location.

B. Programming Language:

1. All controllers must be fully user-programmable using a single programming language for all control devices. Use of “canned” (preprogrammed, burned-in) software is not acceptable.
2. The control programming language must allow virtually any control sequences to be written. Software shall be capable of the sequences specified in Section 230929 without exception.
3. All custom programs shall be modifiable from Operator Workstations without having to “burn chips”. Software shall allow the user to modify and input control sequence software and to download to panels via the control network.
4. The programming language shall support floating point arithmetic using the following operators and functions: +, -, /, x, square root, and x-to-the-y-power, natural log, log, trigonometric functions (sine, cosine, etc.), absolute value, minimum/maximum value from a list of values, and psychrometric parameters (wetbulb, dewpoint, and enthalpy) from temperature and relative humidity.
5. The programming language shall have predefined variables that represent time of day, day of the week, month of the year, and the date. Other predefined variables shall provide elapsed time in seconds, minutes, hours, and days. These elapsed time variables shall be able to be reset by the language so that interval timing functions can stopped and started within a program.
6. The system must be capable of supporting software (“virtual”) points to be used in control sequences and monitored just as if they were real digital or analog points.
7. Control programming shall employ the BACnet protocols for Standard Command Priorities.
8. A PID (proportional-integral-derivative) algorithm with adjustable gains and anti-windup shall be included as an integral part (subroutine) of the programming language, not requiring special programming or hardware.
9. The programming language shall be graphical. BASIC-like or other line- or block-type programming languages are not acceptable. With the graphical programming language, a sequence of operations shall be created by drag-and-drop assembling on screen of graphic blocks that represent each of the commands or functions necessary to complete a control sequence. Blocks represent common logical control devices such as relays, switches, high signal selectors, PID loops, optimum start, etc. Blocks are then interconnected on screen using graphic "wires," each forming a logical connection. Once assembled, each logical grouping of graphic blocks and their interconnecting wires then forms a graphic function block which may be used to control any piece of equipment with a similar point configuration and sequence of operation.

10. The graphic programming software shall support a 'live' mode, where all input/output data, calculated data, and setpoints shall be displayed in a 'live' real-time mode. For each piece of HVAC equipment, the entire graphic program shall be displayed through the GUI. The operator must have the ability to scroll through the entire 'live' graphic program as necessary.

C. Debugging Software:

1. Provide a search capability that will search all control sequences for a given point name to determine all sequences that use or control the point.
2. The control programs shall be capable of being tested on-line or off-line (prior to installation in field panels). The program and results of programming tests shall be displayed graphically using graphical programming language with parameter values displayed in appropriate locations. Simulation capabilities shall include step-by-step, accelerated time, and operator defined simulation criteria like outside weather, demand, and communication status.

2.4 MISCELLANEOUS SOFTWARE

A. Provide a context-sensitive, on-line help system to assist the operator in operating and editing the system. On-line help shall be available for all applications and shall provide relevant data for the application or object that help is being called from.

B. Provide software for viewing (but not editing) electronic versions of as-built shop drawings of:

1. Mechanical, electrical, and plumbing systems in AutoCAD Release 14 or 2000+ format.
2. EMCS drawings in format selected by contractor (see limitations in Section 230900).

PART 3 - EXECUTION

3.1 SYSTEM CONFIGURATION

A. Contractor shall thoroughly and completely configure EMCS system software, supplemental software, network software etc. on CSS, POTs, and servers.

3.2 POINT STRUCTURING AND NAMING

A. The intent of this section is to require a consistent means of naming points across the Campus EMCS. Contractor shall configure the systems from the perspective of the Campus EMCS, not solely the local project. The following requirement establishes a standard for naming points and addressing Buildings, Networks, Devices, Instances, etc.

B. Point Summary Table:

1. The term 'Point' includes all physical I/O points, virtual points, and all application program parameters.
2. With each schematic, Contractor shall provide a Point Summary Table listing:

a. Building number and abbreviation.
b. System type.
c. Equipment type.
d. Point suffix.
e. Full point name (see Point Naming Convention paragraph).

f. Point description.
g. Ethernet backbone network number.
h. Network number.
i. Device ID.
j. Device MAC address.
k. Object ID (object type, instance number).
l. Engineering units.
m. Device make and model #. Include range of device if model number does not so indentify.
n. Device physical location description. Include floor and column line intersection to one decimal place (e.g. line 6.2 and line A.3)

3. Point Summary Table shall be provided in both hard copy and in a relational database electronic format (ODBC-compliant).
4. The EMCS Contractor shall coordinate with the Owner's representative and compile and submit a proposed Point Summary Table for review prior to any object programming or project startup.
5. The Point Summary Table shall be kept current throughout the duration of the project by the Contractor as the Master List of all points for the project. Project closeout documents shall include an up-to-date accurate Point Summary Table. The Contractor shall deliver to the Owner the final Point Summary Table prior to final acceptance of the system. The Point Summary Table shall be used as a reference and guide during the commissioning process.

C. Point Naming Convention:

1. All point names shall adhere to the format as established below, unless otherwise agreed to by the Owner. New categories and descriptors may be created with approval of the Owner.
2. Format:

a. Building.Category.System.EquipmentTag.Component.Property.
b. Example: 001LIB.HVAC.Heatplant.B-1.HWS.Temperature.

Building	Category	System	Equipment Tag	Component	Property	Typical units
Building number	ELCT	Lighting Plug Generator MIsc	(from equipment schedules)	SWITCH PHOTO CB	Command Status Light Power	On/off On/off Footcandles Watts
	HVAC	Air handling Exhaust Heatplant Coolplant Misc		CWS CWR HWS HWR CHWS	Voltage Current ValvePos DamperPos Temperature	Volts Amps %open %open °F
	PLMB	Dom water Air Nat gas N2 O2 Irrigation Waste Misc		CHWR OA SA RA EA GAS FLUID	Humidity Pressure Flow Energy Speed Signal	%RH Psig, " H_2O Cfm, gpm Btu %, Hz Hz
	MISC	Weather				

D. Device Addressing Convention:

1. BACnet network numbers and Device Object IDs shall be unique throughout the network.
2. All assignment of network numbers and Device Object IDs shall be coordinated with the Owner.
3. Each Network number shall be unique throughout all facilities and shall be assigned in the following manner unless specified otherwise:

   BBBFF, where: BBB = 1-655 assigned to each building, FF = 00 for building backbone network, 1-35 indicating floors or separate systems in the building.

4. Each Device Object Identifier property shall be unique throughout the system and shall be assigned in the following manner unless specified otherwise:

   XXFFBBB, where: XX = number 0 to 40, FF = 00 for building backbone network, 1-35 indicating floors or separate systems in the building. BBB = 1-655 assigned to each building.

5. The EMCS Contractor shall coordinate with the Owner or a designated representative to ensure that no duplicate Device Object IDs occur.
6. Alternative Device ID schemes or cross project Device ID duplication if allowed shall be approved before project commencement by the Owner.

E. I/O Point Physical Description:

1. Each point associated with a hardware device shall have its BACnet long-name point description field filled out with:

   a. The device manufacturer and model #. Include range of device if model number does not so identify.
   b. For space sensors (temperature, CO_2, etc.), include room number in which sensor is located.

3.3 POINT PARAMETERS

A. Provide the following minimum programming for each analog input:

1. Name.
2. Address.
3. Scanning frequency or COV threshold.
4. Engineering units.
5. Offset calibration and scaling factor for engineering units.
6. High and low alarm values and alarm differentials for return to normal condition
7. High and low value reporting limits (reasonableness values), which shall prevent control logic from using shorted or open circuit values.
8. Default value to be used when the actual measured value is not reporting. This is required only for points that are transferred across the primary and/or secondary controlling networks and used in control programs residing in control units other than the one in which the point resides. Events causing the default value to be used shall include failure of the control unit in which the point resides, or failure of any network over which the point value is transferred.
9. Selectable averaging function that shall average the measured value over a user selected number of scans for reporting.

B. Provide the following minimum programming for each analog output:

1. Name.
2. Address.

3. Output updating frequency.
4. Engineering units.
5. Offset calibration and scaling factor for engineering units.
6. Output range.
7. Default value to be used when the normal controlling value is not reporting.

C. Provide the following minimum programming for each digital input:

1. Name.
2. Address.
3. Engineering units (on/off, open/closed, freeze/normal, etc.)
4. Debounce time delay.
5. Message and alarm reporting as specified.
6. Reporting of each change of state, and memory storage of the time of the last change of state.
7. Totalization of on-time (for all motorized equipment status points), and accumulated number of off-to-on transitions.

D. Provide the following minimum programming for each digital input:

1. Name.
2. Address.
3. Output updated frequency.
4. Engineering units (on/off, open/closed, freeze/normal, etc.)
5. Direct or Reverse action selection.
6. Minimum on-time.
7. Minimum off-time.
8. Status association with a DI and failure alarming (as applicable).
9. Reporting of each change of state and memory storage of the time of the last change of state.
10. Totalization of on-time (for all motorized equipment status points), and accumulated number of off-to-on transitions.
11. Default value to be used when the normal controlling value is not reporting.

3.4 SITE-SPECIFIC APPLICATION PROGRAMMING

A. All site specific application programming shall be written in a manner that will ensure programming quality and uniformity among the various buildings. The EMCS Contractor will ensure:

1. Programs for all buildings are developed by one programmer, or a small group of programmers with rigid programming standards, to ensure a uniform style.
2. Programs for like functions are identical, to reduce debugging time and to ease maintainability.
3. Programs are thoroughly debugged before they are installed in the field.

B. Massage and tune application programming for a fully functioning system. It is the Contractor's responsibility to request clarification on sequences of operation that require such clarification.

C. All site-specific programming shall be fully documented and submitted for review and approval:

1. Prior to downloading into the panel (see Submittal Package 2 in Section 230900.)
2. At the completion of functional performance testing, and.
3. At the end of the warranty period (see Warranty Maintenance in Section 230900).

D. All programming, graphics and data files must be maintained in a logical system of directories with self-explanatory file names. All files developed for the project will be the property of the Owner and shall remain on the workstations/servers at the completion of the project.

3.5 GRAPHIC SCREENS

A. All site specific graphics shall be developed in a manner that will ensure programming quality and uniformity among the various buildings.

B. Schematics of MEP systems.

1. Schematics shall be 3-D and shall be based substantially on the schematics provided on design drawings.
2. All relevant I/O points and setpoints being controlled or monitored for each piece of equipment shall be displayed with the appropriate engineering units. Animation or color changes shall be used to indicate on/off status of mechanical components. Include appropriate engineering units for each displayed point value. Verbose names (English language descriptors) shall be included for each point on all graphics; this may be accomplished by the use of a pop-up window accessed by selecting the displayed point with the mouse.
3. Animation or equipment graphic color changes shall be used to indicate on/off status of mechanical components.
4. Indicate all adjustable setpoints and setpoint high and low limits (for automatically reset setpoints), on the applicable system schematic graphic or, if space does not allow, on a supplemental linked-setpoint screen.

C. Displays shall show all points relevant to the operation of the system, including setpoints and setpoint limits for setpoints that are automatically reset.

D. The current value and point name of every I/O point and setpoint shall be shown on at least one graphic and in its appropriate physical location relative to building and mechanical systems.

E. Show weather conditions (local building outside air temperature ands humidity, wind speed, and wind direction) in the upper left hand corner of every graphic.

F. CAD Files: The contract document drawings will be made available to the Contractor in AutoCAD 2010+ format upon request for use in developing backgrounds for specified graphic screens, such as floor plans and schematics. However the Owner does not guarantee the suitability of these drawings for the Contractor’s purpose.

G. Provide graphics for the following as a minimum:

1. Homepage (Campus, District or Facility Homepage). Background shall be a campus map, approximately to scale. Include links to each building, central plant, domestic water pumping station, etc. Include real-time site utility data such as: building electrical demand, domestic cold water flow, and natural gas demand shown roughly on the map where the utilities connect to the site. Also include kW demand limit values and demand limit level.
2. Building homepage. Background shall be a bldg footprint, approximately to scale, oriented as in the campus homepage. Include links to each floor and mechanical room/roof, and to summary graphics described below. Include real-time building utility data such as: building electrical demand, chilled water demand (flow and Btu/h), hot water demand (flow and Btu/h), domestic cold water demand, steam demand (if applicable), and natural gas demand (if applicable) shown roughly on the building footprint where the utilities connect to the building.
3. Each occupied floor plan, to scale.

a. HVAC. Floor plan graphics shall show heating and cooling zones throughout the buildings in a range of colors, which provide a visual display of temperature relative to their respective setpoints (see paragraph 2.2G.8). The colors shall be updated dynamically as a zone's actual comfort condition changes. In each zone, provide links to associated terminal equipment.
b. Lighting. Floor plan graphics shall show lighting control zones throughout the buildings in a range of colors, which provide a visual display of temperature relative to their respective setpoints (see paragraph 2.2G.9). The colors shall be updated dynamically as a zone's actual lighting condition changes. In each zone, provide links to associated lighting panel screen to allow manual overrides.
c. If multiple floor plans are necessary to show all areas, provide a graphic building key plan. Use elevation views and/or plan views as necessary to graphically indicate the location of all of the larger scale floor plans. Link graphic building key plan to larger scale partial floor plans. Provide links from each larger scale graphic floor plan screen to the building key plan and to each of the other graphic floor plan screens.

4. Each equipment floor/roof plan, to scale, with links to graphics of all DDC controlled/monitored equipment.
5. Each air handler and fan-coil. Provide link to associated HW and CHW pumping stations where applicable.
6. Each zone terminal. Provide link to associated air handling unit where applicable and to floor plan where terminal is located.
7. Each building pumping station. Provide link to central plant for heating and cooling systems.
8. Plumbing, potable water pumping and domestic water heating system.
9. Potable water, irrigation and natural gas meter.
10. Lighting panels. Indicate status of each relay and provide links to allow override.
11. Electrical power monitoring system.

    a. Site: Show site single line diagram up to each building ATS, in order to illustrate the 12 KV power distribution and connection of each building to one of the two site circuits. The power flow would change on the diagram (by changing line color and/or width) to show which power line is active into each building as the ATS position is changed. Show ATS status at each building and a link to each building’s electrical system graphic.
    b. For each building: Show a schematic of the electrical system based on one-line diagrams. Show status and power of each switch, breaker, meter, etc. and override buttons for overriding switch positions.

12. Central plant equipment including chilled water system, cooling tower system, hot water system, steam system, generators, etc. The flow path shall change on the diagram (by changing piping line color and/or width) to show which piping has active flow into each boiler, chiller, tower, etc. as valve positions change.
13. Weather station. Show actual, daily, month-to-date, year-to-date, and historical high and low peaks and average temperature, humidity, wind speed, wind direction (average only), and solar radiation.
14. Summary graphics. Provide a single text-based page (or as few as possible) for each of the following summary screens showing key variables listed in columns for all listed equipment:

    a. For each building:

        1) Air handling units: operating mode, on/off status, supply air temperature, supply air temperature setpoint, fan speed, duct static pressure, duct static pressure setpoint, outdoor air damper position, coil valve positions
        2) Zone terminal units: operating mode, airflow rate, zone temperature, zone temperature setpoint, damper position, supply air temperature (reheat boxes),

supply air temperature setpoint (reheat boxes), fan status (fan-powered boxes), fume hood status and exhaust airflow rate (laboratory).

3) Electrical meters and switches: Volts, current, kW, switch positions.

15. All other DDC controlled/monitored equipment.

H. Alarms: Each programmed alarm shall appear on at least one graphic screen. In general, alarms shall be displayed on the graphic system schematic screen for the system that the alarm is associated with (for example, chiller alarm shall be shown on graphic cooling system schematic screen). For all graphic screens, display analog values that are in a 'high alarm' condition in a red color, 'low alarm' condition in a blue color. Indicate digital values that are in alarm condition in a red color.

3.6 POT SOFTWARE

A. Direct Panel Access:

1. One of the POTs shall be configured to access BCs and AACs by directly connecting to these panels without having to connect to the CSS via the network. The purpose of this requirement is to provide access to building EMCS panels in case the Supervisory LAN is down.
2. At the end of commissioning and then again at the end of the warranty period, fully synchronize the database on this POT with that on the CSS.

B. Temporary Interface prior to Acceptance:

1. Point database and control programming shall not be installed on and merged with that on the CSS until the system is fully commissioned and accepted by the Owner. During this phase, the Contractor shall provide a temporary POT configured with proper software for this purpose, connected to the EMCS locally at the building.
2. Once the EMCS has been accepted by the Owner, merge the database and control programming with existing systems on the CSS.

C. TAB Coordination:

1. Software shall be provided free of charge on at least a temporary basis to the TAB contractor to allow them to calibrate terminal box airflow controls and other work specified under Section 230593 Testing, Adjusting, and Balancing..
2. Software may be provided for installation on POT provided by TAB contractor or Contractor shall loan a POT or hand held device with software installed to the TAB contractor for the duration of TAB work.
3. Provide sufficient training to the TAB contractor to allow them to use the software for balancing and airflow calibration purposes. Contractor shall include a single training session; additional training due to changes in TAB personnel shall be paid for by the TAB contractor.

END OF SECTION 23 09 26

SECTION 23 09 29

EMCS POINTS AND SEQUENCE OF OPERATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 WORK INCLUDED

A. Provide and install the following:

1. Real I/O points connected to the EMCS.
2. Sequence of operation of all controlled systems.

B. Refer to Section 230900 for general requirements.

1.3 RELATED WORK AND REQUIREMENTS

A. Other EMCS Sections:

1. Section 230900 Energy Management and Control System (EMCS) - General
2. Section 230913 EMCS Basic Materials and Devices
3. Section 230916 EMCS Operator Interfaces
4. Section 230919 EMCS Field Panels
5. Section 230923 EMCS Communication Devices
6. Section 230926 EMCS Software and Programming
7. Section 230933 EMCS Commissioning

PART 2 - PRODUCTS

2.1 CONTROL POINTS

A. See Construction Drawings.

PART 3 - EXECUTION

3.1 SEQUENCE OF OPERATION – GENERAL

A. See Construction Drawings.

END OF SECTION 23 09 29

SECTION 23 09 33

EMCS COMMISSIONING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 WORK INCLUDED

A. Provide the following:

1. EMCS and equipment testing and start-up.
2. Validation of proper and thorough installation of EMCS and equipment.
3. Functional testing of control systems.
4. Demonstration testing of control systems.
5. Documentation of tests, procedures, and installations.
6. Coordination of EMCS training.
7. Documentation of EMCS Operation and Maintenance materials.

B. Refer to Section 230900 for general requirements.

1.3 RELATED WORK AND REQUIREMENTS

A. Other EMCS Sections:

1. Section 230900 Energy Management and Control System (EMCS) - General
2. Section 230913 EMCS Basic Materials and Devices
3. Section 230916 EMCS Operator Interfaces
4. Section 230919 EMCS Field Panels
5. Section 230923 EMCS Communication Devices
6. Section 230926 EMCS Software and Programming
7. Section 230939 EMCS Points and Sequence of Operation

1.4 COORDINATION

A. Assist Architect (or Commissioning Coordinator), including attending commissioning meetings.

B. Testing, Adjusting, and Balancing:

1. Coordinate with TAB contractors in test and balance work as specified in Section 230593 Testing, Adjusting, and Balancing. A significant number of balancing procedures require the EMCS to be operational and require Contractor time to assist the TAB contractor in their

work.

2. Terminal unit calibration:

    a. Provide software and/or portable devices for terminal unit calibration per Section 230926.
    b. Connections shall be provided local to the device being calibrated. For instance, for VAV boxes, connection of the operator's terminal shall be either at the sensor or at the terminal box.

C. Coordinate with Division 23 and 26 contractors in the performance of pre-functional, functional, and post-occupancy commissioning activities.

1.5 SEQUENCING

A. The following list outlines the general sequence of events for submittals and commissioning:

1. Submit Submittal Package 1 (Hardware and Shop Drawings) and receive approval.
2. Initiate installation of EMCS hardware, devices and wiring.
3. Develop point database and application software.
4. Simulate sequencing and debug programming off-line to the extent practical.
5. Submit Submittal Package 2 (Programming and Graphics) and receive approval.
6. Complete installation of EMCS hardware, devices and wiring.
7. Install point database and application software in field panels.
8. Submit Submittal Package 3 (Functional Testing) and receive approval.
9. Perform EMCS Pre-functional Tests (start up, calibration and tuning) and submit Pre-functional Tests for approval.
10. Field test application programs prior to functional testing.
11. Receive EMCS Pre-functional Test Report approval and approval to schedule Functional Tests.
12. Prepare and initiate commissioning Trend Logs.
13. Assist TAB contractor in TAB tests and determining setpoints as specified in Section 230593.
14. Perform and record functional tests and submit Functional Test Report for approval.

    a. Some tests may not be possible due to weather conditions. These tests may be deferred to post-occupancy period.

15. Submit Package 4 (Training Materials) and receive approval.
16. Receive EMCS Functional Test Report approval and approval to schedule Demonstration Tests.
17. Perform Demonstration Tests to Commissioning Coordinator and Architect and submit Demonstration Test Report.
18. Receive acceptance of Demonstration Tests.
19. Train Owner personnel on EMCS operation and maintenance.
20. Substantial Completion.
21. Submit Package 5 (Post-Construction Trend Logs) in format specified for review and approval.
22. Receive approval of successful Trend Log tests, or retest as required.
23. Complete all items in Completion Requirements per Section 230900.
24. Provide administration level password access to the Owner.
25. Final Acceptance.
26. Begin Warranty Period.

27. Prepare and initiate post-occupancy Trend Logs.
28. Perform deferred alternate season functional tests and submit amended Functional Test Report for approval.
29. Receive amended EMCS Functional Test Report approval.
30. Two months prior to end of Warranty Period, submit Package 6 (End-of-Warranty Trend Logs) in format specified for review and approval.
31. Receive approval of successful Trend Log tests, or retest as required.
32. Revise and submit record documents and O&M Manuals.
33. Update all software as specified.
34. End of Warranty Period.

1.6 FUNCTIONAL TEST DOCUMENTATION

A. Pre-functional Tests:

1. Prepare forms to document the proper startup of the EMCS.
2. All equipment shall be included test forms including but not limited to:

    a. Wiring: End-to-end checkout of all wiring at terminations. Power to all controllers and actuators. Confirmation of emergency power where specified.
    b. Digital Outputs: proper installation, normal position, response to command at CU
    c. Digital Inputs: proper installation, device test, response at CU.
    d. Analog Outputs: proper installation of devices, verification of maximum and minimum stroke.
    e. Analog Inputs: proper installation of sensors, calibration.
    f. Panels: Confirmation of location, power source (electrical circuit used), confirmation of emergency power where specified.
    g. Alarms and Safeties: Verification of alarm routing to all specified devices and correct hierarchy. Example: confirm alarm routing to cell phones, email, servers, remote workstations. Confirm that appropriate alarm levels are routed to appropriate devices.
    h. Loop Tuning: Document setting of P/I parameters for all loops, chosen setpoints, time delays, loop execution speed.
    i. Network Traffic: Document speed of screen generation, alarm and signal propagation in system with all required commissioning trends active.

3. Each form shall have a header or footer where the technician performing the test can indicate his/her name and the date of the test.
4. Submit forms for approval in Submittal Package 3.
5. Complete work, document results on forms, and submit for approval as Pre-Functional Test Report.

B. Functional Tests:

1. Architect will prepare functional testing forms after Submittal Package 2 has been reviewed and approved. Tests will be designed to test all sequences in a formal manner with simulations and expected outcomes.
2. Review tests and recommend changes that will improve ease of testing or avoid possible system damage, etc.
3. Adapt forms from Architect into electronic format. Each form shall have a header or footer where the technician performing the test can indicate his/her name and the date of the test.
4. Complete work, document results on forms, and submit for approval as Functional Test

Report.

C. Assist Commissioning Coordinator/Architect as specified including attending commissioning meetings.

PART 2 - PRODUCTS

2.1 INSTRUMENTATION

A. Instrumentation required to verify readings, calibrate sensors, and test the system and equipment performance shall be provided by Contractor.

B. All equipment used for testing and calibration shall be NIST/NBS traceable and calibrated within the preceding 6-month period. Certificates of calibration shall be submitted.

C. Test equipment used for testing and calibration of field devices shall be at least twice as accurate as respective field device (e.g., if field device is ±0.5% accurate, test equipment shall be ±0.25% accurate over same range).

PART 3 - EXECUTION

3.1 PRE-FUNCTIONAL TESTS

A. General:

1. Inspect the installation of all devices. Review the manufacturer's installation instructions and validate that the device is installed in accordance with them.
2. Verify proper electrical voltages and amperages, and verify that all circuits are free from faults.
3. Verify integrity/safety of all electrical connections.
4. Verify that shielded cables are grounded only at one end.
5. Verify that all sensor locations are as indicated on drawings and are away from causes of erratic operation.
6. Ensure that minimum speed settings programmed into variable speed drive are at or below the minimum speed settings in control sequences.

B. Digital Outputs:

1. Verify that all digital output devices (relays, solenoid valves, two-position actuators and control valves, magnetic starters, etc.) operate properly and that the normal positions are correct.

C. Digital Inputs:

1. Adjust setpoints, where applicable.

a. For current switches used as status on fans, adjust current setpoint so that fan status is "off" when fan discharge damper (if present) is fully closed and when belt is broken

(temporarily remove belt).

b. For current switches used as status on pumps, adjust current setpoint so that pump status is “off” when pump is dead-headed (temporarily close discharge valve).
c. For differential pressure sensors on pumps and fans, set so that status is on when pump operating with all valves open (out on its curve).

D. Analog Outputs:

1. Verify start and span are correct and control action is correct.
2. Check all control valves and automatic dampers to ensure proper action and closure. Make any necessary adjustments to valve stem and damper blade travel.
3. Check all normal positions of actuators with spring return.
4. For outputs to reset other manufacturer’s devices (for example, chiller setpoint) and for feedback from them, calibrate ranges to establish proper parameters.

E. Analog Input Calibration:

1. Sensors shall be calibrated as specified on the points list. Calibration methods shall be one of the following:

   a. Factory. Calibration by factory, to standard factory specifications. Field calibration is not required.
   b. Handheld. Field calibrate using a handheld device with accuracy meeting the requirements of Paragraph 2.1.
   c. Drywell Bath. Field calibrate using a 2-point procedure, using a drywell calibrator block constructed for that purpose, or an ice bath with a reference standard.

2. The calibrating parameters in software (e.g. slope and intercept) shall be adjusted as required. A calibration log shall be kept and initialed by the technician showing date and time, sensor and hand-held readings, and calibration constant adjustments and included in the Pre-functional Test Report.
3. Inaccurate sensors must be replaced if calibration is not possible.

F. Alarms and Interlocks:

1. A log shall be kept and initialed by the technician showing date and time, alarm/interlock description, action taken to initiate the alarm/interlock, and resulting action, and included in the Pre-functional Test Report.
2. Check each alarm separately by including an appropriate signal at a value that will trip the alarm.
3. Coordinate with Division 26 to test fire and life safety systems alarm contacts.
4. Interlocks shall be tripped using field contacts to check the logic, as well as to ensure that the fail-safe condition for all actuators is in the proper direction.
5. Interlock actions shall be tested by simulating alarm conditions to check the initiating value of the variable and interlock action.

G. Variable Frequency Drive Minimum Speed:

1. Minimum speed for VFD-driven fans and pumps shall be determined in accordance with this Paragraph. Tests shall be done for each piece of equipment, except that for multiple pieces of identical equipment used for identical applications, only one piece of equipment need be tested with results applied to all. Note that for fans and pumps, there is no minimum speed

required for motor cooling. Power drops with cube of speed, causing motor losses to be minimal at low speeds.

2. The work shall be done only after fan/pump system is fully installed and operational.
3. Determine the minimum speed setpoint as follows:

    a. Start the fan or pump.
    b. Manually set speed to 6 Hz (10%) unless otherwise indicated in control sequences. For cooling towers with gear boxes, use 20% or whatever minimum speed is recommended by tower manufacturer.
    c. Observe fan/pump in field to ensure it is visibly rotating.

        1) If not, gradually increase speed until it is.

    d. The speed at this point shall be the minimum speed setpoint for this piece of equipment.
    e. Record minimum speeds in log and store in software point as indicated in Section 230929.

H. Tuning:

1. Tune all control loops to obtain the fastest stable response without hunting, offset or overshoot. Record tuning parameters and response test results for each control loop in the Pre-functional Test Report. Except from a startup, maximum allowable variance from set point for controlled variables under normal load fluctuations shall be as follows. Within 3 minutes of any upset (for which the system has the capability to respond) in the control loop, tolerances shall be maintained (exceptions noted):

Controlled Variable	Control Accuracy
Duct Pressure	±0.1" w.g.
Building and relief plenum	±0.01" w.g.
Airflow and waterflow	±10%
Space Temperature	±1.5ºF
Chilled Water Temperature	±1ºF
Hot Water Temperature	±3ºF
Duct Temperature	±2ºF
Water Differential Pressure	±1.5 psi
Others	±2 times reported accuracy

I. Interface and Control Panels:

1. Ensure devices are properly installed with adequate clearance for maintenance and with clear labels in accordance with the Record Drawings.
2. Ensure that terminations are safe, secure and labeled in accordance with the Record Drawings.
3. Check power supplies for proper voltage ranges and loading.
4. Ensure that wiring and tubing are run in a neat and workman-like manner, either bound or enclosed in trough.
5. Check for adequate signal strength on communication networks.
6. Check for standalone performance of controllers by disconnecting the controller from the

LAN. Verify the event is annunciated at Operator Interfaces. Verify that the controlling LAN reconfigures as specified in the event of a LAN disconnection.

7. Ensure that buffered and/or volatile information is held through power outage.
8. With all system and communications operating normally, sample and record update/annunciation times for critical alarms fed from the panel to the Operator Interface.
9. Check for adequate grounding of all DDC panels and devices.

J. Operator Interfaces:

1. Verify that all elements on the graphics are functional and are properly bound to physical devices and/or virtual points, and that hot links or page jumps are functional and logical.
2. Verify that the alarm printing, logging, paging, emailing etc. is functional and per requirements.

K. Trending/Network Traffic Test. Perform this test to verify that system has been design adequately to simultaneously capture trends and allow proper operation of the control system.

1. The test shall be performed after the verification trends (see paragraph 3.5A) have been set up and are operational.
2. Test 1:

   a. Randomly select a device whose failure will generate a Level 1 or 2 alarm and manually shut it off. The status points for the device must indicate the change of state of the device at the Operator Workstation within 5 seconds.
   b. The test shall be repeated for four devices in each building.

3. Test 2:

   a. A clock signal from a field controller randomly selected will be sent as a programmable point to up to 3 BCs. The clock signal stored in BCs shall be sampled with the rest of the trend data. The system shall be considered acceptable if these clock signals are no more than 2 seconds off of the system clock as sampled concurrently during data collection.

4. If the system fails any test, the system architecture shall be revised as required (e.g. more trend memory, more controllers with trend storage capability, network repeaters to allow an increase in network speed, etc.) followed by additional tests.

3.2 TESTING, ADJUSTING, AND BALANCING (TAB) COORDINATION

A. Coordinate with Work performed under Section 23 05 93 Testing, Adjusting, and Balancing. Some balancing procedures require the EMCS to be operational and require Contractor time and assistance.

B. Calibration Software:

1. Software shall be provided free of charge on at least a temporary basis to allow calibration of terminal box airflow controls and other Work specified under Section 230593 Testing, Adjusting and Balancing.
2. Software shall be provided for installation on POT(s) provided by Others or Contractor shall loan a POT or handheld device with software installed for the duration of Work specified

under Section 230593 Testing, Adjusting, and Balancing.

3. Provide sufficient training to those performing Work specified under Section 230593 Testing, Adjusting, and Balancing to allow them to use the software for balancing and airflow calibration purposes. Contractor shall include a single training session for this purpose.

C. Setpoint Determination:

1. Perform pre-functional tests described in the specifications before assisting in setpoint determination.
2. Coordinate with Work performed under Section 230593 Testing, Adjusting, and Balancing to determine fan and pump differential pressure setpoints, outdoor air damper minimum positions and DP setpoints, etc. as indicated in Section 230593 Testing, Adjusting and Balancing.

D. Coil Valve Leak Check:

1. Coordinate test procedures with those outlined in Section 230593 Testing, Adjusting and Balancing to provide control valve leak check tests.
2. Test conditions for each hydronic system:

a. Tests shall be done when central plant cooling and heating systems are operational.
b. Close all control valves.
c. Start all fans associated with control valves.
d. Open bridge connection control valve.
e. Start both pumps.
f. Observe flow meter. If reading changes after pumps start, there is a leaking valve.
g. Observe supply air temperature at each coil after test starts.
h. Should any supply air temperature rise, close the isolation valves to the coil to see if temperature changes. If so, this validates the valve is not fully closing.
i. Remedy the condition by adjusting the stroke and range, increasing the actuator size/torque, replacing the seat, or replacing the valve as applicable.

3.3 FUNCTIONAL TESTS

A. Test schedule shall be coordinated with the Commissioning Authority, Commissioning Coordinator and/or Architect.

B. Functional tests may be witnessed by the Architect at the Owner’s option.

C. All approved Functional Tests shall be conducted by the Contractor with results confirmed and signed by the Contractor’s start-up technician.

1. Seasonal Impacts: It shall be assumed that not all tests will be possible due to weather conditions. Those that are not possible shall be deferred until the next season, performed during the warranty period.

D. Test documentation shall be submitted to the Owner for review and approval.

3.4 DEMONSTRATION TEST

A. Demonstration tests consist of a small representative sample of functional tests and systems randomly selected by the Owner. Tests will be designed to occur over no longer than ***2*** days.

B. Schedule the demonstration with the Architect 1 week in advance. Demonstration shall not be scheduled until the Functional Test Report has been approved.

C. The Contractor shall supply all personnel and equipment for the demonstration, including, but not limited to, instruments, ladders, etc. Contractor-supplied personnel shall be those who conducted the Functional tests or who are otherwise competent with and knowledgeable of all project-specific hardware, software, and the HVAC systems.

D. The system will be demonstrated following procedures that are the same or similar to those used in the Pre-Functional and Functional Tests. The Architect will supply the test forms at the site at the start of the tests.

E. Demonstration tests may be witnessed by the Architect at the Owner's option.

F. Contractor shall conduct tests as directed by and in the presence of the Architect and complete test forms. Completed forms shall be submitted as the Demonstration Test Report to the Owner and Commissioning Coordinator after tests are complete.

G. Demonstration Tests shall be successfully completed and approved prior to Substantial Completion.

3.5 TREND LOG TESTS

A. Trends shall be fully configured to record and store data to the OWS or server for the points and at the interval listed in Section 230929 as follows:

1. Commissioning: Configure trends prior to functional testing phase. Retain configuration until post-construction trend review has been completed successfully and accepted by the Architect. Trends shall be deactivated after acceptance.
2. Continuous: After system acceptance, configure trends for the purpose of long term future diagnostics. Configure trends to overwrite the oldest trends at the longest interval possible without filling the server hard disk beyond 80%.

B. Commissioning (Post Construction) Trend Test.

1. Trend logging shall not commence until Demonstration Tests are successfully completed.
2. Hardware Points: Contractor shall configure points to trend as indicated in the Commissioning Trend column listed in Section 230929 points list with the following qualifications.

   a. For equipment of identical function, such as VAV zones and AHUs with identical components and control sequences, only a sample of such equipment need be trended. The sampling shall be 10% of the identical components, but no more than 10 and no less than three. Review with Architect before setting up trends.
   b. All points trended for one HVAC subsystem (e.g. air handling unit, chilled water system, etc.) shall be trended during the same trend period and the same time intervals so that data may be easily plotted using a spreadsheet.

3. Software Points: Include the following in trends of systems and zones whose hardware points are being trended as called for above. Time interval shall be the same as associated hardware point.

    a. All setpoints and limits that are automatically reset, such as supply air temperature and fan static pressure setpoints, plus the points that are driving the reset, such as zone level cooling and static pressure requests.
    b. All setpoints that are adjustable by occupants.
    c. Outputs of all control loops, other than those driving a single AO point that is already being trended.
    d. System mode points (e.g. Warm-up, Occupied, etc.).
    e. Global overrides such as demand shed signals.
    f. Calculated performance monitoring points, such as chiller efficiency.

4. Submit for review and approval by the Commissioning Authority and/or Architect a table of points to be trended along with trend intervals or change-of-value a minimum of 14 days prior to trend collection period.
5. Trends shall be uploaded to the OWS or Server in data format specified in Section 230926.
6. Trend logs of all points indicated above shall be collected for a 3 week Trend Period.
7. At the completion of the Trend Period, data shall be reviewed by the Contractor to ensure that the system is operating properly. If so, data shall be submitted to the Architect in an electronic format agreed to by the Owner and Contractor (e.g. CD-ROM or via direct access to the OWS or server via the internet).
8. Data will be analyzed over approximately a two- to three-week period by the Commissioning Authority and/or Architect.
9. The system shall be accepted only if the trend review indicates proper system operation without malfunction, without alarm caused by control action or device failure, and with smooth and stable control of systems and equipment in conformance with these specifications. If any but very minor glitches are indicated in the trends, steps 4 to 6 above shall be repeated for the same Trend Period until there is a complete Trend Period of error free operation.

C. Post Occupancy Trend Tests.

1. After successfully completing the Commissioning Trend Tests, the Contractor shall configure all points to trend as indicated in the Continuous Trend column listed in Section 230929 points list.
2. Archive trends up to the OWS or server without overwriting stored data for the entire Warranty Period.
3. The system shall be accepted and warranty period considered complete only if the trend review indicates proper operation without malfunction without alarm caused by control action or device failure, and with smooth and stable control of systems and equipment in conformance with these specifications. If any but very minor glitches are indicated in the trends, steps above shall be repeated until there is a complete Trend Period of error free operation.

3.6 REMEDIAL WORK

A. Repair or replace defective Work, as directed by Architect in writing, at no additional cost to the Owner.

B. Restore or replace damaged Work due to tests as directed by Architect in writing, at no additional

cost to the Owner.

C. Restore or replace damaged Work of others, due to tests, as directed by Architect in writing, at no additional cost to the Owner.

D. Remedial work identified by site reviews, review of submittals, demonstration test, trend reviews, etc. shall be performed to the satisfaction of the Architect, at no additional cost to the Owner.

E. Contractor shall compensate Architect and Commissioning Authority on a time and material basis at standard billing rates for any additional time required to witness additional demonstration tests or to review additional EMCS trends beyond the initial tests, at no additional cost to the Owner.

3.7 TRAINING

A. Coordinate schedule and materials with Architect and/or Commissioning Authority.

B. Interim Training:

1. Provide minimal training so the operating staff can respond to occupant needs and other operating requirements during start-up and commissioning phase.

C. Formal Training:

1. Provide training sessions at locations and for personnel indicated below.
2. Training shall be conducted after all commissioning is complete and systems are fully operational.
3. The length of each training period will depend on the complexity of the system and the audience, described below. Minimum training shall be as listed below, but period shall be longer if required to complete the training tasks described below.

    a. On site job training: Include 40 hours total of on-site training to assist personnel in becoming familiar with site-specific issues, systems, control sequences, etc. (including general EMCS system training).

4. Training may be in non-contiguous days at the request of the Owner.
5. Contractor shall be video training sessions, see Section 230010 Mechanical General Provisions.
6. During the warranty period, provide unlimited telephone support for all trained operators.

D. Operators are divided into three categories and shall receive training including but not limited to the tasks listed.

1. Day-to-day Operators shall be trained to:

    a. Proficiently operate the system.
    b. Understand control system architecture and configuration.
    c. Understand EMCS system components.
    d. Understand system operation and control sequences.
    e. Operate the workstation and peripherals.
    f. Log on and off the system.
    g. Access graphics, point reports, and logs.

h. Adjust and change system set points, time schedules, and holiday schedules.
i. Recognize malfunctions of the system by observation of the printed copy and graphical visual signals.
j. Understand and acknowledge alarms.
k. Understand system drawings, and Operation and Maintenance manual.
l. Understand the Project layout and location of control components.
m. Print point and predefined reports.

2. Advanced Operators shall be trained to do all items for Day-to-day operators plus:

a. Make and change graphics on the workstation.
b. Create, delete, and modify alarms, including annunciation and routing.
c. Create, delete, and modify point trend logs, and graph or print these both on an ad-hoc basis and at user-definable time intervals.
d. Create, delete, and modify reports.
e. Add, remove, and modify system's physical points.
f. Create, modify, and delete programming.
g. Add control panels.
h. Add Operator Workstations.
i. Create, delete, and modify system displays — both graphical and otherwise.
j. Perform EMCS system field checkout procedures.
k. Perform EMCS controller unit operation and maintenance procedures.
l. Perform workstation and peripheral operation and maintenance procedures.
m. Perform EMCS system diagnostic procedures.
n. Configure hardware including PC boards, switches, communication, and I/O points.
o. Maintain, calibrate, troubleshoot, diagnose, and repair hardware.
p. Adjust, calibrate, and replace system components.
q. Maintain software and prepare backups.

3. System Managers/Administrators shall be trained to do all items for Day-to-day operators plus:

a. Maintain software and prepare backups.
b. Create and print custom reports, including tenant billing summaries.
c. Interface with job-specific, third-party operator software.
d. Add new users and understand password security procedures.

E. Training materials shall include step-by-step instructions (including illustrations, screen captures, etc.) for how to perform all task identified in herein such that a new Operator, who has not attended the training in person and has minimal familiarity with this EMCS system, can easily follow the instructions and successfully perform all of the identified tasks. One copy of training material shall be provided per student. An electronic copy of the materials shall be stored on the OWS.

F. The instructor(s) shall be factory-trained instructors experienced in presenting this material.

G. The type and number of personnel and location for training shall include.

1. Day-to-day Operator: 2.
2. Advanced Operator: 1.
3. System Managers/Administrators: 1.

END OF SECTION 23 09 29

SECTION 23 11 23

FUEL GAS PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes materials, equipment, fabrication, special-duty valves, specialties, and installation for the following:

1. Natural gas piping.

1.3 PROJECT CONDITIONS

A. Site Gas System Pressure: (CONTRACTOR SHALL VERIFY).

B. Building Gas System (CONTRACTOR SHALL COORDINATE WITH SUBMITTED GAS-FIRED EQUIPMENT).

1.4 SUBMITTALS

A. See Section 230010 – Mechanical General Provisions.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Piping (below ground and above ground	R			R
Valves, all types	R			R
Meters	R	R		R
Pressure regulators	R			R
Specialties	R	R		R

1.5 QUALITY ASSURANCE

A. FM Standard: Provide components listed in FM's Fire Protection Approval Guide if specified to be FM approved.

B. IAS Standard: Provide components listed in IAS's Directory of AGA and CGA Certified Appliances and Accessories if specified to be IAS listed.

C. UL Standard: Provide component listed in UL's Gas and Oil Equipment Directory if specified to be UL listed.

D. ANSI Standard: Comply with ANSI Z223.1 and NFPA 54 (2009 Edition), "National Fuel Gas Code."

1.6 COORDINATION

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Using Agency or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Owner not less than seven days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Appliance Connector Valves.

a. Conbraco Industries, Inc.: Apollo Div.
b. Mueller Co.: Mueller Gas Products Div.
c. Watts Industries, Inc.: Water Products Div.
d. Brass Craft Manufacturing Co.
e. American Valve.

2. Gas Valves, NPS 2 and smaller.

a. Nibco, Inc.
b. Flow Control Equipment, Inc.
c. Grinnell Corp.
d. Honeywell, Inc. Co.
e. Crane Valves.
f. McDonald: A.Y. McDonald Mfg. Co.
g. Milwaukee Valve Co., Inc.
h. Mueller Co.: Mueller Gas Products Div.
i. Watts Industries, Inc.: Water Products Div.

3. Plug Valves, NPS 2-1/2 and larger.

a. Walworth Co.
b. Olson Technologies, Inc.; Homestead Valve Div.
c. Milliken Valve Co., Inc.

4. Service Meters: As approved by the Utility Provider or Owner.
5. Line Pressure Regulators.

a. American Meter Co.
b. Equimeter, Inc.
c. Fisher Controls International, Inc.
d. Schlumberger Industries: Gas Div.

6. Appliance Pressure Regulators.

a. Eaton Corp.: Controls Div.
b. Harper Wyman Co.
c. Maxitrol Co.

2.2 PIPING MATERIALS

A. Steel Pipe: ASTM A 53; Type E or S; Grade B (Grade A for pipe 1-1/2 inch and smaller) Schedule 40; black.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern, with threaded ends according to ASME B1.20.1.
2. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends according to ASME B1.20.1.
3. Cast-Iron Flanges and Flanged Fittings: ASME B16.1, Class 125.
4. Steel Welding Fittings: ASME B16.9, wrought steel or ASME B16.11, forged steel.
5. Steel Threaded Fittings: ASME B16.11, forged steel with threaded ends according to ASME B1.20.1.
6. Joint Compound and Tape: Suitable for natural gas.
7. Steel Flanges and Flanged Fittings: ASME B16.5.
8. Gasket Material: Thickness, material, and type suitable for natural gas.

B. Polyethylene Pipe: All polyethylene pipe used in the Project must comply with ASTM D-2513 and be manufactured in the United States.

1. Pipe and Fitting Material. All pipes shall conform to the requirements of the currently approved ASTM D-25 13 specification “Thermoplastic Gas Pressure Pipe, Tubing and Fittings.” All fittings shall conform to the requirements of ASTM D-2683 specification “Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe” or ASTM D3261 “Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.” All pipes shall be manufactured of virgin material, with the exception of the clean rework material that is generated from the manufacturer’s own production, as long as the pipe and/or fittings meet the required specifications. All pipe formulation must have suitable outdoor weather resistance. The color of all polyethylene pipes shall be either orange or yellow.
2. Pipe Design. All pipe shall be designed for direct burial as specified in D.O.T. Title 49, Part 192, “Transportation of Natural and Other Gas By Pipeline: Minimum Federal Safety Standards,” through current Amendment, for natural gas mains and services operated at 60 psig. or less. The pipe must also be suitable for replacing old steel mains and services. The pipe must be homogeneous and be free of holes, cracks, foreign

material, blisters or other deleterious faults. The minimum design stress must comply with the requirements of ASTMD-2513.

3. Any defect such as a groove, notch, or gouge, greater than ten percent (10%) of the wall thickness of the pipe, shall not be used.

C. Transition Fittings: Type, material, and end connections to match piping being joined.

2.3 SPECIALTY VALVES

A. Valves, NPS 2 and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.

B. Valves, NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.

C. Appliance Connector Valves: ANSI Z21.15 and IAS listed.

D. Gas Stops: Bronze body with AGA stamp, plug type with bronze plug and flat or square head, ball type with chrome-plated brass ball and lever handle, or butterfly valve with stainless-steel disc and fluorocarbon elastomer seal and lever handle; 2-psig minimum pressure rating.

E. Gas Valves, NPS 2 and Smaller: ASME B16.33 and IAS-listed bronze body and 125-psig pressure rating.

1. Tamperproof Feature: Include design for locking.

F. Plug Valves, NPS 2-1/2 and Larger: ASME B16.38 and MSS SP-78 cast-iron, lubricated plug valves, with 125-psig pressure rating.

1. Tamperproof Feature: Include design for locking.

G. Automatic Gas Valves: ANSI Z21.21, with electrical operator for actuation by appliance automatic shutoff device.

2.4 PRESSURE REGULATORS

A. Description: Single stage and suitable for fuel gas service. Include steel jacket and corrosion-resistant components, elevation compensator, and atmospheric vent.

1. NPS 2 and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.
2. NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.
3. Line Pressure Regulators: ANSI Z21.80.
4. Appliance Pressure Regulators: ANSI Z21.18. Regulator may include vent limiting device, instead of vent connection, if approved by Architect.

B. Pressure Regulator Vents: Factory- or field-installed, corrosion-resistant screen in opening if not connected to vent piping.

2.5 METERS

A. Natural gas meter: Provide outside adjacent to mechanical room entrance, a meter for the Owner's use in determining the gas usage for this building. Meter shall be pipe or pedestal

mounted, rotary style, enamel coated steel case. Provide combined register totalizer, water escape hole in housing and means for sealing against tampering. Provide with a pulse sensor so the building meter reading system can connect to the gas meter.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Refer to 312000 – Earth Moving.

3.2 INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping adjacent to machines to allow service and maintenance.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Select system components with pressure rating equal to or greater than system operating pressure.

I. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

J. Arrange piping to allow inspection and service of equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels if valves or equipment requiring maintenance is concealed behind finished surfaces.

K. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

L. Install sleeve seals for piping penetrations of concrete walls and slabs.

M. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.3 PREPARATION

A. Close equipment shutoff fuel gas to premises or section of piping. Perform leakage test as specified in Article entitled, Field Quality Control, to determine that all equipment is turned off in affected piping section.

B. Comply with ANSI Z223.1, paragraph entitled, Prevention of Accidental Ignition.

3.4 SERVICE ENTRANCE PIPING

A. Extend fuel gas piping and connect to fuel gas distribution for service entrance to building.

B. Install dielectric fitting downstream from and adjacent to each service meter unless meter is supported from service-meter bar with integral dielectric fitting. Install shutoff valve downstream from and adjacent to dielectric fitting.

3.5 PIPING APPLICATIONS

A. Flanges, unions, transitions and special fittings with pressure ratings same as or higher than system pressure rating may be used in applications below, provided compliance with the IFGC is maintained.

B. Fuel Gas Piping above ground: Use the following:

1. NPS 2 and Smaller: Steel pipe, malleable-iron threaded fittings, and threaded joints.
2. NPS 2-1/2 and Larger: Steel pipe, steel welding fittings, and welded joints.

C. Fuel-Gas Piping below ground: Use the following:

1. Thermoplastic gas pressure pipe, tubing and fittings, ASTM D2513 with transition riser.

3.6 VALVE APPLICATIONS

A. Appliance Shutoff Valves for Pressure 0.5 psig or Less.: Appliance connector valve or gas stop.

B. Appliance Shutoff Valves for Pressure 0.5 to 2 psig: Gas stop or gas valve.

C. Appliance Shutoff Valves for Pressure 2 to 5 psig: Gas valve.

D. Piping Line Valves, NPS 2 and Smaller: Gas valve.

E. Piping Line Valves, NPS 2-1/2 and Larger: Plug valve or general-duty valve.

3.7 PIPING INSTALLATION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:

1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
2. Cut threads full and clean using sharp dies.
3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints:

1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
2. Bevel plain ends of steel pipe.
3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

F. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.

G. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.

H. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

I. PE Piping Install regulator assemblies aboveground. Include gas valve or plug valve for each assembly.

1. Install gas valve or plug valve and strainer upstream from each service pressure regulator.
2. Install service pressure regulators with vent outlet turned down and with corrosion-resistant-metal insect screen.

J. Service Entrance Piping: Extend fuel gas piping and connect to fuel gas distribution for service entrance to building.

1. Exterior service meter will be provided by gas utility.

K. Concealed Locations: Except as specified below, install concealed gas piping in airtight conduit constructed of Schedule 40, seamless, black steel pipe with welded joints. Vent conduit to outside and terminate with screened vent cap.

1. Above-Ceiling Locations: Gas piping may be installed in accessible spaces, subject to approval of authorities having jurisdiction, whether or not such spaces are used as plenums. Do not locate valves above ceilings.
2. In Partitions: Do not install concealed piping in solid partitions. Protect tubing from physical damage when installed inside partitions or hollow walls.

3. In Walls: Gas piping with welded joints and protective wrapping specified in "Protective Coating" Article in Part 2 may be installed in walls, subject to approval of authorities having jurisdiction.
4. Prohibited Locations: Do not install gas piping in or through circulating air ducts, chimneys or gas vents (flues), ventilating ducts, or elevator shafts.

    a. Exception: Accessible above-ceiling space specified above.

L. Drips and Sediment Traps: Install drips at points where condensate may collect. Include outlets of service meters. Locate where readily accessible for cleaning and emptying. Do not install where condensate would be subject to freezing.

1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use minimum-length nipple of 3 pipe diameters, but not less than 3 inches long, and same size as connected pipe. Install with space between bottom of drip and floor for removal of plug or cap.

M. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings and in floor channels, unless indicated to be exposed to view.

N. Install fuel gas piping at uniform grade of 0.1 percent slope upward toward risers.

O. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

P. Connect branch piping from top or side of horizontal piping.

Q. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment, and elsewhere as indicated. Unions are not required on flanged devices.

R. Install strainer on inlet of each line pressure regulator and automatic and electrically operated valve.

S. Install pressure gage upstream and downstream from each line pressure regulator.

T. Install flanges on valves, specialties, and equipment having NPS 2-1/2 and larger connections.

U. Install vent piping for gas pressure regulators and gas trains, extend outside building, and vent to atmosphere. Terminate vents with turned-down, reducing-elbow fittings with corrosion-resistant insect screens in large end.

V. Purging Pipes and Fittings: A combustible gas indicator shall be used when purging mains and piping. When purging gas from abandoned lines, the air and the gas must be discharged aboveground and directed away from power lines or structures. When purging air from new lines, installation of a 3/4 service saddle and non-corrodible riser is required four (4) feet from each deadend on all new installations of pipe in order to purge air from all deadends simultaneously. Release gas into new lines at a rate that will prevent formation of a hazardous mixture of gas and air or precede natural gas with a slug of inert gas.

W. Pipe Placement and Backfill.

1. When installing polyethylene pipe, sufficient slack shall be provided to allow for possible contraction. The polyethylene pipe shall not have a bend that is less than 25 times the outside diameter of the pipe. If a bend is required that is less than 25 times the outside diameter of the pipe, then an approved polyethylene elbow fitting is required. A fusion

joint shall not be placed at a bend. During extremely high temperature conditions it may be necessary to cool the pipe before the last connection.

2. No polyethylene gas line shall be installed above ground. During maintenance, repair, and tie-in work, temporary polyethylene gas lines may be used above ground.
3. The minimum clearance required between the distribution piping and other underground structures is twelve (12) inches. Trench width and minimum cover shall comply with another Section of specification, Excavation, Trenching and Backfilling for Utilities. Unless otherwise shown on plans, pipe embedment shall be select material and remainder of trench may be backfilled with spoil from trenching operation.

3.8 VALVES AND VALVE BOXES

A. Provide valves and valve boxes plumb. All boxes shall be installed flush with the finished grade. Support box with brick or other approved material. Adequate backfill shall be placed around the valve boxes and valve extension boxes to prevent any damage or settlement to the pipeline that may be transferred to the pipe through the valve box. Protective sleeves shall be installed over fusion joints and extend through the valve boxes on the polyethylene valve installations.

3.9 HANGERS AND SUPPORTS

A. Refer to Section 230529 – Hangers and Supports.

3.10 CONNECTIONS

A. Install piping adjacent to appliances to allow service and maintenance. Connect piping to appliances using gas with shutoff valves and unions. Install valve upstream from and within 72 inches of each appliance. Install union downstream from valve.

B. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance using gas.

C. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer’s published torque-tightening values. If manufacturer’s torque values are not indicated, use those specified in UL 486A and UL 486B.
2. Do not use gas pipe as grounding electrode.

3.11 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each service meter, pressure regulator and specialty valve.

1. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each service meter, pressure regulator and specialty valve.
2. Refer to 230553 – Mechanical Identification.

B. Label piping per 230553 – Mechanical Identification.

3.12 PAINTING

A. Use materials and procedures in Division 09 – Painting.

B. Paint exterior pipe, fittings, pressure regulators, specialty valves, etc.

1. Pipe and Fittings, Color: Yellow (Confirm color with Architect prior to painting).
2. Pressure Regulators, Specialty valves, Etc., Color: Red (Confirm color with Architect prior to painting).

C. Paint exposed interior pipe, fittings, pressure regulators, specialty valves, etc.

1. Pipe and Fittings, Color: Yellow (Confirm color with Architect prior to painting).
2. Pressure Regulators, Specialty valves, Etc., Color: Red (Confirm color with Architect prior to painting).

3.13 FIELD QUALITY CONTROL

A. Inspect, test, and purge piping according to ANSI Z223.1, Part 4 "Inspection, Testing, and Purging," and requirements of authorities having jurisdiction. Isolate pressure reducing valves and equipment controls during testing. Test pressure to be 100 psi for a period of 24 hours with no drop in pressure.

B. Repair leaks and defects with new materials and retest system until satisfactory results are obtained.

C. Report test results promptly and in writing to Architect.

D. Verify capacities and pressure ratings of pressure regulators, valves and specialties.

E. Verify correct pressure settings for pressure regulators.

F. Verify that specified piping tests are complete.

3.14 ADJUSTING

A. Adjust controls and safety devices. Replace damaged and malfunctioning controls and safety devices.

Natural Gas Piping Test Log							
Date	System	Description of Piping Section Tested	Test Press. (psig)	Test Duration (hours)	Results Pass/ Fail	Witness (Contractor) Initials	Witness (Professional) Initials
This form stall be completed and submitted with the project closeout documents. Contractor shall copy this form if more sheets are required. Piping pressure test log shall be kept at project site and shall be made available to the Architect upon request.							

END OF SECTION 23 11 23

SECTION 23 21 13

HEATING AND COOLING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes special-duty valves and specialties for the following:

1. Hot-water heating piping.
2. Chilled water piping.
3. Auxiliary and intermediate drain pan piping.

1.3 REFERENCE STANDARDS

A. ASME B31.1 or B31.9 as applicable for shop and project site welding of piping work.

B. ASTM A53 – Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.

C. ASTM A120 – Pipe, Steel, Black, Welded and Seamless, for Ordinary Uses.

D. ASTM A234 – Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.

E. ANSI/ASME SEC 9 – Welding and Brazing Qualifications.

F. ANSI/ASME B16.3 – Malleable Iron Threaded Fittings Class 150 and 300.

G. ANSI/ASME B16.22 – Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

H. ANSI/ASME B16.26 – Cast Copper Alloy Fittings For Flared Copper Tubes.

I. ANSI/ASTM B32 – Solder Metal.

J. ANSI/ASTM B88 – Seamless Copper Water Tube.

K. ASTM B280 – Seamless Copper Tube for Air Conditioning and Refrigeration Field Service .

L. ANSI/AWS A5.8 – Brazing Filler Metal.

M. ANSI/AWS D1.1 – Structural Welding Code.

1.4 SUBMITTALS

A. See Section 230010 – Mechanical General Provisions.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Piping materials	R			R
Pipe fittings	R			
Solder	R2			

1.5 QUALITY ASSURANCE

A. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

1. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

B. Welding materials and labor to conform to ASME Code and applicable state Labor Regulations.

C. Use welders fully qualified and licensed by state authorities.

D. Each length of pipe, fitting, trap, fixture or device used in any piping system shall be stamped or indelibly marked with.

1. Weight or quality.
2. Maker's name or mark.

E. Examine piping layouts and determine requirements for piping offsets, loops or expansion joints to adequately protect systems.

1. Determine locations and design of anchors and pipe guides to maintain proper piping alignment.
2. Determine anchor reaction forces and coordinate locations of anchors with Architect.

F. Conform to ANSI/ASME B31.1

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Welding Fittings.

1. Babcock and Wilcox Tubular Products Division.
2. Bonney Forge Foundry, Inc..
3. Landish Company.
4. Or equal.

C. Flange Gaskets.

1. John Crane Company.
2. Garlock Mechanical Packing Division.
3. Goodrich.
4. Or equal.

D. Solder.

1. Westinghouse.
2. J.W. Harris Co., Inc..
3. Engelhard.
4. Or equal.

E. Pipe Joint Compound.

1. Rectorseal.
2. Permatec.
3. John Crane.
4. Or equal.

2.2 PIPING AND FITTINGS

A. General.

1. Piping shall.

a. Be commercially round and straight.
b. Be of uniform quality and workmanship.
c. Be free from all defects.
d. Be identified.

B. Pressure Piping.

1. Pressure piping shall conform to requirements of ANSI Safety Code for Pressure Piping, B31.1.
2. Type PP-1: Black Steel: Schedule 40 or Standard Weight, ASTM A53 Type E Grade B (electric resistance welded).

a. 2-1/2 inches and larger.
b. Welded joints.

1) Steel welding-neck fittings, ANSI B16.9-93.
2) Steel welding-neck flanges and flanged fittings, ANSI B16.5-88, 150 pounds per square inch.

c. 0.375 inch wall for sizes 12 inch and larger.

3. Type PP-2: Copper Tubing.

a. 2 inches and smaller.
b. ANSI H23.1; Type L or K.
c. Hard temper unless indicated otherwise.
d. Wrought-copper, solder joint fittings, ANSI B16.22, in sizes available.
e. Cast-bronze solder-joint fittings, ANSI B16.18, only in sizes not available in wrought copper.
f. Cast-bronze, threaded, ground-joint unions, ANSI B16.15, 2 inches and smaller.
g. Cast bronze, flanged unions, ANSI B16.24, 150 pounds per square inch class, 2-1/2 inches and larger.

C. Fittings and Flanges: Standard products of respective manufacturer of piping as hereinbefore specified.

D. Flange Gaskets.

1. Full faced or flat ring type to suit flange facings, selected from one of following materials.
2. Gaskets for flanged joints shall comply with ANSI B16.21.
3. Full faced for cast iron flanges.
4. Raised face for steel flanges.

a. Red rubber, ASTM D1330.
b. 1/16 inch thick.
c. Equal to Crane Style 555.

5. Gaskets coated with thread lubricant when being installed.

E. Flange Bolts: Open-hearth bolt steel.

F. Unions.

1. Steel Piping 2 inches and smaller.

a. 250 pounds per square inch: ground joint.
b. Equal to Grinnell Fig. 554.

2. Steel Piping Larger than 2 inches: Welding flanges.
3. Copper Piping: Equal to Nibco No. 633.

G. Dielectric Connections.

1. Unions.

a. Only allowed where union is required elsewhere in specifications or on drawings. Use nipple specified below otherwise.
b. 2 inches and smaller.

1) 250 pounds per square inch water on gage (WOG).
2) Standard gaskets for plumbing.
3) High temperature gaskets for heating.
4) Equal to EPCO Model FX.

c. 2-1/2 inches and larger.

1) Brass.

a) Brass half-union, ANSI B16.1, 1989, 175 pounds per square inch water on gage (WOG).
b) To welding flange as hereinbefore specified.
c) Equal to EPCO Model X.

2) Copper.

a) Half union with EPDM insulator gasket.
b) 150 pounds per square inch water on gage (WOG).
c) The Copper component of the flange adapter shall be Third Party Classified by Underwriters Laboratories Inc.

2. Nipples.

a. Applicable to all hydronic systems.

1) Minimum 4 inch long stainless steel, brass, or copper nipple with non-conducting thermo-plastic internal lining.
2) ASTM Standard F-492 for continuous use at temperatures up to 225°F.
3) ClearFlow or equal.

b. Allowed for closed-circuit hydronic systems only: minimum 6 inch long brass nipple.

2.3 PIPING SPECIALTIES

A. See Section 230516 “Piping Specialties”.

2.4 SOLDER

A. S-1: Silfos or Silvaloy 15 silver solder (brazing) with 15 percent silver, 80 percent copper and 5 percent phosphorous.

B. S-1A: Safety Silv 56 cadmium-free silver solder (brazing) with 55 to 57 percent silver, 21 -23 percent copper, 15 to 19 percent zinc, 4 to 6 percent tin, and 0.15 percent other metals.

C. S-2, either.

1. 95 percent tin 5 percent antimony solder, lead free, or.
2. 95.6 percent tin, 4 percent copper, 0.4 percent silver, lead free.

PART 3 - EXECUTION

3.1 PIPE SERVICES

Service	Type of Pipe	Remarks
Above Ground Hydronic (HW, CHW)	PP-1; PP-2 Type L Hard	to 250 degrees Fahrenheit
Auxiliary pan drains	PP-2 Type L Hard	
Chemical water treatment	PP-2 Type L Hard	

3.2 INSTALLATION

A. Coordinate with work of other trades.

B. Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently leak resistant piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints and couplings but with adequate and accessible unions for disassembly and maintenance/replacement of valves and equipment. Reduce sizes where indicated by use of reducing fittings. Align piping accurately at connections, within 1/16-inch misalignment tolerance.

C. Install underground piping per manufacturer's instructions.

D. Arrangement.

1. Except for large scale details piping is diagrammatically indicated. Install generally as shown.
2. Do not scale drawings for exact location of piping.
3. Install piping to best suit field conditions, in coordination with other trades.
4. Piping Arrangement.

    a. Arrange piping neatly along walls.
    b. In neat, horizontal groups.
    c. Each group to be in one plane, insofar as possible.
    d. Maintain required slope.

5. Do not sleeve structural members without consent of the Architect.
6. Maintain maximum 1-inch clearance from adjacent work, including insulation, except as noted.
7. Install piping concealed above ceilings or in walls unless otherwise indicated.
8. Installation of piping shall be made with use of appropriate fittings. Bending of piping will not be allowed.
9. Unions installed shall be accessible.
10. Locate piping runs vertically and horizontally; avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. In finished and occupied spaces, conceal piping from view by locating in column enclosures, in hollow wall construction, or above suspended ceilings; do not encase horizontal runs in solid partitions, except as indicated.
11. Electrical equipment spaces: Do not run piping through transformer vaults and other electrical or electronic equipment spaces and enclosures unless the piping serves equipment in the room.

12. Use tapered reducers where any change in pipe size occurs. Bushings shall not be used.
13. Conceal piping in finished portions of building, above the floor line. Cutting of walls and floors shall be held to the minimum possible to secure the proper installation.
14. Provide concealed high points with air chambers with 1/4-inch copper tube vent line and stop cock carried to accessible point.
15. Install piping subject to expansion or contraction in a manner permitting strains to be evenly distributed and alleviated.
16. Pipe the discharge of each relief valve, air vent, backflow preventer, and similar device to floor sink or drain.

E. Installation of Protective Pipe Wrap.

1. Wrap pipe and fittings with two layers of protective wrap according to manufacturer's instructions. Overlap each layer of warp minimum 1/2 inch. Extend wrap three feet beyond section underground.
2. Protect all steel pipe buried in ground from corrosion by the application of protective pipe wrap. Clean and prime piping before application of the wrapping material.
3. No rocks or sharp edges shall be backfilled against the wrap. When backfilling with other than sand, protect wrap with an outer wrapping of Kraft paper; leave in place during backfill.
4. Wrap all copper piping below grade or concrete with plastic sleeve.

3.3 EXPANSION CONTROL

A. General.

1. Install piping to permit free expansion and contraction without damaging piping or construction.
2. Provide offsets, expansion loops, anchors, guides and supports to permit expansion, within stress limits of ANSI 31.1 Pressure Piping for temperature ranges specified.
3. Where pipe loops or changes in direction of piping cannot be employed to absorb expansion and contraction, provide expansion joints.
4. Install pipe guides so that movement takes place along axis of pipe only. Pipe moves laterally at expansion elbows.
5. Make riser offsets in manner to avoid pocket forming due to expansion.

B. Expansion Calculations.

1. Thermal Expansion.

a. Determine thermal linear expansion of each segment of piping systems.
b. Base expansion calculations on following temperatures, plus 30 percent safety factor.

1) Hot Water Heating.

a) Idle temperature: 50 degrees Fahrenheit.
b) Maximum temperature: 210 degrees Fahrenheit.

2) Chilled Water.

a) Operating temperature: 40 degrees Fahrenheit.
b) Maximum temperature: 100 degrees Fahrenheit.

c. Determine effect of linear expansion upon piping layout in building.

1) If resulting stresses exceed maximum allowable limits introduce additional loops and/or offsets.
2) Where space limitations preclude installation of loops and/or offsets provide expansion joints.

2. Structural Considerations

a. Install pipe anchors to provide required restraints on expanding piping systems.
b. Install pipe guides to provide required restraints against lateral action of expanding piping systems.

1) Spacing for expansion joints: per manufacturer's recommendations.
2) Spacing for pipe loops and/or offsets: as required to maintain alignment within allowable stress limits.

c. Locate anchors and guides only at building structural members capable of taking imposed reaction loads.
d. Determine horizontal and vertical reaction loads of anchors and guides to building structure.

1) Coordinate details and reaction loads with structural engineer for building.
2) If necessary, revise location and number of anchors and guides as recommended by structural engineer to result in allowable reaction loads to building.

C. Provision for Expansion.

1. Loops, bends, offsets.

a. As indicated or because of job required relocation of piping and equipment.
b. Design as follows:

1) Use spring type loop U-bend or offset U-bend.
2) Corner radii five to six times pipe diameters.
3) Join bends only by welding.

a) Welding-steel piping.
b) Brazing-copper or bronze piping.

D. Sloping, Air Venting and Draining.

1. Slope piping as indicated, true to line and grade, and free of traps and air pockets.
2. Reducers/increasers.

a. Eccentric.

1) At pump suction where reducer is required.
2) Top side flat.

b. Concentric: All other locations.

3. Connect branch piping to bottom of mains in closed systems.
4. Provide drain valves and hose adapters as indicated on drawings and at the bottom of all risers.

5. Vents: See Section 230516 “Piping Specialties.”

E. Piping Specialties: See Section 230516 “Piping Specialties.”

F. Pipe Hanging and Supports: See Section 230529 “Hangers and Supports.”

G. Copper.

1. Crimping of copper tubing prohibited.
2. Isolate copper tubing from ferrous materials and hangers with two thicknesses of 1 inch wide 10 mil polyvinyl tape, spiral-wrapped around pipe. Total width shall be a minimum of 3 inches.

H. Coatings: Reapply coal-tar coating on buried piping, after installation, to surfaces from which coating has been removed or scraped.

I. Pipe Identification: See Section 230553 “Mechanical Identification.”

J. Care of Floors.

1. Do not set pipe vises or threading machines on unprotected concrete floors.
2. Cover floor when making plumbing connections to avoid staining floors with oil, white or red lead or other substances.
3. Remove any stains at no additional cost to the Owner.

3.4 PIPE JOINTING

A. This section does not apply to refrigerant piping.

B. Fittings.

1. Provide standard, manufacturing fittings in all cases.
2. Prohibited fittings.

    a. Field fabricated.
    b. Bushings on pressure piping.
    c. Clamp-on branch connections.

3. Provide insulating couplings or dielectric unions at all connections of ferrous piping to non-ferrous piping.
4. Branch connections, steel piping.

    a. Equal to main and to two pipe sizes smaller: weld tees, same weight as piping.
    b. Three or more pipe sizes smaller than main, but 2-1/2 inches and larger: Bonney Weld-o-lets.
    c. Two inches and smaller: Bonney Weld-o-lets, Thread-o-lets, threaded Nip-o-lets, or steel couplings.

C. Unions: Provide unions or flanges to render all items in systems easily removable, including.

1. Control valves.
2. Both sides of pumps and equipment.
3. Where indicated on drawings.
4. Exceptions.

a. Copper water piping 1-inch or less, at Contractor's options, since the copper can be easily cut and the union is a less secure joint than a soldered joint.
b. Where unions are not allowed by code: Unions not allowed.

D. Pipe Ends.

1. Perform pipe cutting and end preparation to result in clean ends with full inside diameter.
2. Grind and ream as necessary.

E. Nipples.

1. Close nipples not permitted.
2. Provide extra heavy pipe for nipples where unthreaded portion is less than 1-1/2 inch long.

F. Threaded Joints: not allowed other than unions.

G. Welded Joints.

1. Weld pipe joints in accordance with recognized industry practice and as follows:

a. Welding shall be done by qualified welders in a first-class, workmanlike manner, conforming to the American Standard Code for Pressure Piping USA B-31.1 and B-31.1A.
b. Bevel pipe ends at a 37.5 degree angle where possible, smooth rough cuts, and clean to remove slag, metal particles, and dirt.
c. Do not weld-out piping system imperfections by tack-welding procedures; re-fabricate to comply with requirements.
d. Standards: Conform to Section UI, Chapter 4, "Welding of Pipe Joints", ANSI B31.1 and applicable portion of ASME Boiler and Pressure Vessel Code, Section IX.
e. Operator's qualifications: All welders engaged in work under this Section shall be qualified in accordance with State requirements. Each operator's certificate shall be on file at site and made available to State upon request. Welding of pressure piping shall be done by-welders who have been qualified by recognized agency within 6 months prior to date of Contract.
f. Preparation for welding: Bevel piping on both ends before welding; both ends shall have 1-1/6 inch land at bottom of bevel. Pipe with a 3/4 inch wall thickness or less shall be beveled to a standard 37.5 degrees.
g. Use backing rings on all butt-welding joints 6-inches and larger.
h. State employed Inspector will visually inspect welds. Any weld judged defective by visual inspection shall be cut out and tested in presence of Inspector. If percentage of defective coupons is deemed excessive, contractor shall cut additional coupons as directed by the Architect or the State Inspector. Removal and replacement of test coupons and samplings shall be done at no additional cost to the Owner. At the option of the State Inspector or the Architect, certain welds may be required to be radiographed.

2. Where required, peen and wheel-grind welds.
3. Ends of pipe may be burned for welding.

a. Grind bevel and remove scale between welding joint.
b. Ragged edges with metal beads, poor alignment other inferior work will be rejected.

4. Perform welding with oxyacetylene or electric arc process.

H. Soldered and Brazed Joints.

1. Solder.

    a. Use Solder S-1 for underground copper piping.
    b. Use Solder S-2 other than above.

2. Clean surfaces to be jointed, of oil, grease, rust and oxides.

    a. Remove grease from fittings by washing in solution of 1/16 sodium carbonate and three gallons hot water (except as otherwise specified for medical gas piping).
    b. Clean socket of fitting and end of pipe thoroughly with emery cloth to remove rust and oxides.
    c. Wipe excess solder from joint before it hardens.

3. When soldering or brazing materials that could be damaged by heat, remove sensitive parts and protect parts from heat. Joints shall be cool before reassembling valve.
4. Cut tubing square, reamed, and burrs removed.
5. Prevent annealing of fittings and tubing when making connections.

3.5 FLASHING AND SLEEVES

A. See Section 230529 “Hangers and Support.”

3.6 CLEANING

A. General.

1. During Construction.

    a. Keep openings in piping closed to prevent entrance of foreign matter.
    b. Clean pipe, fittings and valves internally.
    c. Hammer welds to remove slag and weld beads.

2. Clean system after pressure test. Do NOT let system sit filled with un-chemically treated water for more than 4-hours.

B. Cleaning Procedure.

1. Upon start-up fill with clean water.
2. Add alkaline detergent.

    a. Sodium silicate and/or sodium phosphate with non-foaming wetting agent.
    b. Phenolphthalein alkalinity to 2000 to 5000 parts per million as CaCo/3.
    c. Supplied and supervised by water treatment company.

3. Install temporary filter bags in line strainers during start-up.
4. Circulate water of each system at respective design flow rates or greater.

    a. Three 8-hour periods.
    b. At end of each 8-hour period remove and clean strainers and blow off low points.
    c. After third period, completely drain out entire systems of cleaning solution and removed filters at strainers.

d. Refill systems with clean water and circulate for additional 8-hour period at end of which interval, completely drain systems.
e. Drain, refill with clear water; circulate.
f. Test for alkalinity.

1) Not more than 200 parts per million in excess of alkalinity of rinsing water.
2) Repeat flushing of water of each system at respective minimum design flow rate as described above, until 200 parts per million or less.

5. Protect against damage from freeze up or discharge of water.
6. Should any pipe be plugged or should foaming of water systems occur, disconnect piping, clean again, and reconnect at no additional cost to the Owner.

C. Upon completion of cleaning, dose system with chemicals to obtain corrosion inhibition conditions as recommended by water treatment company.

3.7 FIELD QUALITY CONTROL

A. Testing of Water Piping.

1. Test water piping at completion of roughing in, in accordance with the following schedule and show no loss in pressure or visible leaks after a minimum duration of four hours, or time as indicated, at the test pressures indicated.
2. Make connections to existing systems with flanged connection. During testing of the new work, provide a slip-in plate to restrict test pressure to new systems only. Remove plate and complete connection to existing system at completion of testing.
3. Inspect pressure piping in accordance with procedures of ANSI B31.
4. Less than 100 pounds per square inch operating pressure: Test hydrostatically to 150 pounds per square inch.
5. Over 100 pounds per square inch operating pressure.

a. Test hydrostatically to 1-1/2 times operating pressure.
b. Never exceed test pressure ANSI B16.1 basis.

6. Duration: 2 hours.

a. With system valves capped and pressure apparatus disconnected.

1) Pressure change: none.
2) Compensate for temperature change.

7. Leaks and defects.

a. Repair or replace as directed by the Architect.
b. At no additional cost to the Owner.

8. Notify Architect in writing one week before test.
9. Furnish written report and certification that tests have been satisfactorily completed to the Architect.
10. Include written report and certification that tests have been satisfactorily completed.
11. Final connection to system shall be witnessed by Architect.

Hydronic Piping Test Log							
Date	System	Description of Piping Section Tested	Test Press. (psig)	Test Duration (hours)	Results Pass/ Fail	Witness (Contractor) Initials	Witness (Professional) Initials

This form stall be completed and submitted with the project closeout documents. Contractor shall copy this form if more sheets are required. Piping pressure test log shall be kept at project site and shall be made available to the Architect upon request.

END OF SECTION 23 21 13

SECTION 23 21 23

PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for all water pumps except.

1. Where integral with manufactured piece of equipment.
2. Where specialty pumps applicable to specific systems are specified under the relevant Section.

1.3 REFERENCE STANDARDS

A. Underwriters' Laboratories, Inc.: UL 778 – Motor Operated Water Pumps.

B. American Society of Mechanical Engineers: ASME Section VIII – Boiler and Pressure Vessel Code – Pressure Vessels.

C. ANSI/HI Pump Standards.

1.4 SUBMITTALS

A. See Section 230010 – Mechanical General Provisions.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Pump data	R	R		R
Mounting details				R

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

1. ITT, Bell and Gossett.
2. Grundfos (PACO).
3. Armstrong.
4. Or equal.

2.2 GENERAL

A. Centrifugal, single stage, unless otherwise noted.

B. Bronze fitted.

C. Statically and dynamically balance rotating parts.

D. Construction to permit complete servicing without breaking piping connections.

E. Pumps to operate at 1750 rpm unless specified otherwise.

F. Bearings: Grease lubricated roller or ball bearings.

G. Shaft seals.

1. Mechanical.
2. Single, inside mounted, end face rubber bellows type.
3. Springs: stainless steel.
4. Seal head: brass or stainless steel.
5. Babbitt filled carbon rotating washer.
6. Stationary seat: Ni-Resist.
7. Elastomer: EPDM.

H. Substitutions.

1. Brake horsepower rating at design conditions shall be no more than 10 percent above that scheduled.
2. Motor horsepower shall be no larger than that scheduled, or compensate Division 26 contractor for any associated cost to increasing motor size.

I. Motors: See pump schedule and Section 230513 “Common Motor Requirements for HVAC Equipment.”

J. Pump characteristics.

1. Pump curve shall rise continuously from maximum capacity to shutoff.
2. Shutoff head approximately 10 percent greater than design head.
3. Operation at or near peak efficiency.

4. For pumps serving variable flow (2-way valve) systems; or where multiple pumps operate in parallel other than lead/standby applications.

    a. Pump shall be capable of operating at 40 percent beyond design flow rate without exceeding break off point.
    b. Motors shall be selected for non-overloading operation at a flow rate 40 percent beyond design flow rate.

5. Impeller diameter.

    a. Maximum 90 percent of maximum published impeller diameter.
    b. Constant speed pumps: Trim to duty.
    c. Variable speed pumps: Trim to the maximum impeller size that does not cause an increase in motor size (so that maximum efficiency is achieved).

K. Pumps and flanges tested and rated to withstand 1-1/2 times specified working pressures based on both inlet pressures scheduled and pump shut-off head or 175 pounds per square inch working pressure at 250 degrees Fahrenheit, whichever is greater.

L. Pumps to be suitable for handling fluids at scheduled temperatures.

M. Pressure taps on both inlet and outlet for gauge connection mounted in the pump casing (not in external piping).

N. Factory tested.

O. Painted with at least one coat of high-grade machinery enamel.

2.3 END SUCTION

A. Base/motor type as scheduled.

1. Close-coupled.

    a. Back pullout feature for easy replacement of seals.
    b. Mounting base that provides sufficient height so the pump casing is above the bottom of the base feet (not requiring the pump to hang out over the front of the inertia base or housekeeping pad).

B. Mounting base that provides sufficient height so the pump casing is above the bottom of the base feet (not requiring the pump to hang out over the front of the inertia base or housekeeping pad).

C. Shaft: stainless steel.

D. Casing wearing ring: None.

E. Suction and discharge connections: flanged or threaded.

2.4 IN-LINE

A. Type as scheduled.

1. Close coupled.
2. Back pullout design.
3. Suitable for horizontal or vertical operation.

B. Shaft: stainless steel.

C. Wearing rings: renewable bronze.

D. Shaft sleeves: bronze.

E. Casing with suction and discharge gauge ports, vent and plugged drain ports.

F. Capable of being serviced without disturbing piping connections.

G. Pump volute base ring tapped for 1-1/2 inch 125 pound ANSI flange to support pump.

H. Pump flanges to have 125 pound ANSI flange drilling.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate with work of other trades.

B. Install pump in accordance with manufacturer's written installation instructions.

C. Provide access space around pumps for service. Provide no less than minimum as recommended by manufacturer.

D. Install on isolation base or housekeeping pad as specified.

E. Decrease to pump suction from line size with flat-top eccentric reducers on horizontal inlet piping (or suction diffuser where indicated on drawings), concentric reducers elsewhere.

F. Support piping adjacent to pump such that no weight is carried on pump casings.

G. Allow at least 5 pipe diameters between pump suction entry and closest elbow, unless a pump suction diffuser is installed.

H. Inlet and discharge valves and other piping specialties shall be pipe size, not pump inlet or discharge connection size.

I. Equipment Mounting:

1. Install base-mounted pumps on cast-in-place concrete equipment bases.

J. Floor mounted pumps: mount base to foundation or inertia base.

1. Bolts in embedded pipe sleeve.
2. Double nuts or shims to form level assembly.

K. Equipment Mounting: Install in-line pumps with continuous-thread hanger rods and spring hangers with vertical-limit stop of size required to support weight of in-line pumps.

3.2 MOUNTING AND ALIGNMENT

A. See Section 230548 – Mechanical Sound and Vibration Control.

B. Floor mounted pumps: mount base to foundation or inertia base.

1. Bolts in embedded pipe sleeve.
2. Double nuts or shims to form level assembly.

C. Pour non-shrink grout under base, filling voids, and allow to set.

3.3 INSPECTION

A. Verify that adequate clearance between pump and adjacent walls or equipment is available to permit maintenance and repairs.

B. Check that pump is suspended from building structure and not supported by piping.

3.4 PRE-OPERATING CHECKS

A. Before operating pumps.

1. Assure that piping is clear of debris which might clog pump.
2. Vent air from pump system to assure water in pump and piping system.
3. Check for proper and sufficient lubrication.
4. Check for correct operation of check valve.
5. Check for correct rotation.
6. Confirm alignment again after grouting has properly set and re-align if required.
7. Check packing nut adjustment for proper leakage rate and packing lubrication.
8. Assure that strainer is clean before commencing testing.
9. Check for proper adjustment of vibration isolation.

3.5 TESTING AND ADJUSTING

A. After starting pumps.

1. Check for high bearing temperatures.
2. Check temperature of packing gland or mechanical seal for proper cooling operation.
3. Check for motor overload by taking ampere reading at maximum operating conditions, i.e. all valves open and individual pump running.
4. Check shut-off head to ensure impellers properly trimmed.

B. See Section 230593 – Testing, Adjusting, and Balancing.

3.6 TRAINING

A. See Sections 230010 – Mechanical General Provisions.

B. Engage a factory-authorized service representative to train Owner's maintenance personnel on.

1. Procedures for starting and stopping and troubleshooting pumps.
2. Procedures and schedules for maintaining and servicing pumps.
3. Organization and content of Operations & Maintenance Manuals.

END OF SECTION 23 21 23

SECTION 23 23 00

REFRIGERANT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes materials, equipment, fabrication, special-duty valves, specialties, and installation for the following:

1. Refrigerant piping.

1.3 REFERENCE STANDARDS

A. ANSI/ARI 495 – Refrigerant Liquid Receivers.

B. ANSI/ARI 710 – Liquid Line Dryers.

C. ANSI/ASHRAE 34 – Number Designation of Refrigerants.

D. ANSI/ASTM B32 – Solder Metal.

E. ANSI/ASTM B88 – Seamless Copper Water Tube.

F. ASTM B280 – Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

G. ANSI/AWS A5.8 – Brazing Filler Metal.

H. ANSI/AWS D1.1 – Structural Welding Code.

1.4 SUBMITTALS

A. See Section 230010 – Mechanical General Provisions.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Piping and fitting materials	R			R
Valves and specialties	R			R
Solder	R2			

1.5 QUALITY ASSURANCE

A. Each length of pipe, fitting, trap, fixture or device used in any piping system shall be stamped or indelibly marked with:

1. Weight or quality.
2. Maker's name or mark.

B. Examine piping layouts and determine requirements for piping offsets, loops or expansion joints to adequately protect systems.

1. Determine locations and design of anchors and pipe guides to maintain proper piping alignment.
2. Determine anchor reaction forces and coordinate locations of anchors with Architect.

C. Conform to ANSI/ASME B31.1.

1.6 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-410A.

1. Suction Lines for Air-Conditioning Applications: 300 psig.
2. Suction Lines for Heat-Pump Applications: 535 psig.
3. Hot-Gas and Liquid Lines: 535 psig.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 280, Type ACR.

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

E. Brazing Filler Metals: AWS A5.8.

F. Flexible Connectors:

1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
2. End Connections: Socket ends.
3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch- long assembly.
4. Pressure Rating: Factory test at minimum 500 psig.
5. Maximum Operating Temperature: 250 ˚F.

2.2 VALVES AND SPECIALTIES

A. Service Valves:

1. Body: Forged brass with brass cap including key end to remove core.
2. Core: Removable ball-type check valve with stainless-steel spring.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Copper spring.
5. Working Pressure Rating: 500 psig.

B. Solenoid Valves: Comply with ARI 760 and UL 429; listed and labeled by an NRTL.

1. Body and Bonnet: Plated steel.
2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Threaded.
5. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch (16-GRC) conduit adapter, and 24-V ac coil.
6. Working Pressure Rating: 400 psig.
7. Maximum Operating Temperature: 240 ˚F.
8. Manual operator.

C. Thermostatic Expansion Valves: Comply with ARI 750.

1. Body, Bonnet, and Seal Cap: Forged brass or steel.
2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
3. Packing and Gaskets: Non-asbestos.
4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
5. Suction Temperature: See DX Coil (AHU) Schedule.
6. Superheat: Adjustable.
7. Reverse-flow option (for heat-pump applications).
8. End Connections: Socket, flare, or threaded union.
9. Working Pressure Rating: 700 psig.

D. Moisture/Liquid Indicators:

1. Body: Forged brass.
2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
3. Indicator: Color coded to show moisture content in ppm.
4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
5. End Connections: Socket or flare.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 240 ˚F.

E. Replaceable-Core Filter Dryers: Comply with ARI 730.

1. Body and Cover: Painted-steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets.
2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
3. Desiccant Media: Activated alumina.
4. End Connections: Socket.
5. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
6. Maximum Pressure Loss: 2 psig.
7. Working Pressure Rating: 500 psig.
8. Maximum Operating Temperature: 240 ˚F.

2.3 REFRIGERANTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Atofina Chemicals, Inc.
2. DuPont Company; Fluorochemicals Div.
3. Honeywell, Inc.; Genetron Refrigerants.
4. Or equal.

B. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A.

A. Suction Lines NPS 3-1/2 and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

B. Hot-Gas and Liquid Lines: Copper, Type ACR, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered.

3.2 VALVE AND SPECIALTY APPLICATIONS.

A. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at top.

B. Install thermostatic expansion valves as close as possible to distributors on evaporators.

1. Install valve so diaphragm case is warmer than bulb.
2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

C. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary.

D. Install filter dryers in liquid line between compressor and thermostatic expansion valve.

E. Install flexible connectors at condensing units.

3.3 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

K. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels if valves or equipment requiring maintenance is concealed behind finished surfaces.

L. Install refrigerant piping in protective conduit where installed belowground.

M. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

N. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Liquid lines may be installed level.

O. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

P. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

Q. Identify refrigerant piping and valves according to Section 230553 “Identification for HVAC Piping and Equipment.”

R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 “Sleeves and Sleeve Seals for HVAC Piping.”

S. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 “Sleeves and Sleeve Seals for HVAC Piping.”

T. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 “Escutcheons for HVAC Piping.”

3.4 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or soldering, to prevent scale formation.

D. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

3.5 HANGERS AND SUPPORTS

A. See Section 230529 “Hangers and Supports for HVAC Piping and Equipment.”

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
2. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:

1. NPS 1/2: Maximum span, 60 inches; minimum rod size, 1/4 inch.
2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch.
3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch.
4. NPS 1-1/4: Maximum span, 96 inches; minimum rod size, 3/8 inch.
5. NPS 1-1/2: Maximum span, 96 inches; minimum rod size, 3/8 inch.

6. NPS 2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
7. NPS 2-1/2: Maximum span, 108 inches; minimum rod size, 3/8 inch.

D. Support multi-floor vertical runs at least at each floor.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.

    a. Fill system with dry nitrogen to the required test pressure.
    b. System shall maintain test pressure at the manifold gage throughout duration of test.
    c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
    d. Remake leaking joints using new materials and retest until satisfactory results are achieved.

3.7 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Install core in filter dryers after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
4. Charge system with a new filter-dryer core in charging line.

3.8 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:

1. Verify that compressor oil level is correct.
2. Open compressor suction and discharge valves.

3. Open refrigerant valves except bypass valves that are used for other purposes.

E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

Refrigerant Piping Test Log							
Date	System	Description of Piping Section Tested	Test Press. (psig)	Test Duration (hours)	Results Pass/ Fail	Witness (Contractor) Initials	Witness (Professional) Initials
This form stall be completed and submitted with the project closeout documents. Contractor shall copy this form if more sheets are required. Piping pressure test log shall be kept at project site and shall be made available to the Architect upon request.							

END OF SECTION 23 23 00

SECTION 23 25 00

WATER TREATMENT – CLOSED SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Services of water treatment firm.
2. Chemicals.
3. Systems provided with water treatment prior to testing and starting for regular operation.

B. Intent of the Section is to provide complete chemical treatment to protect the following systems from scale formations, corrosion, algae and slime growth.

1. Chilled water.
2. Hot water.

1.3 WATER TREATMENT SERVICES

A. Retain qualified water treatment specialist for complete water treatment service including:

1. Perform analysis of water conditions, including local makeup water.
2. Recommend methods and materials required to comply with Paragraph 1.2B above.
3. Furnish all water treatment chemicals.
4. Supervise installation of water treatment chemicals and systems.
5. Provide written report of makeup water conditions and recommended methods and materials for initial and ongoing treatment of all piping systems.
6. Relieve operating staff and contractor of all responsibility for chemical handling, water testing and adjusting water treatment equipment during Warranty Treatment Period (other than providing required maintenance of treatment equipment).
7. Conduct monthly visits of qualified technical representative to:

    a. Collect samples from each treated system for analysis at firm laboratory.
    b. Inspect and adjust of water treating devices.

B. Water Treatment Period:

1. Water treatment applied concurrently with operation of each system for 1 year after project Substantial Completion.

2. Upon completion of the Warranty Treatment Period, inform Owner in writing of various types of service agreements available.

1.4 SUBMITTALS

A. See Section 230010 – Mechanical General Provisions.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. "R" means required.
2. "R2" means required only for products and equipment differing for the specified manufacturer and model and for "or equals" where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Piping diagram	R			
Bypass chemical feeders	R	R		R
Chemicals	R	R		R
Water analysis	R	R		
Water treatment services	R			

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Water Treatment Service and Chemicals.

1. Anderson Chemical.
2. Chem-Aqua.
3. Nalco Chemical.
4. GE Betz.
5. Certified.
6. Or equal.

C. Bypass chemical feeders.

1. J.L. Wingert Co.
2. Industrial Chemical Corporation.
3. Or equal.

2.2 GENERAL

A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

B. Chemical Feed System Description:

1. Closed-Loop System: One bypass feeder on each system with isolating and drain valves with inlet piping connecting to discharge of circulating pumps, and outlet side of feeder connected to suction side of pump unless otherwise indicated.

a. Introduce chemical treatment through bypass feeder when required or indicated by test.

2.3 PERFORMANCE REQUIREMENTS

A. Maintain water quality for HVAC systems that controls corrosion and build-up of scale and biological growth for maximum efficiency of installed equipment without posing a hazard to operating personnel or the environment.

B. Base HVAC water treatment on quality of water available at Project site, HVAC system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction.

C. Closed-Loop System: Maintain system essentially free of scale, corrosion, and fouling to sustain the following water characteristics:

1. Conductivity: 1200 to 2500 umhos. (nitrite raises system conductivity).
2. Acceptable pH: Not less than 7.0 or greater than 8.5 (except for piping flush and clean step where the pH level is in the alkaline range of 9.5 to 10.5).
3. Hardness: < 5 ppm. (when closed loops have soft water make-up water).

2.4 CHEMICAL FEEDING EQUIPMENT

A. Bypass Chemical Feeders.

1. Batch feeder for closed circulating water systems.
2. Install feeder in convenient location where it may be easily refilled, maximum 4 feet above floor.
3. Install as indicated on drawings.

a. Support from floor.
b. Valves on air release, inlet, outlet and drain.
c. Air release valve on top.
d. Drain valve on bottom.
e. Capacity: 5 gallons.
f. 3/4-inch tappings.
g. Dome bottom with legs.
h. Steel or stainless steel.
i. Cap: Cast iron with Buna N O-ring: Quarter turn to open.
j. Operating pressure and temperature:

1) Minimum rated operating pressure up to 125 pounds per square inch.
2) Minimum rated operating temperature up to 250 °F.

4. Wingert Model DB-5HD or equal.

2.5 CHEMICAL TREATMENT TEST EQUIPMENT

A. Test Kit: Manufacturer recommended equipment and chemicals, in a carrying case, for testing pH, total dissolved solids, dissolved oxygen, biocount, chloride, and total alkalinity and for calcium hardness field tests.

B. Corrosion Test Coupon Assembly: Constructed of corrosion material, complete with piping, valves, and mild steel and copper coupons. Locate copper coupon downstream from mild steel coupon in the test coupon assembly.

1. Two-station rack for closed-loop systems.

2.6 CHEMICALS

A. Furnish chemicals recommended by water-treatment system manufacturer that are compatible with piping system components and connected equipment.

B. Provide supply of the following chemicals for treatment of water systems during the treatment period identified in 1.3B.

C. System Cleaner: Liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products.

D. Biocide: Chlorine release agents or microbiocides.

E. Closed-Loop, Water Piping Chemicals: Sequestering agent to reduce deposits and adjust pH, corrosion inhibitors, and conductivity enhancers.

F. All products shall be properly registered with the US Environmental Protection Agency and EPA registration number shall be clearly shown on all product literature and drum labels.

PART 3 - EXECUTION

3.1 WATER ANALYSIS

A. Perform an analysis of supply water to determine the type and quantities of chemical treatment needed to maintain the water quality as specified in "Performance Requirements" Article.

3.2 INSTALLATION

A. Per manufacturer’s recommendations

B. Install chemical application equipment on concrete bases level and plumb. Maintain manufacturer's recommended clearances. Arrange units so controls and devices that require servicing are accessible. Anchor chemical tanks and floor-mounting accessories to substrate.

C. Install water-testing equipment on white polypropylene backboard (on wall or free-standing support structure) near water-chemical-application equipment.

D. Install interconnecting control wiring for chemical treatment controls and sensors.

E. Mount sensors and injectors in piping circuits.

F. Bypass chemical feeders.

1. Mount on floor with top of reservoir tank maximum 4 feet above floor.
2. Supply to bottom of feeder to encourage mixing.

G. Valves and Piping.

1. See Section 232112 – Heating and Cooling Piping for piping materials and installation.
2. See drawings; arrange to be confirmed by manufacturer.

3.3 INITIAL CLEANING OF SYSTEMS

A. Prior to operation clean system as specified in Section 232112 – Heating and Cooling Piping.

B. Upon completion of cleaning, dose system with chemicals to obtain specified corrosion inhibition conditions.

3.4 START-UP AND SUPERVISION

A. Provide installation supervision and start-up automatic water treatment systems by qualified representative of water treatment equipment/chemical supplier.

3.5 TRAINING

A. Engage a factory-authorized service representative to train Owner's maintenance personnel on:

1. Procedures for programming and troubleshooting controllers.
2. Procedures and schedules for testing and maintaining water quality.
3. Organization and content of Operations & Maintenance Manuals.

END OF SECTION 23 25 00

SECTION 23 31 13

DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Ductwork.
2. Plenums.
3. Boiler flues and breechings.
4. Fasteners, sealants, and gaskets.
5. Hangers and supports.

1.3 REFERENCE STANDARDS

A. SMACNA HVAC Duct Construction Standards, latest edition.

1.4 DEFINITIONS

A. Seam: locks or weld applied longitudinally to close section of duct, for example longitudinal seam, spiral seam.

B. Joint: abutting connection between duct sections for continuity of air passage, for example cross joint, transverse joint, coupling.

C. Reinforcement: hardware applied to strengthen duct, for example girth angles, tie rods, fasteners (not connectors), and the like.

D. Stiffening: folding, bending, beading, crossbreaking or corrugating of sheets to achieve strength through shape, for example pocket lock secures joint and is transverse stiffener, with girth angle and fasteners applied (not connectors), joint or stiffener is reinforced.

E. Duct Classification:

1. Velocity:

a. Low: to 2000 feet per minute.
b. High: above 2000 feet per minute.

2. Pressure classification: except as indicated on the Drawings:

    a. Low: to 2 inches water gauge.
    b. Medium: above 2 inches to 6 inches water gauge. Default 3 inches if not otherwise indicated on the Drawings.
    c. High: above 6 inches water gauge.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements.

1. Entire ductwork system, including materials and installation, installed in accordance with NFPA 90A.
2. Ductwork and components shall be listed as U.L. 181, 181A and 181B, Class I air duct, flame rating not to exceed 25 and smoke rating not to exceed 50.
3. Flues shall conform to the requirements of NFPA-211. Products shall be listed to UL-103 and shall carry the appropriate UL listing mark or label.

B. Mockups:

1. Before installing duct systems, build mockups representing static-pressure classes in excess of 2inch wg. Build mockups to comply with the following requirements, using materials indicated for the completed Work:

    a. Five transverse joints.
    b. One access door(s).
    c. Two typical branch connections, each with at least one elbow.
    d. Two typical flexible duct or flexible-connector connections for each duct and apparatus.
    e. One 90-degree turn(s) with turning vanes.
    f. One fire damper(s).
    g. Perform leakage tests specified in "Field Quality Control" Article. Revise mockup construction and perform additional tests as required to achieve specified minimum acceptable results.

2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 SUBMITTALS

A. See Section 230010 Mechanical General Provisions.

B. Submit product data, O&M data, and samples and show item on shop and coordination drawings according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

C. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Ductwork materials and fittings	R			R
Duct fasteners, sealants, and gaskets	R			
Flexible duct	R			R
Flue	R			R
Duct pressure testing reports		R		

D. Mockups:

1. Before installing duct systems, build mockups representing static-pressure classes in excess of 3-inch wg. Build mockups to comply with the following requirements, using materials indicated for the completed Work:

   a. Five transverse joints.
   b. One access door(s).
   c. Two typical branch connections, each with at least one elbow.
   d. Two typical flexible duct or flexible-connector connections for each duct and apparatus.
   e. One 90-degree turn(s) with turning vanes.
   f. One fire damper(s).
   g. Perform leakage tests specified in "Field Quality Control" Article. Revise mockup construction and perform additional tests as required to achieve specified minimum acceptable results.

2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Spiral oval and round ducts:

1. United Sheet Metal Division, United McGill.
2. Semco Manufacturing, Inc.
3. Eastern Sheetmetal.
4. Lindab, Inc.
5. Or equal.

C. Duct Connection Systems:

1. Ductmate Industries, Inc.
2. Fabriduct Transverse Duct Connection system.
3. Ward Industries, Inc.
4. Or equal.

D. Flexible Connections:

1. Ventfabrics.
2. Duro Dyne.
3. Or equal.

E. Flexible Ducts:

1. Thermaflex.
2. Hart & Cooley.
3. Flexmaster.
4. Or equal.

F. Duct Sealants:

1. Foster Products Corporation.
2. Hardcast Corporation.
3. 3M.
4. Or equal.

G. Flexible Duct Clamps:

1. Panduit.
2. Dura-Dyne.
3. Young Regulator Company.
4. Or equal.

H. Hi-Efficiency Branch Take-Off Fittings:

1. Flexmaster.
2. Crown.
3. Sheet Metal Connectors.
4. Or equal.

I. Flues:

1. Metal-Fab, Inc..
2. American Metal Products Amerivent.
3. Simpson Dura-Vent.
4. Or equal.

2.2 MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Steel Sheet Metal:

1. Cold rolled soft steel sheets.
2. ASTM A653 and A924.
3. Galvanizing: 1-1/4 ounces per square foot, total both sides.

    a. General: G-90.

b. Exposed to weather: G-90.
c. Plenum walls and blank-offs where in contact with cooling coil: G-90.

4. Lock-forming quality.

C. Stainless Steel Sheet Metal:

1. ASTM A480.
2. Type 304 unless otherwise specified herein.
3. Lock-forming quality.
4. Finish:

a. No. 3 or 4 finish on ducts exposed to occupant view.
b. No. 2B or 3 finish on concealed ducts.

D. Miscellaneous Products.

1. Screws and rivets:

a. Same material as sheet, except as indicated on the Drawings.
b. On aluminum sheets, provide cadmium plated or stainless steel.
c. Zinc or cadmium plated, permitted on galvanized sheets.
d. Minimum screw size: No. 10.
e. Minimum rivet size: 4 pound.

2. Duct Sealants:

a. Sealing compound: UL-181 listed, water based:

1) Foster Safetee Duct Sealant 32-19.
2) Childers CP-146.
3) Hardcast Products Group Flex-Grip 550.
4) Or equal.

b. Rolled Elastomeric Duct Sealant: Hardcast Products Group Foil Grip 1403-181BFX, or equal, UL 181 listed.
c. Gaskets:

1) Continuous, reinforced, inert self-conforming type.
2) 1/8 inch thick.
3) Width: to match angle connection..
4) 3M Weatherban Ribbon Sealant PF5422 or equal.

d. Two-Part Hard-Setting Joint Tape:

1) Two part process includes tape and hard setting sealant.
2) Mineral impregnated woven fiber tape.
3) Impregnated with activator/adhesive of polyvinyl acetate type.
4) UL Listed.
5) Flame spread: 10.
6) Smoke contributed: 0.
7) Equal to Hardcast RTA-50 sealant and DT-5400 4 inch tape.

3. Spring Fasteners:

a. Oval head stud and receptacle.
b. Screwdriver slot.
c. Self-ejecting.
d. Dzus or equal.

4. Angles, tie rod and shapes for reinforcing ducts: In accordance with SMACNA HVAC Duct Construction Standards, except as indicated on the Drawings.
5. Duct connection system:

a. Transverse bolted duct joints.
b. Flanges with permanent, non-hardening sealant.
c. Ductmate Industries Ductmate 25 and 35, Fabriduct TDC, or equal.

E. Flexible Connections:

1. Conforming to UL Standard No. 214 and NFPA 90A.
2. SMACNA HVAC Duct Construction Standards, except as indicated on the Drawings.
3. With metal edges at each end: No. 24 USSG galvanized steel.
4. Length of fabric connections.

a. Minimum: 4 inch.
b. Maximum: 10 inch.

5. Materials:

a. Coated glass fabric.
b. Flame spread rating: 25.
c. Smoke development rating: 50.
d. 30 ounces per square yard.
e. Sewed and cemented seams.
f. Indoors:

1) Neoprene.
2) Ventfabrics, Inc. Ventglas or equal.

g. Outdoors:

1) Weather-resistant.
2) Fiberglass with Hypalon.
3) UV, sunlight, and ozone resistant.
4) Ventfabrics, Inc. Ventlon or equal.

h. Fume Hood:

1) Fabric coated with Teflon fluorocarbon resins.
2) Meets UL Standard #214 for flammability and NFPA 102 requirements.
3) Ventfabrics, Inc. Ventel or equal.

F. Turning Vanes:

1. Galvanized steel ductwork: galvanized steel or painted black steel, except as indicated on the Drawings.
2. Other ductwork: same material as ductwork.
3. Construction per SMACNA HVAC Duct Construction Standards for:

a. Double wall vanes.
b. Vane length: Provide separate equal size sections for vane length greater than those indicated in referenced Standards.
c. Vane runners: Type 1 or 2 acceptable.

4. Vane radius:

a. 2 inch radius: duct width up to 36 inches.
b. 4-1/2 inch radius: duct with 36 inches or larger.

5. Vane shall be at the correct angle for airflow (leading edge in line with the entering duct section; leaving edge in line with existing duct section). If only 45° angles are available, turning vanes shall only be used in 90° elbows where the entering width equals the exiting width; all other elbows shall be full radius type unless otherwise indicated on the drawings.

G. Hi-Efficiency Branch Take-Off Fittings: Low-pressure round take-off fittings in rectangular duct:

1. Factory-fabricated hi-efficiency take-off fitting.
2. 26 gauge body, G90 galvanized steel.
3. 1” wide mounting flange with fully closed corners and pre-punched screw holes, adhesive coated gasket on flange.
4. Balancing damper:

a. 20 gauge blade.
b. G90 galvanized steel 3/8 inch square control shaft.
c. Nylon shaft bearings/bushings.
d. 2” high insulation stand-off.
e. Duro Dyne KR-3 Locking hand quadrant or equal.

5. No scoop allowed for any application.
6. Flexmaster STOD or equal.

2.3 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General: Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction with galvanized sheet metal, according to SMACNA’s “HVAC Duct Construction Standards – Metal and Flexible.” Comply with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.

1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure classification.
2. Materials: free from visual imperfections such as pitting, seam marks, roller marks, stains, and discolorations.

B. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 0.0359 inches thick or less, with more than 10 square feet of unbraced panel area, unless ducts are lined.

C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

E. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.4 SINGLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).

C. Factory-fabricated spiral lock seam duct:

1. Snap-lock is not acceptable.
2. Factory-fabricated longitudinal seam acceptable for ducts larger than standard factory sizes.
3. Ducts up to 20 Inches in Diameter: Interior, center-beaded slip coupling, sealed before and after fastening, attached with sheet metal screws.
4. Ducts 21 to 72 Inches in Diameter: Three-piece, gasketed, flanged joint consisting of two internal flanges with sealant and one external closure band with gasket.
5. Ducts larger than 72 Inches in Diameter: Companion angle flanged joints per SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," Fig. 3-2.
6. Round Ducts: Prefabricated connection system consisting of double-lipped, EPDM rubber gasket. Manufacture ducts according to connection system manufacturer's tolerances.
7. Flat Oval Ducts: Prefabricated connection system consisting of two flanges and one synthetic rubber gasket.

D. Fittings:

1. Same material and construction as duct in which installed.
2. For ductwork exposed to occupant view, do not use fabricated fitting at taps to VAV boxes and outlets. Instead use saddle tap cut into continuous spiral duct. Intent is for spiral duct to be continuous for aesthetic reasons. Saddle tap flange shall be 0.5 inches or less.
3. 90 degree tees, laterals, and conical tees:

    a. Fabricate to comply with SMACNA’s “HVAC Duct Construction Standards – Metal and Flexible”, with metal thicknesses specified for longitudinal-seam straight ducts.
    b. Center-line take-off, unless otherwise indicated on the Drawings.

4. Elbows:

    a. Seams:

        1) 4 inch and higher pressure class and all ducts exposed to occupant view: continuously welded seams.
        2) 1 inch to 3 inch pressure: spot welded with bonded (sealed) seams.

b. Gores:

1) 2 gores - less than or equal to 30 degrees.
2) 3 gores - 31 degrees through 45 degrees.
3) 4 gores – 46 degrees through 60 degrees.
4) 5 gores - over 61 degrees

2.5 DOUBLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

A. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension) of the inner duct.

B. Round, Longitudinal- and Spiral Lock-Seam Ducts: Fabricate supply ducts of galvanized steel according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible." Ducts to have a perforated inner liner, a 1-inch layer of fiberglass insulation (1-1/2 pounds per cubic foot density) and an outer pressure cell.

C. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on static-pressure class unless otherwise indicated.

D. Inner Duct: Minimum 0.028-inch perforated galvanized sheet steel having 3/32-inch-diameter perforations, with overall open area of 23 percent.

E. Duct Joints:

1. Ducts up to 20 Inches in Diameter: Interior, center-beaded slip coupling, sealed before and after fastening, attached with sheet metal screws.
2. Ducts 21 to 72 Inches in Diameter: Three-piece, gasketed, flanged joint consisting of two internal flanges with sealant and one external closure band with gasket.
3. Ducts larger than 72 Inches in Diameter: Companion angle flanged joints per SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," Fig. 3-2.
4. Round Ducts: Prefabricated connection system consisting of double-lipped, EPDM rubber gasket. Manufacture ducts according to connection system manufacturer's tolerances.
5. Flat Oval Ducts: Prefabricated connection system consisting of two flanges and one synthetic rubber gasket.

F. 90-Degree Tees and Laterals and Conical Tees: Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," with metal thicknesses specified for longitudinal-seam straight ducts.

G. Diverging-Flow Fittings: Fabricate with reduced entrance to branch taps and with no excess material projecting from fitting onto branch tap entrance.

H. Fabricate elbows using die-formed, gored, pleated, or mitered construction. Unless elbow construction type is indicated, fabricate elbows as follows:

1. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
2. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from minus 2- to plus 2-inch wg:
3. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from 2- to 10-inch wg:

4. Flat Oval Mitered Elbows: Welded construction with same metal thickness as longitudinal-seal flat oval duct.
5. Round Elbows 8 Inches and Less in Diameter: Fabricate die-formed elbows for 45- and 90-degree elbows and pleated elbows for 30, 45, 60, and 90 degrees only. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
6. Round Elbows 9 through 14 Inches in Diameter: Fabricate gored or pleated elbows for 30, 45, 60, and 90 degrees unless space restrictions require mitered elbows. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
7. Round Elbows Larger Than 14 Inches in Diameter and All Flat-Oval Elbows: Fabricate gored elbows unless space restrictions require mitered elbows.
8. Die-Formed Elbows for Sizes through 8 Inches in Diameter and All Pressures 0.040 inch thick with 2-piece welded construction.
9. Round Gored-Elbow Metal Thickness: Same as non-elbow fittings specified above.

I. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
3. Coat insulation with antimicrobial coating.
4. Cover insulation with polyester film complying with UL 181, Class 1.

2.6 FLEXIBLE DUCTS

A. General Requirements:

1. Flexible ducts shall be used for supply air ducts only (not acceptable for return, exhaust, relief, outdoor, etc. air ducts).
2. UL 181, Class I Air Duct.
3. Labeled for compliance with IMC.
4. Minimum working pressure:

   a. 0 to 4 inch positive static pressure class: 4 inches.
   b. 0 to 1 inch negative static pressure class: 1 inch.

5. Acoustic Performance:

   a. Regenerative noise due to air turbulence within the duct shall not exceed the following sound power levels for a 12 inch diameter duct with an air speed of 1,000 feet per minute.

	Sound Power Levels, dB re. 10^{-12} Watts, at Octave Band Center Frequency, Hz				
	125	*250*	*500*	*1000*	*2000*
Maximum Regenerative Noise	*30*	*31*	*30*	*22*	*20*

6. Insulated Flexible Duct:

a. Chlorinated polyethylene (CPE) inner liner duct permanently bonded to a vinyl or zinc coated spring steel wire helix.
b. Fiberglass insulating blanket; minimum R-value:

1) Ducts outside the conditioned space and in conditioned envelope: 4.2.
2) Ducts outside conditioned space and conditioned envelope: 8.0.

c. Low permeability outer vapor barrier of fiberglass bi-directional reinforced metallized film laminate.
d. Flexmaster Type 8M or equal.

B. Flexible ductwork clamps:

1. Straps listed for use with flexible ductwork.
2. 2 inches and greater SP Class: Galvanized-steel strap with cadmium-plated hex screw to tighten band with a worm-gear action.

a. Adjustable toggle type.
b. Dura-Dyne Dyna Clamps or equal.

3. Less than 2 inches SP Class: Adjustable nylon strap.

a. With factory furnished installed tool.
b. Panduit PAN-TY Cable Ties, Heat Stabilized Nylon 6/6 or equal.

2.7 FLUES

A. Category IV appliances:

1. Positive pressure, double wall, factory-built, UL 1738 listed for Category IV appliances burning natural gas.
2. The vent shall have an inner gas carrying pipe of AL-29-4C superferritic stainless steel. The outer jacket shall be 430 stainless steel. The space between the inner and outer pipe, the thickness of materials, and construction of the modular sections and accessories shall be as specified by the terms of the product's UL Listing.
3. The stack system shall be from one manufacturer and shall be complete with caps, supports, and bracing.
4. Where exposed to weather, the outer closure band shall be sealed to prevent rainwater from entering the space between inner and outer walls.
5. Metal-Fab Model CG, Selkirt Saf-T Vent CI Plus, or equal.

2.8 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate with work of other trades.

B. Ductwork Installation – General:

1. Install ducts in accordance with manufacturer's written installation instructions.
2. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
3. Construct with gages, joints, bracing, reinforcing, and other details per latest IMC, ASHRAE, SMACNA and NFPA, unless specified otherwise.

    a. Comply with most stringent.
    b. Provide ducts with IMC gages or thicker when traversing rated corridors.
    c. Combustion air ducts: Minimum 24 gage.

4. Construct of galvanized sheet metal, except where otherwise indicated herein or on Drawings.
5. Provide for duct rigidity by either of these methods:

    a. Beading at 12 inches on center, maximum.
    b. Crossbreak outward in ducts having positive internal pressure.
    c. Crossbreak inward in ducts having negative internal pressure.

        1) Exception: All ducts exposed to rain shall outward crossbreak on top of the duct.

6. Duct dimensions indicated are outside duct dimensions (OD) unless indicated on the Drawings as inside dimension (ID or net, clear dimension).
7. Alter duct sizes on basis of equal friction where required to facilitate installation. Reflect changes in shop drawings for review by Architect.
8. At duct penetrations of walls, floors and ceilings where exposed to occupant view, provide sheet metal angle type escutcheons with no sharp corners or edges.

a. Clearance from duct to opening shall not exceed 2 inches.
b. Escutcheons shall overlap wall, floor, or ceiling surface by ½ inch minimum.

9. Frame, trim, caulk and seal all duct penetrations through acoustical walls and partitions.
10. Tapers:

a. Pitch sides of duct in diverging or converging airflow maximum of 1 to 4 taper.
b. Abrupt, bushing type fitting not allowed.

11. Duct Openings:

a. Provide openings where required to accommodate thermometers, smoke detectors, controllers, and the like. Insert through airtight rubber grommets.
b. Where openings are provided in insulated ductwork for insertion of instruments, install insulation material inside metal ring for use as plug.
c. At fire dampers allow adequate length of duct to install access door.

12. Avoid penetration of ducts; provide airtight seal at unavoidable penetrations of hanger rods.
13. No exposed sharp metal allowed.

a. All exposed pins, screws and sharp objects shall be covered with hardening silicon.
b. All exposed sheet metal edges shall be hemmed with exposed corners rounded smooth.
c. Remove all sheet metal fish hooks.

14. Install lining in ducts and plenums as specified in Section 230700 – Mechanical Insulation.
15. Flexible Connections:

a. Coated glass fabric.
b. For indoor or outdoor use.
c. Use diaphragm type at plug fan inlets.
d. Install at connections to fans and air handling units and as indicated on Drawings.
e. 2 inch slack in fabric; install to allow minimum movement of 1 inch in both tension and compression.
f. Protect from direct solar and rain exposure with sheet metal shroud where outdoors.

16. Volume dampers: Install dampers as specified in Section 233300 – Duct Accessories

C. Elbows and Splits:

1. Use radius elbows in rectangular ducts unless otherwise indicated on the Drawings: Centerline radius dimension shall not be less than 1-1/2 duct width.
2. Where space does not permit duct radius specified above install short radius splitter vanes per SMACNA HVAC Duct Construction Standard.

a. Number of vanes determined by ratio of inner radius (R) to duct width in plane of radius (W).
b. One vane: Radius to width ratio above 0.3.
c. Two vanes: Radius to width ratio between 0.1 to 0.3
d. Three vanes: Radius to width ratio 0.1 and smaller.

3. Use square turns with turning vanes in rectangular ductwork, unless otherwise indicated on the Drawings, at following locations.

a. Use only where full radius elbow cannot fit.

b. Use only in ducts with 2000 fpm or less design velocity.
c. In high and medium pressure ductwork spot weld turning vane to duct.

D. Rectangular Duct Joints:

1. Transverse Joints:

a. In medium pressure ductwork shall be Fabriduct TDC or Ductmate or equal.
b. In low pressure ductwork shall be Fabriduct TDC or equal except that ducts under 19 inches longest side may be slip & drive (S&D)

2. Longitudinal seams shall be Pittsburgh. Snap lock not allowed.

E. Plenum walls, blank-offs, and casings:

1. Construct per SMACNA HVAC Duct Construction Standard, Casings and Plenums.
2. Static pressure class:

a. Upstream of fan: -2 inches.
b. Downstream of fan: fan static pressure or greater.

3. Seal all joints, edges, and penetrations as per HVAC ducts as specified herein.

F. Round and oval ductwork:

1. Joints between ducts:

a. Made with beaded sleeve joints as scheduled.
b. Duct sealer applied to male end.
c. Mechanically fastened with sheet metal screws or pop rivets.
d. Over joint and screw or rivet heads, apply coating of duct sealer.

1) Duct where exposed to occupant view: Sealant shall be within joint only and not visible.

2. Joints, duct and fitting:

a. Slip projecting collar of fittings into duct: Per SMACNA HVAC Duct Construction Standard.
b. Apply duct sealer: Seal and tape as specified above.
c. Mechanically fasten: Fastening schedule: Per SMACNA HVAC Duct Construction Standard.

3. Branch take-offs:

a. Medium pressure: 45 degrees (fittings).
b. Low pressure: straight 90 degrees (fittings).

4. Horizontal supports:

a. One or two piece clamp band strap.
b. Minimum: one per section.
c. Support fittings as required to prevent sagging.

5. Vertical Supports: one of the following:

    a. Clamp bands with extended ends supported by floor.
    b. Clamp bands with knee bracing.
    c. Pedestal at base of vertical.

G. Flexible ductwork:

1. Not allowed for:

    a. Return, exhaust, or outdoor air ducts.
    b. Product conveying systems such as kitchen exhaust and laboratory exhaust.
    c. Dryer exhaust (other than final exposed connection at dryer).
    d. Medium and high pressure ducts.

2. Continuous, single pieces:
3. Length:

    a. Low pressure:

        1) Maximum 5 feet, except where longer lengths are indicated on drawings. Where longer lengths are shown, the last 3 feet to 5 feet shall be wire flex duct and remaining ductwork shall be aluminum flex duct.
        2) Minimum length: 3 feet.

4. End connections:

    a. Connect to duct collars, terminal unit connections and round air outlets per manufacturer's instructions.
    b. Secure with strap clamps specified above.

5. Installations:

    a. Support adequately to avoid excessive droop.
    b. Minimum inside bending radius not less than one duct diameter.
    c. Install as straight as possible except as shown on drawings for sound attenuation.
    d. Cut ducts to lengths required rather than create bends to take up excess lengths except as shown on drawings for sound attenuation.

H. Grille connections:

1. Provide at entry to diffuser collar either.

    a. Straight duct for 1 duct diameters or greater.
    b. Full radius elbow.
    c. Side inlet plenum.

        1) Height: 4 inches minimum taller than top of grille to provide room for uniform airflow to grille.
        2) Width/length: 2 inches wider than duct or round diffuser collar, whichever is larger.
        3) Internal surfaces lined with minimum 1/2 inch thick Type AL duct liner as specified under Section 23 07 00 – Mechanical Insulation.

4) At contractor's option, where plenum is required at round neck diffuser, square neck diffuser with length and width equal to diffuser diameter may be substituted.

d. Thermaflex FlexFlow Elbow or equal.

2. Connections at grilles shall be insulated to the extent the duct is insulated including the final register box.
3. Seal connections at grilles per seal class of upstream ductwork.

I. Ducts exposed to weather:

1. Galvanized steel G-90, 304 stainless steel, or aluminum.
2. Make ducts subject to rain watertight.
3. Construct as follows to assure water run-off.

a. Arrange standing seams to not act as dams.
b. Longitudinal seams at bottom of duct.
c. Construct all ducts subject to rain watertight and to insure water runoff by one or more of following techniques.

1) Slope entire top of duct down toward side..
2) Vertical struts within duct to bow top panels of duct into convex shape.

4. Seal as specified herein.

J. Sound-rated duct packing:

1. Wherever possible avoid duct penetrations through sound-rated walls, floors and ceilings.
2. Provide packing for unavoidable duct penetrations.

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Ductwork exposed to occupant view shall be run straight and true, in line with building elements. No sagging or out-of-true straight runs shall be acceptable. Sidewall taps and duct joints shall be clean and free of visual blemishes and all sealant shall be internal to joint and not visible. Ducts shall have no external markings or tags. All duct beads shall be parallel.

C. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

D. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

E. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

F. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT CLASSIFICATION

A. Minimum operating pressure for each duct system, general.

B. Static pressure class, unless otherwise indicated on the Drawings.

Application	SMACNA Pressure Class
Discharge of air handlers through shaft fire/smoke damper	4 inches
Air distribution duct from fire/smoke damper to VAV terminal boxes	3 inches
VAV downstream of terminal boxes	1 inch
Discharge of air handler though air distribution devices (for constant volume systems)	2 inches
Toilet exhaust	-2 inches
Return	-2 inches
Other fans systems	Per fan static
Return air transfers	1 inch negative

3.4 DUCT SEALING

A. Seal ducts per the Seal Level table below:

1. Seal factory fabricated ducts and plenums, including terminal boxes, if not factory sealed to Seal Level listed.
2. Provide more stringent sealing if required to meet other requirements herein.

Seal Level Requirement					
Duct Location	Duct Type				
	Supply		Exhaust	Return	Outdoor
	≤2 in. water column[b]	>2 in. water column[b]			
Outdoors	A	A	A	A	A
Unconditioned Spaces	A	A	A	A	A
Return Air Plenums	A	A	A	A	A
Conditioned Spaces	A	A	A	A	A
[b] Duct design static pressure classification.					

Seal Level Definitions	
Seal Level	Sealing Requirements
A	All transverse joints, longitudinal seams, and duct wall penetrations
B	All transverse joints and longitudinal seams
C	Transverse joints only

Longitudinal seams are joints oriented in the direction of airflow. Transverse joints are connections of two duct sections oriented perpendicular to airflow. Duct wall penetrations are openings made by any screw fastener, pipe, rod or wire. Spiral lock seams in round and flat oval duct need not be sealed. All other connections are considered transverse joints, including but not limited to taps and other branch connections, access door frames and jambs, duct connections to equipment, etc.

B. Ducts not exposed to weather: Seal using one of the following:

1. Duct sealer compound.
2. Gasketted TDC or Duct-Mate.
3. Two-Part Hard-Setting Joint Tape.
4. Flexible duct:

    a. Secure with straps or clamps as specified herein.
    b. Supplement with duct tape, both inner and outer liner.

5. Indoor duct where exposed to occupant view: Sealant shall be within joint only and not visible.
6. Fire and fire/smoke dampers: Sealant shall be listed as approved on manufacturer's UL installation sheet.
7. Continuously welded ducts: Additional sealing not required.

C. Duct exposed to weather:

1. TDC or Duct-Mate joints: Utilize interior joint gasket material plus a bead of butyl rubber sealant at the joint and continuous metal clip or cleat over the top of all four joints (top bottom and sides).

2. Continuously welded ducts: Additional sealing not required.
3. Other joints: Apply two part hard-setting joint tape to:

    a. Longitudinal joints.
    b. Horizontal joints.
    c. Transverse joints.
    d. TDC or Duct-Mate joints.
    e. Duct penetrations.
    f. Screws through duct.
    g. Gores of elbows.

D. Seal punched holes and corner cracks.

E. Seal all factory fabricated ducts, including transverse joints on gored elbows.

F. Seal end caps.

G. After installation and testing reseal joints found to be leaking at no additional cost to the Owner.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.6 FLUE INSTALLATION

A. Install in accordance with manufacturer’s installation instructions and UL listing requirements and with local codes.

B. Category 1 Appliances: Minimum stack height shall be in accordance with GAMA Venting Tables for Category I Appliances and IMC.

C. Support from building structure using rigid structural shapes for attachment of fixed point supports. Anchor supports to structure by welding, bolting, steel expansion anchors, or concrete inserts. Size of structural shapes shall be in accordance with manufacturer’s recommendations.

D. Roof penetration pieces shall be UL listed products of the chimney manufacturer. Where roof is pitched up to 45° roof penetration pieces shall be of the pitched type so that it is not necessary to provide a horizontal roof curb. If roof pitch exceeds 45°, provide a curb around roof opening.

E. All inner pipe joints shall be held together by means of formed vee bands and sealed with P077 Silicone Sealant for flue gas temperature up to 600°F, or P071 High Temperature Sealant for flue gas temperatures over 600°F.

F. Screws shall be of the hex head type with shoulder stops and tapered leading threads for easy starting. Nuts for the inner and outer bands shall be retained by means of a free-floating cage to allow easy alignment.

G. Where exposed to weather:

1. The outer closure band shall be sealed with the same sealant as the inner joint.
2. Paint with one coat of corrosion and heat resistant primer and cone coat heat resistant paint. Paint color selected by Architect.

H. Termination:

1. Roof termination: Terminate with listed wind resistant flue cap 3 feet above the highest point where it pass through a roof and at least 2 feet higher than any portion of the building within a horizontal distance of 10 feet.
2. Wall termination: Terminate with listed 45° miter cut with bird screen unless otherwise indicated on plans.

3.7 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.8 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer.

3.9 DUCT PRESSURE TESTING

A. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
2. Test the following systems:

    a. Supply, Return, Exhaust, and Outdoor Air Ducts: Test 100% of installed duct sections.
    b. Field installed plenums. Test 100% of all field installed plenums.

3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
4. Test for leaks before applying external insulation.
5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
6. Give seven days' advance notice for testing.

B. General:

1. Pretesting shall be conducted prior to conducting test in presence of Architect. Once all required ductwork has passed the pretest duct pressure test, the Architect shall be notified to visit the site for witness testing.
2. Use portable high pressure blower and necessary instruments to indicate amount of leakage.
3. Conduct tests as prescribed in SMACNA HVAC Air Duct Leakage Test Manual, and make test before duct sections are concealed.
4. Procedure:

    a. Seal openings in ducts and plenums to be tested.
    b. Connect test apparatus to test section using flexible duct connection or hose.
    c. Close damper on blower suction side, to prevent excessive buildup of pressure.
    d. Start blower and gradually open damper on suction side of blower.
    e. Build up pressure in test section equal to static pressure class.
    f. Noise generated from duct leakage not acceptable. Seal as required.
    g. Determine amount of air leakage by makeup air flow measurements:

        1) Maximum permitted leakage for HVAC ductwork shall be:

$$CFM_{max} = \left(\frac{A}{100}\right) C_L P^{0.65}$$

Where,

CFM_{max} = The maximum permitted leakage, cubic feet per minute (cfm).

A= Surface area of the tested duct sections, square feet.

C_L= Duct leakage class, cfm/100 square feet at 1 inch water column.

= 6 for rectangular sheet metal, rectangular fibrous ducts, and round flexible ducts

= 3 for round/flat oval sheet metal or fibrous glass ducts

P= Test pressure which shall be equal to the design duct pressure class rating, inches water column.

2) Allowable leakage can also be calculated as 1 percent of the design operating air volume for the entire system. If this method is used, the total system leakage must first be determined and then compared with the 1 percent (of system volume flow) allowable leakage. Acceptance is indicated if the actual measured leakage of the entire system is less than the calculated allowable leakage.
3) If leakage exceeds permitted limit, repair leaks and retest duct sections at no additional cost to the Owner until permitted leakage limits are obtained.

5. Visually mark tested sections with certification sticker and initials of field test inspector.

C. Documentation:

1. Submit certification of test results of compliance to Architect.
2. Include certified test results showing compliance per Section 230010 – Mechanical General Provisions.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.10 SYSTEM LEAK TESTING

A. Scope of Testing:

1. Supply: All supply air duct systems.
2. Return: All return air duct systems.
3. Exhaust: Systems greater than 10,000 cfm design capacity.
4. Outdoor air: Not required.

B. General:

1. Tests shall be done after air balancing; see 230593 – Testing, Adjusting and Balancing.

2. Determine the maximum allowable leakage per system using the methodology in described above. The duct surface area shall be all ductwork downstream of the fan through the air outlets.
3. Or, use the 1 percent allowable leakage as described above.

C. Test Conditions:

1. Fan balance complete and operating at design airflow conditions.
2. For variable volume fans, set all the variable volume boxes to design maximum airflow rates and operate the fan at optimum static pressure setpoint; (see 230593 Testing, Adjusting and Balancing); fan and boxes to remain in a static state during the testing.

D. Leakage Testing:

1. Collect the following information from air balance reports for each tested fan system. (This work is already required in Section 230593 Testing, Adjusting and Balancing, so no new work is required.)

   a. Pitot traverse in the supply (exhaust) duct downstream, positive pressure side (downstream, negative pressure side) of the fan, and
   b. Totaling the readings of individual air outlets or terminals

2. Subtract the readings in Paragraph above. If the difference in the readings, accounting for the accuracy of the test instruments, is greater than the amount allowed in Paragraphs above, repair air leaks as required and retest.

E. Documentation:

1. Submit certification of test results of compliance to Architect.
2. Include certified test results showing compliance per Section 230010 – Mechanical General Provisions.

3.11 PROTECTION

A. Adhere to SMACNA Duct Cleanliness for New Construction Guidelines for Intermediate Level Duct Cleanliness unless more stringent requirements are indicated herein.

B. Storage: Porous materials, such as lined and flexible duct, shall be stored where they will not be exposed to rain or other moisture sources.

C. Temporary closure: Provide temporary closure of polyethylene film or other covering which will prevent entrance of dust and debris at the following conditions:

1. Exposed ends of unlined installed ducts at the end of each day.
2. Exposed ends of lined ducts or plenums whether in storage or installed.

D. Duct cleaning:

1. Using the connected fan(s) force air at high velocity through duct to remove accumulated dust.
2. Protect equipment and spaces, which may be harmed by excessive dirt with filters, or bypass during cleaning.

3. In areas, which must be kept dust free, seal all outlets duct tight. When closures are removed avoid spilling dust in room.

3.12 INSPECTION

A. Verify that adequate clearance between ducts and adjacent walls or equipment is available to permit proper sealing, maintenance and repairs.

3.13 PRE-OPERATING CHECKS

A. Before operating the duct systems: Set all manual dampers in full open position.

3.14 TESTING AND ADJUSTING

A. After starting the duct systems: Check for noise and leakage. Repair as required at no additional cost to the Owner.

B. See Section 230593 – Testing, Adjusting, and Balancing: Coordination with Balance Agency:

1. Provide services of a sheet metal installer familiar with the system ductwork to provide assistance to the balancing agency during the initial phases of air balancing in locating all sheet metal dampers.
2. Install missing dampers.

END OF SECTION 23 31 13

SECTION 23 33 00

DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Access Doors.
2. Balancing Dampers.
3. Backdraft Dampers.
4. Fire dampers.
5. Fire and Smoke Dampers.
6. Wall Louvers.
7. Combination Louvers/dampers.
8. Drain Pans.
9. Belt Guard.
10. Condensate Pumps.
11. All duct accessories except, where integral with manufactured piece of equipment.

1.3 QUALITY ASSURANCE

A. Fire, smoke, and fire/smoke dampers shall be UL listed and constructed in accordance with UL Standard 555 Fire Dampers and UL Standard 555S.

B. Demonstrate operation of smoke dampers to authorities having jurisdiction and Architect as part of life safety testing.

C. Access doors shall be UL labeled.

D. Damper pressure drop and leakage ratings shall be based on tests and procedures performed in accordance with AMCA 500 - Test Methods for Louvers, Dampers and Shutters.

1.4 SUBMITTALS

A. See Section 230010 Mechanical General Provisions.

B. Submit product data, O&M data, and samples and show item on shop and coordination drawings according to the following table.

1. “R” means required.

2. "R2" means required only for products and equipment differing for the specified manufacturer and model and for "or equals" where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Access doors	R2			R
Balancing dampers	R2			R
Automatic dampers	R	R		R
Backdraft dampers	R2			R
Fire dampers	R	R		R
Smoke dampers	R	R		R
Fire/Smoke dampers	R	R		R
Wall louvers	R			R
Combination louvers/dampers	R	R		R
Drain pans	R2			R
Condensate pumps	R	R		
Belt guards	R2			

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Access Doors, Ducts.

1. Ventfabrics, Inc.
2. Duo Dyne, Corporation .
3. Ruskin Mfg. Company .
4. PCI Industries – Pottorff .
5. Ductmate .

C. Access Doors, Plenum.

1. Ventfabrics, Inc.
2. Duo Dyne, Corporation.
3. Elgen Manufacturing Company.

D. Balancing and Automatic Dampers.

1. Ruskin Manufacturing Company.
2. Greenheck Fan Corp.
3. PCI Industries - Pottorff
4. Johnson Controls.

E. Backdraft Dampers.

1. Ruskin Manufacturing Company.

2. Greenheck Fan Corp.
3. Air Balance, Inc.
4. American Warming and Ventilating Inc.

F. Damper Hardware.

1. Ventfabrics, Inc.
2. Duo Dyne, Corporation.
3. Young Regulator Company.

G. Fire Dampers and Combination Smoke and Fire Dampers.

1. Ruskin Manufacturing Company.
2. Greenheck Fan Corp.
3. Air Balance Inc.
4. PCI Industries – Pottorff.

H. Wall Louvers and Combination Louver/dampers.

1. Ruskin Manufacturing Company.
2. Greenheck Fan Corp.
3. PCI Industries – Pottorff.

2.2 DUCT ACCESS DOORS

A. In accordance with SMACNA Duct Construction Manuals, except as indicated in the Drawings.

B. Construction:

1. Galvanized steel.
2. Rating same as duct pressure class.
3. Where duct is insulated:

   a. Fiberglass insulation, thickness to match duct insulation installed R-value, see 230700 – Mechanical Insulation.
   b. Double wall.

4. Removable type with safety chain linking door permanently to frame.
5. Positive seal polyethylene gasket.
6. Paired progressive cam-locks, quantity as required for tight, low leakage fit.
7. No tools required for opening and closing.

C. Size:

1. 20 inches x 14 inches unless otherwise indicated in the Drawings.
2. Ducts less than 16 inches: one dimension 20 inches; other dimension 2 inch less than duct width.
3. Larger sizes where required for access.

D. Provide in the following locations:

1. Coils in ducts (including at VAV boxes).

a. Entering and leaving side for cooling coils.
b. Entering side for heating coils.

2. Automatic dampers: linkage side.
3. Smoke dampers.
4. Fire dampers.
5. Smoke detection heads.
6. At the top of each lined duct riser accessible from the fan room floor (for inspection of duct liner).
7. Fan bearings enclosed in ducts.
8. Sprinkler heads in ducts.
9. Motors, actuators or other accessories that require access or service inside ducts.
10. Outdoor air plenums as required to clean plenum from dirt and debris.
11. Where otherwise indicated on the Drawings.

2.3 MANUAL, AUTOMATIC AND BACKDRAFT DAMPERS

A. Manual Dampers:

1. Conform to requirements of SMACNA HVAC Duct Construction Standards.
2. General:

a. Blades of same material as duct where damper is located.
b. Damper Hardware:

1) Ventlok 400 and 4000 series or equal; for low pressure systems 2 inch SMACNA pressure class and less.
2) Ventlok HiVel hardware or equal; for greater than 2 inch SMACNA pressure class.

c. Actuating quadrants typical for single and multi-blade dampers; provide closed bearing on opposite end from quadrant to prevent air leakage: Ventlok No. 609 or equal.
d. Bearing at one end of damper rod: Ventlok No. 609 or equal.
e. Sealed bushings installed at both ends to avoid duct leakage.
f. Accessible quadrant at other end of damper rod.

1) With lever and lock screw: Ventlok No. 635 or equal.
2) Insulated ducts.

a) Quadrants mounted on collar to clear insulation.
b) Ventlok Nos. 637, 638, or 639 or equal.
c) Selection based on insulation thickness.

g. For dampers above non-removable ceilings and without ceiling access panels provide Ventlok No. 677 or equal concealed damper regulator.

1) With paintable cover plate.
2) Required interconnecting hardware.

3. Single blade dampers:

a. Galvanized steel ductwork: galvanized steel, except as indicated in the Drawings.
b. Blade: Two gages heavier than duct gage, or 18 gage, whichever is lighter.

4. Multi-blade dampers.

    a. Low Pressure/Low Velocity Systems (2 inch water column or less static pressure class and 1500 fpm or less face velocity).

        1) Opposed blade damper.
        2) Ruskin Model CD35 or equal.

    b. High Pressure/High Velocity Systems (greater than 2 inch water column static pressure class or greater than 1500 fpm face velocity):

        1) Rectangular.

            a) Opposed blade damper.
            b) Ruskin Model CD60 or equal.

        2) Round and Oval.

            a) Oval: Ruskin Model CDR25 and DO25 or equal.
            b) Round: Up to 20 inch diameter: Ruskin Model MDRS25 or equal.
            c) Round: Larger than 20 inch diameter: Ruskin Model CDRS25 or equal.

B. Automatic Dampers:

1. Actuators: See Section 230913 – EMCS Basic Materials and Control System.
2. Construction:

    a. Return air dampers (AHUs):

        1) Class 2 smoke-rated Ruskin Model SD-36 or equal.
        2) End switches: Provide end switch to indicate fully-closed position.

    b. Blade Action:

        1) Throttling duty: opposed.
        2) Mixing duty: parallel.
        3) Two-position: parallel or opposed.

    c. Bearings: Molded synthetic sleeve, turning in extruded hole in frame.
    d. Seals:

        1) Blade: Inflatable PVC coated fiberglass material or neoprene mechanically attached to blade edge.
        2) Jamb: Flexible metal compression type.

    e. Linkage: concealed in frame. External linkage and jack-shafts will not be accepted.
    f. Axles: Minimum 1/2 inch diameter plated steel, hex-shaped, mechanically attached to blade. Side access for direct-coupled actuator.

3. Finish: Mill galvanized.
4. Damper area: See Drawings for sizes.
5. Low Pressure/Low Velocity Systems (2 inch water column or less static pressure class and 1500 fpm or less face velocity).

a. Integral, heavy-duty factory-installed motorized damper acceptable for exhaust fans unless otherwise scheduled.
b. Ruskin Model CD36 or equal.

6. High Pressure/High Velocity Systems (greater than 2 inch water column static pressure class or greater than 1500 fpm face velocity):

a. Ruskin Model CD60 or equal.

C. Backdraft Dampers:

1. Required locations:

a. Where indicated on the Drawings.
b. In suction or discharge of all exhaust fans as listed in equipment schedule.

1) Integral, heavy-duty factory-installed type acceptable unless otherwise scheduled.

2. General Applications:

a. Construction:

1) Extruded aluminum construction.
2) Extruded vinyl locked into blade edge.
3) Blade ends overlapping frame.

b. Performance:

1) Start to open: .02 inches w.g. or less.
2) Fully open: .05 inches w.g. or less.
3) Leakage for 24 inch wide damper: 25 cfm per ft^2 or less.

c. Ruskin Series CBD4 or equal.

3. High Velocity Applications:

a. Applies to discharge of air handlers and where velocity exceeds 1500 fpm. Damper shall be specifically designed for location at turbulent fan discharge.
b. Frame:

1) Minimum 12 gage galvanized steel channel.
2) Bolt Holes: Both flanges.

c. Blades:

1) Airfoil-shaped with integral structural reinforcing tube running full length of each blade.
2) Material: 7 inches x minimum 0.080 inch Alloy 6063-T5 extruded aluminum.
3) For multiple section dampers, provide galvanized steel or aluminum bracket to link dampers so they operate together.

d. Axles: Minimum 3/4 inch diameter plated steel.
e. Bearings: Bolt-on bearings with re-lube ball bearings.

f. Linkage:

1) 3/16 inch thick x 3/4 inch plated steel tie bar with minimum 16 gage plated steel linkage arms; stainless steel pivot pins.
2) Located out of airstream (side or external linkage).

g. Counterbalance: Located out of airstream.
h. Seals:

1) Blade:

a) Mechanically attach blade seals to blade.
b) Silicone rubber, rated for 300 degrees Fahrenheit.

2) Jamb: Vinyl

i. Ruskin CBS92 or equal.

2.4 FIRE DAMPERS

A. Ratings (test conditions and label) per UL Standard 555.

1. 250 degrees Fahrenheit minimum.
2. 1-1/2 hour fire rating, unless otherwise indicated in the Drawings.
3. Dynamic (closes against air flow).

B. Factory sleeve.

C. Damper.

1. Multi-bladed, equipped with fusible link, spring loaded type.
2. Style:

a. As indicated on the Drawings.
b. Ducted, rectangular duct: Style B (out of airstream).
c. Ducted, round duct: Style A (in airstream) with damper sleeve 2” in each dimension larger than duct; plus cap and collar.
d. Unducted: Style A (in airstream).

D. Fusible Link.

1. UL listed.
2. Fusible links on fire dampers shall be constructed to UL Standard 33 – Fusible Links for Fire Protection Service.
3. Temperature rating: Per code.

E. Type:

1. Rectangular type up to 1000 feet per minute: Ruskin DIBD2 or DIBD10 Style A or equal.
2. Rectangular type 1000 feet per minute and higher: Ruskin DIBD2 or DIBD10 Style B or equal.
3. Circular and oval type: Ruskin DIBD2 Style CR and CO, or DIBD10 Style R and LO or equal.

F. Status end switches:

1. Where indicated on the Drawings.
2. Ruskin SP100 or equal Switch Package.

2.5 COMBINATION SMOKE AND FIRE DAMPERS

A. Fire ratings (test conditions and label) per UL Standard 555.

1. 250 degrees Fahrenheit minimum.
2. 1-1/2 hour fire rating, unless otherwise indicated in the Drawings.

B. Factory sleeve.

C. Damper.

1. Two-position duty: Either parallel blade or opposed blade.
2. Leakage class as scheduled, minimum Class 2, rated per UL 555S.
3. Locate damper in sleeve starting at approximately 3” from end of the sleeve opposite the damper actuator end. (Damper shall be installed with this end protruding 3 inches out from inside surface of wall.)

D. Actuator.

1. 120 volt.
2. Two-position unless otherwise indicated on drawings.
3. Spring return normally closed unless otherwise indicated on drawings.
4. Electronic cut-out at full-open so that actuator creates no noise holding open.
5. Permanently lubricated gears.
6. Direct coupled with steel clamp; aluminum clamp and external linkage not acceptable.

E. Controls.

1. Heat-actuated electric release.
2. Controlled closure to prevent duct and HVAC component damage.
3. Time to drive from full closed to open and or spring from full open to closed shall not exceed the following:

   a. FSD’s: 15 seconds.
   b. All others: 75 seconds.

4. Damper to automatically reopen after a test, smoke detection or power failure condition. In the event of heat activated closure, the damper must be manually reset at the damper.
5. Release temperature: as scheduled on drawings or use the following: 165 ºF. This must be <286 ºF for life safety system or whatever design-fire temperature is for exhaust dampers. Should be about 50°F above normal temperature, not less than 160°F per IBC. In non-life safety buildings, use 165ºF. For life safety bldgs with smoke control, use 250ºF which is more than 50ºF above the design smoke temperature, typically 165ºF.
6. Ruskin EFL or equal.

F. Status end switches.

1. Where indicated on the Drawings.
2. Ruskin SP100 or equal Switch Package.

G. Type.

1. Ruskin Type FSDR25, or equal for round ducts. (UL R5531, CSFM #3230-245:108).
2. Ruskin Type FSD36, or equal for 1800 feet per minute and below. (UL R5531, CSFM #3235-0245:0124).
3. Ruskin Type FSD60 or equal for 1800 feet per minute and above. (UL R5531, CSFM #3235-0245:0126).
4. Alternative Ruskin Type FSD60FA or equal for 1800 feet per minute and above. (UL R5531, CSFM #3230-245:116 respectively).
5. Ruskin Type FSD60M, for short sleeve where needed. (UL R5531, CSFM #3230-245:110).

H. Smoke Detector.

1. Detects presence of smoke in the airstream of ductwork in HVAC systems without a minimum operating velocity including no flow operation.
2. UL Listed.
3. CSFM Listing.
4. Ruskin DSDN, or as provided by Div-26 or equal.

2.6 CONDENSATE PUMP

A. Manufacturer: Little Giant, Diversitech, or equal.

B. Provide where scheduled.

C. Contractor shall verify pumping head requirements.

D. Features:

1. Discharge check valve.
2. 115-volt with grounded plug connection.
3. High level alarm contact.

2.7 BELT GUARDS

A. Fabricated per OSHA and SMACNA Duct Construction Standards.

2.8 WALL LOUVERS & COMBINATION LOUVER/DAMPERS

A. Louvers licensed to bear AMCA Certified Ratings Seal. Ratings based on tests and procedures performed in accordance with AMCA 511 and comply with AMCA Certified Ratings Program. AMCA Certified Ratings Seal applies to air performance and water penetration ratings.

B. Materials.

C. Screen.

D. Gutters: Drain gutter in head frame.

E. Downspouts: Downspouts in jambs to drain water from louver for minimum water cascade from blade to blade.

F. Vertical Supports: Hidden vertical supports to allow continuous line appearance up to 120 inches.

G. Sill: Steeply angled integral sill eliminating areas of standing or trapped moisture where mold or mildew may thrive and effect indoor air quality.

H. Assembly: Factory assemble louver components; mechanically fastened.

I. Blank off panels for unused portions of louvers: 20 gage galvanized sheet metal.

J. Factory Finish:

1. Kynar 500 (70% Kynar Resin) 2-Coat Fluoropolymer Coating or equal, unless otherwise specified on Drawings.

a. Conform to AAMA 2605-98.
b. Apply coating following cleaning and pretreatment.
c. Cleaning: AA-C12C42R1X.
d. Dry louvers before final finish application.
e. Total Dry Film Thickness: Approximately 1.2 mils, when baked at 450 degrees Fahrenheit for 10 minutes.
f. Warranty: Limited 20 year warranty on standard colors.
g. Color: Color as selected by Architect from manufacturer's standard colors.

K. Basis of Design Louvers:

1. Outside air intake: Greenheck EHH-601 or equal. 6-inch deep wind-driven rain louver.
2. Exhaust outlet: Greenheck EHH-601 or equal. 6-inch deep wind-driven rain louver.
3. Combination louver/damper: Greenheck EACA-601 or equal, 6” frame.

2.9 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Compliance with ASHRAE/IESNA 90.1-2010 includes Section 6.4.3.3.3 - "Shutoff Damper Controls," restricts the use of backdraft dampers, and requires control dampers for certain applications. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Volume dampers.

1. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

    a. Volume dampers shall be installed as far away from air outlets as functionally reasonable to avoid noise in the occupied space.
    b. Provide also in wyes and branch take-offs to outlets whether indicated on the Drawings or not, except.

        1) To sidewall outlets in exposed ducts (opposed blade dampers in outlets shall be provided).

2. For ductwork exposed to occupant view, volume damper handles shall be on top of duct or otherwise concealed from occupant view.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Fire and smoke dampers.

1. Provide in ducts and openings as indicated in the Drawings.
2. Provide access door in duct adjacent to each in location where damper may be inspected and internal fusible link or fire-stat may be replaced.
3. Install duct smoke detector provided by Division 26 if required; see Division 26 drawings.
4. Smoke and fire dampers installed in tunnel corridors shall have weight of damper supported from structure above.

H. Control dampers.

1. Field mounted control dampers installed with concealed linkage shaft accessible on side of damper with space for direct-coupled actuator.
2. Actuator installation: See Section 230913 – EMCS Basic Materials and Devices

I. Install belt guards at all exposed belts.

J. Drain pans.

1. See Section 221316 – Sanitary Waste and Vent Piping.
2. Condensate drain pans (including pans on fan-coils, packaged units, and air handlers).

    a. Slope to drain connection to allow complete draining of pan.
    b. Provide condensate pump where scheduled.
    c. Piping from intermediate drain pan to lowest pan.

        1) Pipe to within 1 inch of and discharge into lowest drain pan.

d. Piping from lowest pan drain connection to sewer.

1) Trap height and offset must allow water seal to remain and to allow complete drainage of pan both when fan is operating or not.

e. Field test.

1) Test all drain pans after installation to ensure proper slope and drainage and to prevent conditions of water stagnation that result in microbial growth.
2) Drainage shall be considered acceptable if after covering the entire pan with 1/2 inch water, the pan drains within 3 minutes to leave puddles no more than 2 inch in diameter and no more than 1/8 inch deep.
3) Test with the fan system in operation for pans on the suction side of the fan, and with the fan off for pans on the discharge side of the fan.
4) Document tests: See Section 230010 – Mechanical General Provisions.

3. Auxiliary drain pans.

a. See Section 221316 – Sanitary Waste and Vent Piping.
b. Separate drain from main drain pan.
c. Discharge where water flow is readily observed but not over any material or equipment that may be damaged by water.

K. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. On both sides of duct coils.
2. Upstream from duct filters.
3. At outdoor-air intakes and mixed-air plenums.
4. At drain pans and seals.
5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
7. At each change in direction and at maximum 50-foot spacing.
8. Upstream from turning vanes.
9. Upstream or downstream from duct silencers.
10. Control devices requiring inspection.
11. Elsewhere as indicated.

L. Install access doors with swing against duct static pressure.

M. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

N. Install duct test holes where required for testing and balancing purposes.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.

2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.
5. Operate remote damper operators to verify full range of movement of operator and damper.

3.3 TESTING AND ADJUSTING

A. After starting duct accessories.

1. Check for noise and leakage; repair as required at no additional cost to the Owner.
2. Operation test: Test each piece of equipment to show that it will operate in accordance with requirements.

B. See Section 230593 – Testing, Adjusting, and Balancing

END OF SECTION 23 33 00

SECTION 23 34 23

FANS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Centrifugal fans.
2. Propeller fans.
3. Centrifugal inline fans.
4. Ceiling exhaust fans.
5. Roof mounted fans.
6. Axial flow fans.
7. All fans except where integral with manufactured piece of equipment.

1.3 REFERENCE STANDARDS

A. ANSI/AFBMA Standard 9 – Load Rating and Fatigue Life for Ball Bearings.

B. AMCA 99 – Standards Handbook.

C. AMCA 210 – Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.

D. AMCA 300 – Reverberant Room Method for Sound Testing of Fans.

E. AMCA 301 – Methods for Calculating Fan Sound.

F. ANSI/AFBMA 11 – Load Ratings and Fatigue Life for Roller Bearings.

G. NFPA 92A – Recommended Practice for Smoke Control Systems.

H. NFPA 92B – Standard for Smoke Management Systems in Malls, Atria, and Large Areas.

I. UL 705 – Standard Power Ventilators.

J. UL 762 – Standard Power Ventilators for Restaurant Exhaust Applications.

1.4 QUALITY ASSURANCE

A. AMCA certified ratings per applicable AMCA standard based on the testing conducted in an independent laboratory.

B. Performance Ratings: Conform to AMCA 210 and bear the AMCA Certified Rating Seal.

C. Sound Ratings: AMCA 301; tested to AMCA 300 and bear the AMCA Certified Sound Rating Seal.

D. Fabrication: Conform to AMCA 99.

E. Conform to AMCA Bulletins regarding construction and testing.

1. Fans shall bear AMCA certified rating seal.

F. Scheduled equipment performance is minimum capacity required.

G. Scheduled electrical capacity shall be considered as maximum available.

H. Classification for Spark Resistant Construction, levels A, B, and C conform to AMCA 99.

1.5 SUBMITTALS

A. See Section 230010 – Mechanical General Provisions.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Fans	R	R		R
Performance curves	R			
Sound Power ratings	R			
Motor ratings and electrical characteristics	R			
Dampers, housings, linkages, and operators	R			
Roof curbs	R			R
Fan speed controllers and other accessories	R	R		

C. Include:

1. Complete graph of fan curves, not just curve for design conditions.
2. Sound power levels:

a. Fans 1 horsepower and larger: dB by octave bands.
b. Fans less than 1 horsepower: sones.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Belts: One set(s) for each belt-driven unit.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

1. Loren Cook.
2. Greenheck.
3. PennBarry.
4. Or equal.

2.2 GENERAL

A. AMCA certification in accordance with ARI Standard 210 and 211, and AMCA Standard 2408 for centrifugal fans.

B. Fans used shall not increase motor size, increase noise level, or increase tip speed by more than 10 percent, or increase inlet air velocity by more than 20 percent, from specified criteria.

C. Performance.

1. See fan schedule on the Drawings.
2. Capacities: minimum as scheduled on the Drawings.
3. Brake horsepower rating: Maximum 10 percent above that scheduled on the Drawings.
4. Fans and drives shall be capable of accommodating static pressure variations of plus or minus 10 percent.
5. Motor horsepower: No larger than that scheduled on the Drawings, or compensate Division 26 contractor for any associated cost to increasing motor size.

D. Wheels.

1. Class as stated per AMCA rating for static pressure.
2. Formed steel or extruded aluminum.
3. Statically and dynamically balanced in its own bearings with a maximum full amplitude shaft deflection at bearings not to exceed 0.001-inch at 1200 RPM.
4. Exposed fan wheels protected by finger proof screen.

E. Shafts.

1. AISI C-1045 hot rolled and accurately turned, ground, and polished.
2. Sized for a critical speed of at least 125% of maximum RPM.

F. Motors.

1. Comply with Section 230513 – Motors and Controllers.
2. Provide electrically commutated motor (ECM) where scheduled.

G. Housing.

1. Bolted and welded construction utilizing corrosion resistant fasteners.
2. Scroll wrapper and scroll side panels shall be a minimum 12 gauge steel.
3. The entire fan housing shall have continuously welded seams.
4. Spun inlet bell and shaped cut-off for centrifugal fans.
5. Weatherproof drive covers at utility sets shall have access doors.

H. Direct Drive.

1. Internal thermally protected motor.
2. Speed controller.

I. Belt Drive.

1. Matched, multiple V-belt.
2. Capacity: minimum 1.5 times motor horsepower.
3. Pulleys:

    a. Cast iron.
    b. Variable pitch diameter.

        1) Except motors with variable speed drives.
        2) Fans up to 7-1/2 hp motor.
        3) Fans from 10 hp to 25 hp, under 1000 rpm.

    c. Fixed pitch diameter.

        1) All motors with variable speed drives.
        2) Fans 10 hp and over 1000 rpm.

    d. Select at mid point of range.
    e. For fans that operate as part of the life safety system, provide a minimum of two belts.

4. Automatic belt tensioner to maintain proper belt tension and provide quick belt removal and replacement, where scheduled.
5. Companion sheaves to maintain belts parallel.
6. Drive guards.

    a. Comply with requirements of State OSHA.
    b. Provide holes in belt guards for tachometer readings.
    c. Indoor Belt Drives: 16 gage expanded metal or wire screen enclosure with 70 percent free area and steel frame.
    d. Outdoor Belt Drives: 16 gage solid galvanized sheet metal with stamped louvers near top and bottom for ventilation.

J. Bearings.

1. Designed and tested specifically for use in air handling applications.
2. Heavy duty regreasable ball or roller type in a cast iron pillow block housing.
3. Bearing shaft mounting mechanism shall be concentric mount, not set screw mount.
4. Grease fittings extended to accessible locations outside housing.

5. Life rating: Minimum 200,000 hours per ABMA Standard 9 or 11 L_{50} rating, at maximum catalog speed.

K. Painting.

1. Electrostatically applied, baked polyester powder coating, minimum 2 mil thick.
2. Paint must exceed 1,000 hour salt spray under ASTM B117 test method.

L. Discharge: As indicated on Drawings.

M. Smoke Control Fans.

1. Fans used for smoke control purposes shall comply with the International Building Code.
2. Belt-drive fans shall have 1.5 times the number of required belts and no less than two belts.
3. Shall operate within their nameplate rating.
4. UL listed power ventilator for Smoke Control Systems.
5. UL listed for 500˚F for 4 hours and 1,000˚F for 15 minutes.

N. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch-thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base.

1. Configuration: Built-in cant and mounting flange.
2. Overall Height: 14 inches minimum (Coordinate heights with roof construction).
3. Sound Curb: Curb with sound-absorbing insulation.
4. Pitch Mounting: Manufacture curb for roof slope.
5. Metal Liner: Galvanized steel.
6. Burglar Bars: 1/2-inch- thick steel bars welded in place to form 6-inch squares.
7. Mounting Pedestal: Galvanized steel with removable access panel.
8. Vented Curb: Unlined with louvered vents in vertical sides.

2.3 UTILITY SET FANS

A. Fan Wheels: Single-width, single inlet; welded to cast-iron or cast-steel hub and spun-steel inlet cone, with hub keyed to shaft.

1. Blade Materials: Steel.
2. Blade Type: Backward inclined.
3. Spark-Resistant Construction: AMCA 99, Type B.

B. Accessories:

1. Inlet and Outlet: Flanged.
2. Companion Flanges: Rolled flanges for duct connections of same material as housing.
3. Backdraft Dampers: Gravity actuated with counterweight and interlocking aluminum blades with felt edges in steel frame installed on fan discharge.
4. Access Door: Gasketed door in scroll with latch-type handles.
5. Inlet Screens: Removable wire mesh.
6. Drain Connections: NPS 3/4 threaded coupling drain connection installed at lowest point of housing.
7. Weather Hoods: Weather resistant with stamped vents over motor and drive compartment.
8. Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.

2.4 CENTRIFUGAL ROOF VENTILATORS

A. Housing: Removable, top; square, one-piece, aluminum base with venturi inlet cone.

1. Upblast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains and grease collector.
2. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.

B. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

C. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
3. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
4. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.
5. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.

2.5 UPBLAST PROPELLER ROOF EXHAUST FANS

A. Wind Band, Fan Housing, and Base: Reinforced and braced galvanized steel, containing galvanized-steel butterfly dampers and rain trough, motor and drive assembly, and fan wheel.

1. Damper Rods: Steel with bronze bearings.
2. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.

B. Fan Wheel: Replaceable, cast-aluminum, airfoil blades fastened to cast-aluminum hub; factory set pitch angle of blades.

2.6 IN-LINE CENTRIFUGAL FANS

A. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.

B. Direct-Drive Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing; with wheel, inlet cone, and motor on swing-out service door.

C. Belt-Driven Units: Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.

D. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.

E. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Volume-Control Damper: Manually operated with quadrant lock, located in fan outlet.
3. Companion Flanges: For inlet and outlet duct connections.

4. Fan Guards: 1/2- by 1-inch mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.
5. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.

2.7 LABORATORY EXHAUST FANS

A. UL 705, Power Ventilators listed.

B. Direct-drive or belt-drive as indicated on drawings.

C. Housing corrosion resistant coating:

1. The first powder coat applied over the prepared surface shall be a zinc rich epoxy primer (no less than 70% zinc) and heated to a gelatinous consistency (partial cure) at which the second powder coat of polyester resin shall be electrostatically applied and simultaneously be cured at a uniform temperature of 400°F.
2. The coating system, a total thickness of up to 6 mils, is not affected by the UV component of sunlight (does not chalk), and has superior corrosion resistance to acid, alkali, and solvents. Coating system shall exceed 4000 hour ASTM B117 Salt Spray Resistance.

D. Housing construction:

1. Fan housing shall be bifurcated, allowing all drive components, including the motor, to be serviced without contact of the contaminated airstream. Must be manufactured of welded steel and meet specification section 2.15 for corrosion resistant coating. No uncoated metal fan parts will be acceptable.
2. Fan housings that are fabricated of polypropylene or fiberglass that have lower mechanical properties than steel, have rough interior surfaces in which corrosive, hazardous compounds can collect, and / or which chalk and structurally degrade due to the UV component of the sunlight shall not be acceptable.
3. A high velocity discharge nozzle shall be supplied by the fan manufacturer designed to efficiently handle an outlet velocity of up to 7000 FPM. Discharge stack caps or hinged covers, impeding exhaust flow shall not be permitted.
4. An integral fan housing drain shall be used to drain rainwater when the fan is de-energized.
5. A bolted & gasketed access door shall be supplied for impeller inspection and service.
6. Fan assembly shall be AMCA type C spark resistant construction minimum or as noted on the schedule.

E. Fan Wheel:

1. Fan impeller shall be mixed flow design with non-stall characteristics. The impeller shall be electronically balanced both statically and dynamically exceeding AMCA Standards.
2. Fan impeller shall be manufactured of welded and coated steel.
3. Vacuum Seal: Fan impeller shall include a secondary fan blade located on the impeller back plate. This secondary impeller shall create a negative pressure at the shaft opening; preventing hazardous or toxic exhaust fumes from escaping through the housing shaft opening. Mechanical shaft seals that wear out and need to be replaced or seal systems that use hoses or tubes that can leak, are not acceptable.

F. Bypass air plenum:

1. A bypass air plenum shall be provided as shown on drawings. The plenum shall be provided with bypass air damper(s) for introducing outside air at roof level upstream of the fan, complete with bypass air weatherhood and bird screen.

2. The plenum shall be constructed of welded and coated steel and meet specification section 2.15 for corrosion resistant coating. Plenums that are fabricated of plastics or resins that are combustible and have mechanical properties less than steel shall not be acceptable.
3. The bypass air plenum shall be mounted on factory fabricated roof curb provided by the fan manufacturer.
4. Bypass air damper(s) shall be opposed-blade design for airflow control, airfoil design, fabricated of steel for structural rigidity as standard. Bypass damper(s) shall have plated steel damper rods, stainless steel sleeved bearings, 301 stainless steel jamb seals and the blades shall have polymer edge seals. Damper model shall be equal to or exceed a heavy duty control damper. Damper blade drive linkage shall be set by manufacturer and welded to eliminate linkage slippage. All damper access and service (drive actuators) shall be performed outside of the contaminated airstream.
5. Fan isolation damper(s), shall be parallel-blade design, airfoil design, fabricated of steel for structural rigidity as standard. Damper(s) shall be coated up to 4 mils of chemically resistant Hi-Pro Polyester resin, electrostatically applied and baked. Isolation damper(s) shall have plated steel damper rods stainless steel sleeved bearings, 301 stainless steel jamb seals and the blades shall have polymer edge seals. Damper model shall be equal to or exceed a heavy duty control damper. Damper blade drive linkage shall be set by manufacturer and welded to eliminate linkage slippage. All damper access and service (drive actuators) shall be performed outside of the contaminated airstream.
6. Isolation damper actuator(s), shall be wired to a step-down transformer. Actuator and transformer are located in a weatherproof enclosure.
7. Blower / Plenum vibration isolation shall be limited to neoprene / cork vibration pads.

G. Fan Motors and Drives.

1. Motors shall be premium efficiency, standard NEMA frame, 1800 or 3600 RPM, Totally Enclosed Fan Cooled (TEFC) Explosion Proof with a 1.15 service factor. A factory-mounted NEMA 3R disconnect switch shall be provided for each fan. Motor maintenance shall be accomplished without fan impeller removal or requiring maintenance personnel to access the contaminated exhaust components.
2. Drive belts and sheaves shall be sized for 200% of the motor horsepower, and shall be readily and easily accessible for service. Drive shall consist of a minimum of two belts under all circumstances.
3. Fan shaft to be turned and polished of 316 stainless steel as standard, coated with corrosion resistant coating.
4. Fan shaft bearings shall be Air Handling Quality, ball or roller pillow block type and be sized for an L-10 life of no less than 100,000 hours. Bearings shall be fixed to the fan shaft using concentric mounting locking collars, which reduce vibration, increase service life, and improve serviceability. Bearings that use set screws shall not be allowed.
5. All shaft bearings shall have extended lube lines with Zerk fittings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate with work of other trades.

B. Install fans in accordance with manufacturer’s written installation instructions.

C. See Section 233113 – Metal Ducts for duct connections.

D. See Section 230900 – Energy Management & Control System.

E. Flexible duct connection at inlet and outlet: See Section 233113 – Ducts.

F. Backdraft Dampers.

1. Comply with ASHRAE 90.1 and IMC.
2. Provide backdraft or shutoff dampers for suction or discharge of every exhaust fan as scheduled on the Drawings.
3. See schedules on the Drawings and Section 233300 – Duct Accessories for where fan manufacturer may provide dampers and when specialty damper manufacturer must provide them.

G. Roof Mounted Fans.

1. Install on factory fabricated curbs.

a. Exception: Install Utility fans as indicated on the Drawings.

2. See Division 7 Thermal and Moisture Protection for waterproofing and roofing.
3. Roof curbs:

a. Secured to structure with hold down methods as detailed.
b. Made fully weatherproof.

H. Pipe scroll drains to code compliant waste receptacle.

3.2 MOUNTING AND ALIGNMENT

A. See Section 230548 – Mechanical Sound and Vibration Control.

3.3 INSPECTION

A. Verify that adequate clearance between fans and adjacent walls or equipment is available to permit maintenance and repairs.

3.4 PRE-OPERATING CHECKS

A. Do not operate fans for any purpose, temporary or permanent, until:

1. Ductwork is clean.
2. Filters in place.
3. Bearings lubricated.

3.5 TESTING AND ADJUSTING

A. Before starting fans install belts and motor guards.

B. Start and test fans in accordance with manufacturers written installation instructions.

C. Start up and adjust fans to insure proper operation.

D. The submitted sound power level shall be verified through actual measurements and calculations in accordance with AMCA standards 300 and 301.

E. After starting fans: Check for objectionable noise or vibration. Correct as needed at no additional cost to the Owner.

F. Balancing: See Section 230593 – Testing, Adjusting and Balancing.

3.6 TRAINING

A. See Section 230010 – Mechanical General Provisions.

END OF SECTION 23 34 23

SECTION 23 36 00

AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Shutoff, single-duct air terminal units.

1.3 QUALITY ASSURANCE

A. Terminal units rated and certified in accordance with ARI Standard 880-98 Certification Program.

B. Heating coils rated in accordance with ARI Standard 410.

C. All electrical components shall be UL listed and installed in accordance with the UL Standard 1995.

1.4 SUBMITTALS

A. See Section 230010 – Mechanical General Provisions

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
VAV boxes	R	R		R
Hot water coils	R			R
Air terminal unit accessories	R	R		

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. VAV Boxes.

1. Titus.
2. Price.
3. Trane.
4. Or equal.

2.2 VAV BOXES

A. General.

1. Ship as a complete assembly requiring no field assembly (including accessories).
2. Casings:

a. Minimum 22-gage, galvanized steel outer wall.
b. Leakage rating: 7 cubic feet per minute maximum leakage at 1 inch water column.
c. Acoustic lining.

1) Material: Fiberglass with scrim-backed foil liner or solid metal lining over all surfaces and edges.
2) Minimum thickness:

a) Terminals located in conditioned space or return air plenum: 1/2 inch.
b) Terminals located in unconditioned spaces: 1 inch.

3) Minimum 1.5 pound per cubic foot density.
4) Maximum thermal conductivity: 0.28 Btu-in per hour per foot squared per degree Fahrenheit (BTU-inch/h·ft^2·°F) measured on a horizontal plane in accordance with ASTM C518 at a mean temperature of 75 degrees Fahrenheit.
5) Meet erosion test method described in UL publication No. 181.
6) Meet smoke developed and flame spread rating requirements of NFPA-90A.
7) Meet ASTM C1136 and ASTM C665 for biological growth in insulation.

d. Gasketted access door.

1) For actuators inspection, repair and replacement if mounted internally.
2) Upstream of reheat coil for inspection and cleaning.

e. Discharge duct connection.

3. Controls unit mounted by manufacturer.

a. Multi-point, cross-flow or flow-ring, center averaging sensor.

1) The average amplification factor for sizes 6 to 16 inch shall be greater than 2.0 and minimum amplification factor shall be 1.8. Provide documentation with submittal that substantiates this requirement.
2) Be rated for inlet or discharge duty, as indicated on the Drawings.
3) Provide accurate flow sensing regardless of inlet duct configuration.
4) Brass balancing taps and unit mounted airflow versus flow sensor pressure signal charts for field airflow measurements.

b. Control panel.

1) Control panel with cover to fully enclose VAV box controller.

c. For Direct Digital Controls, see Section 230900 – Energy Management & Control Systems

4. Radiated and discharge sound power.

a. Equal or less in each octave band than terminal selections scheduled on the Drawings at noted capacities assuming 1.0 inch inlet static pressure, with a tolerance of + 2 dB in any band.
b. Minimum performace sound power less than 68 dB in the 125 Hz octave band.
c. Due to added space and pressure drop, providing additional plenums or attenuators to meet sound power ratings is not acceptable.

5. Total pressure drop.

a. Equal or less than terminal selections scheduled on the Drawings at noted capacities, with a tolerance of 0.02 inches of water.
b. This limitation is in total, not static, pressure. Where total pressure is not listed on certified performance documents, provide a table of manual adjustments of static pressure with velocity pressure calculated from inlet and outlet velocities.

6. Dampers.

a. Heavy gage steel.
b. Single blade damper; opposed blade dampers are not acceptable.
c. Shaft rotating in self-lubricating Delrin or equal bearings; nylon bearings are not acceptable. Shaft shall be clearly marked on the end to indicate damper position.
d. Damper shall have durable synthetic seal. Foam seals are not acceptable.
e. Close-off leakage rating: 5 cubic feet per minute maximum leakage at 1.50 inches water column.

7. Hot water heating coils.

a. Removable type.
b. Tubes.

1) 2-row, unless otherwise scheduled on the Drawings.
2) Copper, 0.015 inches minimum tube wall thickness.
3) Connections: external, same end, solder type connection, minimum 1/2 inch outside diameter.

c. Fins.

1) Aluminum, with full fin collars.

2) As scheduled on the Drawings or as required to provide heating capacity listed.
3) Maximum: 12 fins per inch.

d. Factory leak-tested at 300 pounds per square inch.
e. Access or removable panel for coil inspection and cleaning.

B. Variable Air Volume Terminal Units.

1. Single duct: Equal to Trane VCWF.
2. Options and features: As scheduled on the drawings.
3. Electrical Services (factory mounted).

a. One point wiring connection for all electrical devices.
b. Control panel.
c. Controls transformer.
d. Components mounted in sheet metal control enclosure.
e. ETL or UL listed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate with work of other trades.

B. Install terminal units in accordance with manufacturer's written installation instructions.

C. Duct connections: See Section 233113 – Ducts.

1. Provide sheet metal duct connections at inlet; flexible not acceptable.
2. No flexible connection required on duct outlet.

D. Sound attenuation discharge duct.

1. Downstream of units where indicated on the Drawings.
2. Sound linings: Type AL. See Section 230713 – Duct Insulation.
3. Minimum lining 5 feet of duct downstream of box.
4. Provide a minimum of 3 feet of ductwork prior to first fitting or outlet branch duct takeoff.

E. Piping connections: See Section 232112 – Heating and Cooling Piping.

F. Coordinate access with respective trades.

G. See Section 230900 – Energy Management & Control Systems.

3.2 MOUNTING AND ALIGNMENT

A. Support VAV boxes at four corners with minimum, 1" x 18 gage sheet metal straps or 3/8 inch all-thread rod. Secure lower end of strap to the side of unit casing with minimum two #10 sheet metal screws, or bolt through casing with washers to prevent leakage. Bend end of strap and secure to bottom of casing with one #10 sheet metal screws.

B. See Section 230548 – Mechanical Sound and Vibration Control.

3.3 INSPECTION

A. Verify that adequate clearance between air terminal units and adjacent walls or equipment is available to permit maintenance and repairs.

3.4 TESTING AND ADJUSTING

A. Before operating air terminal units.

1. Complete the provided Pre-Functional Test Data Sheet for each air terminal unit.

B. After starting air terminal units: Check for objectionable noise or vibration. Correct as needed at no additional cost to the Owner.

C. See Section 230593 – Testing, Adjusting, and Balancing.

3.5 TRAINING

A. See Section 23 00 10 – Mechanical General Provisions.

END OF SECTION 23 36 00

SECTION 23 37 00

AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following: All air outlets, inlets, grilles, registers and diffusers except where integral with manufactured piece of equipment

1.3 REFERENCE STANDARDS

A. ARI Standard 650 – Air Outlets and Inlets.

B. ASHRAE Standard 70 – Methods of Testing for Rating the Airflow Performance of Outlets and Inlets.

C. AMCA Standard 500 – Laboratory Methods of Testing dampers for Rating.

D. NFPA Standard 90A – Installation of Air Conditioning and Ventilating Systems.

E. NFPA 90B – Standard for the Installation of Warm Air Heating and Air Conditioning Systems.

1.4 QUALITY ASSURANCE

A. Comply with ARI Standard 650, ASHRAE Standard 70, AMCA Standard 500, NFPA Standard 90A, and NFPA Standard 90B.

B. Provide outlets and inlets that have, as minimum, throw and noise criteria ratings for each size device as listed in manufacturer's current data, rated as required by the above standards.

1.5 SUBMITTALS

A. See Section 230010 – Mechanical General Provisions

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.

2. "R2" means required only for products and equipment differing for the specified manufacturer and model and for "or equals" where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Grilles, registers, and diffusers	R			R
Accessories	R			

PART 2 - PRODUCTS

2.1 MANUFACTUERERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

1. Price.
2. Titus.
3. Metal Aire.
4. Nailor.
5. Or equal.

2.2 GENERAL

A. Manufacturer shall examine and approve of application of each outlet.

B. Noise level at design capacities: no larger than diffuser selection indicated on the drawings.

C. Volume dampers:

1. Do not provide dampers built into grille or directly attached to the grille unless specifically called out on drawings or in this Section.
2. Volume damper key-operated adjustable from face of diffuser on register except as noted.
3. Opposed blade.

D. Diffuser frame:

1. Frame type shall be coordinated with ceiling type. Refer to architectural reflected ceiling Drawings.

   a. At plaster or drywall ceilings: lay-in diffuser with drywall frame (Price SPF or APF to match diffuser material). Drywall frame to match diffuser color.

2. No visible screw allowed on diffusers or frames, unless otherwise indicated on the Drawings.
3. Linear and bar diffusers shown as one collinear piece on plans shall be constructed as one piece within manufacturing limitations and to appear as one section if manufacturing limitations require multiple pieces.

E. Outlets may be steel or aluminum unless otherwise indicated on Drawings.

F. Color:

1. Face and frame: Factory-baked #26 white enamel unless otherwise indicated on the Drawings.
2. Internal parts of grille visible from occupied space, including all parts behind perforated face diffusers and visible parts of plenums: flat black.

G. Provide square to round adapters where required.

2.3 STYLES

A. General.

1. See diffuser schedule on the Drawings for outlet style and size.
2. Throw pattern per the Drawings.
3. Specific frame, border, and other product references refer to Price.

B. Square cone diffusers Price ASCD.

1. 3 cones.
2. Removable inner assembly of cones that extend below the diffuser face.

C. Sidewall – Supply Price 620.

1. Double deflection.
2. 3/4" blade spacing, fully adjustable.
3. Front set of blades shall run parallel with the short grille dimension.
4. Drywall frame with recessed screw holes.
5. Register with aluminum opposed blade damper.

D. Sidewall – Return Price 630.

1. 3/4" blade spacing, fully adjustable.
2. Blades shall run parallel with the short grille dimension.
3. Drywall frame with recessed screw holes.
4. Register with aluminum opposed blade damper.

E. Egg Crate Price 80.

1. 1/2" x 1/2" x 1/2" aluminum grid core.

F. Linear Slot Diffuser Price TBD4.

1. Three slots.
2. 1-inch slot.
3. Integral insulated plenum, minimum 1/2 inch thick equal to Type AL duct liner as specified under Section 230700 Mechanical Insulation.
4. Mitered corners.

G. Linear Jet Slot Diffuser Price JS.

1. Continuous linear slot diffuser.
2. Two slots.
3. 1-inch slot.
4. Mitered corners.

2.4 SCREENED OPENINGS

A. Mesh:

1. 3/4 in. square pattern.
2. No. 16 galvanized wire.
3. Interwoven.
4. Welded or secured to frame.

B. Frames:

1. 1 inch by 1 inch by 1/8 inch galvanized steel angles.
2. Continuous around perimeter of screen (welded at corners).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate with work of other trades.

B. Install air outlets and inlets in accordance with manufacturer's written installation instructions and Section 233113 – Ducts.

C. Return and exhaust registers: Install with blades oriented to prevent sight through outlets.

D. Grille backs or plenums visible through grilles painted flat black.

E. Transfer grilles.

1. See indications on the Drawings.
2. Wall installations, unless otherwise indicated, provide two grilles.

a. One on each side of wall, except where open to return air plenum.
b. Connecting sheet metal collar with 18 inch elevation offset for sound and light attenuation.

F. Provide duct screens at termination ducts as indicated on the Drawings.

3.2 MOUNTING AND ALIGNMENT

A. See Section 230548 – Mechanical Sound and Vibration Control.

B. All air outlets and inlets shall be secured to building.

1. Ceiling grilles shall be secured to prevent falling from ceiling during construction or service with minimum of two 16-gage ceiling wires, two 22-gage by 1 inch galvanized sheet metal strap or two #10 sheet metal screws.
2. Comply with IBC.

C. Mount directional grilles as indicated on the Drawings.

D. Adjust grille throw patterns.

1. As indicated on the Drawings.
2. For double-deflection grilles, adjust rear blades horizontal and front blades in 45 degree pattern at each end gradually rotating to be almost straight at blades in center of grille.
3. Adjust grille throw patterns prior to test and balance. See Section 230593 – Testing, Adjusting, and Balancing.

3.3 INSPECTION

A. Verify mounting, direction and adjustments are installed as indicated on the Drawings.

3.4 TESTING AND ADJUSTING

A. See Section 230593 – Testing, Adjusting, and Balancing.

END OF SECTION 23 37 00

SECTION 23 40 00

AIR CLEANING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Filter media.
2. Filter frames in built-up systems.

1.3 REFERENCE STANDARDS

A. ASHRAE Standard 52.2-1999 – Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.

B. ANSI/UL 900 – Test Performance of Air Filter Units.

1.4 QUALITY ASSURANCE

A. Filters shall have MERV ratings in accordance with ASHRAE Standard 52.2 with preconditioning as specified in Appendix J of that Standard.

1.5 SUBMITTALS

A. See Section 230010 – Mechanical General Provisions

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Filters	R			
Filter frames	R			
Filter gauges	R	R		

PART 2 - PRODUCTS

2.1 MANUFACTUERERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Filter Media and Frames:

1. Camfil/Farr Filtration Group.
2. Flanders/Precisionaire.
3. American Air Filter.
4. Or equal.

2.2 FILTERS

A. General.

1. UL 900 listed.
2. Disposable type.
3. Each filter shall consist of media, media support grid, and enclosing frame.
4. Each filter shall have flow direction and MERV rating permanently affixed to frame.

B. Type 1: Pleated Filter:

1. 2 inch or 4 inch pleated.
2. Media: Cotton & synthetic media (no polyester).
3. Minimum performance:

    a. MERV 8.

4. Maximum initial pressure drop at 500 feet per minute face velocity shall not to exceed 0.3 inches water column. Final pressure drop shall be no less than 1.0 inch water column.
5. Camfil/Farr 30/30 or equal.

C. Type 2: Bulk Media:

1. 1 inch fiberglass.
2. Filter media shall consist of a continuous filament fiberglass of graduated density. Media shall include a skin on the leaving air side. Furthermore, the media shall be treated with a non-toxic, non-flammable, odor free adhesive.
3. UL listed, Class 2.

2.3 FRAMES

A. For air handlers and fan-coils, see individual specifications Sections.

2.4 FILTER GAUGE

A. See Section 230900 – Energy Management & Control Systems (DP sensors with LCD display).

B. Differential pressure type.

C. Accurate to 2 percent of full range.

D. Sensing probes and shut off valves for each gauge port.

E. Field adjustable to 2 inches water gauge.

F. Dwyer 2000 Magnehelic gauge or equal.

PART 3 - EXECUTION

3.1 FILTER MEDIA

A. Media as selected in equipment schedules on the Drawings.

B. Construction filters:

1. Type 1 for all equipment: roll media not acceptable.
2. Type 2 filter media is intended to be utilized over return/exhaust air grilles, registers and/or open ductwork during the construction period when the systems are being operated. This filter media in not to be utilized inside the housing of any HVAC systems.

C. Spare Filters:

1. Provide three (3) sets of spare filters for each piece of HVAC equipment and filter grille except the following (provide only one (1) spare set):

   a. PTAC's (thru-wall units).
   b. VRF system (indoor units).

3.2 INSTALLATION

A. Factory installed in air handling equipment.

B. Coordinate with work of other trades.

C. Install Air Cleaning Devices in accordance with manufacturer's written installation instructions.

D. Filter gauges.

1. Required only for filters with MERV 8 and greater and on systems greater than 2000 cfm.
2. Install filter gauge to filter or AHU housing in a position where reading will be visible but not block maintenance access.
3. Mount probes on upstream and downstream side of filter and pipe to gauge ports with soft copper tubing per gauge manufacturer's instructions.

E. See Section 230900 – Energy Management & Control Systems.

F. See Section 230593 – Testing, Adjusting, and Balancing.

3.3 START-UP PROCEDURES

A. Do not operate air handling unit fan systems for any reason until spaces served have been cleaned of dust and debris, to avoid contamination of supply air or return air paths and equipment.

B. Supply fans shall not be operated unless filters are installed, including temporary filters for use during test and balance.

C. If the final pressure drop of the temporary filters is reached during test and balance, replace them with a spare set.

D. Before turning system over to the Owner, remove temporary construction filters and install clean final filters:

1. Remove prefilters in front of cartridge, bag, and HEPA filters after construction and do not replace. Prefilters shall not be used during normal operation.
2. See also Section 230593 – Testing, Adjusting, and Balancing, Section 230010 – Mechanical General Provisions and Section 230500 – Basic Materials and Methods for media installation during temporary equipment operation and test and balance periods.

3.4 INSPECTION

A. Verify that adequate clearance between Air Cleaning Devices and adjacent walls or equipment is available to permit maintenance and replacement of filters.

B. Verify that filters are firmly seated in frame to minimize bypass.

3.5 TRAINING

A. See Section 230010 – Mechanical General Provisions.

END OF SECTION 23 40 00

SECTION 23 52 16

CONDENSING BOILERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes gas-fired, fire-tube condensing boilers, trim, and accessories for generating hot water.

1. Boilers.
2. Controls and boiler trim.

1.3 REFERENCE STANDARDS

A. Published specifications standards, tests or recommended methods of trade, industry or governmental organizations apply to work in this section where cited below:

1. CSA – Canadian Standards Association International.
2. American Society of Mechanical Engineers: ASME Section VIII – Boiler and Pressure Vessel Code – Pressure Vessels.
3. ANSI Z21.13 Standard for Gas-Fired Low Pressure Steam and Hot Water Boilers.
4. AHRI/GAMA/Hydronics Institute Testing and Rating Standard for Rating Boilers.

1.4 SUBMITTALS

A. See Section 230010 – Mechanical General Provisions.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Boilers	R	R		R
Boiler controls and trim	R	R		R

C. Boiler

1. Certified dimensioned shop drawings.
2. Materials of construction, thickness of tubes, shell, boilerplate and insulation.
3. Firing and combustion air control systems.
4. Electrical requirements.
5. Safety devices.
6. Minimum and maximum gas pressure at burner.
7. Controls.
8. Wiring diagrams.
9. Field mounted equipment and devices.

D. Manufacturer's instructions for:

1. Installation.
2. Operation.
3. Maintenance and repair.

E. Boiler factory fire test confirming emissions, turndown and efficiency including:

1. Percent of oxygen at 100 percent, 75 percent, 50 percent, and 25 percent of rated capacity.
2. Percent NOx at 100 percent, 75 percent, 50 percent, and 25 percent of rated capacity.
3. Fuel efficiency at 100 percent, 75 percent, 50 percent, and 25 percent of rated capacity.

F. Written warranty indicating full compliance with Warranty paragraph herein.

1.5 WARRANTY

A. The pressure vessel and heat exchanger shall be fully guaranteed for 10 years, non-prorated, against failure due to condensate corrosion, thermal stress, mechanical defects, or workmanship without a minimum flow rate or minimum return water temperature requirement.

B. All other components, including but not limited to forced draft fans, diffusers, burner housing, pilot assemblies, etc., shall be unconditionally guaranteed for 5 years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models are acceptable.

1. Fulton.
2. Aerco.
3. Cleaver-Brooks.
4. Or equal.

2.2 GENERAL

A. Factory assembled, piped, wired and tested.

1. Manufacturer responsible for all unit components for fully functional boiler assembly.
2. Factory assembled as a self-contained unit.
3. Test and fired at factory.

B. Constructed and certified in accordance with.

1. ASME Code Section IV.
2. ASME “H” Stamp.
3. ASME CSD-1 Code requirements.
4. AHRI/GAMA Efficiency Rating Certified.

C. Maximum operating conditions.

1. 190 degrees Fahrenheit.
2. 160 psig working pressure.

D. Single point power connection. Include all required transformers.

E. The boiler shall not require the use of flow switches or other devices to ensure minimum flow.

F. Performance:

1. See schedule on Drawings for.

   a. Design pressure.
   b. Design temperatures.
   c. Capacity.

2. Minimum efficiency.

   a. Minimum 10:1 turndown.
   b. Greater than 91% steady-state thermal efficiency as certified by AHRI.
   c. Efficiency shall increase as firing rate decreases.

3. External convection and radiation heat losses to the boiler room from the boiler shall be less than 0.5 percent of the rated input.

2.3 BOILER CONSTRUCTION

A. Heat Exchanger.

1. 316 L stainless steel designed for condensing flue gases.
2. 40 °F minimum boiler return water temperature.
3. Zero minimum flow rate required. (If substituted boiler requires minimum flow, Contractor shall provide all pumps, valves, controls, etc. required at no additional cost to the Owner.)

B. Combustion Fan & Venting.

1. Built-in forced draft variable speed fan modulated to maintain correct fuel-to-air ratio at all gas valve operating conditions. There shall be no linkage of any kind controlling the burner and or firing rate.
2. Damper to shut-off combustion airflow when boiler is off (to reduce cycling losses).
3. Vertical or horizontal venting with Category IV vent. See Section 233113 – Ducts.

4. Combustion air either direct ducted from outdoors or air drawn from boiler room (see Contract Drawings).

C. Gas Burner.

1. Natural gas.
2. Modulating power burner.
3. Spark ignition (no standing pilot).

D. Gas Train.

1. UL 795 compliant.
2. ASME CSD-1.
3. Each gas train shall have a gas shutoff valve and main gas valve with built-in redundant valve seats and gas regulator.

E. Trim.

1. Drain connection.
2. Combination thermometer and pressure gauge.
3. Safety Relief Valve: ASME rated, factory set to pressure scheduled on drawings.
4. Condensate trap and condensate neutralizer.

2.4 CONTROLS

A. LCD and touchpad visible without the removal of any panels or doors for configuration and setpoint adjustment. Display at a minimum:

1. Power on.
2. Call for heat.
3. Failure/alarm.
4. Hot water supply temperature.

B. External control and monitoring (by EMCS).

1. 4-20 mA input to reset boiler leaving water temperature setpoint.
2. Failure alarm contact.
3. Pump start contact with adjustable relay.
4. BACnet/MSTP remote communications interface.

C. Safeties.

1. Safeguard/flame monitoring system utilizing a rectification type flame sensor.
2. Dual water high limits.
3. Air pressure switch.
4. Main and auxiliary low water cutoff. Switches shall not require manual reset after power outage.

PART 3 - EXECUTION

3.1 BOILER INSTALLATION

A. Complete structural, mechanical, and electrical connections in accordance with manufacturer's installation instructions.

B. Provide start-up service by factory representative.

C. Install boilers as indicated on drawings.

1. Install in accordance with NFPA 54.
2. Allow satisfactory arrangement in space available.
3. Provide sufficient room for replacing boiler tubes, cleaning, and servicing of components.
4. Anchor through vibration isolation devices in accordance with Section 230548 – Mechanical Sound and Vibration Control.

D. Boiler Trim.

1. Provide blowdown valves for low water cutoffs to floor drain.
2. Pipe drain valves to floor drain.
3. Pipe discharge of relief valves, full size to floor drain.
4. Pipe condensate drain(s) through the condensate trap (use tubing suitable for pH 5 water) to the condensate neutralizer then to drain.

E. Connect to flue (and combustion intake where applicable) per manufacturer's instructions. See Section 233113 – Ducts.

3.2 TESTS AND START-UP

A. After installation is completed.

1. Test boilers hydrostatically in accordance with ASME recommendations: Test to specified working pressure.
2. Test operating and safety controls by firing boiler and,

    a. Raising water temperature.
    b. Lowering water level.

3. Test burner capacity by observing gas meter while firing burners at high fire. Gas consumption shall be within 5 percent of rated input.

B. Provide services of factory representative of boiler manufacturer to:

1. Supervise start up and adjust burners and controls.
2. Test individual burner controls for proper operation.
3. Test safety controls for proper operation.
4. Test burner firing rates for proper capacity.

C. Submit written report by boiler manufacturer confirming that safety and operating controls and burners have been properly installed, calibrated and adjusted.

3.3 CLEANING

A. Flush and clean boiler on completion of installation, according to manufacturer's written instructions.

B. After completing boiler installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes including chips, scratches, and abrasions with manufacturer's touchup paint.

3.4 TRAINING

A. Engage a factory-authorized service representative to train Owner’s maintenance personnel on:

1. Procedures for starting and stopping and troubleshooting boilers.
2. Procedures and schedules for maintaining and servicing boilers.
3. Organization and content of boiler Operations & Maintenance Manuals.

B. Electrical: Comply with applicable requirements in Division 26 Sections.

C. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

END OF SECTION 23 52 16

SECTION 23 64 26

SCREW WATER CHILLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Packaged, air-cooled chillers.

1.3 DEFINITIONS

A. COP: Coefficient of performance. The ratio of the rate of heat removal to the rate of energy input using consistent units for any given set of rating conditions.

B. DDC: Direct digital control.

C. EER: Energy-efficiency ratio. The ratio of the cooling capacity given in terms of Btu/h to the total power input given in terms of watts at any given set of rating conditions.

D. IPLV: Integrated part-load value. A single-number part-load efficiency figure of merit calculated per the method defined by AHRI 550/590 and referenced to AHRI standard rating conditions.

E. kW/Ton: The ratio of total power input of the chiller in kilowatts to the net refrigerating capacity in tons at any given set of rating conditions.

F. NPLV: Nonstandard part-load value. A single-number part-load efficiency figure of merit calculated per the method defined by AHRI 550/590 and intended for operating conditions other than AHRI standard rating conditions.

1.4 SUBMITTALS

A. See Section 23 00 10 Mechanical General Provisions.

B. Submit product data, O&M data, and samples and show item on shop and coordination drawings (where shop and coordination drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Chillers	R	R		R
Chiller controls	R	R		
Chiller accessories	R	R		
Chiller BACnet PICS Statement	R			

C. Product Data: For each type of product.

1. Performance at ARI standard conditions and at conditions indicated.
2. Performance at ARI standard unloading conditions.
3. Performance data including; unit efficiency, full load and part load performance data, acoustical data, etc.
4. Minimum evaporator flow rate.
5. Refrigerant capacity of water chiller.
6. Oil capacity of water chiller.
7. Fluid capacity of evaporator.
8. Minimum entering condenser-air temperature.
9. Performance at varying capacity with constant design entering condenser-air temperature. Repeat performance at varying capacity for different entering condenser-air temperatures from design to minimum in 10 ˚F increments.
10. Dimensioned plan and elevation view drawings, required clearances, and location of all field connections.
11. Product data indicating rated capacities, weights, specialties and accessories, electrical requirements and wiring diagrams.
12. Required clearances for maintenance and operation.
13. Size and location of piping and wiring connections.
14. Wiring Diagrams: For power, signal, and control wiring.

D. Coordination Drawings: Floor plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Structural supports.
2. Piping roughing-in requirements.
3. Wiring roughing-in requirements, including spaces reserved for electrical equipment.
4. Access requirements, including working clearances for mechanical controls and electrical equipment, and tube pull and service clearances.

E. Startup service reports.

F. Warranty: Sample of special warranty.

G. Touchup Paint: 32 oz. container of paint used for finish coat. Label outside of container with detailed description of paint to allow for procurement of a matching paint in the future.

1.5 QUALITY ASSURANCE

A. AHRI Certification: Certify chiller according to AHRI 590 certification program(s).

B. AHRI Rating: Rate chiller performance according to requirements in AHRI 550/590.

C. ASHRAE Compliance:

1. ASHRAE 15 for safety code for mechanical refrigeration.
2. ASHRAE 147 for refrigerant leaks, recovery, and handling and storage requirements.

D. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1.

E. ASME Compliance: Fabricate and label chiller to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, and include an ASME U-stamp and nameplate certifying compliance.

F. Comply with NFPA 70.

G. Comply with requirements of UL and UL Canada and include label by a qualified testing agency showing compliance.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Ship chillers from the factory fully charged with refrigerant.

B. Ship each chiller with a full charge of refrigerant. Charge each chiller with nitrogen if refrigerant is shipped in containers separate from chiller.

C. Ship each oil-lubricated chiller with a full charge of oil.

1. Ship oil factory installed in chiller.

D. During shipment, provide protective covering over vulnerable components. Fit nozzles and open pipe ends with enclosures.

E. Comply with Section 230010 “Mechanical General Provisions.”

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of chillers that fail in materials or workmanship within specified warranty period.

1. Extended warranties include, but are not limited to, the following:

a. Complete chiller including refrigerant and oil charge.
b. Parts and labor.
c. Loss of refrigerant charge for any reason.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Performance Tolerance: Comply with the following in lieu of AHRI 550/590:

1. Allowable Capacity Tolerance: Five (5) percent.
2. Allowable Full-Load Energy Efficiency Tolerance: Five (5) percent.

3. Allowable Part-Load Energy Efficiency Tolerance: Five (5) percent.

2.2 PACKAGED, AIR-COOLED CHILLERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Daikin Applied.
2. Trane.
3. YORK; a Johnson Controls company.
4. Or equal.

B. Description: Factory-assembled and run-tested chiller complete with base and frame, condenser casing, compressors, compressor motors and motor controllers, evaporator, condenser coils, condenser fans and motors, electrical power, controls, and accessories.

C. Fabricate base, frame, and attachment to chiller components strong enough to resist chiller movement during a seismic event when chiller base is anchored to field support structure.

D. Cabinet:

1. Base: Galvanized-steel base extending the perimeter of chiller. Secure frame, compressors, and evaporator to base to provide a single-piece unit.
2. Frame: Rigid galvanized-steel frame secured to base and designed to support cabinet, condenser, control panel, and other chiller components not directly supported by base.
3. Casing: Galvanized steel.
4. Finish: Coat base, frame, and casing with a corrosion-resistant coating capable of withstanding a 1000-hour salt-spray test according to ASTM B 117.
5. Sound-reduction package designed to reduce sound level without affecting performance and consisting of the following:

    a. Acoustic enclosure around compressors.
    b. Reduced-speed fans with acoustic treatment.

6. Architectural Louvered Panel Package: Provide removable louvered panels with fasteners for additional protection of compressors, evaporator, and condenser coils without inhibiting service access. Finish to match cabinet.

E. Compressors:

1. Description: Positive displacement, hermetically sealed.
2. Casing: Cast iron, precision machined for minimum clearance about periphery of rotors.
3. Rotors: Manufacturer's standard one- or two-rotor design.
4. Each compressor provided with suction and discharge shutoff valves, crankcase oil heater, and suction strainer.

F. Service: Easily accessible for inspection and service.

G. Capacity Control: On-off compressor cycling and modulating slide-valve assembly or port unloaders combined with hot-gas bypass, if necessary, to achieve performance indicated.

1. Maintain stable operation throughout range of operation. Configure to achieve most energy-efficient operation possible.
2. Operating Range: From 100 to 10 percent of design capacity.

3. Condenser-Air Unloading Requirements over Operating Range: Drop-in, entering condenser-air temperature of 5 ˚F drop for each 10 percent in capacity reduction.

H. Oil Lubrication System: Consisting of pump if required, filtration, heater, cooler, factory-wired power connection, and controls.

1. Provide lubrication to bearings, gears, and other rotating surfaces at all operating, startup, shutdown, and standby conditions including power failure.
2. Thermostatically controlled oil heater properly sized to remove refrigerant from oil.
3. Factory-installed and pressure-tested piping with isolation valves and accessories.
4. Oil compatible with refrigerant and chiller components.
5. Positive visual indication of oil level.

I. Vibration Control:

1. Vibration Balance: Balance chiller compressors and drive assemblies to provide a precision balance that is free of noticeable vibration over the entire operating range.

a. Overspeed Test: 25 percent above design operating speed.

2. Isolation: Mount individual compressors on vibration isolators.

J. Compressor Motors:

1. Hermetically sealed and cooled by refrigerant suction gas.
2. High-torque, induction type with inherent thermal-overload protection on each phase.

K. Compressor Motor Controllers:

1. Star-Delta, Reduced-Voltage Controller: NEMA ICS 2, closed transition.

L. Refrigerant Circuits:

1. Refrigerant: Type as indicated on Drawings.
2. Refrigerant Type: R-134a. Classified as Safety Group A1 according to ASHRAE 34.
3. Refrigerant Compatibility: Chiller parts exposed to refrigerants shall be fully compatible with refrigerants, and pressure components shall be rated for refrigerant pressures.
4. Refrigerant Circuit: Each shall include a thermal- or electronic-expansion valve, refrigerant charging connections, a hot-gas muffler, compressor suction and discharge shutoff valves, a liquid-line shutoff valve, a replaceable-corefilter-dryer, a sight glass with moisture indicator, a liquid-line solenoid valve, and an insulated suction line.
5. Pressure Relief Device:

a. Comply with requirements in ASHRAE 15 and in applicable portions of ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
b. ASME-rated, spring-loaded pressure relief valve; single- or multiple-reseating type.

M. Evaporator:

1. Description: Shell-and-tube design.

a. Flooded type with fluid flowing through tubes and refrigerant flowing around tubes within the shell.

2. Code Compliance: Tested and stamped according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
3. Shell Material: Carbon steel.
4. Shell Heads: Removable carbon-steel heads located at each end of the tube bundle.
5. Fluid Nozzles: Terminated with grooved end connections for connection to field piping.
6. Tube Construction: Individually replaceable copper tubes with enhanced fin design, expanded into tube sheets.
7. Heater: Factory-installed and -wired electric heater with integral controls designed to protect the evaporator to 0 ˚F.

N. Air-Cooled Condenser:

1. Plate-fin coil with integral subcooling on each circuit, rated at 450 psig.

    a. Construct coil casing of galvanized steel.
    b. Construct coils of copper tubes mechanically bonded to aluminum fins.
    c. Hail Protection: Provide condenser coils with louvered panels to protect against hail damage.

2. Fans: Direct-drive propeller type with statically and dynamically balanced fan blades, arranged for vertical air discharge.
3. Fan Motors: Totally enclosed nonventilating or totally enclosed air over enclosure, with permanently lubricated bearings. Equip each motor with overload protection integral to either the motor or chiller controls.
4. Fan Guards: Steel safety guards with corrosion-resistant coating.

O. Electrical Power:

1. Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point, field-power connection to chiller.
2. House in a unit-mounted, NEMA 250, Type 3R enclosure with hinged access door with lock and key or padlock and key.
3. Wiring shall be numbered and color-coded to match wiring diagram.
4. Install factory wiring outside of an enclosure in a raceway.
5. Field-power interface shall be to UL 489, instantaneous-trip circuit breaker with lockable handle.

    a. Disconnect means shall be interlocked with door operation.

6. Provide branch power circuit to each motor and to controls with one of the following disconnecting means:

    a. NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 60947-4-1.
    b. UL 489, motor-circuit protector (circuit breaker) with field-adjustable, short-circuit-trip set point.

7. Provide each motor with overcurrent protection.
8. Overload relay sized according to UL 1995 or an integral component of chiller control microprocessor.
9. Phase-Failure and Undervoltage Relays: Solid-state sensing with adjustable settings.
10. Control Transformer: Unit-mounted transformer with primary and secondary fuses and sized with enough capacity to operate electrical load plus spare capacity.

a. Power unit-mounted controls where indicated.
b. Power unit-mounted, ground fault interrupt duplex receptacle.

11. Control Relays: Auxiliary and adjustable time-delay relays.
12. For chiller electrical power supply, indicate the following:

a. Current and phase to phase for all three phases.
b. Voltage, phase to phase, and phase to neutral for all three phases.
c. Three-phase real power (kilowatts).
d. Three-phase reactive power (kilovolt amperes reactive).
e. Power factor.
f. Running log of total power versus time (kilowatt-hours).
g. Fault log, with time and date of each.

P. Controls:

1. Standalone and microprocessor based.
2. Enclosure: Share enclosure with electrical power devices or provide a separate enclosure.
3. Control panel shall be dead front construction for enhanced service technician safety. Provide and field install NEMA 4 enclosure over factory-mounted unit controller for protection. Coordinate NEMA 4 enclosure dimensions with unit controller dimensions.

a. NEMA 4 enclosure with lift-off hinges.
b. Continuously welded, no holes or knockouts.
c. Seamless, watertight foam gasket.
d. Hasp and staple for padlocking.
e. Removable door.
f. Hoffman NEMA 4 A-ALP or equal.

4. Operator Interface: Multiple-character digital or graphic display with dynamic update of information and with keypad or touch-sensitive display located on front of control enclosure. In either imperial or metric units, display the following information:

a. Date and time.
b. Operating or alarm status.
c. Operating hours.
d. Outdoor-air temperature if required for chilled-water reset.
e. Temperature and pressure of operating set points.
f. Entering and leaving temperatures of chilled water.
g. Refrigerant pressures in evaporator and condenser.
h. Saturation temperature in evaporator and condenser.
i. No cooling load condition.
j. Elapsed time meter (compressor run status).
k. Pump status.
l. Antirecycling timer status.
m. Percent of maximum motor amperage.
n. Current-limit set point.
o. Number of compressor starts.

5. Control Functions:

a. Manual or automatic startup and shutdown time schedule.
b. Entering and leaving chilled-water temperatures, control set points, and motor load limits.

c. Current limit and demand limit.
d. External chiller emergency stop.
e. Anti-recycling timer.
f. Automatic lead-lag switching.
g. Variable evaporator flow.

6. Manually Reset Safety Controls: The following conditions shall shut down chiller and require manual reset:

a. Low evaporator pressure or high condenser pressure.
b. Low chilled-water temperature.
c. Refrigerant high pressure.
d. High or low oil pressure.
e. High oil temperature.
f. Loss of chilled-water flow.
g. Control device failure.

7. Trending: Capability to trend analog data of up to five parameters simultaneously over an adjustable period and frequency of polling.
8. Security Access: Provide electronic security access to controls through identification and password with at least three levels of access: view only; view and operate; and view, operate, and service.
9. Control Authority: At least four conditions: Off, local manual control at chiller, local automatic control at chiller, and automatic control through a remote source.
10. Interface with Energy Management and Control System (EMCS): Factory-installed hardware and software to enable the EMCS to monitor, control, and display chiller status and alarms.

a. Hardwired Points:

1) Control: On-off operation,

b. ASHRAE 135 (BACnet) communication interface with the DDC system for HVAC shall enable the DDC system for HVAC operator to remotely control and monitor the chiller from an operator workstation. Control features and monitoring points displayed locally at chiller control panel shall be available through the DDC system for HVAC.

Q. Insulation:

1. Material: Closed-cell, flexible elastomeric, thermal insulation complying with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
2. Thickness: 1-1/4 inches (high-humidity insulation package).
3. Factory-applied insulation over cold surfaces of chiller components.

a. Adhesive: As recommended by insulation manufacturer and applied to 100 percent of insulation contact surface. Seal seams and joints.

4. Apply protective coating to exposed surfaces of insulation to protect insulation from weather.

R. Accessories:

1. Factory-furnished, thermal dispersion typed chilled-water flow switch for field installation, if not factory installed.

2. Individual compressor suction and discharge pressure gages with shutoff valves for each refrigerant circuit.
3. Factory-furnished neoprene isolators for field installation.
4. Low ambient kit: Allow chiller operation down to 0 ˚F.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine chillers before installation. Reject chillers that are damaged.

B. Examine roughing-in for equipment support, anchor-bolt sizes and locations, piping, and electrical connections to verify actual locations, sizes, and other conditions affecting chiller performance, maintenance, and operations before equipment installation.

1. Final chiller locations indicated on Drawings are approximate. Determine exact locations before roughing-in for piping and electrical connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 CHILLER INSTALLATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases.

B. Coordinate sizes, locations, and anchoring attachments of structural-steel support structures.

C. Provide additional structural-steel as required.

D. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

E. Install chillers on support structure indicated.

F. Equipment Mounting:

1. Install chillers on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Division 03.
2. Comply with requirements for vibration isolation devices specified in Section 230548. "Mechanical Sound and Vibration."

G. Maintain manufacturer's recommended clearances for service and maintenance.

H. Charge chiller with refrigerant and fill with oil if not factory installed.

I. Install separate devices furnished by manufacturer and not factory installed.

3.3 CONNECTIONS

A. Comply with requirements for piping specified in Section 232112 "Heating and Cooling Piping," Section 230516 Piping Specialties," Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to chiller to allow service and maintenance.

C. Evaporator Fluid Connections: Connect to evaporator inlet with shutoff valve, strainer, flexible connector, thermometer, and plugged tee with pressure gage. Connect to evaporator outlet with shutoff valve, balancing valve, flexible connector, flow switch, thermometer, plugged tee with shutoff valve and pressure gage, and drain connection with valve. Make connections to chiller with a flange or mechanical coupling.

D. Connect each chiller drain connection with a union and drain pipe, and extend pipe, full size of connection, to floor drain. Provide a shutoff valve at each connection.

3.4 ELECTRICAL POWER CONNECTIONS

A. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

C. Provide nameplate for each electrical connection indicating electrical equipment designation and circuit number feeding connection. Nameplate shall be laminated phenolic layers of black with engraved white letters at least 1/2 inch high. Locate nameplate where easily visible.

3.5 CONTROLS CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

B. Connect control wiring between chillers and other equipment to interlock operation as required to provide a complete and functioning system.

C. Connect control wiring between chiller control interface and EMCS system for remote monitoring and control of chillers. Comply with requirements in Section 230900 "Energy Management and Control System - General."

D. Provide nameplate on face of chiller control panel indicating control equipment designation serving chiller and the I/O point designation for each control connection. Nameplate shall be laminated phenolic layers of black with engraved white letters at least 1/2 inch high.

3.6 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Verify that refrigerant charge is sufficient and chiller has been leak tested.
3. Verify that pumps are installed and functional.
4. Verify that thermometers and gages are installed.

5. Operate chiller for run-in period.
6. Check bearing lubrication and oil levels.
7. For chillers installed indoors, verify that refrigerant pressure relief device is vented outdoors.
8. Verify proper motor rotation.
9. Verify static deflection of vibration isolators, including deflection during chiller startup and shutdown.
10. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.

B. Inspect field-assembled components, equipment installation, and piping and electrical connections for proper assembly, installation, and connection.

C. Prepare test and inspection startup reports.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain chillers.

END OF SECTION 23 64 26

SECTION 237313

MODULAR CENTRAL-STATION AIR-HANDLING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Air handling units.
2. Field installed coils.

1.3 REFERENCE STANDARDS

A. AMCA 99 – Standards Handbook.

B. AMCA Standard 203.

C. ANSI/AMCA 210 – Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.

D. ANSI/AMCA 230 – Laboratory Methods of Testing Air Circulator Fans for Rating.

E. AMCA 300 – Reverberant Room Method of Sound Testing of Fans.

F. AMCA Standard 301 – Method for Calculating Fan Sound Ratings from Laboratory Test Data.

G. AMCA Standard 500-D – Laboratory Methods of Testing Dampers for Rating.

H. AMCA 500-L – Laboratory Methods of Testing Louvers for Rating.

I. ARI 410 – Standard for Forced – Circulation Air-Cooling and Air Heating Coils.

J. ARI 430 – Central Station Air-Handling Units.

K. ANSI/AFBMA 9 – Load Ratings and Fatigue Life for Ball Bearings.

L. ANSI/AFBMA 11 – Load Ratings and Fatigue Life for Roller Bearings.

M. ASHRAE/ANSI Standard 111.

N. ASHRAE Standard 52.

O. ASTM A525 – Specification for General Requirements for Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process.

P. NFPA 90A – Installation of Air Conditioning and Ventilation Systems.

Q. SMACNA – Low Pressure Duct Construction Standards.

R. UL Standard 1995.

1.4 QUALITY ASSURANCE

A. AMCA certified ratings per applicable AMCA standard based on the testing conducted in an independent laboratory.

B. Conform to AMCA Bulletins regarding construction and testing. Fans shall bear AMCA certified rating seal for both sound and performance.

C. Units shall be designed and manufactured in strict accordance with UL 1995, Standard for Heating and Cooling Equipment. Air handler shall be ETL or UL listed in accordance with UL 1995, or the current equivalent by UL, and shall carry the ETL or UL label. If manufacturer cannot provide ETL/UL sticker on air handler, it will be the sole responsibility of the contractor to arrange for local, on-site, ETL or UL approval and labeling at no additional cost to the Owner.

D. Schedule equipment performance is minimum capacity required.

1.5 SUBMITTALS

A. See Section 23 00 10 Mechanical General Provisions.

B. Submit product data, O&M data, and samples and show item on shop and coordination drawings (where shop and coordination drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Air handling units	R	R		R
Coils, performance data	R	R		R
Fans, performance data	R			
Acoustical performance data	R			
Motors	R	R		
Variable frequency drives	R	R		R
Dampers and actuators	R	R		
Filters	R			
Factory installed controls	R	R		R
Accessories	R	R		R
Coordination drawings				R

C. Additional submittal requirements.

1. List of exceptions to the specifications including section number and a detailed description of alternative materials and methods. If there are no exceptions, so state in precise language.
2. List of proposed manufacturers for fans, filters, coils, motors, drives, dampers and other components.
3. Complete graph of fan curves (not just curve for design conditions) indicating efficiency, BHP, and RPM.
4. Sound power levels per ARI 260 by octave bands; radiated and at inlet and discharge.
5. Coil performance and flow rates.
6. Filter and filter frame product data.
7. Wiring diagram.
8. Control panel location, including elevation indicating height above the ground.
9. Internal static pressure drop with filters clean and dirty.
10. Casing materials of construction and methods of assembly.
11. Construction details including panel sealing, thermal break, door seal and hardware, shipping split and field treatment of panel penetration (sleeve) details.
12. The number of shipping sections requiring field reassembly.
13. Complete dimensional data including exterior dimensions and dimensions of internal components.
14. Coordination Drawings: Submit with Shop Drawings. Show mechanical-room layout and relationships between components and adjacent structural and mechanical elements. Show service clearance requirements, and support locations, type of support, and weight on each support. Indicate and certify field measurements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models are acceptable.

1. Daikin.
2. Trane.
3. York/Johnson Controls.
4. Or equal.

2.2 GENERAL

A. Types and performance as scheduled on Drawings.

B. Performance certified under ARI Standard 430.

C. Units prepared for shipping with all openings securely covered and watertight.

D. All outdoor opening shall have a 1/2 inch mesh bird-screen provided on louvers.

2.3 FANS, MOTORS, AND DRIVES

A. Comply with Section 233400 – HVAC Power Ventilators and Section 230513 – Motors and Controllers.

B. Mounted on common shaft.

C. Type.

1. As schedule, or:
2. Any type that has no greater sound power levels and fan power than fan selected on Drawings. All sound pressure level measurements and calculations shall be in accordance with the latest version of AMCA Standard 300 Reverberant Room Method for Sound Testing of Fans and AMCA Standard 301 Method for Calculating fan Sound Ratings from Laboratory Test Data. Test and calculation procedures based on sound intensity measurements may be substituted for the above procedures, if directed in advance by the Professional.

D. Discharge arrangement: As indicated on the Drawings.

2.4 CABINETS

A. Double wall, 2-inch thick with solid galvanized steel exterior and interior panels.

1. Outer liner: Minimum 16-gage galvanized sheet metal.
2. Inner liner shall be 20 gage solid galvanized steel except as follows:

a. Provide solid 304 stainless steel liner at humidifier, 1 foot upstream, 3 feet downstream.
b. Provide 22 gauge perforated steel liner in any section of the unit (except at cooling coil) where required to meet acoustical criteria, and at a minimum in all sections exposed to the fan.

B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

C. Insulation.

1. Minimum 2-inches thick.
2. Minimum 1.5 pound density.
3. Casing panels (roof, walls, floor) and external structural frame members shall be completely insulated filling the entire panel cavity in all directions so that no voids exist. Panel insulation shall comply with NFPA 90A.

D. Cabinets should be provided with a minimum 6-inch base rail sufficient to support the weight of the unit from the four corners.

E. Reinforced and braced with angles configured such that all side panels are removable without compromising structural integrity of unit.

F. Coils shall be removable from side or top panels.

G. Standard factory finish.

1. Indoor units galvanized.
2. Outdoor units painted: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on enamel finish, consisting of prime coat and thermosetting topcoat.

2.5 ACCCESS DOORS

A. Hinged access doors with quick opening handles.

B. Gasketted air tight when closed.

C. Sections with windows minimum are 12 inches by 12 inches.

1. Economizer section.
2. Fan section.

D. Sections without window.

1. Both upstream and downstream of cooling coils.
2. Upstream of filter section.

E. All doors shall be a 60-inch high when sufficient unit height is available, or the maximum height allowed by the unit height.

F. Multiple door handles shall be provided for each latching point of the door necessary to maintain the specified air leakage integrity of the unit.

2.6 DRAIN PANS

A. Under cooling coil and extending under blank plenum section downstream.

B. 304 Stainless steel: minimum 16-gauge; in accordance with ASHRAE 62.1.

C. Corners soldered, welded or brazed.

D. Pitched to drain flange to fully drain; double broken, double sloped to ensure no standing water.

E. Drain flange.

1. Minimum per code.
2. Stainless steel or brass.
3. Welded or soldered into bottom of pan.

F. Accessible for cleaning.

G. Insulation: minimum 1 in. thick, coated fiberglass board or injected foam insulation, NFPA-90 or UL listed: Intermediate drain pans need not be insulated.

2.7 FILTER SECTION

A. Holding Frames: Holding frames shall be factory fabricated of 16-gage galvanized steel and shall be equipped with gaskets and 2 heavy duty positive sealing fasteners. Each fastener shall

be capable of withstanding 25 pounds pressure without deflection and be attached or removed without the use of tools.

B. Filter type, MERV rating, and arrangement shall be provided as defined in Section 234000 – Air Cleaning Devices.

C. Filters shall be lifted out where access is available upstream of the filter, or side slide out when front access is not available.

D. Filter gauges: See Section 234000 – Air Cleaning Devices.

E. Performance: Select fan for mean pressure drop (midway from clean to maximum).

F. Manufacturer shall provide one set of startup filters.

2.8 ECONOMIZER (OR MIXING BOX)

A. Low leakage parallel blade dampers, Ruskin CD-60 or equal.

B. Outdoor air and return airflow directed into each other.

C. Actuators: See Section 230913 – EMCS Basic Materials and Devices.

D. Dampers designed to operate with direct-coupled electric actuators with linkage concealed in frame (exposed linkage and jackshafts not acceptable), independent actuator for each damper section.

E. Do not link outdoor air and return air dampers. Each shall operate independently.

2.9 VIBRATION ISOLATION

A. Internally isolated.

B. Spring, 2 inch static deflection.

C. Comply with Section 230548 – Mechanical Sound and Vibration Control.

2.10 HOT AND CHILLED WATER COILS

A. Extended surface type coils.

1. Copper tubes.

a. Brazed or welded joints.
b. Minimum thickness: 0.020 inches.
c. Outside diameter: 1/2 inch or 5/8 inch.

2. Plate fins of aluminum, unless otherwise indicated on Drawings.

a. Minimum thickness: 0.0075 inches.

B. Rows and fin spacing.

1. To meet performance scheduled at similar pressure drop.
2. Selected with tube fouling factor of 0.0001.
3. Maximum fins: 10 per inch.
4. Select to avoid moisture carryover.

C. Circuiting: full row.

D. Headers: Copper tubing or cast iron.

E. Certified by ARI per current Standard 410.

F. For field installed coils, coil frame designed for bolting to other sections or ductwork.

G. Coil Casing.

1. Minimum 16-gauge.
2. 304 stainless steel casing and tube sheet.
3. Intermediate supports of same materials as casing.

H. Design for 200 pounds per square inch, 250 degrees Fahrenheit unless otherwise indicated on Drawings.

I. Factory tested to.

1. 300 psi for water coils.

J. Factory cleaned, degreased and flushed. Piping connections shall be capped with removable caps.

2.11 AUXILIARY CONTAINMENT PAN (UNDERNEATH AHU)

A. Provide fully welded stainless steel leak containment pan underneath AHU. Containment pan shall be sized to such that it extends 6 inches beyond the AHU on all sides with 6 inch high sides (completely around perimeter). Containment pan shall be sealed with waterproof protective coating.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate with work of other trades.

B. Units shall ship with all openings securely covered and watertight. Protection shall be retained until completion of construction or until opening is field connected to ductwork.

C. Verify that adequate clearance between air handling units and adjacent walls or equipment is available to permit maintenance and repairs.

D. Provide auxiliary drain pans where required, see Section 233300 – “Air Duct Accessories.”

E. Provide accurate alignment between unit and connected ducts.

F. Install air handling units in accordance with manufacturer's written installation instructions.

G. Outdoor units shall be fully waterproof.

H. Mount units sufficiently high to allow for proper condensate trapping and drainage.

I. Piping.

1. See Section 232112 – "Heating and Cooling Piping."
2. See piping diagrams.
3. Do not block access doors with piping. Access doors shall be capable of opening 90 degrees.
4. Pipe condensate to nearest appropriate drain.

J. See Section 230900 – "Energy Management and Control System."

K. The Contractor shall be responsible to coordinate all installation requirements with other trades to ensure that a complete installation for each unit is being provided. Coordination efforts shall include such items as unloading and hoisting requirements, field wiring requirements, field piping requirements, field ductwork requirements, requirements for assembly of field-bolted or welded joints, and all other installation and assembly requirements.

L. The AHU manufacturer shall provide all screws and gaskets for joining of sections in the field.

M. The Contractor shall verify that the following items have been completed prior to scheduling the AHU manufacturer's final inspection and start up:

1. All spring-isolated components have had their shipping restraints removed and the components have been leveled.
2. On all field-joined units, that all interconnections have been completed, i.e., electrical and control wiring, piping, casing joints, bolting, welding, etc.
3. All water piping connections have been completed and hydrostatically tested and all water flow rates have been set in accordance with the capacities scheduled on the Drawings.
4. All ductwork connections have been completed and all ductwork has been pressure tested for its intended service.
5. All power wiring, including motor starters and disconnects, serving the unit has been completed.
6. All automatic temperature and safety controls have been completed.
7. All dampers are fully operational.
8. All shipping materials have been removed.
9. All (clean) filter media has been installed in the units.

3.2 INSPECTION

A. Verify that adequate clearance between air handling units and adjacent walls or equipment is available to permit maintenance and repairs.

3.3 PRE-OPERATING CHECKS

A. Before operating air handling units:

1. Complete provided Pre-Functional Test Data Sheet for each unit.

3.4 CLEANING

A. Clean modular air-handling units externally and internally, on completion of installation, according to manufacturer's written instructions. Clean fan interiors to remove foreign material and construction dirt and dust. Vacuum clean fan wheels, cabinets, and coils entering air face.

B. After completing system installation and testing, adjusting, and balancing modular air-handling and air-distribution systems, clean filter housings and install new filters.

3.5 TESTING AND ADJUSTING

A. Do not operate fans for any purpose, temporary or permanent until:

1. See Section 230500 – Basic Mechanical Materials and Methods.
2. Ductwork is clean.
3. Filters are in place.
4. Bearings are in place.
5. Bearings are lubricated.
6. Fan(s) has been run under observation.

B. Start and test fans in accordance with manufacturer's written installation instructions.

C. Test cooling coil drain pans. See Section 233300 – Duct Accessories.

D. Start-up and adjust completed air handling units to insure proper operation.

E. See Section 230593 – Testing, Adjusting, and Balancing.

F. After starting fans: Check for objectionable noise and/or vibration. Correct as needed at no additional cost to the Owner.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air-handling units.

B. See Section 230010 – Mechanical General Provisions.

END OF SECTION 23 73 13

SECTION 23 74 33

OUTDOOR-AIR HANDLING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes dedicated outdoor air units capable of supplying up to 100 percent outdoor air and providing cooling and heating.

1.3 SUBMITTALS

A. See Section 23 00 10 Mechanical General Provisions.

B. Submit product data, O&M data, and samples and show item on shop and coordination drawings (where shop and coordination drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Air handling units	R	R		R
Coils, performance data	R	R		R
Fans, performance data	R			
Acoustical performance data	R			
Motors	R	R		
Variable frequency drives	R	R		R
Dampers and actuators	R	R		
Filters	R			
Factory installed controls (controllers, control devices, etc.)	R	R		R
Accessories	R	R		R
Coordination drawings				R

C. Additional submittal requirements.

1. List of exceptions to the specifications including section number and a detailed description of alternative materials and methods. If there are no exceptions, so state in precise language.
2. List of proposed manufacturers for fans, filters, coils, motors, drives, dampers and other components.
3. Complete graph of fan curves (not just curve for design conditions) indicating efficiency, BHP, and RPM.
4. Sound power levels per ARI 260 by octave bands; radiated and at inlet and discharge.
5. Coil performance and flow rates.
6. Filter and filter frame product data.
7. Wiring diagram.
8. Control panel location, including elevation indicating height above the ground.
9. Internal static pressure drop with filters clean and dirty.
10. Casing materials of construction and methods of assembly.
11. Construction details including panel sealing, thermal break, door seal and hardware, shipping split and field treatment of panel penetration (sleeve) details.
12. The number of shipping sections requiring field reassembly.
13. Coordination Drawings: Submit with Shop Drawings. Show mechanical-room layout and relationships between components and adjacent structural and mechanical elements. Show service clearance requirements, and support locations, type of support, and weight on each support. Indicate and certify field measurements.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: Two sets for each air-handling unit.
2. Gaskets: Two sets for each access door.
3. Fan Belts: One set for each air-handling unit fan.

1.5 QUALLITY ASSURANCE

A. Regulatory Requirements: Comply with provisions of the following codes:

B. UL Standard: Provide units complying with UL 1812, "Ducted Heat Recovery Ventilators"; or UL 1815, "Nonducted Heat Recovery Ventilators."

C. UL and NEMA Compliance: Provide ancillary electrical components required as part of energy recovery units that are listed and labeled by UL and that comply with applicable NEMA standards.

D. Comply with NFPA 70 for components and installation.

E. DX and water coils shall be AHRI Certified per standard 410-2001.

1.6 SEQUENCING AND SCHEDULING

A. Coordinate size and location of equipment supports, housekeeping pad, and wall penetrations.

B. Coordinate construction sequencing of associated plumbing and electrical systems.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to replace components of units that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Heat Exchangers: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

1. Greenheck.
2. Thybar.
3. Aaon.
4. Or equal.

2.2 DEDICATED OUTDOOR AIR UNITS

A. Surfaces in contact with the airstream shall comply with requirements of ASHRAE Standard 62.1-2010.

B. Unit Casing and Frames.

1. Double wall construction.
2. Unit shall be of internal frame type construction of G90 galvanized steel per ASTM A653.
3. Exterior panels shall be a minimum of 18 gauge galvanized steel. Where top panels are joined there shall be a standing seam.
4. All exterior metal-to-metal-seams shall be sealed with closed cell neoprene gasketing, requiring no caulking at job site.
5. Unit shall be furnished with a G90 galvanized base rail of sufficient height to install a condensate p-trap per manufacturer's recommendation. Minimum base rail height shall be 6". Units not provided with a factory fabricated base rail, a field constructed base rail shall be provided with same construction as factory fabricated base rail.
6. Contractor shall be responsible for providing a housekeeping pad.

C. Casing Insulation.

1. Rigid urethane foam.
2. Thickness: 1 inch (minimum).
3. Meets UL94HF-1 flame requirements.
4. Location and application: Full coverage of entire cabinet exterior to include walls, roof of unit. Insulation shall be installed between inner and outer shells of all cabinet exterior components.

D. Energy Recovery Wheel.

1. Wheel shall be of the enthalpy type for both sensible and latent heat recovery, and be designed to insure laminar flow.

2. Desiccant shall be silica gel.
3. Wheel shall be constructed of light weight polymer media.
4. Polymer media shall be mounted in a stainless steel rotor for corrosion resistance.
5. Wheel design shall consist of removable segments.
6. Segments shall be removable without the use of tools.
7. Silica gel desiccant shall be permanently bonded to wheel media.
8. Wheels with sprayed on desiccant coatings are not acceptable.
9. Pre-tensioned urethane drive belt.
10. Wheel performance criteria are to be as specified in AHRI Standard 1060, complying with the Combined Efficiency data in the submittal.
11. Modulating wheel defrost control (energy recovery wheel VFD).
12. Bypass dampers. See damper specifications herein.

E. Access Doors.

1. Hinged access doors.
2. All components shall be easily accessible through large hinged access doors for both exhaust and supply compartments.
3. Energy recovery wheel shall be mounted in a slide-out track.
4. Access doors to be provided in each individual section where blowers, filters and motorized damper are required.
5. Fabricated of 18 gauge G90 galvanized steel.

F. Fan Sections.

1. Centrifugal fans to be double width, double inlet, single fan forward curved type.
2. All blower wheels shall be statically and dynamically balanced.
3. Motors shall be permanently lubricated, heavy duty type, matched to the fan load and furnished at the specified voltage, phase and enclosure.
4. Ground and polished steel fan shafts shall be mounted in permanently lubricated, sealed ball bearing pillow blocks.
5. Bearings shall be selected for minimum (L10) life in excess of 100,000 hours at maximum cataloged operating speeds.
6. Blowers shall be quiet running, forward curved type and enable independent balancing of exhaust and supply airflows by providing separate motors for exhaust and supply blowers.
7. Fan and motor assembly shall be mounted on heavy gauge galvanized rails and internally isolated on 1.125 inch thick neoprene vibration isolators.
8. Blower performance shall be factory tested for flow rate, pressure, power, air density, rotation speed and efficiency. Ratings are to be established in accordance with AMCA 210, “Laboratory Methods of Testing Fans for Rating”.
9. Flexible duct connections.

G. Motor and Drives.

1. Premium efficiency, see 230513 Motors and Controllers. Inverter duty, suitable for use with variable frequency drive.
2. Motors shall be permanently lubricated, heavy duty type, matched to the fan load and furnished at the specified voltage, phase, and enclosure.
3. Drives shall be sized for a minimum of 150% of driven horsepower.
4. Pulleys shall be fully machine cast.
5. Energy recovery wheel motors shall have integral overload protection.
6. Supply and exhaust fan motor and enthalpy wheel controllers: Variable frequency drives, see Section 230513 Motor Controllers.

H. Dampers.

1. Motorized outdoor air intake and exhaust air dampers.
2. Low leakage type, factory installed. End/jamb seals and insulated blades.
3. Meet ASHRAE Standard 90.1-2010 damper leakage requirements.

I. Drain Pan.

1. Materials of Construction: Welded stainless steel.
2. Sloped in two directions.
3. Welded stainless steel drain connection.
4. Complies with ASHRAE Standard 62.1-2010.
5. P-trap per manufacturer's recommendation.

J. Filters.

1. 2" MERV 8 disposable filters.

K. Electrical.

1. All internal electrical components shall be prewired for single point power connection.
2. All electrical components shall be UL listed, approved or classified where applicable and wired in compliance with the National Electrical Code.
3. Single-point high voltage connection.

L. Direct Expansion (DX) Cooling/Heating Coil.

1. Factory tested and rated in accordance with AHRI 410.
2. Copper tubes with permanently expanded aluminum fins, 12 fpi or less.
3. Galvanized frame.
4. Interlaced configuration.

M. Hot Gas Reheat Coil.

1. Factory tested and rated in accordance with AHRI 410.
2. Copper tubes with permanently expanded aluminum fins, 12 fpi or less.
3. Galvanized frame.

N. Natural Gas Furnace.

1. Indirect gas-fired furnace.
2. Factory assembled, piped and wired complying with NFPA 54 and ANSI Z21.47.

    a. Furnace shall bear AGA label.

3. Burners: Stainless steel.

    a. Ignition: electronically controlled electric spark with flame sensor.

4. Stainless steel heat exchanger drain pan.
5. Power vent: integral, motorized centrifugal fan interlocked with gas valve.
6. Concentric vent kit.
7. 4:1 electronically modulating gas control valve.
8. Gas train: single-body, regulated, redundant, 24 VAC gas valve assembly containing pilot solenoid valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff.
9. Fabricate section to allow removal and replacement of furnace and to allow in-place access for service.

O. Unit Controls.

1. The unit shall be constructed so that it can function as a stand-alone heating and cooling system controlled by factory-supplied controllers, thermostats and sensors or it can be operated as a heating and cooling system controlled by an Energy Management and Control System (EMCS).
2. DDC controller with integral LCD screen and built-in keypad.
3. DDC controller communication protocol: BACnet MSTP.
4. Variable frequency drives (supply and exhaust fans, energy recovery wheel).
5. Unit shall be furnished with the following sensors, also See Drawings.

    a. Dirty filter sensors (supply and exhaust).
    b. CO2 sensor (duct mounted).
    c. Temperature sensors.

        1) Outdoor air entering wheel.
        2) Outdoor air leaving wheel.
        3) Outdoor air leaving cooling coil.
        4) Outdoor air supply air.
        5) Exhaust air entering wheel.
        6) Exhaust air leaving wheel.

    d. Pressure sensors.

        1) Outdoor air wheel pressure.
        2) Outdoor air filter pressure.
        3) Exhaust air wheel pressure.
        4) Exhaust air filter pressure.

    e. Current sensors.

        1) Supply fan.
        2) Exhaust fan.

    f. Energy recovery wheel rotation sensor.
    g. Phase monitor.
    h. Defrost control.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for piping, ducts, and electrical systems to verify actual locations of connections before equipment installation.

C. Examine roof curbs and equipment supports for suitable conditions where units will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's rigging and installation instructions for unloading units and moving to final locations.

B. Curb Support: Install roof curb on roof structure according to "The NRCA Roofing Manual."

1. Install and secure units on curbs and coordinate roof penetrations and flashing with roof construction.
2. Coordinate size, installation, and structural capacity of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 077200 "Roof Accessories."
3. Coordinate size, location, and installation of unit manufacturer's roof curbs and equipment supports with roof Installer.

C. Restrained Curb Support: Install restrained vibration isolation roof-curb rails on roof structure according to "The NRCA Roofing Manual."

D. Install wall- and duct-mounted sensors furnished by manufacturer for field installation. Install control wiring and make final connections to control devices and unit control panel.

E. Comply with requirements for gas-fired furnace installation in NFPA 54, "National Fuel Gas Code."

F. Install separate devices furnished by manufacturer and not factory installed.

G. Install new filters at completion of equipment installation and before testing, adjusting, and balancing.

H. Install drain pipes from unit drain pans to sanitary drain.

1. Drain Piping: Drawn-temper copper water tubing complying with ASTM B 88, Type L, with soldered joints.
2. Pipe Size: Same size as condensate drain pan connection.

3.3 CONNECTIONS

A. Where installing piping adjacent to units, allow space for service and maintenance.

B. Refrigerant piping: Refrigerant piping: Comply with applicable requirements in Section 232300 “Refrigerant Piping.”

C. Gas Piping Connections:

1. Comply with requirements in Section 231123 "Fuel Gas Piping."
2. Connect gas piping to furnace, full size of gas train inlet, and connect with union, pressure regulator, and shutoff valve with sufficient clearance for burner removal and service.
3. Install AGA-approved flexible connectors.

D. Duct Connections:

1. Comply with requirements in Section 233113 "Ducts."
2. Drawings indicate the general arrangement of ducts.

3. Connect ducts to units with flexible duct connectors. Comply with requirements for flexible duct connectors in Section 233300 "Duct Accessories."

E. Electrical Connections: Comply with requirements for power wiring, switches, and motor controls in electrical Sections.

1. Install electrical devices furnished by unit manufacturer but not factory mounted.

3.4 CLEANING

A. After completing system installation, including outlet fittings and devices, inspect and clean exposed finishes. Remove dirt and construction debris and repair damaged finishes.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Inspect units for visible damage to furnace combustion chamber.
3. Perform the following operations for both minimum and maximum firing and adjust burner for peak efficiency:

    a. Measure gas pressure at manifold.
    b. Measure combustion-air temperature at inlet to combustion chamber.
    c. Measure flue-gas temperature at furnace discharge.
    d. Perform flue-gas analysis. Measure and record flue-gas carbon dioxide and oxygen concentration.
    e. Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.

4. Verify operation of remote panel including pilot-light operation and failure modes. Inspect the following:

    a. High-limit heat exchanger.
    b. Alarms.

5. Start refrigeration system when outdoor-air temperature is within normal operating limits and measure and record the following:

    a. Cooling coil leaving-air, dry- and wet-bulb temperatures.
    b. Cooling coil entering-air, dry- and wet-bulb temperatures.
    c. Condenser coil entering-air dry-bulb temperature.
    d. Condenser coil leaving-air dry-bulb temperature.

6. Simulate maximum cooling demand and inspect the following:

    a. Compressor refrigerant suction and hot-gas pressures.
    b. Short-circuiting of air through outside coil or from outside coil to outdoor-air intake.

7. Inspect casing insulation for integrity, moisture content, and adhesion.
8. Verify that clearances have been provided for servicing.
9. Verify that controls are connected and operable.
10. Verify that filters are installed.

11. Clean coils and inspect for construction debris.
12. Clean furnace flue and inspect for construction debris.
13. Inspect operation of power vents.
14. Purge gas line.
15. Inspect and adjust vibration isolators.
16. Verify bearing lubrication.
17. Clean fans and inspect fan-wheel rotation for movement in correct direction without vibration and binding.
18. Adjust fan belts to proper alignment and tension.
19. Start unit.
20. Inspect and record performance of interlocks and protective devices including response to smoke detectors by fan controls and fire alarm.
21. Operate unit for run-in period.
22. Calibrate controls.
23. Adjust and inspect high-temperature limits.
24. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.
25. Verify operational sequence of controls.
26. Measure and record the following airflows. Plot fan volumes on fan curve.

    a. Supply-air volume.
    b. Outdoor-air flow.

B. After startup, change filters, verify bearing lubrication, and adjust belt tension.

C. Remove and replace components that do not properly operate and repeat startup procedures as specified above.

D. Prepare written report of the results of startup services.

3.6 ADJUSTING

A. Adjust initial temperature and humidity set points.

B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

C. After starting units: Check for objectionable noise or vibration. Correct as needed at no additional cost to the Owner.

D. Balancing: See Section 230593 “Testing, Adjusting and Balancing for HVAC.”

E. Prepare test and inspection reports.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 23 74 33

SECTION 23 81 29

SPLIT SYSTEM – MULIZONE VRF HEAT PUMP EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes variable refrigerant flow (VRF) system consisting of separate evaporator-fan coil units, heat recovery units (branch controllers), compressor-condenser components and system controls.

1.3 SUBMITTALS

A. See Section 230010 – Mechanical General Provisions

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Outdoor units	R	R		R
Indoor units	R	R		R
Heat recovery units (branch controllers)	R	R		R
System controls and accessories	R	R		R
Installer’s qualifications (factory training certificate)	R			

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: Five set(s) for each type of indoor unit.

1.5 QUALITY ASSURANCE

A. The VRF system installer must be factory-trained and certified prior to submission of bid. A factory-trained and certified employee of the installer must be on-site when HVAC system is being installed and placed in operation.

B. The lowest and best bidder is to provide a letter from the manufacturer verifying the training certification and a minimum of four (4) successful installations of specified VRF system with references within 72 hours of receipt of bid to Architect.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of equipment and are based on the basis of design system indicated.

D. The units shall be listed by Electrical Laboratories (ETL) and bear the ETL label.

E. All wiring shall be in accordance with the National Electrical Code (N.E.C.).

F. The units shall be manufactured in a facility registered to ISO 9001 and ISO 14001 which is a set of standards applying to environmental protection set by the International Standard Organization (ISO).

G. A full charge of R-410A for the condensing unit only shall be provided in the condensing unit.

H. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

I. ASHRAE Compliance:

1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - " Procedures," and Section 7 - "Construction and System Start-up."

J. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

1.6 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases.

B. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

1. Warranty Period:

a. For Compressor: Five years from date of Substantial Completion.

b. For Parts: Five years from date of Substantial Completion.
c. For Labor: One year from date of Substantial Completion.

B. The system shall be installed by a factory trained and manufacturer certified contractor with extensive training on this type equipment. Training to be performed and certification to be provided by the manufacturer. A completed system commissioning report shall be submitted to the Manufacturer's service department to ensure full warranty coverage for the Owner"

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. LG HVAC.
2. Mitsubishi HVAC.
3. Trane Co.
4. Daikin.
5. Or equal.

B. A Mitsubishi City Multi VRF system has been approved by the Owner and is the basis of design for this project. The piping systems, controls, electrical systems, drains, equipment space (including service space), and equipment capacities are as required by the Mitsubishi City Multi system. A bid based using any other equipment must also include the cost for the system design and installation which includes the additional or revised equipment, piping, electrical, supports, controls, and drains required for proper operation. Design must be prepared and documents sealed by a Architect Engineer registered in the State of Mississippi. The alternate system design must be approved by the Architect before executing the sub-contract. The Contractor shall assume all additional cost for design review, design revisions, controls, electrical, piping, and drains beyond those quantities required for City Multi.

2.2 OUTDOOR UNITS

A. General: The outdoor units shall be designed specifically for use with a variable refrigerant flow system and components. Units shall be equipped with multiple circuit boards that interface to the control system and perform all functions necessary for operation. The units shall have a powder coated finish and shall be completely factory assembled, piped and wired. Each unit must be run tested at the factory.

B. Unit Cabinets.

1. The casing shall be fabricated of galvanized steel, bonderized and finished with a powder coated baked enamel.

C. Fan.

1. The unit shall be furnished with one direct drive, variable speed propeller type fan.
2. The motor shall have inherent protection, permanently lubricated bearings, and be completely variable speed.
3. The fan shall be provided with a raised guard to prevent contact with moving parts.
4. The outdoor unit shall have a vertical discharge airflow.

D. Coil.

1. The condenser coil shall be of nonferrous construction with lanced or corrugated plate fins on copper tubing and shall be protected with an integral metal guard and shall be protected with an integral metal guard.
2. Refrigerant flow from the condenser shall be controlled by means of an inverter driven compressor.
3. The condenser coil shall include 4 circuits with two position valves for each circuit, except for the last stage.

E. Compressor.

1. The compressor shall be a high performance, inverter driven, modulating capacity scroll compressor with a factory mounted crankcase heater.
2. The outdoor unit shall have an accumulator with refrigerant level sensors and controls.
3. The outdoor unit shall have an inverter to modulate capacity. The capacity shall be completely variable down to a 16% of rated capacity.
4. The compressor shall be equipped with an internal thermal overload, a high pressure safety switch, over-current protection and DC bus protection.
5. The compressor shall be mounted to prevent the transmission of vibration.
6. The outdoor unit shall be capable of operating at 0 deg F ambient temperature without additional low ambient controls.
7. The outdoor unit shall have high efficiency oil separator plus additional logic controls to ensure adequate oil volume in the compressor is maintained.

F. Electrical.

1. The outdoor unit electrical power shall be 208 volts, 3 phase, 60 hertz.
2. The unit shall be capable of satisfactory operation within voltage limits of 198 volts to 253 volts.
3. The outdoor unit shall be controlled by integral microprocessors.
4. The control voltage between the indoor units and the outdoor unit shall be completed using a 2 conductor shielded cable to provide total integration of the system.

2.3 HEAT RECOVERY UNITS (BRANCH CONTROLLERS)

A. General: Heat recovery units (HRU) shall be designed specifically for use with a variable refrigerant flow system and components. These units shall be equipped with a circuit board that interfaces to the control system and shall perform all functions necessary for operation. The unit shall have a galvanized steel finish and shall be completely factory assembled, piped and wired. Each unit shall be run tested at the factory. The units shall be mounted indoors where indicated on the drawings. The sum of connected capacity of all indoor air handlers shall be as scheduled on the drawings. Each HRU shall operate the number of indoor units in accordance with the schedule on the drawings.

B. Unit Cabinet.

1. The casing shall be fabricated of galvanized steel.
2. Each cabinet shall house a liquid-gas separator and multiple refrigeration control valves.
3. The unit shall house a tube-in-tube heat exchanger.

C. Refrigerant Valves.

1. The unit shall be furnished with multiple two position refrigerant valves.

2. Each circuit shall have one (32,000 BTUH or smaller evaporator section) two-position liquid line valve and a two-position suction line valve.
3. The refrigerant connections shall be flare-type connections.
4. Linear electronic expansion valves shall be used to control the variable refrigerant flow.
5. Valves in the variable refrigerant flow system shall be Diamond Back VC series ball valves with HKG-20HF insulation kits or equal. Valve shall be a 700 psig Schrader valve for service connections. This valve kit shall be used with all systems.

D. Integral Drain Pan.

1. An integral condensate pan and drain shall be provided (if required by manufacturer).

E. Electrical.

1. The unit electrical power shall be 208 volts, 1 phase, 60 hertz.
2. The unit shall be capable of satisfactory operation within voltage limits of 198 volts to 254 volts.
3. The HRU shall be controlled by integral microprocessors.
4. The control voltage between the indoor units and the outdoor unit shall be communicated on a 2 conductor shielded cable.

2.4 RECESSED CEILING CASSETTE, DUCTLESS HEAT PUMPS INDOOR UNITS

A. General: The recessed ceiling cassette unit shall recess into the ceiling with a ceiling grille, an electronic expansion valve, controls that can be used with the outdoor unit and HRU. Each system shall perform in accordance to the ratings scheduled on the drawings.

B. Indoor Unit: The indoor unit shall be factory assembled, wired and run tested and shall contain within the unit all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, an emergency operation function and a test run switch. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.

C. Unit Cabinet: A four-way grille shall be fixed to bottom of cabinet allowing, two, three, or four - way discharge.

D. Fan.

1. The evaporator fan shall be an assembly with a turbo fan direct driven by a single motor, be statically and dynamically balanced; fan motor shall have permanently lubricated bearings.
2. The indoor fan shall have four (4) speeds, High, Mid 1, Mid 2, and Low, two of which may be selected by the room controller.
3. The indoor unit shall have an adjustable air outlet system offering 4-way airflow, 3-way airflow, or 2-way airflow.
4. The auto air swing vanes shall be capable of automatically swinging up and down for uniform air distribution.

E. Filter.

1. Return air shall be filtered by means of a long-life permanent filter to provide approximately 2,500 hours of use in a normal office environment before cleaning.

F. Coil.

1. The evaporator coil shall be of nonferrous construction with smooth plate fins on copper tubing with inner grooves for high efficiency heat exchange.
2. All tube joints shall be brazed with phoscopper or silver alloy and shall be pressure tested at the factory.
3. A condensate pan and drain shall be provided under the coil.
4. The condensate pump shall be able to raise drain water 33 inches above the condensate pan.
5. Both refrigerant lines from the HRU to the indoor units shall be insulated.

G. Electrical.

1. The unit electrical power shall be 208 volts, 1 phase, 60 hertz.
2. The system shall be capable of satisfactory operation within voltage limits of 198 volts to 254 volts.

H. Controls.

1. This unit shall have controls provided by the manufacturer to perform input functions necessary to operate the system.

2.5 WALL-MOUNTED HEAT PUMP INDOOR UNITS

A. General: The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, and a test run switch. Indoor unit and refrigerant piping shall be charged with dehydrated air before shipment from the factory.

B. Unit Cabinet.

1. The unit shall have multi-directional drain and refrigerant piping arrangements providing options for four (4) directions for refrigerant piping and two (2) directions for draining.
2. Unit shall have a separate back plate which secures the unit firmly to the wall.

C. Fan.

1. The evaporator fan shall be an assembly with one or two line-flow fan(s) direct driven by a single motor, be statically and dynamically balanced and run on a motor with permanently lubricated bearings.
2. A manual adjustable guide vane shall be provided with the ability to change the airflow from side to side (left to right).
3. A motorized air sweep louver shall provide an automatic change in airflow by directing the air up and down to provide uniform air distribution.
4. The indoor fan shall be capable of four (4) speeds, High, Mid 1, Mid 2, and Low, two of which may be selected by the room controller.

D. Filter.

1. Return air shall be filtered by means of an easily removable washable filter.

E. Coil.

1. The evaporator coil shall be of nonferrous construction with smooth plate fins on copper tubing with inner grooves for high efficiency heat exchange.
2. All tube joints shall be brazed with phoscopper or silver alloy and shall be pressure tested at the factory.
3. A condensate pan and drain shall be provided under the coil.
4. The condensate pump shall be able to raise drain water 33 inches above the condensate pan.
5. Both refrigerant lines from the HRU to the indoor units shall be insulated.

F. Electrical.

1. The unit electrical power shall be 208 volts, 1 phase, 60 hertz.
2. The system shall be capable of satisfactory operation within voltage limits of 198 volts to 254 volts.

G. Control.

1. The unit shall have controls provided by the manufacturer to perform input functions necessary to operate the system.

2.6 CONTROLS

A. Overview.

1. General: The control network shall consist of a centralized controller, software, and remote room controllers for each indoor unit.
2. The VRF system controls shall be capable of supporting remote controllers, centralized system controllers, and system integration to Energy Management and Control System (EMCS) via BACnet/IP.

B. VRF control system network.

1. The VRF control system shall consist of remote controllers, centralized controllers, and integrated web based interface communicating over a high-speed communication bus. The control system shall support operation monitoring, scheduling, error email distribution, personal browsers, tenant billing, online maintenance support, and integration to the EMCS via a BACnet/IP Gateway.

C. Remote indoor unit controllers.

1. Allows the user to change on/off, temperature setting, and fan speed setting. The room temperature shall be sensed at either the Remote Controller or the Indoor Unit dependent on the indoor unit dipswitch setting. The Remote Controller shall display a four-digit error code in the event of system abnormality/error.

D. Central controller.

1. The centralized VRF system controller shall be capable of controlling a minimum of 50 indoor units across multiple outdoor units. The centralized controller shall support operation superseding that of the remote controllers, system configuration, daily/weekly/annual scheduling, monitoring of operation status, error email notification, online maintenance tool and malfunction monitoring. The centralized controller shall have basic operation controls which can be applied to an individual indoor unit, a group of indoor units (up to 128 indoor units) or all indoor units (collective batch operation). This

basic control set of operation controls for the centralized controller shall include on/off, operation mode selection (cool, heat, auto, dry and fan), temperature setting, fan speed setting, airflow direction setting, error mail notification, and online maintenance. The centralized controller shall be able to enable or disable operation of local remote controllers. The centralized controller shall allow the user to define daily, weekly, and annual schedules with operations consisting of ON/OFF, mode selection, temperature setting, and permit/prohibit of remote controllers.

a. Centralized controller shall communicate with the VRF control system via a RS-485 daisy-chain communication protocol.
b. 10.2-inch backlit touchscreen LCD display screen.
c. Centralized controller shall allow web-access.
d. Support two digital input and two digital outputs for device interlocks.

E. VRF Control System Integration.

1. The BACnet interface shall be compliant with BACnet/IP (ANSI/ASHRAE 135, 135a) and UDP/IP of Ethernet (ANSI/ASHRAE 135-1005, 135b). The BACnet® interface shall support BACnet Broadcast Management (BBMD). The BACnet® interface shall support a minimum of 50 indoor units. Operation and monitoring points include, but are not limited to, on/off, operation mode, fan speed, prohibit remote controller, filter sign reset, alarm state, error code, scheduling, and error address.

2.7 ELECTRCIAL CHARACTERISTICS

A. General.

1. The controls network shall operate at 24VDC. Controller power and communications shall be via a common non-polar communications bus.

B. Wiring.

1. Control wiring shall be installed in a system daisy chain configuration from indoor unit to remote controller to indoor unit, to the HRU (main and subs, if applicable) and to the outdoor unit. Control wiring to remote controllers shall be run from the indoor unit terminal block to the controller associated with that unit.
2. Control wiring for schedule timers, system controllers, and centralized controllers shall be installed in a daisy chain configuration from outdoor unit to outdoor unit, to system controllers, to the power supply.
3. The central system controller shall be capable of being networked with other central system controllers for web based control.

C. Wiring Type.

1. Wiring shall be 2-conductor (16 AWG or 18 AWG), twisted shielded pair, stranded wire.
2. Network wiring shall be CAT-5e with RJ-45 connection.

2.8 POWER SUPPLY

A. The power supply shall supply 12VDC for the centralized controller and 24VDC voltage for the central control transmission. The power supply shall have the capacity to power a maximum of 2 centralized controllers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Equipment Mounting:

1. Install ground-mounted, compressor-condenser components on cast-in-place concrete housekeeping pad.

D. Install and connect refrigerant piping to component's quick-connect fittings. Install tubing to allow access to unit.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

C. Duct Connections: Duct installation requirements are specified in Section 233113 "Metal Ducts." Drawings indicate the general arrangement of ducts. Connect supply and return ducts to split-system air-conditioning units with flexible duct connectors. Flexible duct connectors are specified in Section 233300 "Air Duct Accessories."

D. Connect condensate drain piping and extend condensate collection piping system.

E. Electrical: Comply with applicable requirements in Division 16 Sections for power wiring, switches, and motor controls.

3.3 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Remove and replace malfunctioning units and retest as specified above.

C. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust initial temperature and humidity set points.

3.5 CLEANING

A. After completing installation, clean furnaces internally according to manufacturer's written instructions.

B. Install new filters in each indoor unit prior to performing Testing, Adjusting, and Balancing work.

3.6 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Final Checks before Startup: Perform the following:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to piping, and electrical systems are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Perform cleaning and adjusting specified in this Section.

C. Provide all technical assistance required to Division 23C Energy Management and Controls contractor in mapping across points to the EMCS.

3.7 CLEANING

A. Clean indoor and outdoor units on completion of installation, according to manufacturer’s written instructions.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner’s maintenance personnel to adjust, operate, and maintain Variable Refrigerant Flow Systems. Refer to Division 23 Section 230010 “Mechanical General Provisions”.

END OF SECTION 23 81 29

SECTION 23 81 23

COMPUTER-ROOM AIR CONDITIONERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for all water pumps except

1. Computer-Room Air-Conditioners
2. Controls and accessories

B. Related Sections

1. Section 23 00 10 – Mechanical General Provisions
2. Section 23 05 00 – Basic Mechanical Materials and Methods
3. Section 23 07 00 – Mechanical Insulation

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE Compliance:

1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2010.

D. ASME Compliance: Fabricate and label water-cooled condenser shell to comply with ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," Division 1.

1.4 SUBMITTALS

A. See Section 23 00 10 – Mechanical General Provisions

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Computer-Room Air Conditioner (color sample)	R	R	R	R
Controls (factory and field mounted)	R	R		
Accessories	R	R		
Mounting details				R

1.5 COORDINATION

A. Coordinate layout and installation of computer-room air conditioners and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

B. Coordinate installation of computer-room air conditioners with computer-room access flooring Installer.

C. Coordinate sizes and locations of equipment supports with actual equipment provided.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of computer-room air conditioners that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Compressors: Manufacturer's standard, but not less than five years from date of Substantial Completion.
2. Warranty Period for Humidifiers: Manufacturer's standard, but not less than five years from date of Substantial Completion.
3. Warranty Period for Control Boards: Manufacturer's standard, but not less than five years from date of Substantial Completion.

1.7 EXTRA MATERIIALS

A. Furnish one set of extra filters for each unit. Package with protective covering for storage and identified with labels describing contents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

1. Data Aire
2. Liebert
3. Stulz

2.2 GENERAL

A. Self-contained, factory assembled, prewired, and prepiped; consisting of cabinet, coils, humidifier, fan, filters, and controls; for vertical floor mounting in upflow configuration.

2.3 CABINET AND FRAME

A. Frame shall be constructed of welded 16 gauge tubular steel, braced for rigidity, supporting mechanical equipment. Frame shall be coated with a corrosion inhibiting finish.

B. Unit shall be provided with complete front, rear and side access via heavy duty hinged steel doors. Doors shall be fabricated of 18 gauge steel. Quarter turn door latches shall be manually actuated via a hand tool. Door gaskets shall be polyurethane to prevent air leakage.

C. Unit shall have powder coated exterior finish. Finish shall prevent corrosion. Unit color shall be by the Professional.

D. Unit Insulation: Thermally and acoustically insulate cabinet interior with 1-inch thick, 1-1/2-pound density fiber insulation.

E. Condensate Drain Pan: Constructed of stainless steel and constructed per ASHRAE Standard 62.1-2010.

2.4 FAN SECTION

A. The supply air fans shall be single width, single inlet plenum fan with backward inclined blades. Fan wheel shall be directly connected to its motor. Fan/motor assembly shall be statically and dynamically balanced for quiet, vibration-free operation.

B. The fan motor shall be an electronically commutated (EC) synchronous DC motor; having soft start capability and shall be controlled via the unit mounted controller and automatically regulated through all modes of operation; independent of valve modulation.

C. Each fan shall have fault monitoring circuitry and integral speed controller for a level of redundancy.

D. The fan shall be mounted within the unit and fully enclosed in a sheet metal enclosure to prevent access to moving parts.

E. The system shall be designed for draw through air arrangement to ensure even air distribution to the entire face of the coil.

F. In the event of a fan failure, the remaining fans will automatically increase in speed to temporarily deliver as much air flow as possible to the controlled space until the failed fan can be repaired or replaced.

2.5 CHILLED WATER COOLING COIL

A. Arrangement: The chilled water cooling coil shall be in an “A” frame arrangement.

B. Coils: Shall be constructed of seamless copper tubes expanded into enhanced style aluminum fins.

C. Face Velocity: Shall be less than 500 feet per minute.

D. Maximum Working Pressure: Shall be 300 PSI.

E. Drain Pan: Coil shall sit in a stainless steel drain pan sloped for drainage. A properly sized condensate drain trap shall be furnished by manufacturer and externally piped by the installing contractor.

2.6 MODULATING CONTROL VALVE

A. Chilled water flow shall be controlled by a 3-way modulating control valve with characterized flow disk for accurate temperature control and dehumidification. The unit microprocessor shall position the valve in response to room conditions.

B. The valve shall be designed for up to 400 PSI water pressure.

2.7 FILTRATION

A. The filter chamber shall be an integral part of the system, designed within the unit for easy front accessibility.

B. An initial set of filters shall be factory installed in the unit.

C. Filters shall be 4-inch deep, disposable, pleated design, extended-surface, nonwoven, reinforced cotton fabric; supported and bonded to welded-wire grid; enclosed in cardboard frame design.

D. Rated not less than MERV 8 per ASHRAE Standard 52.2.

E. A filter differential switch for alarm activation shall be included.

2.8 ELECTRICAL

A. All electrical components, including contactors, relays and control transformers shall be pre-wired and contained in a unit-mounted electrical enclosure with piano-hinged door that shall swing out for easy access and servicing.

B. The control circuit voltage shall be 24 volts AC.

C. The input electrical power shall be as detailed on the project plans and schedule.

2.9 HUMIDIFIER

A. The unit shall be provided with a self-contained, microprocessor-controlled steam generator type humidifier. The steam generating humidifier shall use disposable cylinder type with electronic controls.

B. The humidifier shall discharge pure steam with no material dust carry-over and have a self-regulating automatic flush cycle. Cylinders shall be disposable not requiring cleaning or maintenance. The humidifier fill level, water conductivity and flush rate shall automatically adapt, both in frequency and duration, to variations in the incoming water.

C. Fully modulating to provide gradual 0 to 100 percent capacity with field-adjustable maximum capacity; with high-water probe.

D. Drain duration and drain interval shall be field-adjustable.

E. The capacity and power consumption shall be as detailed on the project plans and schedule.

2.10 WATER DETECTION SENSOR

A. Each unit shall be provided with one (1) water under floor detection sensor.

B. The solid-state water sensor shall be mounted under the unit by the installing contractor to sense the presence of water.

C. The water detector shall become an integral part of the microprocessor panel and shall display "WATER DETECTED IN UNDER FLOOR AREA" message and activate an audible alarm when the sensor is activated.

D. Additionally, three (3) adjustable action settings shall be available when an alarm is detected: Alarm only, shutdown unit or lockout compressor.

2.11 HIGH TEMPERATURE SENSOR

A. The high temperature sensor (Firestat) shall be factory-installed in the unit and shall be factory-set to 125 ºF. It shall immediately shut down the environmental control system when activated. The sensor shall be mounted with the sensing element in the return air.

2.12 MICROPROCESSOR CONTROL SYSTEM

A. The environmental control system shall be furnished with a microprocessor based panel. The panel shall include unit control functions and display normal functions and service diagnostics on a backlit liquid crystal display (LCD). The panel shall allow recall and display of the high and low temperature for the last 24 hours, high and low humidity for the last 24 hours, current percent of capacity and average percent of capacity for the last hour of operation for chilled water valve (if applicable), compressor (if applicable), reheat, humidification, dehumidification, component runtimes (if applicable) for fan motor(s), reheat, humidification, dehumidification and chilled water valve. Programming shall have multilevel password access to prevent unauthorized access. Programming shall be accomplished entirely from the front of the unit without the need to access, set or program switches inside the unit (front door of the unit does not need to be opened). Programmable functions shall be entered on flash memory to ensure program retention should power fail. The historical database shall be maintained by battery backup. Multiple messages shall be displayed by automatically scrolling from each message to the next. Alarm conditions shall be displayed by automatically scrolling from each message to the next. Alarm conditions, in addition to being displayed, shall enunciate an audible alarm. Four programmable summary contacts shall be available for remote alarm monitoring. Additional test or service terminal shall not be required for any functions. The control shall include temperature anticipation, moisture level humidity control and automatic flush cycles.

B. An alarm condition shall continue to be displayed until the malfunction is corrected. Multiple alarms shall be displayed sequentially in order of occurrence and only those alarms which have not been acknowledged shall continue to sound an audible alarm. The panel shall perform an automatic self-test on system start-up. A user accessible diagnostic program shall aid in system component trouble shooting by displaying on the unit LCD screen the name of the controlled item, output relay number, terminal plug and pin number for each controlled item.

C. The control system shall support communication with a BACnet MS/TP Energy Management and Control System (EMCS). See Section 23 09 00 Energy Management & Control System.

2.13 ADDITIONAL REQUIREMENTS

A. Thru-Door Locking Disconnect Switch: The environmental control unit shall include a non-automatic disconnect switch mounted in the high voltage section of the electrical panel. The operating mechanism shall prevent access to the high voltage electrical components until switched to the "OFF" position. The operating mechanism shall protrude through the exterior door and be lockable in the OFF position.

B. Condensate Pump: Units shall be provided with dual float condensate pump. If condensate pump fails control panel shall enunciate an alarm and display. Pumps shall be factory mounted/wired and shall include sump, motor, and automatic control. A factory installed high condensate water level alarm switch will disable the unit prior to condensate pan overflow should the drain become plugged with debris. The audio alarm is activated and a “High Condensate Water Level” message shall be displayed on the display module. The pumps shall be rated for 130 GPH at 20 foot of water maximum head (or 40 GPH at 20 foot of water maximum head with check valve).

C. Modulating Humidifier: The environmental control unit shall be provided with a modulating humidifier feature which matches its output to the signal from the humidity control of the unit controller.

D. Smoke Detector: The environmental control unit shall be provided with a smoke detector. The smoke detector shall be mounted with the sensing element in the return air stream. When the smoke detector is activated, it shall immediately shut down the unit.

E. No Water Flow Alarm: Unit shall be furnished with a NEMA 1 flow switch for field mounting into the chilled water piping to the unit. Upon a loss of water flow the unit control panel shall indicate “No Water Flow” and alarm shall sound.

F. Remote Temperature & Humidity Sensors: Units shall be provided with remote temperature and humidity sensor. The sensor shall be provided in a plastic case for remote mounting. Cable shall be provided for field wiring in 35 length.

G. Phase Loss Relay: Phase loss relay is used to shut down the environmental control unit on the loss of any phase of power. Three phase (3-Ph) equipment only. Automatic reset.

H. Floor Stand: Down flow unit(s) shall be provided with floorstand and vibration isolation pads. The floorstand shall be a completely welded structural angle base frame engineered to support the operating unit. The floorstand height shall be verified and shall have adjustable legs

I. Floor Stand Turning Vane: A factory-supplied, field-mounted turning vane shall be provided.

J. Vibration Isolation Pads: Vibrations isolation pads consisting of high density cork sandwiched between two layers of neoprene shall be supplied for field mounting.

K. Hot Water Reheat: Reheat will be provided by hot water coil with copper tubes and aluminum fins rated for a maximum working pressure of 300 PSI (20 bar). Reheat circuit shall include a factory mounted 2-way hot water valve for temperature control. Coil, control valve and controls as required for a functioning system shall be factory mounted.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate with work of other trades

B. Contractor to examine the areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

C. Provide access space around equipment for service. Provide no less than minimum as recommended by manufacturer

D. Examine roughing-in for hydronic piping systems to verify actual locations of piping connections before equipment installation.

E. Examine walls, floors, and roofs for suitable conditions where equipment will be installed.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

G. Install precision cooling units in accordance with manufacturer’s installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer’s recommended clearances.

H. Install in conjunction with server cabinets for integrated line up of equipment.

3.2 CONNNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties. Provide all piping, fittings, and additional specialties required by manufacturer.

B. Piping Connections: Connect equipment furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer’s piping connection diagram submittal to piping contractor. Install piping to allow proper service and maintenance.

C. Electrical Wiring: Install and connect electrical devices furnished by manufacturer but not specified to be factory mounted. Furnish copy of manufacturer’s electrical connection diagram submittal to electrical contractor.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, start-up and adjust components, assemblies, and equipment installations, including connections.

B. Perform manufacturer’s required tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing

3.4 TESTING AND ADJUSTING

A. See Section 23 05 93 – Testing, Adjusting, and Balancing

3.5 TRAINING

A. See Sections 23 00 10 – Mechanical General Provisions

B. Engage a factory-authorized service representative to train Owner's maintenance personnel on:

1. Procedures for starting and stopping and troubleshooting units
2. Procedures and schedules for maintaining and servicing units
3. Organization and content of Operations & Maintenance Manuals

END OF SECTION 23 81 23

SECTION 23 36 00

AIR SOURCE UNITARY DUCTLESS SPLIT-SYSTEM HEAT PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Ductless split-system heat pumps.

1.3 REFERENCE STANDARDS

A. AHRI Standard 210/240 – Performance Rating of Unitary Air-Conditioning & Air-Source Heat Pump Equipment.

B. U.S. Environmental Protection Agency – Energy Star Products.

1.4 SUBMITTALS

A. See Section 230010 – Mechanical General Provisions

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
DSS outdoor units	R	R		R
DSS indoor units	R	R		R
DSS controls and accessories	R	R		

1.5 QUALITY ASSURANCE

A. Ductless split-system heat pumps rated and certified in accordance with AHRI Standard 210/240.

B. Ductless split-system heat pumps Energy Star rated.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of split-system units and are based on the specific system indicated. Other manufacturers' systems with equal performance characteristics may be considered. Refer to Division 01 Section "Substitutions."

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.6 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of split-system heat pump units that fail in materials or workmanship within specified warranty period.

C. Warranty Period: Five years from date of substantial completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

1. LG Electronics.
2. Mitsubishi.
3. Trane.

2.2 WALL-MOUNTED HEAT PUMP INDOOR UNITS

A. General: The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, and a test run switch. Indoor unit and refrigerant piping shall be charged with dehydrated air before shipment from the factory.

B. Unit Cabinet:

1. The unit shall have multi-directional drain and refrigerant piping arrangements providing options for four (4) directions for refrigerant piping and two (2) directions for draining.
2. Unit shall have a separate back plate which secures the unit firmly to the wall.

C. Fan:

1. The evaporator fan shall be an assembly with one or two line-flow fan(s) direct driven by a single motor, be statically and dynamically balanced and run on a motor with permanently lubricated bearings.
2. A manual adjustable guide vane shall be provided with the ability to change the airflow from side to side (left to right).
3. A motorized air sweep louver shall provide an automatic change in airflow by directing the air up and down to provide uniform air distribution.
4. The indoor fan shall be capable of four (4) speeds, High, Mid 1, Mid 2, and Low, two of which may be selected by the room controller.

D. Filter:

1. Return air shall be filtered by means of an easily removable washable filter.

E. Coil:

1. The evaporator coil shall be of nonferrous construction with smooth plate fins on copper tubing with inner grooves for high efficiency heat exchange.
2. All tube joints shall be brazed with phoscopper or silver alloy and shall be pressure tested at the factory.
3. A condensate pan and drain shall be provided under the coil.
4. The condensate pump shall be able to raise drain water 33 inches above the condensate pan.

F. Electrical:

1. The unit electrical power shall be 208 volts, 1 phase, 60 hertz. (Contractor shall be responsible for coordinating unit electrical characteristics with actual site electrical service.)

G. Control:

1. The unit shall have controls provided by the manufacturer to perform input functions necessary to operate the system.

2.3 AIR-COOLED, COMPRESSOR-CONDENSER COMPONENTS

A. Casing: Steel, finished with baked enamel, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.

B. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

1. Compressor Type: DC inverter driven twin rotary with manual-reset high-pressure switch and automatic-reset low-pressure switch.

C. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid subcooler.

D. Heat Pump Components: Reversing value and low-temperature air cut-off thermostat.

E. Fan: Aluminum-propeller type, directly connected to motor.

F. Motor: Permanently lubricated, with integral thermal-overload protection.

G. Low Ambient Kit: Permits operation down to 0 ˚F.

H. Mounting Base: Polyethylene.

2.4 ACCESSORIES

A. Thermostat: Remote, hard-wired control compressor and evaporator fan, with the following features:

1. Status monitoring.
2. Seven day programming of system stop and start.
3. Liquid-crystal display indicating mode, temperature, set-point temperature, indoor temperature, time setting, operating mode, fan speed, air-flow direction, filter sign and error alarm and code.
4. Fan-speed selection, including auto setting.

B. Automatic-reset timer to prevent rapid cycling of compressor.

C. Diamondback refrigerant line sets (or equal) with flared fittings, each end preinsulated.

D. Refrigerant Valves and Piping:

1. Valves in the variable refrigerant flow system shall be Diamondback BV series ball valves (or equal) with HKG-20HF insulation kits (or equal). Valve shall be a 700 psig Schrador valve for service connections. This valve kit shall be used with all systems.
2. Refrigerant piping between outdoor units and indoor units shall be pre-charged, preinsulated, copper line sets provided by the equipment manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate with work of other trades.

B. Install all system components in accordance with manufacturer’s written installation instructions.

C. Provide access space around indoor and outdoor units for service. Provide no less than minimum as recommended by manufacturer.

D. Install units level and plumb.

E. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to unit to allow service and maintenance.

C. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

A. Installation Inspection: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections, and to prepare a written report of inspection.

B. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

C. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new components, and retest.

D. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 COMMISSIONING

A. Engage a factory-authorized service representative to perform startup service.

B. Verify that units are installed and connected according to the Contract Documents.

C. Lubricate bearings, adjust belt tension, and change filters.

D. Perform startup checks according to manufacturer's written instructions and do the following:

1. Fill out manufacturer's checklists.
2. Check for unobstructed airflow over coils.
3. Check operation of condenser capacity-control device.
4. Verify that vibration isolation devices and flexible connectors dampen vibration transmission to structure.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner’s maintenance personnel to adjust, operate, and maintain units.

1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining units. See Section 230010 “Mechanical General Provisions.”
2. Review data in maintenance manuals. Refer to Section 230010 “Mechanical General Provisions.”

END OF SECTION 23 81 43

SECTION 237313 – FAN COIL UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Fan coil units.

1.3 REFERENCE STANDARDS

A. AMCA 99 – Standards Handbook.

B. AMCA Standard 203.

C. ANSI/AMCA 210 – Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.

D. ANSI/AMCA 230 – Laboratory Methods of Testing Air Circulator Fans for Rating.

E. AMCA 300 – Reverberant Room Method of Sound Testing of Fans.

F. AMCA Standard 301 – Method for Calculating Fan Sound Ratings from Laboratory Test Data.

G. AMCA Standard 500-D – Laboratory Methods of Testing Dampers for Rating.

H. AMCA 500-L – Laboratory Methods of Testing Louvers for Rating.

I. ARI 410 – Standard for Forced – Circulation Air-Cooling and Air Heating Coils.

J. ANSI/AFBMA 9 – Load Ratings and Fatigue Life for Ball Bearings.

K. ANSI/AFBMA 11 – Load Ratings and Fatigue Life for Roller Bearings.

L. ASHRAE/ANSI Standard 111.

M. ASHRAE Standard 52.

N. ASTM A525 – Specification for General Requirements for Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process.

O. NFPA 90A – Installation of Air Conditioning and Ventilation Systems.

P. SMACNA – Low Pressure Duct Construction Standards.

Q. UL Standard 1995.

1.4 QUALITY ASSURANCE

A. AMCA certified ratings per applicable AMCA standard based on the testing conducted in an independent laboratory.

B. Conform to AMCA Bulletins regarding construction and testing. Fans shall bear AMCA certified rating seal for both sound and performance.

C. Units shall be designed and manufactured in strict accordance with UL 1995, Standard for Heating and Cooling Equipment. Air handler shall be ETL or UL listed in accordance with UL 1995, or the current equivalent by UL, and shall carry the ETL or UL label. If manufacturer cannot provide ETL/UL sticker on air handler, it will be the sole responsibility of the contractor to arrange for local, on-site, ETL or UL approval and labeling at no additional cost to the Owner.

D. Schedule equipment performance is minimum capacity required.

1.5 SUBMITTALS

A. See Section 23 00 10 Mechanical General Provisions.

B. Submit product data, O&M data, and samples and show item on shop and coordination drawings (where shop and coordination drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Fan coil units	R	R		R
Coils, performance data	R	R		R
Fans, performance data	R			
Acoustical performance data	R			
Motors	R	R		
Dampers and actuators	R	R		
Filters	R			
Factory installed controls	R	R		R
Accessories	R	R		R
Coordination drawings				R

C. Fan Coil Units.

1. Complete graph of fan curves (not just curve for design conditions) indicating efficiency, BHP, and RPM.
2. Sound power levels per ARI 260 by octave bands; radiated and at the inlet and discharge.
3. Coil performance and flow rates.
4. Filter and filter frame product data.

5. Casing materials of construction and methods of assembly.
6. Complete dimensional data including exterior dimensions and dimensions of internal components.
7. Coordination Drawings: Submit with Shop Drawings. Show mechanical-room layout and relationships between components and adjacent structural and mechanical elements. Show service clearance requirements, and support locations, type of support, and weight on each support. Indicate and certify field measurements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models are acceptable.

1. Daikin.
2. Trane.
3. York/Johnson Controls.
4. Or equal.

2.2 GENERAL

A. Fan and coil capacity as scheduled on Drawings.

2.3 CABINETS

A. Material.

1. External: polyurethane based powder coated A60 galvanized steel.
2. Internal: G90 galvanized steel.

B. Cabinet.

1. Vertical Unit Front Panels: Removable, 16 gauge steel, with extruded aluminum double deflection discharge grille and channel-formed edges, cam fasteners, and insulation on back of panel.
2. Horizontal Unit Bottom Panels: Fastened to unit with cam fasteners, tamperproof screws, hinge, and attached with safety chain; with extruded aluminum return grilles. Telescoping panel to allow the panel to be adjusted to line up flush with the ceiling.
3. Steel recessing flanges for recessing fan-coil units into ceiling or wall.

C. Units shall pass 500 hour salt spray test as described in ASTM B-117.

D. Access panels shall permit full access to internal components. Structural integrity shall remain unaffected by the removal of any or all access panels.

E. Insulation.

1. 0.5 inch 1.5 pound density fiberglass.
2. Foil facing on airstream surface.

3. Protected such that coil condensate shall not be in contact with insulation under any expected operation condition.

2.4 DRAIN PAN

A. Main and auxiliary drain pans.

B. Sloped for positive drainage.

C. Heavy gauge Type 304 stainless steel.

2.5 FAN SECTION

A. Double width, double inlet, forward curved, centrifugal type.

B. Statically and dynamically balanced for smooth, quiet operation.

C. Bearings.

1. Self-aligning, sealed cartridge, permanently lubricated ball bearings.
2. Rubber mounted.
3. Rated for an average life of 200,000 hours.

D. Fan shaft: Solid cold rolled steel designed such that its operating speed is below its first critical speed.

E. Motors.

1. Comply with Section 230513 – Motors and Controllers.
2. Where Scheduled on Drawings.

    a. Electrically commutated motor (ECM).
    b. Programmed with fan curve for “constant airflow” (where constant volume specified).
    c. Controller to accept 0-10 Vdc signal from EMCS to vary cfm setpoint proportional to signal; less than 2 Vdc signal to shut motor off.

F. Belt Drives (where scheduled).

1. V-belt type.
2. Variable pitch motor sheaves.
3. Blower sheave: Cast iron single groove with split tapered bushing that is keyed to the blower shaft.

2.6 FILTER SECTION

A. Filter type as scheduled.

B. Comply with Section 234000 – Cleaning Devices.

C. Hinged side access door.

2.7 HOT AND CHILLED WATER COILS

A. Extended surface type coils.

1. Copper tubes.

a. Brazed or welded joints.
b. Minimum thickness: 0.020 inches.
c. Outside diameter: 1/2 inch or 5/8 inch.

2. Plate fins of aluminum, unless otherwise indicated on Drawings.

a. Minimum thickness: 0.0075 inches.

B. Rows and fin spacing.

1. To meet performance scheduled at similar pressure drop.
2. Selected with tube fouling factor of 0.0001.
3. Maximum fins: 10 per inch.
4. Select to avoid moisture carryover.

C. Circuiting: full row.

D. Headers: Copper tubing or cast iron.

E. Certified by ARI per current Standard 410.

F. For field installed coils, coil frame designed for bolting to other sections or ductwork.

G. Coil Casing.

1. Minimum 16-gauge.
2. 304 stainless steel casing and tube sheet.
3. Intermediate supports of same materials as casing.

H. Design for 200 pounds per square inch, 250 degrees Fahrenheit unless otherwise indicated on Drawings.

I. Factory tested to.

1. 300 psi for water coils.

J. Factory cleaned, degreased and flushed. Piping connections shall be capped with removable caps.

2.8 AUXILIARY CONTAINMENT PAN (UNDERNEATH FCU)

A. Provide fully welded galvanized leak containment pan underneath FCU. Containment pan shall be sized to such that it extends 6 inches beyond the FCU on all sides with 6 inch high sides (completely around perimeter). Containment pan shall be sealed with waterproof protective coating.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate with work of other trades.

B. Units shall ship with all openings securely covered and watertight. Protection shall be retained until completion of construction or until opening is field connected to ductwork.

C. Verify that adequate clearance between air handling units and adjacent walls or equipment is available to permit maintenance and repairs.

D. Provide auxiliary drain pans where required, see Section 233300 – Duct Accessories.

E. Provide condensate pump where scheduled. See Section 233300 – Duct Accessories.

F. Provide accurate alignment between unit and connected ducts.

G. Install fan coil units in accordance with manufacturer's written installation instructions.

H. Mount units sufficiently high to allow for proper condensate trapping and drainage.

I. Piping.

1. See Section 232113 – "Hydronic Piping."
2. See piping diagrams.
3. Do not block access doors with piping. Access doors shall be capable of opening 90 degrees.
4. Pipe condensate to nearest appropriate drain.

J. See Section 230900 – "Energy Management and Control System."

K. The Contractor shall be responsible to coordinate all installation requirements with other trades to ensure that a complete installation for each unit is being provided. Coordination efforts shall include such items as unloading and hoisting requirements, field wiring requirements, field piping requirements, field ductwork requirements, requirements for assembly of field-bolted or welded joints, and all other installation and assembly requirements.

3.2 INSPECTION

A. Verify that adequate clearance between air handling units and adjacent walls or equipment is available to permit maintenance and repairs.

3.3 PRE-OPERATING CHECKS

A. Before operating air handling units:

1. Complete provided Pre-Functional Test Data Sheet for each unit.

3.4 CLEANING

A. Clean fan coil units externally and internally, on completion of installation, according to manufacturer's written instructions. Clean fan interiors to remove foreign material and construction dirt and dust. Vacuum clean fan wheels, cabinets, and coils entering air face.

B. After completing system installation and testing, adjusting, and balancing modular indoor air-handling and air-distribution systems, clean filter housings and install new filters.

3.5 TESTING AND ADJUSTING

A. Do not operate fans for any purpose, temporary or permanent until:

1. See Section 230500 – Basic Mechanical Materials and Methods.
2. Ductwork is clean.
3. Filters are in place.
4. Bearings are in place.
5. Bearings are lubricated.
6. Fan(s) has been run under observation.

B. Start and test fans in accordance with manufacturer's written installation instructions.

C. Test cooling coil drain pans. See Section 233300 – Duct Accessories.

D. Start-up and adjust completed air handling units to insure proper operation.

E. See Section 230593 – Testing, Adjusting, and Balancing.

F. After starting fans: Check for objectionable noise and/or vibration. Correct as needed at no additional cost to the Owner.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air-handling units.

B. See Section 230010 – Mechanical General Provisions.

END OF SECTION 23 73 13

SECTION 23 82 39

UNIT HEATERS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following: All air terminal units including

1. Gas-fired, power-exhausted.
2. Propeller unit heaters with electric-resistance heating coils.
3. Wall and ceiling heaters with propeller fans and electric-resistance heating coils.

B. Related Sections

1. Section 23 00 10 – Mechanical General Provisions
2. Section 23 05 00 – Basic Mechanical Materials and Methods

1.3 SUBMITTALS

A. See Section 23 00 10 – Mechanical General Provisions

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Unit heaters	R	R		R
Unit heater controls	R	R		
Accessories	R	R		

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

C. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Gas-Fired Unit Heater

1. Modine
2. Reznor
3. Trane

C. Electric Unit Heaters

1. Indeeco
2. Markel
3. Trane

2.2 GAS-FIRED UNIT HEATERS

A. General

1. Conforming to ANSI Z83.8 standard for “Gas Unit Heater and Gas-Fired Duct Furnaces” for safe operation, construction and performance.
2. Casing

    a. 20 gauge aluminized steel
    b. Painted with electrostatically applied baked-on polyester powder pain 7-mil thickness.
    c. Provide horizontal air deflectors

3. Efficiency

    a. 80% minimum efficiency provided by an indirect-fired heat exchanger.

4. Venting Arrangement

    a. Powered exhaust
    b. Factory test unit to insure proper ignition when it is subjected to 40 mph wind velocities.
    c. Factory mounted differential pressure switch designed to prevent main burner ignition.
    d. Venting materials and arrangement shall be per manufacturer’s recommendations.

5. Furnace Section

a. 20 gauge aluminized steel tubes
b. The ignition controller shall be 100% shut-off with continuous retry.
c. Gas pressure between 6-7".

6. Electrical

a. All electrical components shall carry UL or ETL listing.
b. A low voltage terminal board shall be provided for direct wiring connection to an external thermostat
c. Single step down transformer shall be provided for all unit controls.

7. Accessories:

a. Suspension kit
b. Thermostat

2.3 ELECTRIC UNIT HEATERS

A. General

1. Casings

a. Fabricated of die formed 18 gauge welded steel and finished with durable powder coated paint
b. Stamped louver periphery inlet grill
c. Adjustable louvers and outward drawn venture
d. Control compartment with master terminal board and hinged and latched access door. Quarter turn fasteners

2. Elements

a. Steel tubes with Nickel-Chromium resistance wire embedded in compacted efficient dielectric
b. Steel helical fins, machine crimped and brazed to tube

3. Motor

a. Totally enclosed
b. Single phase with voltage rating same as heater voltage rating
c. Single-speed units: 1 Phase permanently lubricated thermal protected unit bearing motor.
d. Two-speed units: 1 Phase thermally protected motors with sleeve bearings
e. Sleeve bearing motors lubricated for 5 years continuous or 10 year intermittent use.

4. Wiring

a. Single circuit with elements, motor and control circuits wired in accordance with latest National Electric Code and UL Standard 2021.

5. Limit Controls

a. Built in fan purge to dissipate residual heat from elements upon heater shutdown
b. Automatic reset thermal cutout to shutdown elements and fan motor if safe

operating temperatures are exceeded

6. Controls

   a. Factory installed contactor and control circuit transformers
   b. Wall mounted or unit mounted thermostat. See Contract Drawings for thermostat locations (provide unit mounted if not indicated on Contract Drawings)

7. Accessories

   a. Disconnect switch

8. Mounting

   a. See Contract Drawings for mounting orientation.
   b. Provide all required mounting hardware and ancillary fasteners

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Coordinate with work of other trades.

B. Install unit heaters in accordance with manufacturer's written installation instructions.

C. Install unit heaters to comply with NFPA 90A.

D. Install propeller unit heaters level and plumb.

3.3 INSPECTION

A. Verify that adequate clearance between unit heaters and adjacent walls or equipment is available to permit maintenance and repairs.

3.4 TRAINING

A. See Section 23 00 10 – Mechanical General Provisions

END OF SECTION 23 82 39

SECTION 26 05 11 - ELECTRICAL GENERAL

PART 1 – GENERAL

1.1 GENERAL

A. All work shall conform to the latest editions of the National Electrical Code (NEC) [National Fire Protection Association (NFPA) 70], the Standard for Electrical Safety in the Workplace (NFPA 70E), the Life-Safety Code (NFPA 101), the International Building Code, the Americans with Disabilities Act, and all other applicable federal, state, and local codes and regulations.

B. All work shall be performed in strict compliance with NFPA 70E. Submission of bid shall stand as an agreement by the Contractor to indemnify and hold harmless the Engineer and Owner from all liability related to damage and/or injury to personnel and equipment during the installation of the project.

C. The contract documents are schematic in nature and are intended to convey the intent of the electrical work to be performed on this project. Provide all material, labor, equipment, etc., necessary to provide complete and operable electrical systems.

D. The General Conditions, Supplementary Conditions, General Requirements, Information to Bidders, and all other parts of this set of Contract Documents are hereby adopted and are applicable to the Division 26, 27, and 28 Contractor.

1.2 SCOPE OF WORK

A. Visit site prior to bid. Devise a plan for installation of complete and operable electrical systems meeting the requirements and intent of the Contract Documents. Submission of Bid stands as evidence that the Contractor accepts the Contract Documents as sufficient and complete for the work to be performed. Notify the engineer at least two weeks prior to bid of any discrepancies between the Contract Documents and actual field conditions. No change orders will be granted due to existing conditions that could have been observed during a site visit.

B. Provide temporary power and lighting during construction. Coordinate with the General Contractor for the exact requirements.

C. Electrical switchgear and panelboard layouts are based on sizes of Square D equipment. Equipment manufactured by General Electric, Siemens, and Cutler Hammer are equally acceptable. However, the Electrical Contractor is responsible for selecting and furnishing gear that will fit in the spaces provided and shall be responsible for arranging the gear to meet the required code clearances. Regardless of the manufacturer, the Electrical Contractor shall provide a drawn-to-scale electrical layout with the equipment brochures for all rooms in which panelboards, motor control centers, switchboards, or switchgear are placed. The drawings shall include the work of all other trades including mechanical system piping, ductwork, sprinkler piping, etc. No conduits shall be installed until layouts have been approved.

D. Locate junction boxes, pull boxes, disconnects, and other equipment requiring access in such a manner that they are accessible at the end of construction. Notify the Architect where it is impossible to plan conduit routing or equipment placement in such a manner, and provide the necessary access panels in the ceiling or wall as required. The access panel type and style shall be subject to the Architect's approval. Employ a painter to provide the appropriate coatings as directed by the Architect.

E. Relocate, or recircuit, all electrical equipment, conduit, and circuitry conflicting with or obstructing work on this project. Where the electrical systems are owned by other entities, pay them to relocate, or recircuit, their facilities.

F. Arrange for connection of service to all electrical systems by the appropriate utility company. Coordinate completely with all utility company requirements even if they are different than the contract documents. If utility company requirements are different from the contract documents, notify the engineer at least ten days prior to bid. Pay all utility company charges necessary for installation and connection of service. **No change orders will be granted for utility company connection fees.**

G. Provide all necessary equipment, raceway, circuitry, fittings, lugs, terminations, labor, etc. and connect to all equipment and appliances requiring electrical connections furnished herein, by the Owner, or by other Contractors. Prior to ordering electrical equipment and roughing in for equipment furnished by the Owner or other Contractors, verify all connection types, connection locations, connection heights, voltages, number of phases, conductor sizes, disconnecting means, breaker sizes, etc. Furnish the proper electrical equipment for the equipment actually being supplied.

1.3 WORK IN EXISTING FACILITIES

A. All work shall be scheduled and coordinated through the General Contractor with the Owner. Provide necessary costs for all work during both normal and premium work hours in bid.

B. Provide continuous uninterrupted power to all existing facilities to remain during the entire construction process. Any required power outages must be scheduled and approved by the Owner in writing at least three days prior to the outage.

1.5 SUBMITTALS AND SHOP DRAWINGS

A. Within 30 days after award of Contract and prior to beginning work, provide six bound copies of manufacturers' cut sheets containing information concerning each article of electrical equipment to be furnished on this project. These cut sheets shall contain sufficient information to prove compliance with the contract documents. Information addressing the requirements of the contract documents shall be highlighted. Each bound set shall bear the stamp of the Electrical Contractor as well as the General Contractor.

B. Within 30 days after award of Contract and prior to beginning work, provide six sets of full size shop drawings showing exact equipment locations with all equipment drawn to scale. Show all raceways with their junction boxes and pull boxes. Show all connection types, locations, and heights to equipment. Provide mounting and support details for all raceways and equipment. Coordinate with all other trades to ensure that there are no conflicts between systems. Each set of shop drawings shall bear the stamp of the Electrical Contractor, the General Contractor, and all Project Sub-Contractors. Failure to submit these Shop Drawings will render the Electrical Contractor responsible for resolving all conflicts between trades at his own expense.

C. Submittals and Shop Drawings are reviewed to determine quality of materials. Approval of submittals and shop drawings does not relieve the Contractor of meeting the requirements and intent of the Contract Documents.

D. Outlet, light fixture, and device locations are shown in their approximate locations on the drawings. Coordinate with Architectural drawings to get final locations. Mount all electrical outlets shown at counters such that the bottom of the box is two inches above the backsplash

or six inches above a counter with no backsplash. The Owner reserves the right to relocate outlets, light fixtures, and devices a distance not to exceed twenty feet prior to the installation of outlet boxes.

PART 2 - PRODUCTS

2.1 All electrical equipment and materials shall be new. All equipment and materials shall be stored on the job site in weatherproof enclosures. Electronic equipment shall be stored in facilities where the temperature and humidity are controlled. In addition, comply completely with all manufacturers' requirements for storage and handling.

2.2 All equipment shall be UL listed for the application in which it is used and shall be labeled as evidence of its UL listing.

2.3 Each circuit breaker supplying a multiwire branch circuit shall be installed with a manufacturer supplied handle tie to simultaneously disconnect all ungrounded conductors. Each multi-wire branch circuit shall comply with NEC article 210.4.

2.4 Products shall be selected to maintain or improve the aesthetics of the facility. Gain approval of the Architect or Engineer prior to ordering or installing any electrical equipment or raceway.

PART 3 – EXECUTION

3.1 WORKMANSHIP

All work shall be performed with an emphasis on neatness. The Engineer, Architect, and Owner retain the right to reject work that is, in their judgment, unsatisfactory.

3.2 EXPERIENCE

The Contractor shall have completed at least two jobs of similar size and scope within the past five years. The Engineer reserves the right to reject Contractors based on their inability to submit evidence of their experience, or based on experience with the Contractor on previous projects.

3.3 PERMITS

Obtain and pay for all permits required for work.

3.4 FIREPROOFING

A. Fireproof all penetrations through firewalls with a fireproofing compound listed to maintain the rating of the wall through which the raceway passes.

B. The fire-stopping caulk shall be a one-part, intumescent, latex elastomer. The caulk shall be capable of expanding a minimum of 3 times at 1000°F. The material shall be thixotropic and be applicable to overhead, vertical and horizontal fire-stops. The caulk shall be listed by independent test agencies such as UL or FM and be tested to, and pass the criteria of, ASTM E 814 Fire Test, tested under positive pressure. It shall comply with the requirements of the NEC (NFPA-70), BOCA, ICBO, SBCCI and NFPA Code 101. Fire-stopping caulk shall be paintable, but shall be non-hardening. Fire-stopping caulk shall be 3M Fire barrier CP or approved equal.

C. The fireproofing materials shall be installed by individuals certified to perform such work. Submit evidence of personnel certifications with electrical equipment brochures.

D. Where cable trays are shown crossing firewalls, terminate the cable tray on each side of the wall and run the conductors through conduits installed in the wall. Fireproof around the conductors after installation.

E. Provide mineral wool packing and all other materials recommended by the manufacturer for a complete installation.

3.5 FLASHING

Provide all necessary equipment and flash all roof penetrations in such a manner to ensure that all penetrations are completely sealed and all roof warranties remain in effect. Where there are no roof warranties, the Electrical Contractor shall guarantee the electrical penetrations against leaking for a period of one year from project completion. Employ a professional roofing contractor to perform all flashing.

3.6 PROTECTION

A. Keep energized equipment covered during all phases of construction. Use enclosures, doors, covers, etc., to ensure that neither personnel nor machinery contact live electrical equipment.

B. Replace electrical equipment that is damaged during construction.

3.7 DAMAGED FACILITIES

A. Locate all existing site equipment and utilities prior to beginning construction. Repair all equipment and utilities damaged during construction, or pay for the repair of the equipment and utilities where required by the Owner of the damaged facilities.

B. Coordinate the routing of all circuits and the locations of all devices with the Architect or Engineer and the Owner. Shop drawings shall describe completely the locations and elevations of all raceways, boxes, fittings, and equipment.

3.8 EXCAVATION AND BACKFILL

A. Excavate in such a manner as to minimize erosion of the soil. Backfill trenches around conduits with fine sand that is free of rocks, clods, and debris. Fill sand a minimum of 4” over conduits. Backfill the rest of the trench in six inch increments, wetted, and tamped. Final compaction shall be a minimum of 95% of that of the adjacent earth. Resurface the grade with the same material as that excavated from the grade whether it be paving, concrete, sod, etc. Repair work shall be comparable to the quality of the original site prior to excavation.

B. Provide a 3” wide plastic labeled marker tape 12” below grade over all electrical conduits buried underground. Tapes for power circuits shall have a warning such as “Caution: Buried Electrical Line Below.” Labels on tapes for telephone, data, cable television, and other facilities shall adequately describe the line over which they are buried.

C. Provide a #12 AWG wire in each buried conduit run labeled accordingly on each end.

3.9 IDENTIFICATION

A. Label all switchboards, panel boards, motor starters, disconnects, and motor control centers furnished under Division 26, 27, and 28 and other divisions of this contract with engraved rigid plastic nameplates having letters at least ¼ inch high. Nameplates shall be bolted to the enclosure. All labels shall indicate the voltage, number of phases, the AIC rating, and the panelboard and circuit number from which the device is fed.

B. All circuit breakers in Switchboards, Motor Control Centers, Square D I-Line, and similar pane lboards shall be labeled with plastic nameplates (as described in Part A) providing the name of the load served and the ampacity and number of poles of the breaker.

C. All Square D NQOD, NF and similar panel boards shall have typewritten circuit directories.

D. Label all conductors at all junction boxes, pull boxes, and terminations with typewritten adhesive markers indicating the panel board or switchboard name and circuit number of the conductor. Labels shall be Brady Datatab or approved equal.

E. Label all junction boxes and pull boxes with stenciled painted letters containing the name of the panel board and circuit numbers of the circuits contained within. Use black paint for normal circuits, red paint for emergency circuits, and orange paint for fire alarm circuits. The Contractor may select other colors for junction boxes and pull boxes for auxiliary systems.

F. Label all conduits in the most likely direction of access and view every 50’ and on both ends of each bend with stenciled painted letters containing the name of the panel board and circuit numbers of the circuits contained within. Use black paint for normal circuits, red paint for emergency circuits, and orange paint for fire alarm circuits. The Contractor may select other colors for conduits for auxiliary systems.

3.10 AS-BUILT DRAWINGS

Maintain one set of drawings during construction for as-built markings. Mark these drawings in red to indicate field changes. Provide these drawings to the Engineer at the end of the construction process. Where required under the General Conditions, Special Conditions, or other portions of this contract, provide revised computer drawn as-built drawings to the Engineer at the end of construction.

3.11 TESTING

A. Test all systems, or pay testing agencies as required, for compliance with the requirements of all regulatory agencies.

B. Test the electrical power service ground using a Biddle Three-Terminal Ground Resistance Tester, or approved equal. Grounds shall meet the requirements of the NEC, or of Specification 26 05 26, whichever is more stringent. Test grounds only when the earth is dry. Provide additional ground rods as necessary to achieve the required results.

C. Prior to making final equipment connections, test all service, feeder, and branch circuit conductors for continuity, phase-to-phase faults, and phase-to-ground faults using a Megger BM100 or approved equal test instrument generating 500 Vdc. Insulation resistance shall be a minimum of 500,000 Ohms between any conductor and ground and 1,000,000 Ohms between any two conductors.

D. Test other systems as required in their respective specifications.

E. Provide three bound copies of all test results to the Engineer at the end of the construction process. No Recommendation of Substantial Completion will be granted until all testing reports have been submitted.

3.12 WARRANTY

Provide the Owner a written guarantee to repair, or replace, all faulty equipment and systems for a period of one year from date of Substantial Completion. During this one-year period, a representative of the Contractor shall be on the site actively working on the repairs within 24 hours of the Owner's telephone call. During this period of time, the Owner shall not be charged for any repair work or expenses related with the repair work unless the Contractor can prove that the Owner has damaged the equipment or system.

END OF SECTION

SECTION 26 05 19 – LOW-VOLTAGE POWER CONDUCTORS AND CABLES

PART 1 – GENERAL

1.1 Provide all circuitry, terminations, splices, connectors, lugs, and other equipment necessary for connection of all equipment requiring electrical connections.

PART 2 – PRODUCTS

2.1 CONDUCTORS

A. All electrical conductors shall be soft-drawn annealed copper having 98% conductivity and an insulation rating of 600V.

B. Conductors shall be UL listed for installation in the raceway in which they are to be installed.

C. Conductors shall be rated 90 degrees C for use in residential, commercial, industrial, and institutional facilities, and shall be listed as 105 degrees C appliance wire. Conductors shall be listed under UL 83, UL 1063, and UL 758. If XLP or EPR insulation is used, conductors shall be listed under UL 44 and NEMA WC7.

D. Conductors used for branch circuits, feeders, auxiliary systems, and controls run in dry locations shall have PVC insulation and a Nylon outer jacket. They shall be THHN/THWN or XHHW-2.

E. Conductors used for branch circuits, feeders, auxiliary systems, and controls run in wet locations shall have XLP or EPR insulation and be type XHHW-2.

F. Sizes #10 and #12 shall be solid conductors except where used for controls. All controls conductors shall be stranded.

G. Use minimum #14 AWG conductors for controls and auxiliary circuits. Use larger conductors as required to compensate for voltage drops exceeding 3% of the system voltage.

H. Conductors shall be furnished in the colors described below unless local ordinances require different colors. Conductors #10 and smaller shall be furnished with colored insulation; conductors larger than #10 shall be taped with the appropriately colored tape for a length of at least 2” at each panelboard, junction box, pull box, load, or other exposed location. Ground conductors shall be taped green for their entire exposed length.

System Voltage	208Y/120V, 3-Phase, 4-Wire	120/240V, 3-Phase, 4-Wire	480Y/277V, 3-Phase, 4-Wire
Phase A	Black	Black	Brown
Phase B	Red	Orange	Orange
Phase C	Blue	Blue	Yellow
Neutral	White	White	Gray
Ground	Green	Green	Green

PART 3 – EXECUTION

3.1 CONDUCTORS

A. Install conductors carefully using a minimum of two tradesmen – one feeding the conductors into the conduit, and the other pulling the conductors into the conduit.

B. Join stranded conductors with appropriate mechanical or compression lugs. Wire nuts may be used for solid conductors only.

C. Splices shall only be made in approved enclosures. Splices shall not be pulled inside conduits.

D. Provide cable supports and strain relief connectors as required by the NEC.

E. Furnish junction boxes, pull boxes, handholes, manholes, etc. as required to ensure that the maximum number of bends allowed by the NEC are not exceeded and to ensure that the cables are not damaged during installation.

END OF SECTION

SECTION 26 05 26 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 GENERAL

Ground all equipment, systems, structures, etc., per the latest edition of the National Electrical Code (NEC).

PART 2 – PRODUCTS

2.1 Use mechanical bolted connections in dry locations that are accessible.

2.2 Use exothermic welds in wet locations and locations that will be inaccessible at the end of construction.

2.3 Ground rods shall be UL listed 3/4” x 10’ copper-clad steel ground rods with a minimum copper cladding thickness of 10 mils.

PART 3 – EXECUTION

3.1 Ground rods shall be installed with their tops no less than 6” below grade.

3.2 Bond ground connections to metal raceways at each end of the conduit run. Provide grounding bushings where required by the NEC. Where cable trays are used, bond the ground conductor to each section and fitting of the tray.

3.3 Provide all circuits with an equipment grounding conductor sized per the NEC, or as shown on the drawings. Circuitry shown on drawings does not include the required equipment grounding conductor. Where multiple circuits are run with a common neutral, only one equipment grounding conductor is needed. The equipment grounding conductor shall be furnished with green insulation for conductors #8 AWG and smaller; where larger than #8, the equipment grounding conductor shall be taped green for its entire exposed length.

3.4 The grounding electrode conductor(s) shall be bare or shall be colored green for its entire exposed length.

3.5 Individual ground conductors shall be installed in PVC conduit sized per the NEC.

3.6 Provide receptacles, luminaires, and other devices with a green conductor that bonds the receptacle grounding screw or pigtail, the outlet box grounding screw, and the equipment grounding conductor together.

3.7 In health care facilities, where two or more different panel boards serve the same patient-care area, an 8 AWG insulated continuous copper conductor shall bond these different panel boards together.

3.8 Telephone, cable television, and other auxiliary systems shall be bonded to the electrical building service ground using a conductor no smaller than #6 AWG.

END OF SECTION

SECTION 26 05 33 – RACEWAYS, OUTLET BOXES AND JUNCTION BOXES for ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 GENERAL

A. All electrical systems circuitry shall be contained in raceways unless expressly listed in the specification for that system.

B. Outlet Boxes and Junction Boxes

1. Furnish and install all outlet boxes and junction boxes in accordance with this specification and the requirements of the NEC.

2. Provide outlet boxes for all switches, receptacles, luminaires, telephone jacks, cable jacks, and other devices furnished in this Contract. Provide all necessary hardware including, but not limited to, additional structural support, support brackets, screws, bolts, fixture studs, etc.

3. Outlet boxes and junction boxes in dry locations shall be galvanized stamped steel boxes sized per the latest edition of the National Electrical Code (NEC), but no less than 4” x 4” x 2 1/8” deep. The thickness of the steel shall be in compliance with the requirements of the NEC. Provide stamped steel covers for all junction boxes manufactured to fit the particular box on which it is used.

4. Outlet boxes used in concrete and masonry walls and ceilings shall be of the concrete type manufactured for such applications.

5. Outlet boxes and junction boxes in wet locations shall be of cast metal construction with gasketed waterproof covers. All conduit connections to the boxes shall be made watertight.

6. Wall outlet boxes shall be 4” x 4” x 2 1/8”, or larger as required, with plaster rings provided for final flush installation. Plaster rings shall have single-gang openings unless the equipment mounted inside requires two-gang installation.

7. Floor boxes in slabs on grade shall be deep rectangular, cast iron, fully adjustable boxes with brass rings. Covers shall be made of brass and shall provide flip top access to the power or data jacks inside. Screw-on covers are not acceptable unless a flip-top cover is unavailable for the device installed in the floor box. Provide the box sized as required for the number of devices shown installed. Boxes shall be as follows, or approved equal:

   a. Single-Gang Boxes: Hubbell B2436
   b. Single-Gang Cover Plates: Hubbell S3825
   c. Double-Gang Boxes: Hubbell B4233
   d. Double-Gang Cover Plates: Two Hubbell S3825 Cover Plates
   e. Triple-Gang Boxes: Hubbell B4333
   f. Triple-Gang Cover Plates: Three Hubbell S3825 Cover Plates

8. In slabs above grade, use cast iron, semi-adjustable shallow boxes as follows, or approved equal:

   a. Single-Gang Boxes: Hubbell B2414
   b. Two-Gang Boxes: Hubbell B4214
   c. Three-Gang Boxes: Hubbell B4314

9. Receptacles installed in floor boxes shall be as described in Specification 26 09 23, Switches and Receptacles. Data, Telephone, or Combination Data and Telephone Outlets shall consist of Category 5 rated RJ45 jacks mounted in a Hubbell DJOI strap for use under a S3825 flip top cover plate.

10. In existing slabs above grade, use poke thru boxes as follows, or equal:

    a. Hubbell System One

11. Size all boxes per the requirements of the latest NEC.

1.2 SCOPE OF WORK

A. Raceways

1. Provide all raceways, fittings, couplings, anchors, supports, hangers, etc. for complete raceway systems.

2. Use Schedule 40 polyvinyl chloride (PVC) conduit for circuits run underground and in slabs on grade level. Provide PVC-coated galvanized rigid steel elbows and PVC-coated galvanized rigid steel conduit for all vertical runs extending to a point at least 6" above grade. Galvanized Rigid steel conduit coated with two complete coats of asphaltum or bituminous paint may be used in lieu of PVC-coated galvanized rigid steel conduit.

3. Use Galvanized Rigid Steel (GRS) conduit for all applications where circuits are run above ground exposed to the weather.

4. Use Intermediate Metal Conduit (IMC) for all branch circuits, feeders, and auxiliary circuits requiring conduit 1 ¼" nominal trade size or larger in dry locations.

5. Use Electrical Metallic Tubing (EMT) for all branch circuits and feeders less than 1 ¼" nominal trade size in dry locations and in slabs above grade level.

PART 2 – PRODUCTS

2.1 Products for Raceways

A. PVC conduits, fittings, couplings, adapters, and accessories shall be UL listed and approved for use with 90 degree Celsius conductors. The UL label shall be affixed to each ten foot length of conduit and each fitting. Conduits shall comply with NEMA Specification TC-2 and UL 651. Fittings shall comply with NEMA TC-3 and UL 514b.

B. PVC-coated conduits, fittings, couplings, adapters, and accessories shall be UL listed with PVC as the primary corrosion protection. They shall be hot dipped galvanized rigid steel conduit with threads electro-galvanized after cutting. The conduit shall meet UL 6. The fittings shall meet UL 514B. The PVC coating shall be uniformly applied to the interior and exterior of all conduit and fittings. The coating shall be nominally 2 mils thick. The PVC coating shall extend one pipe diameter or two inches, whichever is less, at every male fitting except unions to fit over the joining female connection. Couplings shall contain a series of longitudinal ribs, 40 mils in thickness, to protect the coating from damage by tools during installation. PVC-coated conduits shall be ETL Verified PVC-001. Fittings shall be manufactured to the same standard. PVC-coated conduit shall be Robroy Plastibond or approved equal.

C. GRS conduits, fittings, couplings, adapters, and accessories shall be UL listed. They shall be hot-dipped galvanized steel. They shall meet the safety standards of UL 6, and shall be manufactured to ANSI C80.1. Threads shall be hot galvanized after cutting.

D. IMC conduits, fittings, couplings, adapters, and accessories shall be UL listed. They shall be hot-galvanized steel. Fittings, couplings, adapters, and accessories shall be the same as those for GRS conduit described above. IMC shall meet UL 1242 and ANSI C80.6. Threads shall be hot galvanized after cutting. The inside of the conduit shall be finished with a corrosion-resistant coating.

E. EMT conduits, fittings, couplings, adapters, and accessories shall be UL listed. They shall be hot galvanized steel and shall be produced in accordance with UL 797 and ANSI C80.3. The inside shall be finished with a corrosion-resistant lubricating coating.

F. Conduit fittings used with EMT conduits may be set screw indenter type or compression type. All metallic fittings for IMC and Rigid conduit shall be compression type fittings.

G. Flexible metallic conduit shall be constructed of galvanized steel and shall be UL listed as compliant with UL 1 and UL 1479.

H. Liquidtight flexible conduit shall be constructed of galvanized steel and shall be coated with a PVC jacket to resist liquids, dirt, grease, and oils. All fittings shall be designed, constructed, and installed to maintain the integrity of the liquidtight connections. Liquidtight flexible conduit shall comply with UL 360.

2.2 ACCEPTABLE MANUFACTURERS FOR OUTLET BOXES AND JUNCTION BOXES.

A. Outlet boxes and junction boxes shall be manufactured by Raco, Steel City, Crouse Hinds, or Appleton.

PART 3 – EXECUTION

3.1 CONDUIT EXECUTION

A. Conduits run underground shall be buried no less than 24” deep. Services and primary conduits feeding transformers shall be buried no less than 48” deep.

B. **Do not install conduits in or below ground floor slabs, except for service conduits, site lighting, and where specifically indicated on the drawings.**

C. Do not install conduits within 6” of the deck where a screw down type roof system is utilized.

D. PVC-coated conduits may be field-bent provided that manufacturer-approved tools are used. Individuals installing PVC-coated conduits shall be trained for installation by factory-certified trainers. Provide evidence of training with equipment brochures.

E. Support and install all conduits per the latest edition of the National Electrical Code. Support groups of conduits with electrical strut supported by threaded rods anchored to the building structure. Supports shall be designed to hold no less than twice the weight of the conduit and conductors to be supported plus an additional 250 pounds at midspan.

F. All conduits shall be grouped and run parallel to each other and to building walls.

G. All conduits shall be assembled according to the manufacturer’s instructions.

H. Conduits run underground shall be assembled to be watertight.

I. Cap all conduits during installation. Pull a mandrel sized for that conduit and a cleaning brush through each conduit before installation of any conductors.

J. Conduits that are obviously damaged and field bends that are obviously out of round shall be replaced.

K. Provide final connections to equipment with flexible metallic conduit. In wet or damp locations, use liquidtight flexible conduit. Flexible conduit shall not exceed 72".

L. Terminate conduits entering boxes with a locknut inside the box and a locknut outside the box. Provide protective bushings on all conduit threads. Use watertight hubs where conduit terminations are exposed to moisture.

M. Use grounding bushings on all feeder conduits, all underground conduits, and where required by the National Electrical Code.

N. Conduits shall be run no closer than 12" to hot water pipes.

O. Where conduits are run through the ceiling and are required to make connections to equipment within the room that is not located near a wall, support the conduit from the structural ceiling and provide a flange bolted to the floor. Install a tee conduit fitting in the vertical run of conduit, and make the connection to the equipment with a piece of flexible conduit extending from the tee conduit fitting to the equipment.

P. Provide expansion fittings where conduits cross building expansion joints. Provide grounding jumpers between the conduits.

Q. Provide EMT conduit sleeves where conduits pass through walls, floors, or footings sized a minimum of two nominal trade sizes larger than the conduit that must pass through the sleeve.

R. Equip all empty conduits with a pullwire or string capable of withstanding 200 pounds of pulling tension.

3.2 Execution for Outlet Boxes and Junction Boxes.

A. All devices shall be flush mounted unless specific written permission is obtained from the Engineer for a particular device in a particular location.

B. Install outlet boxes in walls, and provide plaster rings such that wall finish contractor's finish is flush against the edge of the plaster ring. Workmanship will not be accepted where the hole in the wall shows behind the cover plate, or the wall finish is uneven or unpainted at the edge of the cover plate.

C. Use round or square ceiling outlet boxes as required for the device being installed. The ceiling shall be finished flush against the box; the fixture shall completely cover the box and mount tight against the ceiling. Coordinate the requirements of the fixture prior to installing the box.

D. Provide junction boxes, pull boxes, and conduit fittings where required by the NEC to limit the number of bends in the raceway, and where required to prevent damage to conductors due to long runs.

E. Junction boxes and pull boxes installed in the ground outside shall be Quazite Composolite or approved equal. Mount the boxes over 24" of washed gravel fill. If splices are to be made inside

the boxes, the boxes shall be of the type furnished with a bottom, and all conduit connections shall be watertight. In addition, all conductor splices shall be made watertight using an appropriate splice kit as manufactured by 3M, or an approved equal.

END OF SECTION

SECTION 26 09 23 - SWITCHES AND RECEPTACLES

PART 1 – GENERAL

Furnish and install all switches and receptacles in accordance with this specification and the requirements of the NEC.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

Switches and receptacles shall be manufactured by Hubbell, Cooper Wiring Devices, Leviton, or Pass & Seymour.

2.2 GENERAL

A. Switches and receptacles shall be specification grade. They shall have ampacity and voltage ratings suitable for the application in which they are used.

B. Consult architect or engineer for device colors prior to ordering devices.

C. Provide brushed stainless steel cover plates for all devices. A single cover plate shall cover all devices in one box.

D. Light switches shall be 20 Ampere, 120-277V back-wired and side-wired toggle switches. They shall be rated up to 2 HP at 240V. Each switch shall be equipped with a grounding screw. Switches shall be Hubbell CSB series or approved equal.

E. Duplex NEMA 5-20R receptacles shall be Hubbell HBL 5362A or approved equal.

F. Duplex GFI NEMA 5-20R receptacles shall be Hubbell HBL GF5362A or approved equal.

G. Weatherproof while-in-use cover plates shall be Teddico #34017-7 or approved equal. Cover plates shall be single gang, lockable, and constructed of heavy duty die cast metal.

H. All 125V, 15 and 20 ampere receptacles installed in dwelling units shall be of the tamper-resistant type.

I. All 15 and 20 ampere, 125 and 250V non-locking receptacles installed in wet or damp locations shall be listed as the weather-resistant type.

J. Devices furnished in this Contract, but not listed above, shall be of the same standard of quality as those items listed.

PART 3 – EXECUTION

3.1 Flush mount all devices unless specific written permission is obtained from the Engineer for a particular device in a particular location.

3.2 Install all devices vertically unless the drawings specifically state that the particular device should be mounted horizontally.

3.3 Install receptacles with the ground slot up.

END OF SECTION

SECTION 26 09 25 - OCCUPANCY SENSORS

PART 1 - GENERAL

1.1 Furnish and install a complete system of Occupancy sensors as shown on the drawings and as specified herein. The drawings are provided to show the general scope of the work, and show the absolute minimum components required. Actual system components, quantities, and locations shall be determined by the motion detector vendor and provided to the Contractor with the installation shop drawings.

1.2 The Contractor and Sales Representatives are advised to take notice of specified component characteristics when attempting to select and propose substitutions. It is highly unlikely that substitutions on a one-for-one component basis will produce results that provide acceptable system performance.

1.3 Provide all power packs, hardware, software, devices, circuitry, and other components, material, and labor required to install, configure, and test the entire system to the satisfaction of the Architect, Owner, and Engineer.

1.4 Submit six sets of manufacturer's cut sheets describing completely all equipment, and six sets of shop drawings showing all circuitry including terminal-to-terminal connections.

1.5 The wiring diagrams on these drawings are based on our best interpretation of the manufacturer's data that was available at the time of design; however, they shall not be used for system installation and configuration. The controls equipment vendor is expected to be thoroughly knowledgeable of the equipment that is being proposed, and shall provide detailed shop drawings tailored for each circuit and lighting zone on the project. General manufacturer's data sheets shall not be acceptable. The shop drawings shall be suitable for the installing electrician to use for complete installation of the circuitry without referring to data sheets or installation manuals for connection of lighting control equipment. These requirements shall be followed whether the specified equipment, or products of other manufacturers, is provided.

PART 2 - PRODUCTS

2.1 Wireless Occupancy Sensor: Wireless occupancy sensors shall be passive infrared, ceiling-mounted units. They shall be Lutron #LRF2-OCR2B-P-WH or approved equal.

2.2 Areas up to 500 Square Feet: Occupancy sensors used in areas up to 500 square feet shall be dual technology infrared and microphonics, ceiling-mounted units with a 360 degree, 500 square foot coverage.

2.3 Areas up to 2000 Square Feet: Occupancy sensors used in areas up to 2000 square feet shall be dual technology infrared and microphonics, ceiling-mounted units with a 360 degree, 2000 square foot coverage. They shall be Lutron #LOS-CDT-2000-WH or approved equal.

2.4 Power Packs: Power packs shall be of the same manufacturer as the occupancy sensors. Each shall be capable of controlling a 20 ampere circuit. They shall be rated for operation at the voltage of the system on which they will be used.

2.5 Circuitry: Provide control circuitry as required by the manufacturer for optimum system operation, but no less than the following: Control cables shall be 3-conductor #22 AWG copper with an overall jacket. Adjust conductor sizes as required to overcome unacceptable voltage drop.

PART 3 - EXECUTION

3.1 Occupancy sensors shall be provided so that their coverage areas overlap and there are no dead zones in the rooms where persons may stand and not be detected.

3.2 All work shall be done by qualified system technicians.

3.3 Wiring, including control wiring, shall be in Raceways meeting Specification 26 05 33.

3.4 Guarantee workmanship and material for a period of one year after final acceptance. During the warranty period, repair or replace faulty equipment at no cost to the Owner for labor, material, or expenses.

3.5 Upon completion of job, test entire system. After testing submit a certificate to the Architect stating verification of the following:

A. All devices have been tested and are working properly.

PART 4 – CLOSE-OUT DOCUMENTS

4.1 Provide the following documents to the Architect for delivery to the Owner at the time of substantial completion:

A. Written Guarantee
B. Two sets of data prepared by the manufacturer for each item of electrical equipment completely describing each piece of equipment. The data shall include parts lists, a description of operation, shop drawings, wiring diagrams, maintenance procedures, and other literature required for operation and maintenance of equipment.

4.2 Instruct the Owner on system operational procedures. Notify the Owner and Architect at least one week in advance of the training session. Provide written step-by-step instructional material.

4.3 Notify the General Contractor that you are to present during the Pre-final Inspection. During that inspection, demonstrate all system functionality and capabilities; remove cover plates and panels covers as required to show the quality of the installation. The Owner, Architect, and Engineer reserve the right to reject unsuitable workmanship or performance.

END OF SECTION

SECTION 26 22 00 - TRANSFORMERS

PART 1 – GENERAL

Provide all equipment, labor, and materials required for complete and operable installation of transformers as shown on the drawings and specified herein.

PART 2 – PRODUCTS

2.1 Transformers 1000 KVA and smaller shall be listed by UL. They shall conform to the requirements of ANSI/NFPA 70. They are to be manufactured and tested in accordance with NEMA ST20.

2.2 Transformers shall be designed for operation at 60 Hz. Unless otherwise shown on the drawings, each transformer shall be a three-phase unit with a 480 volt, delta connected primary, and a 208Y/120 volt secondary.

2.3 Transformer shall be of the energy-efficient type.

2.4 Where transformers are shown on the drawings to be K-rated, they shall be UL listed and labeled for the K-rating indicated based on the sum of fundamental and harmonics per UL 1561. They shall be listed for 115 degrees C average temperature rise. K-rated transformers shall have an impedance of 3% to 5% with a minimum reactance of 2% in order to help reduce neutral current when supplying loads with large amounts of third harmonic current.

2.5 All insulating materials shall exceed NEMA ST20 standards and be rated for 220 degrees Celsius according to UL's component recognized insulation system.

2.6 Transformers 15 KVA and larger shall be rated for 150 degrees C temperature rise above an ambient temperature of 40 degrees C. Transformers 25 KVA and above shall have four 2.5% full capacity primary taps (two above and two below).

2.7 The maximum temperature of the top of the enclosure shall not exceed 50 degrees C above an ambient temperature of 40 degrees C.

2.8 Furnish transformers located outside with factory-furnished weatherproof enclosures.

2.9 Transformer coils shall be of continuous wound construction.

2.10 Transformer cores are to be visibly grounded to the enclosure by means of a flexible grounding conductor sized in accordance with applicable UL and NEC standards.

2.11 Transformers shall be ventilated and fabricated of heavy gauge sheet steel. The entire enclosure shall be finished utilizing a continuous process of degreasing, cleaning and phosphatizing, followed by electrostatic deposition of polymer polyester powder coating and baking to provide a uniform coating of all edges and surfaces.

2.12 Sound levels shall be warranted by the manufacturer not to exceed the following:

- 15 to 50 KVA – 45 dB
- 51 to 150 KVA – 50 dB
- 151 to 300 KVA – 55 dB
- 301 to 500 KVA – 60 dB
- 501 to 700 KVA – 62 dB

- 701 to 1000 KVA – 64 dB
- 1001 to 1500 KVA – 65 dB
- 1501 to 2000 KVA – 66 dB

PART 3 – EXECUTION

3.1 Install transformers in strict compliance with the manufacturer's instructions and the latest version of the National Electrical Code.

3.2 Provide concrete housekeeping pads for transformers mounted indoors. Housekeeping pads shall consist of 3.5" thick pads containing #4 reinforcing bars on 6" centers in both horizontal directions in the center of 3000 psi concrete. Where transformers are located outside, the pad shall extend at least 6" above grade and shall have a 12" wide footing at least 4" below the frost line; the footing shall be a minimum of 12" deep.

3.3 Transformers not exceeding 75 KVA may be wall-mounted where sufficient proof is provided that the structure can support the weight and where factory-provided wall brackets are used.

END OF SECTION

SECTION 26 24 00 - PANELBOARDS

PART 1 – GENERAL

1.1 Furnish and install all panelboards, complete with their circuit breakers, phase buses, neutral buses, ground buses, structural supports, and other equipment necessary for complete systems.

1.2 The equipment vendor shall perform all calculations necessary and provide complete Arc Flash Labels as required by the National Electrical Cod (NEC) and the drawings. Note: The drawings typically require more detail than required by the NEC.

PART 2 – PRODUCTS

2.1 GENERAL

A. Panelboards shall be designed, manufactured, and tested to be in compliance with NEMA PB 1, UL 50, UL 67, UL 489, NFPA 70, and the ASTM.

B. Circuit breakers shall be designed, manufactured, and tested to be in compliance with NEMA AB 1, UL 489, and Federal Specification W-C-375B/GEN.

C. Panelboards shall be UL listed for service entrance where used for that purpose.

D. Panelboard ampere interrupting current (AIC) ratings shall equal the lowest rated device in the panelboard. Provide panelboards with the AIC ratings shown on the Contract Drawings. Buses shall be braced to withstand the AIC rating shown on the drawings. Series ratings shall only be used where shown on the panelboard schedules.

E. All panelboards shall be furnished with dead-front, door-in-door construction.

F. Lug locations shall be determined during the creation of shop drawings for proper arrangement with the raceway system.

G. Buses shall be constructed of 98% conductivity copper or tin-plated copper.

H. Panelboard enclosures shall be NEMA 1 when they are to be mounted indoors, and NEMA 3R when they are to be mounted outdoors. Provide special enclosures where shown on the Contract Drawings.

2.2 ACCEPTABLE MANUFACTURERS

Panelboards shall be manufactured by Siemens, Square D, General Electric, or Cutler Hammer.

2.3 PANELBOARD CLASSES

A. Power distribution panelboards shall be available with mains and branch devices up to 1200 amperes. AIC ratings shall be available up to 200,000 Amperes. Power distribution panelboards shall be equipped with a nameplate containing the appropriate system voltage, number of wires, and number of phases for the system on which they are installed.

B. In 480Vac and less applications where a main breaker not exceeding 600 Amperes is required, the AIC rating does not exceed 65,000 Amperes, and no branch breakers exceed 125Amperes, Square D NF and equivalent panelboards may be used.

C. In 480Vac and less applications where a main breaker not exceeding 225 Amperes is required, the AIC rating does not exceed 14,000 Amperes, and no branch breakers exceed 100Amperes, Square D NEHB and equivalent panelboards may be used.

D. In 240Vac and less applications where a main breaker not exceeding 400 Amperes or main lugs not exceeding 600 Amperes is required, the AIC rating does not exceed 22,000 Amperes, and no branch breakers exceed 125 Amperes, Square D NQOD and equivalent panelboards may be used.

2.4 CIRCUIT BREAKERS

A. Circuit breakers shall be thermal magnetic, molded-case with quick-make, quick-break contact action. They shall have thermal and magnetic tripping elements on each pole. Breakers with multiple poles shall have common tripping of all poles. Circuit breaker ampere ratings shall be stamped on the handle. Interrupting ratings of the circuit breakers shall be equivalent to the specified AIC rating of the panelboard. Breakers handles shall reside in a position between “ON” and “OFF” after a trip condition. Breakers shall be rated HACR when used for heating, air-conditioning, and refrigeration; HID when used with High Intensity Discharge fixtures; and shall be rated SWD when used for switching duty.

B. Circuit breaker sizes for motor loads are based on Square D recommendations for use of their breakers at the motor horsepowers listed on the mechanical drawings. If equipment is used other than Square D, adjust breaker sizes per the manufacturer’s recommendations.

C. Each circuit breaker supplying a multiwire branch circuit shall be installed with a manufacturer supplied handle tie to simultaneously disconnect all ungrounded conductors. Each multiwire branch circuit shall comply with NEC article 210.4.

D. Circuit breakers with slash ratings, such as 120/240V or 480Y/277V, shall be used in solidly grounded systems where the nominal voltage of any conductor to ground does not exceed the lower of the two values of the breaker’s voltage rating and the nominal voltage between any two conductors does not exceed the higher value of the circuit breaker’s voltage rating.

E. Circuit breakers with straight voltage ratings, such as 240V or 480V, shall be used in systems other than solidly grounded systems (Corner-Grounded Delta, Ungrounded, Impedance Grounded, etc.) where the nominal voltage between any two conductors does not exceed the circuit breaker’s voltage rating. A two-pole circuit breaker shall not be used to protect a three-phase, Corner-Grounded Delta system unless the circuit breaker is marked 1Φ-3Φ.

PART 3 – EXECUTION

3.1 Install panelboards in complete compliance with all manufacturers’ installation instructions.

3.2 Install conductors neatly in panelboards. Group and tie-wrap circuits that share a common neutral.

3.3 Number circuits exactly as shown on the contract drawings.

END OF SECTION

SECTION 26 26 00 - SWITCHBOARD

PART 1 – GENERAL

1.1 Furnish and install the switchboard, complete with circuit breakers, phase buses, neutral buses, ground buses, structural supports, and other equipment necessary for a complete and operable installation.

1.2 The equipment vendor shall provide a complete protective device coordination study. The equipment vendor shall also perform all calculations necessary, and shall provide complete Arc Flash Labels as required by the National Electrical Code (NEC), NFPA 70E, and the equipment nameplate shown on the drawings. Note: The drawings typically require more detail than required by the NEC.

PART 2 – PRODUCTS

2.1 GENERAL

The switchboard shall meet the following specifications:

A. NEMA 1 enclosure of Code gauge steel phosphated and painted with gray paint.
B. Front Accessible
C. Buses shall be silver plated copper of sufficient size to limit the temperature rise to 65 degrees C based on UL tests.
D. Individual buses shall be covered with insulating material.
E. Bus bracing and all circuit breakers shall be rated for 100,000 AIC.
F. 100% capacity neutral.
G. Overhead Incoming Service – Cable connected.
H. Main Circuit Breaker sized as shown on the drawings. It shall be a 100% rated electronic trip circuit breaker with LSIG.
I. Branch Breakers shall be sized as shown on the drawings. They shall be 100% rated electronic trip circuit breaker with LSIG.
J. Engraved plastic phenolic nameplates identifying all breakers. Show Ampacity, Number of Poles, Load served.

2.2 ACCEPTABLE MANUFACTURERS

Switchboards shall be manufactured by Siemens, Square D, General Electric, Cutler Hammer, or approved equal.

PART 3 – EXECUTION

3.1 Provide a 4” thick concrete housekeeping pad that extends 1 1/2” around all edges of the Switchboard. Provide 1”, 45 degree chamfered edges.

3.2 Install conductors neatly in switchboards. Group and tie-wrap circuits that share a common circuit breaker.

3.3 Install switchboard in complete compliance with all manufacturer’s recommendations.

3.4 Provide Owner’s manual with close-out documents.

END OF SECTION

SECTION 26 28 00 - DISCONNECTS & SEPARATELY-MOUNTED CIRCUIT BREAKERS

PART 1 – GENERAL

Furnish and install all disconnects and separately mounted circuit breakers as shown on the drawings, specified herein, and required by the NEC.

PART 2 – PRODUCTS

2.1 GENERAL

A. Disconnects shall be of the heavy-duty type, and shall be UL listed for service entrance use. They shall meet or exceed the requirements of NEMA Standard KS1. Provide fuses sized to appropriately protect the load served. Equipment manufacturer's recommendations shall take precedence over the Contract Drawings.

B. Fuses shall be dual element, time-delay, Class J fuses. They shall be Bussman Low-Peak or approved equal.

C. Circuit breakers shall be thermal magnetic, molded-case with quick-make, quick-break contact action. They shall have thermal and magnetic tripping elements on each pole. Breakers with multiple poles shall have common tripping of all poles. Circuit breaker ampere ratings shall be stamped on the handle. Interrupting ratings of the circuit breakers shall be equivalent to the specified AIC rating of the panelboard. Breakers handles shall reside in a position between "ON" and "OFF" after a trip condition. Breakers shall be rated HACR when used for heating, air-conditioning, and refrigeration; HID when used with High Intensity Discharge fixtures; and shall be rated SWD when used for switching duty.

D. Circuit breaker sizes for motor loads are based on Square D recommendations for use of their breakers at the motor horsepowers listed on the mechanical drawings. If equipment is used other than Square D, adjust breaker sizes per the manufacturer's recommendations.

E. Circuit breakers with slash ratings, such as 120/240V or 480Y/277V, shall be used in solidly grounded systems where the nominal voltage of any conductor to ground does not exceed the lower of the two values of the breaker's voltage rating and the nominal voltage between any two conductors does not exceed the higher value of the circuit breaker's voltage rating.

F. Circuit breakers with straight voltage ratings, such as 240V or 480V, shall be used in systems other than solidly grounded systems (Corner-Grounded Delta, Ungrounded, Impedance Grounded, etc.) where the nominal voltage between any two conductors does not exceed the circuit breaker's voltage rating. A two-pole circuit breaker shall not be used to protect a three-phase, Corner-Grounded Delta system unless the circuit breaker is marked 1Φ-3Φ.

G. Disconnect and individually-mounted circuit breaker ampere interrupting current (AIC) ratings shall equal the rating of the panelboard from which they are fed unless otherwise noted.

H. Buses shall be constructed of 98% conductivity copper or tin-plated copper.

I. Switches shall be horsepower rated where used to serve motors.

J. Enclosures shall be NEMA 1 when they are to be mounted indoors, NEMA 3R when they are to be mounted outdoors, and NEMA 4X where they are subject to washdown. Provide special enclosures where shown on the Contract Drawings.

2.2 ACCEPTABLE MANUFACTURERS

Disconnects and separately-mounted circuit breakers shall be manufactured by Siemens, Square D, General Electric, or Cutler Hammer.

PART 3 – EXECUTION

3.1 Install disconnects and individually-mounted circuit breakers in complete compliance with all manufacturers' installation instructions. Where necessary, provide structural supports and bracing for installation.

3.2 Disconnects are to be surface-mounted.

3.3 Individually-mounted circuit breakers are to be flush-mounted unless otherwise shown.

END OF SECTION

SECTION 26 32 14.00 10 POLICE ADMIN - EMERGENCY/STANDBY POWER SYSTEMS GENERATOR SET

PART 1 – GENERAL

1.01 Scope

A. Provide complete factory assembled generator set equipment with digital (microprocessor-based) electronic generator set controls, digital governor, and digital voltage regulator.

B. Provide factory test, startup by a supplier authorized by the equipment manufacturer(s), and on-site testing of the system.

C. The generator set manufacturer shall warrant all equipment provided under this section, whether or not is manufactured by the generator set manufacturer, so that there is one source for warranty and product service. Technicians specifically trained and certified by the manufacturer to support the product and employed by the generator set supplier shall service the generator sets.

D. **The Contractor shall be responsible for obtaining the required fuel permit from the local officials.**

1.02 Codes and Standards

A. The generator set installation and on-site testing shall conform to the requirements of the following codes and standards, as applicable. The generator set shall include necessary features to meet the requirements of these standards.

1. CSA 282, 1989 Emergency Electrical Power Supply for Buildings
2. IEEE446 – Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
3. NFPA37 –
4. NFPA70 – National Electrical Code. Equipment shall be suitable for use in systems in compliance to Article 700, 701, and 702.
5. NFPA99 – Essential Electrical Systems for Health Care Facilities
6. NFPA110 – Emergency and Standby Power Systems. The generator set shall meet all requirements for Level 1 systems. Level 1 prototype tests required by this standard shall have been performed on a complete and functional unit, component level type tests will not substitute for this requirement.

B. The generator set and supplied accessories shall meet the requirements of the following standards:

1. NEMA MG1. Alternator shall comply with the requirements of the current version this standard as they apply to AC alternators.
2. UL142 – Sub-base Tanks
3. UL1236 – Battery Chargers
4. UL2200. The generator set shall be UL2200 listed.

C. The control system for the generator set shall comply with the following requirements.

1. CSA C22.2, No. 14 – M91 Industrial Control Equipment.
2. EN50082-2, Electromagnetic Compatibility – Generic Immunity Requirements, Part 2: Industrial.
3. EN55011, Limits and Methods of Measurement of Radio Interference Characteristics of Industrial, Scientific and Medical Equipment.
4. FCC Part 15, Subpart B.

5. IEC8528 part 4. Control Systems for Generator Sets
6. IEC Std 801.2, 801.3, and 801.5 for susceptibility, conducted, and radiated electromagnetic emissions.
7. UL508. The entire control system of the generator set shall be UL508 listed and labeled.
8. UL1236 –Battery Chargers.

D. The generator set manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

1.03 Acceptable Manufacturers

The basis of design for this project is based on generator sets manufactured by Cummins with microprocessor-based controls. The specification is written around this equipment to establish a standard of quality – not to limit competition. Equipment by Kohler or Caterpillar that meets the requirement of this specification is equally acceptable. Proposals must include a line by line compliance statement based on this specification.

1.04 Submittals.

A. Within 10 days after award of contract, provide six sets of the following information for review:
- Manufacturer’s product literature and performance data, sufficient to verify compliance to specification requirements.
- A paragraph by paragraph specification compliance statement, describing the differences between the specified and the proposed equipment.
- Manufacturer's certification of prototype testing.
- Manufacturer's published warranty documents.
- Shop drawings showing plan and elevation views with certified overall dimensions, as well as wiring interconnection details.
- Interconnection wiring diagrams showing all external connections required; with field wiring terminals marked in a consistent point-to-point manner.
- Manufacturer's installation instructions.

Part 2. PRODUCTS

2.01 Generator set

A. Ratings

1. The generator set shall operate at 1800 rpm and at a voltage of: 480Y/277 Volts AC, Three phase, 4-wire, 60 hertz.
2. The generator set shall be rated at 1500 kW, 2500 kVA at 0.8 PF, 3 Phase rating, based on site conditions of: Altitude 4334ft. (1321 meters), ambient temperatures up to 104 degrees F (40 degrees C).
3. The generator set rating shall be based on standby service.

B. Performance

1. Voltage regulation shall be plus or minus 0.5 percent for any constant load between no load and rated load. Random voltage variation with any steady load from no load to full load shall not exceed plus or minus 0.5 percent.
2. Frequency regulation shall be isochronous from steady state no load to steady state rated load. Random frequency variation with any steady load from no load to full load shall not exceed plus or minus 0.5%.
3. The diesel engine-generator set shall accept a single step load of 100% nameplate kW and power factor, less applicable derating factors, with the engine-generator set at operating temperature.

4. Motor starting capability shall be a minimum of 5521 kVA. The generator set shall be capable of recovering to a minimum of 90% of rated no load voltage following the application of the specified kVA load at near zero power factor applied to the generator set. Maximum voltage dip on application of this load, considering both alternator performance and engine speed changes shall not exceed 25%.
5. The alternator shall produce a clean AC voltage waveform, with not more than 5% total harmonic distortion at full linear load, when measured from line to neutral, and with not more than 3% in any single harmonic, and no 3rd order harmonics or their multiples. Telephone influence factor shall be less than 40.
6. The generator set shall be certified by the engine manufacturer to be suitable for use at the installed location and rating, and shall meet all applicable exhaust emission requirements at the time of commissioning.

C. Construction

1. The engine-generator set shall be mounted on a heavy-duty steel base to maintain alignment between components. The base shall incorporate a battery tray with hold-down clamps within the rails.
2. All switches, lamps, and meters in the control system shall be oil-tight and dust-tight

D. Connections

1. The generator set load connections shall be composed of silver or tin plated copper bus bars, drilled to accept mechanical or compression terminations of the number and type as shown on the drawings. Sufficient lug space shall be provided for use with cables of the number and size as shown on the drawings.
2. Power connections to auxiliary devices shall be made at the devices, with required protection located at a wall-mounted common distribution panel.
3. Generator set control interfaces to other system components shall be made on a permanently labeled terminal block assembly. Labels describing connection point functions shall be provided.

2.02 Engine and Engine Equipment

The engine shall be diesel, 4 cycle, radiator and fan cooled. The horsepower rating of the engine at its minimum tolerance level shall be sufficient to drive the alternator and all connected accessories. Two cycle engines are not acceptable. Engine accessories and features shall include:

A. An electronic governor system shall provide automatic isochronous frequency regulation. The governing system dynamic capabilities shall be controlled as a function of engine coolant temperature to provide fast, stable operation at varying engine operating temperature conditions. The control system shall actively control the fuel rate and excitation as appropriate to the state of the generator set. Fuel rate shall be regulated as a function of starting, accelerating to start disconnect speed, accelerating to rated speed. The governing system shall include a programmable warm up at idle and cooldown at idle function. While operating in idle state, the control system shall disable the alternator excitation system.

B. Skid-mounted radiator and cooling system rated for full load operation in 106.2 degrees F (41.2 degrees C) ambient as measured at the alternator air inlet. Radiator fan shall be suitable for use in a system with 0.5 in H_2O restriction. The equipment manufacturer shall fill the cooling system with a 50/50-ethylene glycol/water mixture prior to shipping. Rotating parts shall be guarded against accidental contact.

C. Electric starter(s) capable of three complete cranking cycles without overheating.

D. Positive displacement, mechanical, full pressure, lubrication oil pump.

E. Full flow lubrication oil filters with replaceable spin-on canister elements and dipstick oil level indicator.

F. An engine driven, mechanical, positive displacement fuel pump. Fuel filter with replaceable spin-on canister element. Fuel cooler, suitable for operation of the generator set at full rated load in the ambient

temperature specified shall be provided if required for operation due to the design of the engine and the installation.

G. Replaceable dry element air cleaner with restriction indicator.

H. Flexible supply and return fuel lines.

I. Engine mounted battery charging alternator, 70-ampere minimum, and solid-state voltage regulator.

J. Coolant Heater

1. Engine mounted, thermostatically controlled, coolant heater(s) for each engine. Heater voltage shall be as shown on the project drawings by the circuit feeding it. The coolant heater shall be UL499 listed and labeled.
2. The coolant heater shall be installed on the engine with silicone hose connections. Steel tubing shall be used for connections into the engine coolant system wherever the length of pipe run exceeds 12 inches. The coolant heater installation shall be specifically designed to provide proper venting of the system. The coolant heaters shall have provisions to isolate the heater for replacement of the heater element without draining the coolant from the generator set. The quick disconnect/automatic sealing couplers shall allow the heater element to be replaced without draining the engine cooling system or significant coolant loss.
3. The coolant heater shall be provided with a DC thermostat, installed at the engine thermostat housing. An AC power connection box shall be provided for a single AC power connection to the coolant heater system.
4. The coolant heater(s) shall be sized as recommended by the engine manufacturer to warm the engine to a minimum of 104F (40C) in a 40F (4C) ambient, in compliance with NFPA110 requirements, or the temperature required for starting and load pickup requirements of this specification.

K. Provide vibration isolators, spring/pad type, quantity as recommended by the generator set manufacturer.

L. Starting and Control Batteries shall be calcium/lead antimony type, 12 volt DC, sized as recommended by the engine manufacturer, complete with battery cables and connectors. The batteries shall be capable of a minimum of three complete 15-second cranking cycles at 40F ambient temperature when fully charged.

M. Provide exhaust silencer(s) for each engine of size and type as recommended by the generator set manufacturer and approved by the engine manufacturer. The muffler shall be critical grade. Exhaust system shall be installed according to the engine manufacturer's recommendations and applicable codes and standards.

N. Generators installed inside a building shall be provided with insulating blankets over all exhaust system components.

O. Provide a minimum 10 amp battery charger. Chargers shall be UL 1236-BBHH listed and CSA or CUL certified for use in emergency applications.

1. The charger shall be compliant with UL991 requirements for vibration resistance.
2. The charger shall comply with the requirements of EN61000-4-5 for voltage surge resistance; EN50082-2 for immunity; EN61000-4-2 for ESD; EN61000-4-3 for radiated immunity; ANSI/IEEE C62.41 category B and IN61000-4-4 for electrically fast transient; EN61000-4-6 for conducted emissions; and FCC Part 15 Class A for radiated emissions.
3. The charger shall be capable of charging a fully discharged battery without damage to the charger. It shall be capable of returning a fully discharged battery to fully charged condition within 24 hours. The charger shall be UL-labeled with the maximum battery amp-hour rating that can be recharged within 24

hours. The label shall indicate that the charger is suitable for charging of 200AH batteries per NFPA requirements.

4. The charger shall incorporate a 4-state charging algorithm, to provide trickle charge rate to restore fully discharged batteries, a bulk charge rate to provide fastest possible recharge after normal discharge, an absorption state to return the battery to 100 percent of charge, and a float stage to maintain a fully charge battery and supply battery loads when the generator set is not operating. In addition, the charger shall include an equalization timer. Charge rates shall be temperature compensated based on the temperature directly sensed at the battery.
5. The DC output voltage regulation shall be within plus or minus 1%. The DC output ripple current shall not exceed 1 amp at rated output current level.
6. The charger shall include the following features:
   a) two line alphanumeric display with programming keys to allow display of DC output ammeter and voltmeters (5% accuracy or better), display alarm messages, and perform programming;
   b) LED indicating lamp(s) to indicating normal charging condition (green), equalize charge state (amber), and fault condition (red);
   c) AC input overcurrent, over voltage, and undervoltage protection;
   d) DC output overcurrent protection;
   e) Alarm output relay
   f) Corrosion resistant aluminum enclosure

P. Provide a dual wall sub-base fuel storage tank with sufficient capacity to operate the generator at full load for a minimum of 24 hours. The tank shall be constructed of corrosion resistant steel and shall be UL listed. The equipment, as installed, shall meet all local and regional requirements for above ground tanks.

The double-wall subbase fuel tank shall be equipped with a leak detection system that provides local visual and audible alarms, and provides visual and audible alarms on the remote annunciator panel.

2.03 AC Generator

A. The AC generator shall be; synchronous, four pole, 2/3 pitch, revolving field, drip-proof construction, single prelubricated sealed bearing, air cooled by a direct drive centrifugal blower fan, and directly connected to the engine with flexible drive disc. All insulation system components shall meet NEMA MG1 temperature limits for Class H insulation system and shall be UL1446 listed. Actual temperature rise measured by resistance method at full load shall not exceed 125 degrees Centigrade.

B. The generator shall be capable of delivering rated output (kVA) at rated frequency and power factor, at any voltage not more than 5 percent above or below rated voltage.

C. A permanent magnet generator (PMG) shall be included to provide a reliable source of excitation power for optimum motor starting and short circuit performance. The PMG and controls shall be capable of sustaining and regulating current supplied to a single phase or three phase fault at approximately 300% of rated current for not more than 10 seconds.

D. The subtransient reactance of the alternator shall not exceed 12 percent, based on the standby rating of the generator set.

2.04 Generator Set Control.

The generator set shall be provided with a microprocessor-based control system that is designed to provide automatic starting, monitoring, and control functions for the generator set. The control system shall also be designed to allow local monitoring and control of the generator set, and remote monitoring and control as described in this specification.

The control shall be mounted on the generator set, or may be mounted in a free-standing panel next to the generator set if adequate space and accessibility is available. The control shall be vibration isolated and

prototype tested to verify the durability of all components in the system under the vibration conditions encountered.

The generator set mounted control shall include the following features and functions:

A. Control Switches

1. Mode Select Switch. The mode select switch shall initiate the following control modes. When in the RUN or MANUAL position the generator set shall start, and accelerate to rated speed and voltage as directed by the operator. A separate push-button to initiate starting is acceptable. In the OFF position the generator set shall immediately stop, bypassing all time delays. In the AUTO position the generator set shall be ready to accept a signal from a remote device to start and accelerate to rated speed and voltage.
2. EMERGENCY STOP switch. Switch shall be Red "mushroom-head" push-button. Depressing the emergency stop switch shall cause the generator set to immediately shut down, and be locked out from automatic restarting.
3. RESET switch. The RESET switch shall be used to clear a fault and allow restarting the generator set after it has shut down for any fault condition.
4. PANEL LAMP switch. Depressing the panel lamp switch shall cause the entire panel to be lighted with DC control power. The panel lamps shall automatically be switched off 10 minutes after the switch is depressed, or after the switch is depressed a second time.

B. Generator Set AC Output Metering. The generator set shall be provided with a metering set including the following features and functions:

1. Digital metering set, 1% accuracy, to indicate generator RMS voltage and current, frequency, output current, output KW, KW-hours, and power factor. Generator output voltage shall be available in line-to-line and line-to-neutral voltages, and shall display all three-phase voltages (line to neutral or line to line) simultaneously.

2. The control system shall monitor the total load on the generator set, and maintain data logs of total operating hours at specific load levels ranging from 0 to 110% of rated load, in 10% increments. The control shall display hours of operation at less than 30% load and total hours of operation at more than 90% of rated load.

3. The control system shall log total number of operating hours, total kWH, and total control on hours, as well as total values since reset.

C. Generator Set Alarm and Status Display.

1. The generator set control shall include LED alarm and status indication lamps. The lamps shall be high-intensity LED type. The lamp condition shall be clearly apparent under bright room lighting conditions. Functions indicated by the lamps shall include:

- The control shall include five configurable alarm-indicating lamps. The lamps shall be field adjustable for any status, warning, or shutdown function monitored by the genset. They shall also be configurable for color, and control action (status, warning, or shutdown).
- The control shall include green lamps to indicate that the generator set is running at rated frequency and voltage, and that a remote start signal has been received at the generator set. The running signal shall be based on actual sensed voltage and frequency on the output terminals of the generator set.
- The control shall include a flashing red lamp to indicate that the control is not in automatic state, and red common shutdown lamp.
- The control shall include an amber common warning indication lamp.

2. The generator set control shall indicate the existence of the warning and shutdown conditions on the control panel. All conditions indicated below for warning shall be field-configurable for shutdown. Conditions required to be annunciated shall include:

   low oil pressure (warning)
   low oil pressure (shutdown)
   oil pressure sender failure (warning)
   low coolant temperature (warning)
   high coolant temperature (warning)
   high coolant temperature (shutdown)
   high oil temperature (warning)
   engine temperature sender failure (warning)
   low coolant level (warning)
   fail to crank (shutdown)
   fail to start/overcrank (shutdown)
   overspeed (shutdown)
   low DC voltage (warning)
   high DC voltage (warning)
   weak battery (warning)
   low fuel-daytank (warning)
   high AC voltage (shutdown)
   low AC voltage (shutdown)
   under frequency (shutdown)
   over current (warning)
   over current (shutdown)
   short circuit (shutdown)
   over load (warning)
   emergency stop (shutdown)
   fuel leak (warning)
   (3) configurable conditions

3. Provisions shall be made for indication of three customer-specified alarm or shutdown conditions. Labeling of the customer-specified alarm or shutdown conditions shall be of the same type and quality as the above-specified conditions. The non-automatic indicating lamp shall be red, and shall flash to indicate that the generator set is not able to automatically respond to a command to start from a remote location.

D. Engine Status Monitoring.

1. The following information shall be available from a digital status panel on the generator set control:

   engine oil pressure (psi or kPA)
   engine coolant temperature (degrees F or C)
   engine oil temperature (degrees F or C)
   engine speed (rpm)
   number of hours of operation (hours)
   number of start attempts
   battery voltage (DC volts)

2. The control system shall also incorporate a data logging and display provision to allow logging of the last 10 warning or shutdown indications on the generator set, as well as total time of operation at various loads, as a percent of the standby rating of the generator set.

E. Engine Control Functions.

1. The control system provided shall include a cycle cranking system, which allows for user selected crank time, rest time, and # of cycles. Initial settings shall be for 3 cranking periods of 15 seconds each, with 15-second rest period between cranking periods.
2. The control system shall include an idle mode control, which allows the engine to run in idle mode in the RUN position only. In this mode, the alternator excitation system shall be disabled.
3. The control system shall include an engine governor control, which functions to provide steady state frequency regulation as noted elsewhere in this specification. The governor control shall include adjustments for gain, damping, and a ramping function to control engine speed and limit exhaust smoke while the unit is starting.
4. The control system shall include time delay start (adjustable 0-300 seconds) and time delay stop (adjustable 0-600 seconds) functions.
5. The control system shall include sender failure monitoring logic for speed sensing, oil pressure, and engine temperature which is capable of discriminating between failed sender or wiring components, and an actual failure conditions.

F. Alternator Control Functions:

1. The generator set shall include a full wave rectified automatic digital voltage regulation system that is matched and prototype tested by the engine manufacturer with the governing system provided. It shall be immune from misoperation due to load-induced voltage waveform distortion and provide a pulse width modulated output to the alternator exciter. The voltage regulation system shall be equipped with three-phase line to neutral RMS sensing and shall control buildup of AC generator voltage to provide a linear rise and limit overshoot. The system shall include a torque-matching characteristic, which shall reduce output voltage in proportion to frequency below an adjustable frequency threshold. Torque matching characteristic shall be adjustable for roll-off frequency and rate, and be capable of being curve-matched to the engine torque curve with adjustments in the field. The voltage regulator shall include adjustments for gain, damping, and frequency roll-off. Adjustments shall be broad range, and made via digital raise-lower switches, with an alphanumeric LED readout to indicate setting level. Rotary potentiometers for system adjustments are not acceptable.
2. A microprocessor-based protection device shall be provided to individually monitor all phases of the output current of the generator set and initiate an alarm (over current warning) when load current exceeds 110% of the rated current of the generator set on any phase for more than 60 seconds. The device shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (over current shutdown). The protective functions provided shall be in compliance to the requirements of NFPA70 article 445.
3. A microprocessor-based protection device shall be provided to monitor all phases of the output current for short circuit conditions. The control/protection system shall monitor the current level and voltage. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (short circuit shutdown). The protective functions provided shall be in compliance to the requirements of NFPA70 article 445.
4. Controls shall be provided to monitor the KW load on the generator set, and initiate an alarm condition (over load) when total load on the generator set exceeds the generator set rating for in excess of 5 seconds. Controls shall include a load shed control, to operate a set of dry contacts (for use in shedding customer load devices) when the generator set is overloaded.
5. A microprocessor-based AC over/under voltage monitoring system that responds only to true RMS voltage conditions shall be provided. The system shall initiate shutdown of the generator set when alternator output voltage exceeds 110% of the operator-set voltage level for more than 10 seconds, or with no intentional delay when voltage exceeds 130%. Under voltage shutdown shall occur when the output voltage of the alternator is less than 85% for more than 10 seconds. The system shall monitor individual phases and be connected line to neutral on 3-phase 4-wire generator sets, and for systems that are solidly grounded.

G. Other Control Functions

1. The generator set shall be provided with a network communication module to allow LonMark compliant communication with the generator set control by remote devices. The control shall communicate all engine and alternator data, and allow starting and stopping of the generator set via the network in both test and emergency modes.
2. A battery monitoring system shall be provided which initiates alarms when the DC control and starting voltage is less than 11VDC or more than 32 VDC. During engine cranking (starter engaged), the low voltage limit shall be disabled, and DC voltage shall be monitored as load is applied to the battery, to detect impending battery failure or deteriorated battery condition.

H. Control Interfaces for Remote Monitoring:

1. The control system shall provide four programmable output relays. These relay outputs shall be configurable for any alarm, shutdown, or status condition monitored by the control. The relays shall be configured to indicate: (1) generator set operating at rated voltage and frequency, (2) common warning, (3) common shutdown, (4) load shed command.
2. A fused 10 amp switched 12VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit whenever the generator set is running.
3. A fused 10 amp 12VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit at all times from the engine starting/control batteries.
4. The control shall be provided with a direct serial communication link for the LonWorks communication network interface as described elsewhere in this specification and shown on the drawings.

2.05 Other equipment to be provided with the generator set

A. Provide and install a 20-light LED type remote alarm annunciator with horn, located as shown on the drawings or in a location that can be conveniently monitored by facility personnel. The remote annunciator shall provide all the audible and visual alarms called for by NFPA Standard 110 for level 1 systems for the local generator control panel. Spare lamps shall be provided to allow future addition of other alarm and status functions to the annunciator. Provisions for labeling of the annunciator in a fashion consistent with the specified functions shall be provided. Alarm silence and lamp test switch(es) shall be provided. LED lamps shall be replaceable, and indicating lamp color shall be capable of changes needed for specific application requirements. Alarm horn shall be switchable for all annunciation points. Alarm horn (when switched on) shall sound for first fault, and all subsequent faults, regardless of whether first fault has been cleared, in compliance with NFPA110 3-5.6.2. The interconnecting wiring between the annunciator and other system components shall be monitored and failure of the interconnection between components shall be displayed on the annunciator panel.

B. The annunciator shall include the following alarm labels, audible annunciation features, and lamp colors:

Condition	Lamp Color	Audible Alarm
Normal Power (to Loads)	Green	No
Genset Supplying Load	Amber	No
Genset Running	Green	No
Not in Auto	Red (Flashing)	Yes
High Battery Voltage	Red	Yes
Low Battery Voltage	Red	Yes
Charger AC Failure	Red	Yes
Fail to Start	Red	Yes
Low Engine Temperature	Amber	Yes
Pre-High Engine Temperature	Amber	Yes
High Engine Temperature	Red	Yes

Pre-Low Oil Pressure	Amber	Yes
Low Oil Pressure	Red	Yes
Overspeed	Red	Yes
Low Coolant Level	Amber	Yes
Low Fuel Level	Amber	Yes
Network OK	Green	Yes
Fuel Leak Detected in Outside Tank	Red	Yes
(3) Spares	Configurable	Configurable

Low battery voltage lamp shall also be lighted for low cranking voltage or weak battery alarm.

C. The generator set shall be provided with mounted main line circuit breakers, sized as shown on the drawings. The circuit breakers shall incorporate an electronic trip unit that operates to protect the alternator under all overcurrent conditions, or a thermal-magnetic trip with other overcurrent protection devices that positively protect the alternator under overcurrent conditions. The supplier shall submit time overcurrent characteristic curves and thermal damage curve for the alternator, demonstrating the effectiveness of the protection provided.

D. Outdoor Weather-Protective Enclosure

1. The generator set shall be provided with an outdoor enclosure, with the entire package listed under UL2200. The package shall comply with the requirements of the National Electrical Code for all wiring materials and component spacing. Housing shall provide ample airflow for generator set operation at rated load in an ambient temperature of 100F. The housing shall have hinged access doors as required to maintain easy access for all operating and service functions. All doors shall be lockable, and include retainers to hold the door open during service. Enclosure roof shall be cambered to prevent rainwater accumulation. All electrical power and control interconnections shall be made within the perimeter of the enclosure.
2. All sheet metal shall be primed for corrosion protection and finish painted with the manufacturer's standard color using a two step electrocoating paint process, or equal meeting the performance requirements specified below. All surfaces of all metal parts shall be primed and painted. The painting process shall result in a coating that meets the following requirements:

   Primer thickness, 0.5-2.0 mils. Top coat thickness, 0.8-1.2 mils.

   Gloss, per ASTM D523-89, 80% plus or minus 5%. Gloss retention after one year shall exceed 50%.

   Crosshatch adhesion, per ASTM D3359-93, 4B-5B.

   Impact resistance, per ASTM D2794-93, 120-160 inch-pounds.

   Salt Spray, per ASTM B117-90, 1000+ hours.

   Humidity, per ASTM D2247-92, 1000+ hours.

   Water Soak, per ASTM D2247-92, 1000+ hours.

   Painting of hoses, clamps, wiring harnesses, and other non-metallic service parts shall not be acceptable. Fasteners used shall be corrosion resistant, and designed to minimize marring of the painted surface when removed for normal installation or service work.

3. Enclosure shall be constructed of minimum 12 gauge steel for framework and 14 gauge steel for panels. All hardware and hinges shall be stainless steel.
4. A factory-mounted exhaust silencer shall be installed inside the enclosure. The exhaust shall exit the enclosure through a rain collar and terminate with a rain cap. Exhaust connections to the generator set shall be through seamless flexible connections.
5. The enclosure shall include the following maintenance provisions:
   - Flexible coolant and lubricating oil drain lines, that extend to the exterior of the enclosure, with internal drain valves
   - External radiator fill provision.

E. The sub-base fuel tank shall be UL142 listed and labeled. Installation shall be in compliance to NFPA37. The fuel tank shall be a double-walled, steel construction and include the following features:
1. Emergency tank and basin vents.
2. Mechanical level gauge.
3. Fuel supply and return lines, connected to generator set with flexible fuel lines as recommended by the engine manufacturer and in compliance to UL2200 and NFPA 37 requirements.
4. Leak detection provisions, wired to the generator set control for local and remote alarm indication.
5. Basin drain.
6. Integral lifting provisions.
7. The Contractor shall fill the tank with fuel prior to the beginning of testing, and shall refill the tank at the completion of all testing.

Part 3. EXECUTION

3.01 Sequence of Operation

A. Generator set shall start on receipt of a start signal from remote equipment. The start signal shall be via hardwired connection to the generator set control and a redundant signal over the required network connection.

B. The generator set shall complete a time delay start period as programmed into the control.

C. The generator set control shall initiate the starting sequence for the generator set. The starting sequence shall include the following functions:

D. The control system shall verify that the engine is rotating when the starter is signaled to operate. If the engine does not rotate after two attempts, the control system shall shut down and lock out the generator set, and indicate “fail to crank” shutdown.

E. The engine shall fire and accelerate as quickly as practical to start disconnect speed. If the engine does not start, it shall complete a cycle cranking process as described elsewhere in this specification. If the

engine has not started by the completion of the cycle cranking sequence, it shall be shut down and locked out, and the control system shall indicate “fail to start”.

F. The engine shall accelerate to rated speed and the alternator to rated voltage. Excitation shall be disabled until the engine has exceeded programmed idle speed, and regulated to prevent over voltage conditions and oscillation as the engine accelerates and the alternator builds to rated voltage.

G. On reaching rated speed and voltage, the generator set shall operate as dictated by the control system in isochronous state.

H. When all start signals have been removed from the generator set, it shall complete a time delay stop sequence. The duration of the time delay stop period shall be adjustable by the operator.

I. On completion of the time delay stop period, the generator set control shall switch off the excitation system and shall shut down.

J. Any start signal received after the time stop sequence has begun shall immediately terminate the stopping sequence and return the generator set to isochronous operation.

3.02 Factory Testing.

A. The generator set manufacturer shall perform a complete operational test on the generator set prior to shipping from the factory. A certified test report shall be provided. Equipment supplied shall be fully tested at the factory for function and performance.

B. Factory testing may be witnessed by the owner and consulting engineer. Costs for travel expenses will be the responsibility of the owner and consulting engineer. Supplier is responsible to provide two weeks notice for testing.

C. Generator set factory tests on the equipment shall be performed at rated load and rated power factor. Generator sets that have not been factory tested at rated power factor will not be acceptable. Tests shall include: run at full load, maximum power, voltage regulation, transient and steady-state governing, single step load pickup, and function of safety shutdowns.

3.03 Installation

A. Equipment shall be installed by the contractor in accordance with final submittals and contract documents. Installation shall comply with applicable state and local codes as required by the authority having jurisdiction. Install equipment in accordance with manufacturer's instructions and instructions included in the listing or labeling of UL listed products.

B. Installation of equipment shall include furnishing and installing all interconnecting wiring between all major equipment provided for the on-site power system. The contractor shall also perform interconnecting wiring between equipment sections (when required), under the supervision of the equipment supplier.

C. Equipment shall be installed on concrete housekeeping pads. Equipment shall be permanently fastened to the pad in accordance with manufacturer’s instructions and seismic requirements of the site.

D. Equipment shall be initially started and operated by representatives of the manufacturer.

E. All equipment shall be physically inspected for damage. Scratches and other installation damage shall be repaired prior to final system testing. Equipment shall be thoroughly cleaned to remove all dirt and construction debris prior to initial operation and final testing of the system.

F. The equipment shall be tested in accordance with NFPA 110 requirements for Installation Acceptance regardless of whether the equipment is for a Level 1 installation or not. The Contractor shall be responsible for furnishing and connecting load banks as required. The Contractor shall fill the tank with fuel prior to system testing and shall refill the tank after the completion of all testing.

G. The equipment shall be tested at the end of the one year warranty period in accordance with the requirements of NFPA 110 Routine Maintenance and Operational Testing. The Contractor shall be

responsible for furnishing and connecting load banks as required. The Owner shall be responsible for the fuel for this test. Notify the Owner at least two weeks in advance of this scheduled test of the fuel requirements for the test.

3.04 On-Site Acceptance Test:

A. The complete installation shall be tested for compliance with the specification following completion of all site work. Testing shall be conducted by representatives of the manufacturer, with required fuel supplied by Contractor. The Engineer shall be notified in advance and shall have the option to witness the tests.

B. Installation acceptance tests to be conducted on-site shall include a "cold start" test, a two hour full load test, and a one step rated load pickup test in accordance with NFPA 110. Provide a resistive load bank and make temporary connections for full load test, if necessary.

C. Perform a power failure test on the entire installed system. This test shall be conducted by opening the power supply from the utility service, and observing proper operation of the system for at least 1 hour. Coordinate timing and obtain approval for start of test with site personnel.

3.05 Training

A. The equipment supplier shall provide training for the facility operating personnel covering operation and maintenance of the equipment provided. The training program shall be not less than 4 hours in duration and the class size shall be limited to 5 persons. Training date shall be coordinated with the facility owner.

3.06 Service and support

A. The manufacturer of the generator set shall maintain service parts inventory at a central location which is accessible to the service location 24 hours per day, 365 days per year.

B. The generator set shall be serviced by a local service organization that is trained and factory certified in generator set service. The supplier shall maintain an inventory of critical replacement parts at the local service organization, and in service vehicles. The service organization shall be on call 24 hours per day, 365 days per year.

C. The manufacturer shall maintain model and serial number records of each generator set provided for at least 20 years.

3.07 Warranty

A. The generator set and associated equipment shall be warranted for a period of not less than 5 years from the date of commissioning against defects in materials and workmanship.

B. The generator warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.

END OF SECTION

SECTION 26 36 23 – AUTOMATIC TRANSFER SWITCHES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes transfer switches rated 600 V and less, including the following:

1. Automatic transfer switches

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.

1. Technical data on all major components of all transfer switches and other products described in this section. Data is required for the transfer switch mechanism, control system, cabinet, and protective devices specifically listed for use with each transfer switch. Include steady state and fault current ratings, weights, operating characteristics, and furnished specialties and accessories.

2. Single-Line Diagram: Show connections between transfer switch, bypass/isolation switch, power sources, and load; and show interlocking provisions for each combined transfer switch and bypass/isolation switch.

B. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.

1. Dimensioned outline drawings of assembly, including elevations, sections, and details including minimal clearances, conductor entry provisions, gutter space, installed features and devices and material lists for each switch specified.
2. Internal electrical wiring and control drawings.
3. Interconnection wiring diagrams, showing recommended conduit runs and point-to-point terminal connections to generator set.
4. Installation and mounting instructions, including information for proper installation of equipment to meet seismic requirements.

C. Manufacturer and Supplier Qualification Data

1. The transfer switch manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.
2. The manufacturer of this equipment shall have produced similar equipment for a minimum period of 10 years. When requested, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

D. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Features and operating sequences, both automatic and manual.
2. List of all factory settings of relays, timers and protective devices; provide setting and calibration instructions where applicable.

E. Warranty documents demonstrating compliance with the project's contract requirements.

1.4 QUALITY ASSURANCE

A. Only approved bidders shall supply equipment provided under this contract.

B. Manufacturer Qualifications: The equipment supplier shall maintain a service center capable of providing training, parts, maintenance and emergency repairs to equipment, including transfer switch generator sets and remote monitoring equipment (if applicable) at the site within a response period of less than twenty-four (24) hours from time of notification.

1. The transfer switch shall be serviced by technicians employed by, and specially trained and certified by, the generator set supplier and the supplier shall have a service organization that is factory-certified in both generator set and transfer switch service. The supplier shall maintain an inventory of critical replacement parts at the local service organization, and in service vehicles. The service organization shall be on call 24 hours per day, 365 days per year.
2. Submit names, experience level, training certifications, and locations for technicians that will be responsible for servicing equipment at this site.
3. The manufacturer shall maintain model and serial number records of each transfer switch provided for at least 20 years.

C. Source Limitations: All transfer switches are to be obtained through one source from a single manufacturer. The generator set manufacturer shall warrant transfer switches to provide a single source of responsibility for products provided.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked as suitable for use in emergency, legally required or optional standby use as appropriate for the connected load.

E. The automatic transfer switch installation and application shall conform to the requirements of the following codes and standards:

1. Transfer switches and enclosures shall be UL 1008 listed and labeled as suitable for use in emergency, legally required, and optional standby applications.
2. CSA 282, Emergency Electrical Power Supply for Buildings, and CSA C22.2, No. 14-M91 Industrial Control Equipment
3. NFPA 70, National Electrical Code. Equipment shall be suitable for use in systems in compliance with Articles 700, 701 and 702.
4. Comply with NEMA ICS 10-1993 AC Automatic Transfer Switches
5. IBC 2006 – The transfer switch(es) shall be prototype-tested and third-party certified to comply with the requirements of IBC group III or IV, Category D/F. The equipment shall be shipped with the installation instructions necessary to attain installation compliance
6. IEEE 446 – Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
7. EN55011, Class B Radiated Emissions and Class B Conducted Emissions
8. IEC 1000-4-5 (EN 61000-4-5); AC Surge Immunity
9. IEC 1000-4-4 (EN 61000-4-4) Fast Transients Immunity
10. IEC 1000-4-2 (EN 61000-4-2) Electrostatic Discharge Immunity

11. IEC 1000-4-3 (EN 61000-4-3) Radiated Field Immunity
12. IEC 1000-4-6 Conducted Field Immunity
13. IEC 1000-4-11 Voltage Dip Immunity
14. IEEE 62.41, AC Voltage Surge Immunity
15. IEEE 62.45, AC Voltage Surge Testing

F. Comply with NFPA 110 – Emergency and Standby Power Systems. The transfer switch shall meet all requirements for Level 1 systems, regardless of the actual circuit level.

G. The manufacturer shall warrant the material and workmanship of the transfer switch equipment for a minimum of one (1) year from registered commissioning and start-up, or eighteen (18) months from date of shipment.

H. The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, and etc. during the minimum noted warranty period described above.

1.5 COORDINATION

A. Size and location of concrete bases and anchor bolt inserts shall be coordinated. Concrete, reinforcement and formwork must meet the requirements specified in Division 03. See section 3.1 for additional information on installation

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cummins Power Generation
2. Russelectric
3. ASCO

B. Equipment specifications for this Project are based on automatic transfer switches manufactured by Cummins Power Generation. Switches manufactured by Russelectric or ASCO that meet the requirement of this specification are acceptable, if approved not less than two weeks before scheduled bid date. Proposals must include a line-by-line compliance statement based on this specification.

C. Transfer switches utilizing molded case circuit breakers do not meet the requirements of this specification and will not be accepted.

2.2 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

A. Provide transfer switches in the number and ratings that are shown on the drawings. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer.

B. Fault-Current Closing and Withstand Ratings: UL 1008 WCR ratings must be specifically listed as meeting the requirements for use with protective devices at installation locations, under specified fault conditions. Withstand and closing ratings shall be based on use of the same set of contacts for the withstand test and the closing test.

C. Solid-State Controls: All settings should be accurate to +/- 2% or better over an operating temperature range of - 40 to + 60 degrees C (- 40 to + 140 degrees F).

D. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.

E. Electrical Operation: Accomplished by a non-fused, momentarily energized solenoid or electric motor operator mechanism, mechanically and electrically interlocked in both directions (except that mechanical interlock is not required for closed transition switches).

F. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.

1. Switches using molded-case switches or circuit breakers, or insulated case circuit breaker components are not acceptable.
2. Transfer switches shall be double-throw, electrically and mechanically interlocked, and mechanically held in the Source 1 and Source 2 positions.
3. Main switch contacts shall be high-pressure silver alloy. Contact assemblies shall have arc chutes for positive arc extinguishing. Arc chutes shall have insulating covers to prevent inter-phase flashover.
4. Contacts shall be operated by a high-speed electrical mechanism that causes contacts to open or close within three electrical cycles from signal.
5. The transfer switch operation shall include the ability to switch to an open position (both sources disconnected) for the purpose of load shedding from the generator set.
6. The power transfer mechanism shall include provisions for manual operation under load with the enclosure door closed. Manual operation may be electromechanical or mechanical, but must be coordinated with control function.
7. Transfer switch shall be provided with flame retardant transparent covers to allow viewing of switch contact operation but prevent direct contact with components that could be operating at line voltage levels.
8. The transfer switch shall include the mechanical and control provisions necessary to allow the device to be field-configured for operating speed. Transfer switch operation with motor loads shall be as is recommended in NEMA MG1.
    a. Phase angle monitoring/timing equipment is not an acceptable substitute for this functionality
9. Transfer switches designated on the drawings as “4-pole” shall be provided with a switched neutral pole switched which is switched simultaneously with phase poles.
10. Transfer switches designated on the drawings as “3-pole” shall have a full current-rated neutral bar with lugs.
11. Transfer switches designated on the drawings as “isolation-bypass” switches shall meet the requirements of section 2.4 of this specification.
12. Transfer switches designated on the drawings as “non-automatic” switches shall meet the requirements of section 2.5 of this specification.
13. Transfer switches designated on the drawings as “closed transition” switches shall meet the requirements of section 2.6 of this specification.
14. Transfer switches designated on the drawings as “service entrance” switches shall meet the requirements of section 2.7 of this specification.

G. Control: Transfer switch control shall be capable of communicating with the genset control, other switches and remote programming devices over a high-speed network interface.

H. Factory wiring: Transfer switch internal wiring shall be composed of pre-manufactured harnesses that are permanently marked for source and destination. Harnesses shall be connected to the control system by means of locking disconnect plug(s), to allow the control system to be easily disconnected and serviced without disconnecting power from the transfer switch mechanism

I. Terminals: Terminals shall be pressure type and appropriate for all field wiring. Terminal arrangement and cabinet space must be such that feeder conductors can enter from the top, side or bottom of the switch, at the installer's discretion. Control wiring shall be equipped with suitable lugs, for connection to terminal strips.

J. Enclosures: All enclosures shall be third-party certified for compliance to NEMA ICS 6 and UL 508, unless otherwise indicated:

1. The enclosure shall provide wire bend space in compliance to the latest version of NFPA70, regardless of the direction from which the conduit enters the enclosure.
2. Exterior cabinet doors shall provide complete protection for the system's internal components. Doors must have permanently mounted key-type latches. Bolted covers or doors are not acceptable.
3. Transfer switches shall be provided in enclosures that are third party certified for their intended environment per NEMA requirements.

    a. Transfer switches mounted in a controlled indoor environment shall be provided in NEMA Type 1 enclosures (IEC type IP30).
    b. Transfer switches installed indoors shall be NEMA Type 12 (IEC type IP61) if the Project environment requires dust-proof and/or drip-proof equipment.
    c. Transfer switches located outdoors shall be supplied in NEMA Type 3R (IEC IP34) when dust-proof and/or rain-proof enclosures are required.
    d. Transfer switches that are installed outdoors or in any other uncontrolled environment shall be supplied with NEMA Type 4 or 4X (stainless steel) enclosures (IEC IP65).

2.3 AUTOMATIC TRANSFER SWITCHES

A. Comply with requirements for Level 1 equipment according to NFPA 110.

B. Indicated current ratings:

1. Refer to the Project drawings for specifications on the sizes and types of transfer switch equipment, withstand and closing ratings, number of poles, voltage and ampere ratings, enclosure type, and accessories.
2. Main contacts shall be rated for 600 VAC minimum.
3. Transfer switches shall be rated to carry 100% of rated current continuously in the enclosure supplied, in ambient temperatures of -40 to +60 degrees C (-40 to +140 degrees F), relative humidity up to 95% (non-condensing), and altitudes up to 10,000 feet (3000 meters).

C. Manual Switch Operation: The power transfer mechanism shall include provisions for manual operation under load with the enclosure door closed. Manual operation may be electromechanical or mechanical, but must be coordinated with control function

D. Relay Signal: Control shall include provisions for addition of a pre-transfer relay signal, adjustable from 0 to 60 seconds, to be provided if necessary for elevator operation, based on equipment provided for the project.

E. Control: Transfer switch control shall be provided with necessary equipment and software to communicate with the genset control, other transfer switches, remote annunciation equipment, and other devices over a high speed control network.

F. Neutral Switching: Transfer switches designated on the drawings as 4-pole shall be provided with a switched neutral pole. The neutral pole shall be of the same construction and have the same ratings as the phase poles. All poles shall be switched simultaneously using a common crossbar. Substitute equipment using overlapping neutral contacts is not acceptable.

G. Transfer switches that are designated on the drawings as 3-pole shall be provided with a neutral bus and lugs. The neutral bus shall be sized to carry 100% of the current designated on the switch rating.

H. The transfer switch physically located closest to the generator and not more than 50 ft (15 meters) away, except those served by generator paralleling equipment, shall be provided with a battery charger suitable for the requirements of the application and in compliance with NFPA 110 requirements for Level 1 systems. If no transfer switch is located within this distance, a battery charger shall be installed on the generator set.

I. Automatic Transfer Switch Control Features

1. The transfer switch control system shall be configurable in the field for any operating voltage level up to 600 VAC. Voltage sensing shall be monitored based on the normal voltage at the site. Systems that utilize voltage monitoring based on standard voltage conditions that are not field configurable are not acceptable.
2. All transfer switch sensing shall be configurable from an operator panel or from a Windows XP or later PC-based service tool. Designs utilizing DIP switches or other electromechanical devices are not acceptable.
3. The transfer switch shall be configurable to accept a relay contact signal and a network signal from an external device for load shedding purposes. On receipt of this signal, the transfer switch shall switch to a neutral position when connected to Source 2. If Source 1 is available when the load-shed signal is received, the transfer switch shall connect to Source 1.
4. The transfer switch shall be configurable to accept a relay contact signal and a network signal from an external device to prevent transfer to the generator service.
5. The transfer switch shall provide a relay contact signal prior to transfer or re-transfer. The time period before and after transfer shall be adjustable in a range of 0 to 50 seconds.
6. The control system shall be designed and prototype tested for operation in ambient temperatures from - 40 degrees C to + 60 degrees C (- 40 to +140 degrees F). It shall be designed and tested to comply with the requirements of the noted voltage and RFI/EMI standards.
7. The control shall have optically isolated logic inputs, high isolation transformers for AC inputs and relays on all outputs, to provide optimum protection from line voltage surges, RFI and EMI.
8. The transfer switch network monitoring equipment, when supplied, shall be provided with a battery-based auxiliary power supply to allow monitoring of the transfer switch when both AC power sources are non-operational. The battery power supply shall be monitored for proper condition, and the transfer switch shall include an alarm condition to indicate low battery condition.

J. Transfer Switch Control Panel: The transfer switch shall have a microprocessor-based control with a sealed membrane panel incorporating pushbuttons for operator-controlled functions, and LED lamps for system status indicators. The panel shall also include an alphanumeric display for detailed system information. Panel display and indicating lamps shall include permanent labels.

1. The indicator panel LEDs shall display:
   a. Which source the load is connected to (Source 1 or Source 2)

b. Which source or sources are available
c. When switch is not set for automatic operation, because the control is disabled or the bypass switch is in use
d. When the switch is in test/exercise mode

2. The indicator shall have pushbuttons that allow the operator to activate the following functions:
   a. Activate pre-programmed test sequence
   b. Override programmed delays, and immediately go to the next operation
   c. Reset the control by clearing any faults
   d. Test all of the LEDs by lighting them simultaneously

3. The alphanumeric digital display shall be vacuum fluorescent-type, clearly visible in both bright sunlight and no-light conditions over an angle of 120 degrees, and shall display the following:
   a. AC voltage for all phases, normal and emergency
   b. Source status: connected or not connected.
   c. Load data, including voltage, AC current, frequency, KW, KVA, and power factor.

4. The display panel shall be password-protected, and allow the operator to view and make adjustments:
   a. Set nominal voltage and frequency for the transfer switch
   b. Adjust voltage and frequency sensor operation set points
   c. Set up time clock functions
   d. Set up load sequence functions
   e. Enable or disable control functions including program transition
   f. View real-time clock data, operation log (hours connected, times transferred, failures) and service history

K. Control Functions: Functions managed by the control shall include:

1. Software adjustable time delays:
   a. Engine start (prevents nuisance genset starts in the event of momentary power fluctuation): 0 to 120 seconds (default 3 sec)
   b. Transfer normal to emergency (allows genset to stabilize before load is transferred): 0 to 120 seconds (default 3 sec)
   c. Re-transfer emergency to normal (allows utility to stabilize before load is transferred from genset): 0 to 30 minutes (default 3 sec)
   d. Engine cooldown: 0 to 30 minutes (default 10 min)
   e. Programmed transition: 0 to 60 seconds (default 3 sec)

2. Undervoltage sensing: three-phase normal, three-phase emergency source.
   a. Pickup: 85 to 98% of nominal voltage (default 90%)
   b. Dropout: 75 to 98% of nominal voltage (default 90%)
   c. Dropout time delay: 0.1 to 1.0 seconds (default 0.5 sec)
   d. Accurate to within +/- 1% of nominal voltage

3. Over-voltage sensing: three-phase normal, three-phase emergency source.
   a. Pickup: 95 to 99% of dropout setting (default 95%)
   b. Dropout: 105 to 135% of nominal voltage (default 110%)
   c. Dropout time delay: 0.5 to 120 seconds (default 3 sec)
   d. Accurate to within +/- 1% of nominal voltage

4. Over/under frequency sensing:
   a. Pickup: +/- 5 to +/-20% of nominal frequency (default 10%)

b. Dropout: +/-1% beyond pickup (default 1%)
c. Dropout time delay: 0.1 to 15.0 seconds (default 5 sec)
d. Accurate to within +/- 0.2%

5. Voltage imbalance sensing:
   a. Dropout: 2 to 10% (default 4%)
   b. Pickup: 90% of dropout
   c. Time delay: 2.0 to 20 seconds (default 5 sec)

6. Phase rotation sensing:
   a. Time delay: 100 msec

7. Loss of single-phase detection:
   a. Time delay: 100 msec

L. Control features shall include:

1. Programmable genset exerciser: A field-programmable control shall periodically start the generator, transfer the load to generator for a preset time, then re-transfer and shut down the generator after a preset cool-down period.

   a. Push-button programming control shall have a selection of eight different schedules for exercising generator, with or without load.

2. In event of a loss of power to the control, all control settings, real-time clock setting and the engine start-time delay setting will be retained.
3. The system continuously logs information including the number of hours each source has been connected to the load, the number of times transferred, and the total number of times each source has failed. An event recorder stores information, including time and date-stamp, for up to 50 events.
4. Transfer Override Switch: Overrides automatic re-transfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light to indicate override status.

M. Control Interface

1. Provide one set Form C auxiliary contacts on both sides, operated by transfer switch position, rated 10 amps 250 VAC.
2. The transfer switch shall be provided with a network communication card, and configured to allow network-based communication with the transfer switch and other network system components, including the generator set(s) provided for the Project.
3. Unassigned Auxiliary Contacts: Two normally open, 1-pole, double-throw contacts for each switch position, rated 10A at 240 VAC.

N. Engine Starting Contacts
1. One isolated and normally closed, and one isolated and normally open; rated 10A at 32 VDC minimum.

2.4 SERVICE ENTRANCE TRANSFER SWITCHES

A. Transfer switches must be specifically intended for service entrance applications, and labeled “Suitable for service entrance use only”
B. Transfer switch shall meet NEC requirements for emergency, legally required and standby applications as specified in UL 1008.

C. Entire transfer switch including enclosure must be listed and labeled to UL 1008; switches with only the mechanism listed are not acceptable.
D. Molded case circuit breaker must be UL 489 listed.

2.5 REMOTE ANNUNCIATOR SYSTEM

A. Functional Description: Remote annunciator panel shall annunciate conditions for indicated transfer switches. Annunciation shall include the following:

1. Sources available, as defined by actual pickup and dropout settings of transfer-switch controls.
2. Switch position.
3. Switch in test mode.
4. Failure of communication link.

B. Annunciator Panel: LED-lamp type with audible signal and silencing switch.

1. Indicating Lights: Grouped for each transfer switch monitored.
2. Label each group, indicating transfer switch it monitors, location of switch, and identity of load it serves.
3. Mounting: Flush, modular, steel cabinet, unless otherwise indicated.
4. Lamp Test: Push-to-test or lamp-test switch on front panel.

C. Malfunction of annunciator, annunciation and control panel, or communication link shall not affect functions of automatic transfer switch. In the event of failure of communication link, automatic transfer switch automatically reverts to stand-alone, self-contained operation.

D. Automatic transfer-switch sensing, controlling, or operating function shall not depend on remote panel for proper operation. The remote annunciation system shall not prevent transfer to the alternate source when the primary power source fails, nor prevent return to the primary source if the alternate source fails

PART 3 - EXECUTION

3.1 INSTALLATION

A. Design each fastener and support to carry load indicated by seismic requirements and according to seismic-restraint details. See Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

B. Floor-Mounting Switch: Anchor to floor by bolting.

1. Floor-mounted transfer switches (except drawout switches supported by wheeled carriages, which must be rolled out at floor level) shall be mounted on concrete bases complying with the following requirements:

a. Concrete Bases: 4 inches (100 mm) high, reinforced, with chamfered edges. Extend base no more than 4 inches (100 mm) in all directions beyond the maximum dimensions of switch, unless otherwise indicated or unless required for seismic support. Construct concrete bases according to Division 26 Section "Hangers and Supports for Electrical Systems."

B. Annunciator and Control Panel Mounting: Flush in wall, unless otherwise indicated.

C. Identify components according to Division 26 Section "Identification for Electrical Systems."

D. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

3.2 CONNECTIONS

A. Wiring to Remote Components: Match type and number of cables and conductors to control and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.

B. Field control connections shall be made on a common terminal block that is clearly and permanently labeled.

C. Transfer switch shall be provided with AL/CU mechanical lugs sized to accept the full output rating of the switch. Lugs shall be suitable for the number and size of conductors shown on the drawings.

D. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

E. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 SOURCE QUALITY CONTROL

A. Prior to shipping, factory shall test and inspect components, assembled switches, and associated equipment to ensure proper operation.

B. Factory shall check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements.

C. Factory shall perform dielectric strength test complying with NEMA ICS 1.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: The supplier of the transfer switch(es) and associated equipment shall inspect, test, and adjust components, assemblies, and equipment installations, including connections, and report results in writing.

B. Manufacturer's representative shall perform tests and inspections and prepare test reports.

C. After installing equipment and after electrical circuitry has been energized, installer shall test for compliance with requirements.

1. Perform recommended installation tests as recommended in manufacturer's installation and service manuals.
2. After energizing circuits, demonstrate interlocking sequence and operational function for each switch.

    a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
    b. Verify time-delay settings.
    c. Verify that the transfer switch is accurately metering AC voltage and current (when provided).

d. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.
e. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.

3. Ground-Fault Tests (if integral to transfer switch): Coordinate with testing of ground-fault protective devices for power delivery from both sources.

a. Verify grounding connections and locations and ratings of sensors.

D. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switch. Remove all access panels so joints and connections are accessible to portable scanner.

1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.
2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
3. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 DEMONSTRATION

A. After generator set installation, the generator and transfer switch supplier shall conduct a complete operation, basic maintenance, and emergency service seminar covering generator set and transfer switch equipment, for up to 10 people employed by the Owner.

1. The seminar shall include instruction on operation of the transfer equipment, normal testing and exercise, adjustments to the control system, use of the PC based service and maintenance tools provided under this contract, and emergency operation procedures.
2. The class duration shall be at least 8 hours in length, and include practical operation with the installed equipment.

3.6 SERVICE AND SUPPORT

A. The manufacturer shall supply the Owner with a complete set of the service and maintenance software required to support the product. The software shall be provided at a training class attended by the user, to qualify the user in proper use of the software. The software shall have the following features and capabilities:

1. The software shall be 32 bit and shall be XP and Vista compatible.
2. The software shall use the Windows Explorer format, for ease of use and commonality with other software in use at the facility.
3. The software shall allow adjustment of all functions described herein, adjustment of operating levels of all protective functions, and programming of all optional functions in the controller. Adjustments shall be possible over modem from a facility that is remote from the generator set.
4. The software shall be capable of storing and displaying data for any function monitored by the generator set control. This data shall be available in common file formats, and on graphical “strip chart” displays.
5. The software shall automatically record all control operations and adjustments performed by any operator or software user, for tracking of changes to the control.

6. The software shall display all warning, shutdown, and status changes programmed into transfer switch controller. For each event, the control shall provide information on the nature of the event, when it last occurred, and how many times it has occurred.

END OF SECTION

SECTION 26 41 00 - LIGHTNING PROTECTION SYSTEM

PART 1 - GENERAL

1.1 Furnish and install a complete and operable Lightning Protection System meeting the requirements of NFPA 780, UL 96A, LPI 175, and all other applicable federal, state, and local codes. The contract drawings are provided to give a general scope of the work. The actual system installed shall be based on shop drawings created by a Contractor-selected Lightning Protection System company with no less than five years experience designing and installing lightning protection systems on projects of similar size and scope. The Lightning Protection System shall be a UL Master-labeled system.

1.2 Class II Materials, as defined by NFPA 780 shall be used for any structure that exceeds 75 feet in height. Class I Materials may be used for the shorter structures on the site as permitted by NFPA 780.

1.3 Products listed on the drawings are manufactured by AC Erico. The materials shown are provided to indicate a standard of quality and should not be interpreted as limiting competition. Products of other manufacturers will be acceptable provided they are of equivalent style and quality.

1.4 Provide all materials, equipment, and labor required to install, configure, and test the entire system to the satisfaction of the Architect and Engineer. Include all attachments, flashing, roof penetrations, closures, and other items for complete watertight installation. Coordinate installation with roofing contractor.

1.5 Submit six sets of manufacturer's cut sheets describing completely all equipment, and six sets of shop drawings showing all circuitry including complete construction details. Coordinate with the architectural and structural drawings to determine exact material types for each conductor, connector, air terminal, support, etc. Show manufacturer's part number, material type, and method of installation including bolt and anchor materials and sizes.

PART 2 - PRODUCTS

2.1 Products shown on the drawings represent the minimum requirements for the project. Provide additional equipment as required by codes and standards for a complete UL Master-labeled system.

2.2 Conductors: Conductors shall be copper throughout the system except where they will be in contact with aluminum or other aluminum alloy metals. All conductors in contact with concrete or earth shall be copper. The conductor sizes and types shall be Class II in accordance with NFPA 780 for portions of the building exceeding 75 feet in height. They shall be Class I in accordance with NFPA 780 where allowed by this code.

2.3 Connectors: Connectors shall be selected based on the conductor type that they will be supporting and the material on which they will be mounted. Coordinate with architectural and structural drawings during the creation of shop drawings to determine material types and exact connector types for each location.

2.4 Conduits: Conduits shall be schedule 80 PVC with a UV inhibitor. Size conduits for conductors which they will protect.

PART 3 - EXECUTION

3.1 All work shall be done by qualified technicians.

3.2 All downlead conductors shall be routed inside walls in PVC-conduit. Bond to structural steel outside of PVC-conduit as required by codes. Downleads shall not be run exposed on the outside of the buildings. Make transitions from aluminum to copper conductors on the roof area only. All downlead conductors shall be copper.

3.3 The Electrical Contractor shall not penetrate the roof or walls. Where such penetrations are required, employ the appropriate contractor on the project responsible for such work to provide and seal such penetrations.

3.4 Connect lightning protection system to the electrical power system ground with a main-size copper lightning protection cable exothermically welded to the electrical power system ground rod.

3.5 Guarantee workmanship and material for a period of one year after final acceptance. During the warranty period, repair or replace faulty equipment at no cost to the Owner for labor, material, or expenses.

3.6 Upon completion of job, test entire system for ground resistance. After testing submit a certificate to Architect stating that the system has been installed in strict compliance with all applicable codes and manufacturer's guidelines.

PART 4 – CLOSE-OUT DOCUMENTS

Provide the following documents to the Architect for delivery to the Owner at the time of substantial completion:

A. Written Guarantee

B. Two sets of data prepared by the manufacturer for each item of electrical equipment completely describing each piece of equipment. The data shall include parts lists, shop drawings, wiring diagrams, maintenance procedures, and other literature required for operation and maintenance.

C. Certificate indicating the system bares the UL Master-label.

END OF SECTION

SECTION 26 43 00 - SURGE PROTECTIVE DEVICES (SPDs)

PART 1 – GENERAL

1.1 SCOPE

A. The Contractor shall furnish and install the Surge Protective Device (SPD) equipment having the electrical characteristics, ratings, and modifications as specified herein and as shown on the contract drawings. To maximize performance and reliability and to obtain the lowest possible let-through voltages, the ac surge protection shall be integrated into electrical distribution equipment such as switchgear, switchboards, panelboards, busway (integrated within bus plug), or motor control centers. Refer to related sections for surge requirements in:

1.2 RELATED SECTIONS

A. Section 26 24 00 – Panelboards

1.3 REFERENCES

A. SPD units and all components shall be designed, manufactured, and tested in accordance with the latest applicable UL standard (ANSI/UL 1449 3rd Edition).

1.4 SUBMITTALS – FOR REVIEW/APPROVAL

A. The following information shall be submitted to the Engineer:

1. Provide verification that the SPD complies with the required ANSI/UL 1449 3rd Edition listing by Underwriters Laboratories (UL) or other Nationally Recognized Testing Laboratory (NRTL). Compliance may be in the form of a file number that can be verified on UL's website or on any other NRTL's website, as long as the website contains the following information at a minimum: model number, SPD Type, system voltage, phases, modes of protection, Voltage Protection Rating (VPR), and Nominal Discharge Current (I_n).
2. For sidemount mounting applications (SPD mounted external to electrical assembly), electrical/mechanical drawings showing unit dimensions, weights, installation instruction details, and wiring configuration.

B. Where applicable the following additional information shall be submitted to the engineer:

1. Descriptive bulletins
2. Product sheets

1.5 SUBMITTALS – FOR CONSTRUCTION

A. The following information shall be submitted for record purposes:

1. Final as-built drawings and information for items listed in Section 1.04 and shall incorporate all changes made during the manufacturing process

1.6 QUALIFICATIONS

A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.

B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

D. The SPD shall be compliant with the Restriction of Hazardous Substances (RoHS) Directive 2002/95/EC.

1.7 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of manufacturer's instructions shall be included with the equipment at time of shipment.

1.8 OPERATION AND MAINTENANCE MANUALS

A. Operation and maintenance manuals shall be provided with each SPD shipped.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Eaton Cutler-Hammer

The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features, and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Engineer ten (10) days prior to bid date.

2.2 VOLTAGE SURGE SUPPRESSION – GENERAL

B. Electrical Requirements

1. Unit Operating Voltage – Refer to drawings for operating voltage and unit configuration.
2. Maximum Continuous Operating Voltage (MCOV) – The MCOV shall not be less than 125% of the nominal system operating voltage.
3. The suppression system shall incorporate thermally protected metal-oxide varistors (MOVs) as the core surge suppression component for the service entrance and all other distribution levels. The system shall not utilize silicon avalanche diodes, selenium cells, air gaps, or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.
4. Protection Modes – The SPD must protect all modes of the electrical system being utilized. The required protection modes are indicated by bullets in the following table:

	Protection Modes			
Configuration	L-N	L-G	L-L	N-G
Wye	●	●	●	●
Delta	N/A	●	●	N/A
Single Split Phase	●	●	●	●
High Leg Delta	●	●	●	●

5. Nominal Discharge Current (I_n) – All SPDs applied to the distribution system shall have a 20kA I_n rating regardless of their SPD Type (includes Types 1 and 2) or operating voltage. SPDs having an I_n less than 20kA shall be rejected.
6. ANSI/UL 1449 3rd Edition Voltage Protection Rating (VPR) – The maximum ANSI/UL 1449 3rd Edition VPR for the device shall not exceed the following:

Modes	208Y/120	480Y/277	600Y/347
L-N; L-G; N-G	700	1200	1500
L-L	1200	2000	3000

C. SPD Design

1. Maintenance Free Design – The SPD shall be maintenance free and shall not require any user intervention throughout its life. SPDs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.
2. Balanced Suppression Platform – The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV. Designs incorporating replaceable SPD modules shall not be accepted.
3. Electrical Noise Filter – Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be up to 50 dB from 10 kHz to 100 MHz using the MIL-STD-220A insertion loss test method. Products unable able to meet this specification shall not be accepted.
4. Internal Connections – No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be soldered, hardwired with connections utilizing low impedance conductors.
5. Monitoring Diagnostics – Each SPD shall provide the following integral monitoring options:
   a. Protection Status Indicators - Each unit shall have a green / red solid-state indicator light that reports the status of the protection on each phase.

      i. For wye configured units, the indicator lights must report the status of all protection elements and circuitry in the L-N and L-G modes. Wye configured units shall also contain an additional green / red solid-state indicator light that reports the status of the protection elements and circuitry in the N-G mode. SPDs that indicate only the status of the L-N and L-G modes shall not be accepted.

      ii. For delta configured units, the indicator lights must report the status of all protection elements and circuitry in the L-G and L-L modes.

      iii. The absence of a green light and the presence of a red light shall indicate that damage has occurred on the respective phase or mode. All protection status indicators must indicate the actual status of the protection on each phase or mode. If power is removed from any one phase, the indicator lights must continue to indicate the status of the protection on all other phases and protection modes. Diagnostics packages that simply indicate whether power is present on a particular phase shall not be accepted.

   b. Remote Status Monitor – The SPD must include Form C dry contacts (one NO and one NC) for remote annunciation of its status. Both the NO and NC contacts shall change state under any fault condition.

c. Audible Alarm and Silence Button – The SPD shall contain an audible alarm that will be activated under any fault condition. There shall also be an audible alarm silence button used to silence the audible alarm after it has been activated.

d. ∃Surge Counter – The SPD shall be equipped with an LCD display that indicates to the user how many surges have occurred at the location. The surge counter shall trigger each time a surge event with a peak current magnitude of a minimum of 50 ± 20A occurs. A reset pushbutton shall also be standard, allowing the surge counter to be zeroed. The reset button shall contain a mechanism to prevent accidental resetting of the counter via a single, short-duration button press. In order to prevent accidental resetting, the surge counter reset button shall be depressed for a minimum of 2 seconds in order to clear the surge count total.

i. The ongoing surge count shall be stored in non-volatile memory. If power to the SPD is completely interrupted, the ongoing count indicated on the surge counter's display prior to the interruption shall be stored in non-volatile memory and displayed after power is restored. The surge counter's memory shall not require a backup battery in order to achieve this functionality.

6. Overcurrent Protection

a. The unit shall contain thermally protected MOVs. These thermally protected MOVs shall have a thermal protection element packaged together with the MOV in order to achieve overcurrent protection of the MOV. The thermal protection element shall disconnect the MOV(s) from the system in a fail-safe manner should a condition occur that would cause them to enter a thermal runaway condition.

7. Fully Integrated Component Design – All of the SPD's components and diagnostics shall be contained within one discrete assembly. SPDs or individual SPD modules that must be ganged together in order to achieve higher surge current ratings or other functionality shall not be accepted.

8. Safety Requirements

a. The SPD shall minimize potential arc flash hazards by containing no user serviceable / replaceable parts and shall be maintenance free. SPDs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.

b. SPDs designed to interface with the electrical assembly via conductors shall require no user contact with the inside of the unit. Such units shall have any required conductors be factory installed.

c. Sidemount SPDs shall be factory sealed in order to prevent access to the inside of the unit. Sidemount SPDs shall have factory installed phase, neutral, ground and remote status contact conductors factory installed and shall have a pigtail of conductors protruding outside of the enclosure for field installation.

2.3 SYSTEM APPLICATION

A. The SPD applications covered under this section include distribution and branch panel locations, busway, motor control centers (MCC), switchgear, and switchboard assemblies. All

SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C, B, and A environments.

B. Surge Current Capacity – The minimum surge current capacity the device is capable of withstanding shall be as shown in the following table:

Minimum surge current capacity based on ANSI / IEEE C62.41 location category			
Category	Application	Per Phase	Per Mode
C	Service Entrance Locations (Switchboards, Switchgear, MCC, Main Entrance)	250 kA	125 kA
B	High Exposure Roof Top Locations (Distribution Panelboards)	160 kA	80 kA
A	Branch Locations (Panelboards, MCCs, Busway)	120 kA	60 kA

C. SPD Type – all SPDs installed on the line side of the service entrance disconnect shall be Type 1 SPDs. All SPDs installed on the load side of the service entrance disconnect shall be Type 1 or Type 2 SPDs.

2.4 LIGHTING AND DISTRIBUTION PANELBOARD REQUIREMENTS

A. The SPD application covered under this section includes lighting and distribution panelboards. The SPD units shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category B environments.

1. The SPD shall not limit the use of through-feed lugs, sub-feed lugs, and sub-feed breaker options.
2. SPDs shall be installed immediately following the load side of the main breaker. SPDs installed in main lug only panelboards shall be installed immediately following the incoming main lugs.
3. The panelboard shall be capable of re-energizing upon removal of the SPD.
4. The SPD shall be interfaced to the panelboard via a direct bus bar connection. Alternately, an SPD connected to a 30A circuit breaker for disconnecting purposes may be installed using short lengths of conductors as long as the conductors originate integrally to the SPD. The SPD shall be located directly adjacent to the 30A circuit breaker.
5. The SPD shall be included and mounted within the panelboard by the manufacturer of the panelboard.
6. The SPD shall be of the same manufacturer as the panelboard.
7. The complete panelboard including the SPD shall be UL67 listed.

B. Sidemount Mounting Applications Installation (SPD mounted external to electrical assembly)
1. Lead length between the breaker and suppressor shall be kept as short as possible to ensure optimum performance. Any excess conductor length shall be trimmed in order to minimize let-through voltage. The installer shall comply with the manufacturer's recommended installation and wiring practices.

C. Switchgear, Switchboard, MCC and Busway Requirements

1. The SPD application covered under this section is for switchgear, switchboard, MCC, and busway locations. Service entrance located SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C environments.

2. The SPD shall be of the same manufacturer as the switchgear, switchboard, MCC, and busway
3. The SPD shall be factory installed inside the switchgear, switchboard, MCC, and/or bus plug at the assembly point by the original equipment manufacturer
4. Locate the SPD on the load side of the main disconnect device, as close as possible to the phase conductors and the ground/neutral bar.
5. The SPD shall be connected through a disconnect (30A circuit breaker). The disconnect shall be located in immediate proximity to the SPD. Connection shall be made via bus, conductors, or other connections originating in the SPD and shall be kept as short as possible.
6. The SPD shall be integral to switchgear, switchboard, MCC, and/or bus plug as a factory standardized design.
7. All monitoring and diagnostic features shall be visible from the front of the equipment.

2.5 ENCLOSURES

A. All enclosed equipment shall have NEMA 1 general purpose enclosures, unless otherwise noted. Provide enclosures suitable for locations as indicated on the drawings and as described below:

1. NEMA 1 – Constructed of a polymer (units integrated within electrical assemblies) or steel (sidemount units only), intended for indoor use to provide a degree of protection to personal access to hazardous parts and provide a degree of protection against the ingress of solid foreign objects (falling dirt).
2. NEMA 4 – Constructed of steel intended for either indoor or outdoor use to provide a degree of protection against access to hazardous parts; to provide a degree of protection of the equipment inside the enclosure against ingress of solid foreign objects (dirt and windblown dust); to provide a degree of protection with respect to the harmful effects on the equipment due to the ingress of water (rain, sleet, snow, splashing water, and hose directed water); and that will be undamaged by the external formation of ice on the enclosure. (sidemount units only)
3. NEMA 4X – Constructed of stainless steel providing the same level of protection as the NEMA 4 enclosure with the addition of corrosion protection. (sidemount units only)

PART 3 – EXECUTION

3.1 EXAMINATION

3.2 FACTORY TESTING

A. Standard factory tests shall be performed on the equipment under this section. All tests shall be in accordance with the latest version of NEMA and UL standards.

3.3 INSTALLATION

A. The Contractor shall install all equipment per the manufacturer’s recommendations and the contract drawings.

3.4 WARRANTY

A. The manufacturer shall provide a full ten (10) year warranty from the date of shipment against any SPD part failure when installed in compliance with manufacturer’s written instructions and any applicable national or local code.

END OF SECTION

SECTION 26 51 00 - LIGHTING

PART 1 – GENERAL

1.1 Provide all lighting fixtures (luminaires), lamps, end caps, connectors, fittings, structural support members, supports, brackets, etc., for a complete and operable lighting system.

1.2 Prior to submitting electrical equipment brochures for review and approval, coordinate with the General Contractor and verify that the fixtures are appropriate for the ceiling types in which they are shown to be installed. Also verify that ballast voltage on the submittals is appropriate for the electrical system on which the fixtures are to be installed (regardless of voltage listed in the part number in the Fixture Schedule). Submit with equipment brochures a certificate stating that these items of coordination have been completed.

PART 2 – PRODUCTS

2.1 LUMINAIRES

A. Luminaires are shown in the Luminaire Schedule on the drawings to establish a standard of quality. Manufacturer's names and model numbers shall not be interpreted as a proprietary specification. Notify the engineer at least two weeks prior to bid if an equivalent for a fixture listed in the schedule is not readily available,

B. Prior to submitting electrical equipment brochures for review and approval, coordinate with the General Contractor and verify that the fixtures are appropriate for the ceiling types in which they are shown to be installed. Also verify that ballast voltage on the submittals is appropriate for the electrical system on which the fixtures are to be installed (regardless of voltage listed in the part number in the Fixture Schedule). Submit with equipment brochures a certificate stating that these items of coordination have been completed.

2.2 LAMPS

A. Incandescent lamps shall be rated 125V and shall be of the appropriate size with the appropriate base configuration for installation in the fixture specified. Incandescent lamps shall be clear unless otherwise specified.

B. T8 fluorescent lamps shall be rapid-start with a Color Rendering Index (CRI) of 75 and a color temperature of 3500K.

C. T5 & T5HO fluorescent lamps shall be rapid-start with a Color Rendering Index (CRI) of 82 and a color temperature of 3500K.

D. HID Lamps shall be clear unless otherwise noted. They shall have a color temperature of 3500K. Coordinate base size with fixture socket prior to ordering lamps.

E. LED lamps shall be LM79 and LM80 tested.

2.3 BALLASTS

A. Fluorescent luminaires shall be furnished with energy-saving, high power factor (0.9 or greater), electronic ballasts. Ballasts shall operate lamps without noticeable flicker and shall operate within the IES recommended noise levels. Ballasts shall operate at a frequency no less than 20,000 Hz. Total harmonic distortion shall be less than 10%. Ballasts shall be able to withstand voltage transients in accordance with IEEE C62.41, Category A for normal and common modes. Ballasts shall be compatible with the lamps furnished. Furnish number and

size of ballasts as required to operate the number of lamps indicated with the control schemes shown.

B. Fluorescent ballasts for light fixtures controlled by occupancy sensors shall be programmed start ballasts with the lamps wired in parallel. Failure of one lamp shall leave the rest of the lamps illuminated.

C. Emergency Ballasts: Emergency Ballasts in fluorescent fixtures shall consist of an automatic power failure device, a test switch, and a pilot light that is visible from outside of the fixture. They shall contain a fully automatic solid state charger in a self-contained power pack. The fixture shall be factory wired in a manner that will allow the emergency lamps to be switched while still maintaining charging power to the battery. Wiring Diagrams shall be furnished with the fixture showing switching connections. The battery shall be of the sealed electrolyte type with the capacity to provide power to the lamps provided for a minimum of 90 minutes at a minimum output as indicated below:

Linear and U-Tube T-8 and T-12 Lamps	1100 Lumens
26W DTT	970 Lumens
26W TRT	450 Lumens
32W TRT	575 Lumens
42W TRT	1000 Lumens

The battery shall be able to operate unattended with no maintenance for a period of no less than five years. Emergency ballasts shall be fully compatible with solid state ballasts. Battery packs shall be mounted inside the fixture unless remotely mounted ballasts are shown on the drawings, or unless the fixture is of a type that does not have room for internally mounted battery packs.

D. HID ballasts shall be of the high power factor type (0.9 or greater).

E. Where quartz restrike fixtures are fed at voltages different than 120V, they shall be furnished with integral transformers and all equipment necessary to feed the quartz fixtures at 120V.

2.4 SUPPORTS

A. Provide all structural members necessary to support fixtures in locations shown on the contract drawings. Submit mounting and support details to the Architect or Engineer for approval with the project shop drawings. Notify the General Contractor prior to bid of any structural work that will be required to support the fixtures.

B. Provide hangers, cords, stems, etc., where required. Coordinate with the Architect or Engineer for proper stem lengths prior to ordering fixtures.

C. Recessed lay-in fixtures shall be supported at all four corners independent of the ceiling grid.

D. Provide clips for fixtures installed in lay-in ceilings. Clips shall be equal to Erico Caddy clips # 515 or #515A.

PART 3 – EXECUTION

3.1 Raceways for lighting systems in accessible ceilings shall be run to junction boxes mounted in locations that do not interfere with the ceiling installation, the luminaire installation, or other building systems. Provide final connections to fixtures using conductors in flexible conduit. Flexible conduit whips shall not exceed six feet in length.

3.2 All recessed fixtures shall be mounted with their trims flush against the ceiling.

3.3 Comply completely with all manufacturers' installation instructions.

3.4 Fixture lengths shall be measured and submitted to the manufacturer in accordance with the manufacturer's installation requirements. Fixtures shall be of exact lengths required for the application as determined during construction. Fixtures shall be installed to the Owner, Architect, and Engineer's satisfaction.

3.5 Fixtures shall be warranted for a period of one year after beneficial occupancy. Incandescent lamps shall be warranted for 90 days after beneficial occupancy. Fluorescent and HID lamps shall be warranted for 180 days after beneficial occupancy. LED lamps shall be warranted for a period of two years after beneficial occupancy.

END OF SECTION

SECTION 26 51 01 - MOTION DETECTORS

PART 1 GENERAL

1.1 Furnish and install a complete system of Motion Detectors as shown on the drawings and as specified herein. The drawings are provided to show the general scope of the work, and show the absolute minimum components required. Actual system components, quantities, and locations shall be determined by the motion detector vendor and provided to the Contractor with the installation shop drawings.

1.2 The Contractor and Sales Representatives are advised to take notice of specified component characteristics when attempting to select and propose substitutions. It is highly unlikely that substitutions on a one-for-one component basis will produce results that provide acceptable system performance.

1.3 Provide all power packs, hardware, software, devices, circuitry, and other components, material, and labor required to install, configure, and test the entire system to the satisfaction of the Architect, Owner, and Engineer.

1.4 Submit six sets of manufacturer's cut sheets describing completely all equipment, and six sets of shop drawings showing all circuitry including terminal-to-terminal connections. The shop drawings shall provide a complete schematic of all components used on this project with their interconnecting circuitry. General manufacturer's data sheets are not acceptable. Shop drawings shall be provided whether the contractor provides specified components or materials of other manufacturers.

PART 2 PRODUCTS

2.1 Motion detectors shall be furnished with the manufacture and model number shown on the drawings or an approved equal.

2.2 Power Packs: Power packs shall be of the same manufacturer as the motion detectors. Each shall be capable of controlling a 20 ampere circuit. They shall be rated for operation at the voltage of the system on which they will be used.

2.3 Circuitry: Provide control circuitry as required by the manufacturer for optimum system operation, but no less than the following: Control cables shall be 3-conductor #22 AWG copper with an overall jacket. Adjust conductor sizes as required to overcome unacceptable voltage drop.

PART 3 EXECUTION

3.1 Motion detectors shall be provided so that their coverage areas overlap and there are no dead zones in the rooms where persons may stand and not be detected.

3.2 All work shall be done by qualified system technicians.

3.3 Wiring, including control wiring, shall be in Raceways meeting Specification.

3.4 Guarantee workmanship and material for a period of one year after final acceptance. During the warranty period, repair or replace faulty equipment at no cost to the Owner for labor, material, or expenses.

3.5 Upon completion of job, test entire system. After testing, submit a certificate to the Architect stating

verification of the following:

A. All devices have been tested and are working properly.

PART 4 CLOSE-OUT DOCUMENTS

4.1 Provide the following documents to the Architect for delivery to the Owner at the time of substantial completion:

A. Written Guarantee

B. Two sets of data prepared by the manufacturer for each item of electrical equipment completely describing each piece of equipment. The data shall include parts lists, a description of operation, shop drawings, wiring diagrams, maintenance procedures, and other literature required for operation and maintenance of equipment.

4.2 Instruct the Owner on system operational procedures. Notify the Owner and Architect at least one week in advance of the training session. Provide written step-by-step instructional material.

4.3 Notify the General Contractor that you are to present during the Pre-final Inspection. During that inspection, demonstrate all system functionality and capabilities; remove cover plates and panels covers as required to show the quality of the installation. The Owner, Architect, and Engineer reserve the right to reject unsuitable workmanship or performance.

END OF SECTION

SECTION 27 05 13 - CABLE TELEVISION

PART 1 - GENERAL

1.01 SCOPE OF WORK:

A. Provide a complete and operable Cable Television System including, but not limited to, cabling, conduits, raceways, boxes, outlets, jacks, splitters, preamplifiers, amplifiers, and attenuators.

B. Comply completely with all Cable Company requirements. Include all costs associated with this compliance in bid. Notify Architect at least ten days prior to bid if Cable Company requirements differ from those described in the construction documents.

PART 2 - PRODUCTS

1. Cable for Distribution from Terminal Blocks to Outlet Jacks: Television cable shall be plenum-rated double-shielded RG6/U, #18 AWG bare copper with an aluminum polyester aluminum tape with 100% coverage and an aluminum braid with 45% coverage.

2. Jacks: Outlet boxes shall be flush mounted. Each shall be equipped with a cover plate containing a type F female connector.

3. Conduit shall be sized per the NEC for the number of cables provided, but no less than ¾" nominal trade size.

4. Conduit shall comply with the RACEWAYS specification.

5. Terminal Board: Provide a ¾" x 48" x 48" sheet of plywood, primed, and coated with two coats of enamel paint (consult architect for color and finish texture). Verify terminal board requirements with local cable company.

6. Terminal Blocks: Provide terminal blocks for termination of the Local Cable Television Cables at the New Terminal Board having the number of outlets required to serve the outlets provided in this contract plus 10% spare. Provide terminators as required on the spare outlets.

7. Amplifiers, Preamplifiers, and Attenuators: Provide amplifiers, preamplifiers, and attenuators as required for optimum system operation.

PART 3 - EXECUTION

3.01 CONDUIT ROUTING:

A. Interior conduits for the Cable Television System shall extend from the wall outlets and terminate with a bushing above the cable tray.

B. Provide a 4" PVC conduit from the Main Telephone Data Backboard to the right-of-way for the Cable Television Service. Use only long radius bends. Provide the conduit with a pull string. Coordinate with the cable company to have cable service provided to the building. Pay all costs associated with having the cable service connected.

3.02 CABLING:

Homerun one cable from each Type F jack in each outlet box to the nearest telephone data backboard. Terminate one cable on the terminal block, or amplifier, for Local Cable Television Service.

3.03 WORKMANSHIP & TESTING:

A. Provide a television set and test each outlet for a clear signal and proper operation. Demonstrate operation of the television set at each jack in the presence of the Architect. Provide a typewritten log listing each outlet jack and obtain the Architect's signature as evidence that you have demonstrated proper operation of the system.

B. All work shall be performed by competent technicians trained and experienced for at least two years in the installation of telephone equipment.

C. The Architect and/or Owner may reject work that performs unsatisfactorily or that is not installed to be aesthetically pleasing.

END OF SECTION

SECTION 27 30 00 - TELEPHONE AND DATA SYSTEMS

PART 1 – GENERAL

1.1 Provide complete telephone and data systems in accordance with this specification and the contract drawings. All systems shall be furnished and installed to meet or exceed EIA/TIA Category 6 Standards.

1.2 Prior to the submitting equipment brochures for review, the Electrical Contractor shall coordinate with the General Contractor to call for a coordination meeting with all special systems equipment vendors, the electrical engineer of record, and the Owner's Information Technology and Security Personnel. During this coordination meeting, all aspects of the Telecommunications Cabling System, the CCTV System, the Access Control System, the Intrusion Detection System, the Paging System, and the Intercom System shall be thoroughly reviewed and discussed to ensure that the systems that will be proposed will meet all of the Owner's needs.

1.3 All new wiring on this project shall conform to the EIA TIA 568A T568A or T568B scheme. **Verify with Owner's representative at the coordination meeting which termination configuration to use.**

1.4 Prior to ordering equipment, provide six sets of manufacturer's cut sheets to the Architect or Engineer for the equipment to be installed. Also submit shop drawings showing the floor plan with all wiring tag identification and conduit and cable routing. Do not order any equipment without receiving submittals and shop drawings that have been reviewed and approved by the Engineer.

1.5 Contractors furnishing and installing telephone and data system components shall be regularly involved in furnishing and installing systems of the type specified. They shall have installed five systems similar in size and scope within the past six months. The Telephone and Data System Contractor shall pull the cable as well as install all jacks and make all other system terminations.

PART 2 – PRODUCTS

2.1 Outlet Boxes: Provide outlet boxes in accordance with Specification 26 05 33.

2.2 Plaster Rings: Plaster rings shall be furnished to provide single-gang openings in outlet boxes unless otherwise noted.

2.3 Raceways: Provide raceways in accordance with Specification 26 05 33.

2.4 Jacks: Provide outlet boxes with a strap containing the number of Jacks indicated on the drawings. Outlet jacks shall be 8-position, 8-conductor, RJ-45 jacks that are multivendor supportive accepting most phone and data plugs. Jacks shall have gold-plated (50 microinches minimum) contacts with 110 connections on the back. The jacks shall snap in the straps. The straps shall be colored to match the switches and receptacle color selected by the Architect. The straps shall be covered by a stainless steel wallplate identical to those of the receptacles and switches. Telephone outlet jacks shall be yellow; data jacks shall be blue.

2.5 Cable: All cable shall be Category 6 rated and shall conform to or exceed the EIA/TIA 578 Commercial Building Wiring Standard, Horizontal Cable Section and the EIA/TIA Technical Systems Bulletin 36 for Unshielded Twisted Pair Cables. Other standards supported shall include IEEE 802.3, Ibase5, 10BASE-T; IEEE 802.5, 4 Mbps, 16 Mbps (328 ft/100m), 104 Workstations, proposed ANSI X3T9.5 TP-PMD requirements for UTP at 100 Mbps, and 155 MB ATM. Cabling

shall be UL listed. Telephone cables shall be yellow; data cables shall be blue. All Cable shall be plenum rated.

2.6 Telephone and Data Backboard (TDBB): Wall mount a ¾" x 4' x 4' sheet of fire retardant plywood, primed and painted with two coats of fire retardant paint of the color and finish selected by the Architect. Do not paint over the fire retardant stamp. Provide a ¼" x 4" x 17.75" copper ground block (Erico Eritech TMGB-A18L23PT or approved equal) on the wall, bond a #2 AWG copper conductor to the ground block with a two hole compression lug and run the #2 AWG ground wire to the electrical power system ground. Bond the #2 AWG ground wire to the power system electrode using an exothermic weld.

2.7 Punchdown Blocks: Telephone cables shall terminate at the Telephone & Data Backboard on Punchdown Blocks. Telephone Cabling shall be terminated on 110 punchdown blocks maintaining the Category 6 rating. Furnish punchdown blocks for all telephone outlets in this contract plus 25% additional outlets.

2.8 Patch Panels: Data Cables shall terminate at the Telephone & Data Backboard in patch panels. Provide a patch panel (or panels) at each TDBB to accommodate all cabling plus 15% spare capacity. Provide crossconnecting cables as required to interconnect the patch panels providing the Owner a single connection point for a connection to a server.

2.9 Racks: Provide a freestanding, minimum 78" tall, 19" rack for mounting of the patch panels. The rack shall be mounted on the floor in front of the TDBB.

PART 3 – EXECUTION

3.1 Provide a 1" conduit extending from each outlet box to a point above equipment rack. Terminate the conduit with a protective bushing.

3.2 Route conductors from the outlet box to the patch panels through the conduits.

3.3 Provide a minimum of two data cables to each data outlet or combination telephone/data outlet. Provide one cable to each telephone outlet.

3.4 Mount plywood backboard securely to wall framing members. The bottom of the backboard shall be 6" above the finished floor.

3.5 Provide a #2 copper ground wire in 1" PVC conduit from the Telephone and Data Backboard to the Building Power System Ground.

3.6 Service Conduits: Provide two 4" PVC conduits with long radius elbows from the Telephone and Data Backboard to a point 5' outside of the building. These conduits shall be for future use by the Owner. Conduits bends shall contain radii that are no less than 10 times the conduit diameter. Furnish conduits with pullstrings. Stub conduits up 4" above the floor at the Telephone and Data Backboard and cover with plastic caps. Do not glue the caps on the conduits. Seal conduits below grade to prohibit the entrance, of dirt, water, and gases. Service conduits shall be buried 24" to 36" below grade. Mark the end of the conduits by placing a vertical stick of conduit from the end of the conduit vertically to a point at least 12" above grade. Provide physical protection as well as warning tape attached to stakes around the marker.

Equip all spare conduits with a pullwire or string capable of withstanding 500 pounds of pulling tension.

3.7 Uniquely identify and label all cables at each end using EIA/TIA Standards. Provide engraved or professionally stenciled label markings on the faceplate beside each jack.

3.8 Test each cable for opens, shorts, correct pairs, crossed wiring, and proper termination using a CT200 tester from Atcom Services, Inc. or approved equal. Replace any cable that is unable to pass the tests. Provide a written log of the test results of each cable to the Engineer at the prefinal inspection. Demonstrate testing of any cables selected by the Engineer.

END OF SECTION

SECTION 27 51 13 - PAGING SYSTEM

PART 1 – GENERAL

1.1 Provide a complete and operable Paging System as shown on the drawings and as specified herein. The drawings and this specification are provided to convey the intent of the complete system and do not indicate every cable or component necessary for the complete system that the Contractor shall provide. This specification requires the furnishing vendor to appropriately size the amplifier for the speakers to be provided.

1.2 Prior to the submitting equipment brochures for review, the Electrical Contractor shall coordinate with the General Contractor to call for a coordination meeting with all special systems equipment vendors, the electrical engineer of record, and the Owner's Information Technology and Security Personnel. During this coordination meeting, all aspects of the Telecommunications Cabling System, the CCTV System, the Access Control System, the Intrusion Detection System, the Paging System, and the Intercom System shall be thoroughly reviewed and discussed to ensure that the systems that will be proposed will meet all of the Owner's needs.

1.3 The Paging System shall consist of all components necessary to provide paging through the Owner's telephone system. Minimum system components shall include speakers, circuitry, an amplifier, and a telephone interface module. Provide all additional equipment, material, circuitry, labor, etc. for a complete and operable Paging System.

1.4 Provide all support hardware including additional steel framing, enclosures, hardware, electronics, cables, terminations, and all other components, material, and labor required to install, configure, and test the entire system to the satisfaction of the Architect, Owner, and Engineer. Notify the Electrical Contractor furnishing the power equipment, circuitry, and devices required for the intercom equipment prior to bid. The Electrical Contractor shall include all costs for powering the intercom equipment in the bid.

1.5 The specification provided is intended to establish a standard of quality – not to limit competition. Equivalent systems of other manufacturers will be acceptable. Gain approval of other manufacturers at least 10 days prior to bid. Acceptance of the manufacturer does not ensure that the actual components submitted after bid will be considered equivalent.

1.6 Submit six sets of manufacturer's cut sheets describing completely all equipment, and six sets of shop drawings showing all circuitry including terminal-to-terminal connections. The shop drawings shall provide a complete schematic of all components used on this project with their interconnecting circuitry. General manufacturer's data sheets are not acceptable.

1.02 SUBMITTALS:

Submit six sets of the following documents to the Architect for the Engineer's review and approval prior to ordering any equipment:

A. Technical specification sheets on each equipment item.
B. Complete wiring diagram indicating wire and cable numbers, terminal strip designations, and equipment model numbers.
C. Equipment mounting elevations.
D. Single line diagram.
E. Floor plans showing all equipment locations and conduit routing.
F. Amplifier Sizing Calculations

1.03 QUALIFICATIONS:

A. The Contractor furnishing and installing the system shall be a licensed distributor for the

system being installed. The Contractor shall regularly provide systems of the size, scope, and quality specified.

B. The Contractor shall have completed five projects in the last 2 years of the same complexity and dollar value.

C. The Contractor shall employ qualified electronic technicians, trained in the installation, setup, and repair of systems of the type specified.

PART 2 - PRODUCTS

2.01 All equipment shall be new, U.L. listed equipment.

2.02 Ceiling-Mounted Speakers shall be 8 inch, 6 oz., flush ceiling mount speakers with 70V impedance-matching transformers and integral volume control. Speakers shall be Bogen S86T725-BRV-CG8AW or approved equal. Furnish speakers complete with backboxes, T-grid ceiling supports where required, and aluminum baffle finished with semi-gloss white enamel. Provide appropriate mounting hardware for ceiling into which the individual speakers will be installed.

2.03 Horn Type Speakers shall be weatherproof, 15 watt horn type speakers with a 70V transformer. Horn Type Speakers shall be Bogen SPT-15A or approved equal.

2.04 Amplifier: Bogen TPU15A, TPU35B, TPU60B, TPU100B, TPU250, or approved equal. Size the amplifier for system speakers provided assuming that all are set at their highest tap. Provide attenuators as required to protect speakers from excess power.

2.05 Provide an appropriate telephone interface module at the telephone and data backboard to allow all-call pages to be made via the Owner’s telephone system.

2.06 Mounting Bracket: Mount the amplifier on the telephone and data backboard with a metallic mounting bracket manufactured for the purpose.

2.07 Terminal Blocks: All conductors in cabinets, on equipment racks, etc. shall be terminated on Siemens 66M1-50 punch blocks or approved equal.

2.08 Speaker Cabling: All speaker cabling shall be stranded, twisted, shielded pairs with PVC jacket and a tinned copper drain wire. The shield shall be an aluminum polyester foil providing 100% coverage. The conductors shall be sized as required for system to function appropriately, but shall not be less than #22 AWG.

2.09 Conduit shall be provided per Specification Section 26 05 33, sized per the NEC, but no less than 3/4" nominal trade size.

PART 3 - EXECUTION

3.01 All wiring shall be installed in conduit. Conduit shall be run concealed in office areas.

3.02 Install all components per the manufacturer’s specifications and instructions.

3.03 Furnish terminal strips, punch blocks, and connectors for all interconnections.

3.04 Identify all normally operated controls and electronic devices with an engraved plastic nameplate.

3.05 Installation Testing: Set taps and adjust speakers for Architect’s approval. Demonstrate all features of system. Submit a signed Certificate at the end of system testing certifying that all

equipment has been installed in accordance with the manufacturer's requirements and the system is operating properly.

3.06 Guarantee workmanship and/or material executed under this division for one (1) year after final acceptance. During the warranty period, the Owner shall receive repairs and replacement of faulty equipment at no cost for labor, material, or expenses. A repair technician shall respond to Owner calls by arriving at the school within twenty-four hours of any repair request.

3.07 Coordinate work with other trades. Notify the electrical power system contractor of all power requirements for your equipment prior to bid. Include all labor, installation, and equipment costs for additional power system components not shown on the contract drawings, but required by your equipment in your bid. Notify the Engineer of any conflicts at least ten days prior to bid.

3.08 Install work in accordance with the General Contractor's schedule.

Part 4 – CLOSE-OUT DOCUMENTS

4.01 Provide the following documents to the Architect for delivery to the Owner at time of substantial completion:

A. Written guarantee.

B. Two (2) sets of data prepared by the manufacturer for each item of electrical equipment completely describing each piece of equipment. The data shall include parts lists, description of operation, shop drawings, wiring diagrams, maintenance procedures and other literature required for maintenance of equipment. The data shall reflect as-built conditions.

4.02 Instruct the Owner on system operational procedures. Notify the Owner and Architect at least one week in advance of the training session. Provide written instructional material.

4.03 Notify the General Contractor that you are to be present during the system pre-final inspection. During that inspection, demonstrate all system functionality and capabilities; remove cover plates and panels as required to show the quality of the installation. The system shall demonstrate proper operation and operate without any audible hum, distortion, or erroneous noises. The Owner, Architect, and Engineer reserve the right to reject unsuitable workmanship or performance.

END OF SECTION

SECTION 27 51 23 - INTERCOM SYSTEM

PART 1 - GENERAL

1.1 Provide a complete and operable Intercom System as shown on the drawings and as specified herein. The drawings and this specification are provided to convey the intent of the complete system and do not indicate every cable or component necessary for the complete system that the Contractor shall provide.

1.2 Prior to the submitting equipment brochures for review, the Electrical Contractor shall coordinate with the General Contractor to call for a coordination meeting with all special systems equipment vendors, the electrical engineer of record, and the Owner's Information Technology and Security Personnel. During this coordination meeting, all aspects of the Telecommunications Cabling System, the CCTV System, the Access Control System, the Intrusion Detection System, the Paging System, and the Intercom System shall be thoroughly reviewed and discussed to ensure that the systems that will be proposed will meet all of the Owner's needs.

1.3 The specification provided is intended to establish a standard of quality – not to limit competition. Equivalent systems of other manufacturers will be acceptable. Gain approval of other manufacturers at least 10 days prior to bid. Acceptance of the manufacturer does not ensure that the actual components submitted after bid will be considered equivalent.

1.4 Provide all support hardware including additional steel framing, enclosures, hardware, electronics, cables, terminations, and all other components, material, and labor required to install, configure, and test the entire system to the satisfaction of the Architect, Owner, and Engineer. Notify the Electrical Contractor furnishing the power equipment, circuitry, and devices required for the intercom equipment prior to bid. The Electrical Contractor shall include all costs for powering the intercom equipment in the bid.

1.5 Submit six sets of manufacturer's cut sheets describing completely all equipment, and six sets of shop drawings showing all circuitry including terminal-to-terminal connections. The shop drawings shall provide a complete schematic of all components used on this project with their interconnecting circuitry. General manufacturer's data sheets are not acceptable.

PART 2 – PRODUCTS

2.1 Intercom Master Stations: The Intercom System shall be of the open voice selective call type. It shall mount semi-flush and be equipped with door answering, room monitoring, and privacy capabilities. The unit shall be able to place a call to every station in the system. Master Stations shall be able to place calls to Sub-stations and receive calls from the Sub-Stations. Master Units shall sound an audible tone and be equipped with an LED that illuminates upon being called from a Sub-Station or Master. Master Stations shall be Aiphone LEF-10 or approved equal.

2.2 Intercom Sub-Stations: Intercom-Sub Stations shall be surface mounted and weatherproof. They shall be compatible with the Master Stations. Sub-stations shall be equipped with a button that requests communication with the master station. They shall be Aiphone LE-D or approved equal.

2.3 Intercom Power Supply: The power supply shall be capable of supporting Two Master stations and up to three door stations. The unit shall be an Aiphone PC-12C or approved equal.

2.4 Cable: All cables shall be plenum-rated. Verify the following cabling requirements with the vendor prior to bid.:

(1) Cable for the Intercom Power Supply shall be 3-conductor 22 gauge.

(2) Cable for Master Station to Master Station shall be 10-conductor 20 gauge.
(3) Cable from the first Master Station to the Power Supply shall be 3-conductor, 20 gauge.

PART 3 - EXECUTION

3.1 All Intercom System cabling shall be installed in raceways meeting the requirements of Specification 26 05 33 RACEWAYS.

3.2 Each cable passing from outside to inside the building shall be equipped with surge protectors at each end meeting the requirements of the TRANSIENT VOLTAGE SURGE SUPPRESSORS (TVSSs) FOR COMMUNICATIONS AND AUXILIARY SYSTEMS Specification.

3.3 Provide fuses sized per manufacturers' instructions for all system components.

3.4 Test the entire system to ensure that it is completely operable prior to the pre-final inspection. Notify the General Contractor that you are to be present at the pre-final inspection.

3.5 Provide two hours of instruction to the Owner on operation and use of the system.

3.6 Provide a one-year warranty for the system and all components. The warranty shall begin at the date of final acceptance of the building. During the warranty period, the system shall be repaired or replaced as necessary at no cost to the Owner. During the warranty period, a technician shall be on the job site within twenty-four hours of a problem report from the Owner.

END OF SECTION

SECTION 28 20 00 - INTRUSION DETECTION SYSTEM

PART 1 - GENERAL

1.1 Furnish and install a complete and operable Security System as shown on the drawings and as specified herein.

1.2 Prior to the submitting equipment brochures for review, the Electrical Contractor shall coordinate with the General Contractor to call for a coordination meeting with all special systems equipment vendors, the electrical engineer of record, and the Owner's Information Technology and Security Personnel. During this coordination meeting, all aspects of the Telecommunications Cabling System, the CCTV System, the Access Control System, the Intrusion Detection System, the Paging System, and the Intercom System shall be thoroughly reviewed and discussed to ensure that the systems that will be proposed will meet all of the Owner's needs.

1.3 Provide all enclosure, hardware, software, devices, circuitry, and other components, material, and labor required to install, configure, and test the entire system to the satisfaction of the Architect and Engineer.

1.4 Submit six sets of manufacturer's cut sheets describing completely all equipment, and six sets of shop drawings showing all circuitry including terminal-to-terminal connections. The shop drawings shall provide a complete schematic of all components used on this project with their interconnecting circuitry. General manufacturer's data sheets are not acceptable.

PART 2 - PRODUCTS

2.1 Security System Controller: The Security System Controller shall support up to 9 hardwired zones with a total of 64 zones. It shall support addressable motion detectors and door switches. The controller shall support up to 8 relays or X-10 devices. It shall be connected to the building telephone system and send coded signals to the monitoring agency of the Owner's preference. Pay the monitoring fee from the testing of the system until the General Contractor is granted the Letter of Substantial Completion. The Security System Controller shall be an ADEMCO VISTA-40 or approved equal. **The Security System Controller in the Historic Hospital Building shall operate as a slave to the system in the Police Administration Building.**

2.2 Keypads: Keypads shall have a backlit display that displays system events. They shall make audible "beeps" for entry/exit delays, system status and other alarm conditions. Keypads shall be ADEMCO 6139 or approved equal.

2.3 Motion Detectors: Motion Detectors shall have a 50' x 50', 90 degree coverage and shall detect using passive infrared technology. They shall have both dip switch and serial number addressing. They shall have both horizontal and vertical patterning adjustment. Motion Detectors shall be ADEMCO 998MX or approved equal.

2.4 Glass Break Detectors: Glass Break Detectors shall detect using a dual technology audio and shock glass break detector with a 25' range from the glass. Glass Break Detectors shall be ADEMCO 2500 or equal.

2.5 Door Switches: Door Switches shall be addressable, magnetic contact, recessed type. Door Switches shall be ADEMCO 4191SN or equal.

2.6 Sirens: Sirens mounted indoors shall have an output of 95 Db at 10'. They shall be ADEMCO 747 or approved equal. Sirens mounted in damp locations, such as on the Ground Floor, shall produce 117 dB at 10'. They shall be ADEMCO 702 or approved equal.

2.7 Circuitry: Provide circuitry and cabling as required for optimum system operation, but meeting no less than the following specifications:
(1) Cable for Keypads, Motion Detectors, and Glass Break Detectors shall be 4-conductor, 22 gauge with PVC jacket.
(2) Cable for Door Switches shall be 2-conductor, 20 gauge with PVC jacket.

PART 3 - EXECUTION

3.1 All work shall be done by qualified system technicians.

3.2 Wiring shall be in Raceways meeting Specification 26 05 33.

3.3 Connect to telephone system for complete dialing capability. Employ Owner's designated monitoring agency to monitor system. Consult Owner prior to configuring system.

3.4 Guarantee workmanship and material for a period of one year after final acceptance. During the warranty period, repair or replace faulty equipment at no cost to the Owner for labor, material, or expenses.

3.5 Upon completion of job, test entire system. After testing submit a certificate to Architect stating verification of the following:

PART 4 – CLOSE-OUT DOCUMENTS

4.1 Provide the following documents to the Architect for delivery to the Owner at the time of substantial completion:

A. Written Guarantee
B. Two sets of data prepared by the manufacturer for each item of electrical equipment completely describing each piece of equipment. The data shall include parts lists, a description of operation, shop drawings, wiring diagrams, maintenance procedures, and other literature required for operation and maintenance of equipment.

4.2 Instruct the Owner on system operational procedures. Notify the Owner and Architect at least one week in advance of the training session. Provide written step-by-step instructional material.

4.3 Notify the General Contractor that you are to present during the Pre-final Inspection. During that inspection, demonstrate all system functionality and capabilities; remove cover plates and panels covers as required to show the quality of the installation. The Owner, Architect, and Engineer reserve the right to reject unsuitable workmanship or performance.

END OF SECTION

SECTION 28 23 23 - CLOSED CIRCUIT TELEVISION (CCTV) SYSTEM

PART 1 – GENERAL

A. Provide a complete and operable IP Based Closed Circuit Television System as shown on the drawings and as specified herein. The drawings and this specification are provided to convey the intent of the complete system and do not indicate every cable or component necessary for the complete system that the Contractor shall provide.

B. Prior to the submitting equipment brochures for review, the Electrical Contractor shall coordinate with the General Contractor to call for a coordination meeting with all special systems equipment vendors, the electrical engineer of record, and the Owner's Information Technology and Security Personnel. During this coordination meeting, all aspects of the Telecommunications Cabling System, the CCTV System, the Access Control System, the Intrusion Detection System, the Paging System, and the Intercom System shall be thoroughly reviewed and discussed to ensure that the systems that will be proposed will meet all of the Owner's needs.

C. Provide all support hardware including additional steel framing, enclosures, hardware, electronics, cables, terminations, and all other components, material, and labor required to install, configure, and test the entire system to the satisfaction of the Architect, Owner, and Engineer. Notify the Electrical Contractor furnishing the power equipment, circuitry, and devices required for the CCTV equipment prior to bid. The Electrical Contractor shall include all costs for powering the CCTV equipment in the bid.

D. Submit six sets of manufacturer's cut sheets describing completely all equipment, and six sets of shop drawings showing all circuitry including terminal-to-terminal connections. The shop drawings shall provide a complete schematic of all components used on this project with their interconnecting circuitry. General manufacturer's data sheets are not acceptable.

E. Prior to submitting equipment brochures for approval, the successful Electronic Systems Contractor shall completely review the design to ensure that the lens selection is optimum for each application, that all mounting brackets are appropriate for the wall or ceiling on which they will be mounted, and that all cabling is adequate to overcome any voltage drop problems or distance limitations that may occur.

F. The POE switches, Network Attached Storage, and all camera-related networking devices shall be completely operational on a standalone network that is accessible by the Owner's network. Provide the necessary connections to interface the camera network to the Owner-supplied equipment.

G. All components required for the following basic system operation shall be furnished in the quantities required to completely implement the desired mode of operation. Additional components shall be supplied by the Contractor as required to fully implement the system described. All system components shall record and display high definition color images.

    1) A 19 inch monitor connected to the Data Storage System shall be located in the main Telephone Equipment Room in the Police Administration Building. It shall be capable of viewing all images.

    2) **Future Fire Admin: In the future (not in this contract),** two computer systems shall be furnished, installed, and configured for viewing CCTV images. One computer shall be installed at the Reception Desk in Room 116 and at the desk in Office 204.

3) Police Administration and Historic Hospital Building: Four computer systems shall be furnished, installed, and configured for viewing CCTV images. One computer shall be installed at Security A103. The other three computer systems shall be installed in locations specified by the Owner.

4) There shall be no annual charges for any equipment or software licenses for equipment and software furnished on this project. Remote viewing software shall be entirely free of charge.

PART 2 – PRODUCTS

2.1 Video Management Software

The Video Management Software shall be provided with the system free of charge, with no hidden license or update fees. It shall be a MicroSoft Windows based software.

2.2 Cameras

A. Type A Cameras: Type A cameras shall be Mobotix MX-D15Di-Sec-DNight-FIX-D25N25 or approved equal. Provide with corner wall mount MX-MH-Dome where shown wall mounted.

B. Type AW Cameras: Type A cameras shall be Mobotix MX-D15Di-Sec-DNight-FIX-D25N25 or approved equal. Provide with wall mount MX-WH-Dome where shown wall mounted.

C. Type B Cameras: Type B cameras shall be Mobotix MX-Q24M-Sec-D11 or approved equal.

D. Type C Cameras: Type C cameras shall be Mobotix MX-M24M-Sec-N22 or approved equal. Provide with pole mount MX-MH-SecureFlex-ESWS where shown pole mounted.

E. Type D Cameras: Type D cameras shall be Mobotix 6MP-P25 with B041 Super Wide lense.

F. Type V Cameras: Type V cameras shall be Mobotix V15M-Sec-DNight-D22N22-6MP-F1.8 in Detention-Grade Vandal Resistant housings.

2.3 POE Switches: The camera POE switches shall be HP ProCurve Switch 2510 Series or approved equal. A POE switch shall be mounted in the Telecommunications Equipment Rack in the Telephone Equipment Room.

2.4 Data Storage System: Provide a complete system of equipment for data storage and viewing for all camera images. All images shall be recorded continuously. Provide the network attached storage (NAS), transmitters, receivers, cabling, software, installation and all other equipment required for a complete and operable system. The NAS shall be a QNAP TS-469U-SP with 6 TB of hard drive storage included or approved equal.

2.5 Equipment Mounting: Mount the equipment in the Telecommunications Equipment Rack furnished under Section 27 30 00. The NAS and switches in the Telephone Equipment Room shall be mounted in the rack.

2.6 Computer Systems: The computer systems shall meet the following specifications:

A. Central Processing Unit (CPU): The personal computer system CPU shall be dual core @ 2.4 GHz (Core Duo Intel processor or equivalent AMD). The system shall have at least 4 gigabytes of RAM and be equipped with at least a 250 gigabyte hard drive. The unit shall be furnished with a CD-RW drive and a DVD-RW drive. The CPU shall be equipped with at least two communications ports along with all other necessary hardware and software to support all components of the system. The system shall have a parallel port, a serial port, no less than three USB ports, and a 10/100/1000 Mbps (Gigabit) Ethernet port. The system shall have a graphics card with 512 megabytes video memory or higher and DVI/HDMI ports compatible with the provided monitor. The CPU, monitor, keyboard, and entire system shall be manufactured by Hewlett Packard, Dell, Toshiba, or Sony.

B. Monitor: The monitor shall be at least a 21" Flat Screen.

C. Keyboard: The keyboard shall be a standard QWERTY keyboard with numeric keypad on the right side.

D. Mouse: The mouse shall be a Microsoft or Logitech three-button mouse. Track balls will not be accepted.

E. Software: The computer shall be furnished with the vendor's latest Windows-based software installed.

2.7 Monitor: The 19" multiplex monitor connected to the DAS shall be Pelco PMCL419HB or approved equal.

2.8 Circuitry: Provide all circuitry necessary for optimum performance of system components. Minimum requirements are provided as follows. Increase conductor sizes and modify cable types as required to compensate for voltage drop or other system or site conditions.

A. Video Signal Cable: All CCTV video cabling shall be Category 6 rated UTP, outdoor-rated cable installed in conduit.

B. Fiber Optic Cabling: Cameras at distances exceeding the limitations of Category 6 cable shall be fed with four strand, single mode fiber optic cable. Media converters shall be provided at the nearest POE switch and at the camera. Coordinate remote camera locations with the Electrical Contractor to ensure that he provides 120V power in those locations.

C. Power Cable: Coordinate remote camera locations with the Electrical Contractor to ensure that he provides 120V power in the locations where fiber optic to POE media converters are provided. Power cable shall be #12 AWG unshielded cable with PVC jacket. It shall be West Penn #227 or approved equal. Increase conductor sizes as required to accommodate voltage drop. The Owner shall not be responsible for additional 120V power as required to accommodate additional media converters.

PART 3 – EXECUTION

3.1 All CCTV cabling shall be installed in raceways meeting the requirements of the RACEWAYS specification.

3.2 Surge Protective Devices shall be installed on all cables where they leave and where they enter any building.

3.3 Test the entire system to ensure that it is completely operable prior to the pre-final inspection. Notify the General Contractor that you are to be present at the pre-final inspection.

3.4 Schedule a training session with the Owner through the General Contractor at the Owner's convenience. The training session shall be scheduled to occur after the Owner's switches have been installed and the Owner's computer network has been made operable. The installation and configuration of remote viewing of CCTV images shall be demonstrated with the completed CCTV system provided in this contract. Begin scheduling this training at least one month prior to substantial completion. Provide four hours of instruction to the Owner on operation and use of the system. Video the training session and provide a DVD of the training session to the Owner with the close-out documents. The training session shall not be conducted until all system components have been tested and verified to be operating properly.

3.5 Provide a one-year warranty for the system and all components and a five-year warranty on all fixed cameras. The warranty shall begin at the date of final acceptance of the building. During the warranty period, the system shall be repaired or replaced as necessary at no cost to the Owner. During the warranty period, a technician shall be on the job site within twenty-four hours of a problem report from the Owner.

END OF SECTION

SECTION 28 30 00 - ACCESS CONTROL SYSTEM

PART 1 - GENERAL

1.1 Provide a complete and operable Door Locking Control System as shown on the drawings and as specified herein. The drawings and this specification are provided to convey the intent of the complete system and do not indicate every cable or component necessary for the complete system that the Contractor shall provide.

1.2 Prior to the submitting equipment brochures for review, the Electrical Contractor shall coordinate with the General Contractor to call for a coordination meeting with all special systems equipment vendors, the electrical engineer of record, and the Owner's Information Technology and Security Personnel. During this coordination meeting, all aspects of the Telecommunications Cabling System, the CCTV System, the Access Control System, the Intrusion Detection System, the Paging System, and the Intercom System shall be thoroughly reviewed and discussed to ensure that the systems that will be proposed will meet all of the Owner's needs.

1.3 The specification provided is intended to establish a standard of quality – not to limit competition. Equivalent systems of other manufacturers will be acceptable.

1.4 Provide all support hardware including additional steel framing, enclosures, hardware, electronics, cables, terminations, and all other components, material, and labor required to install, configure, and test the entire system to the satisfaction of the Owner and Engineer. Notify the Electrical Contractor furnishing the power equipment, circuitry, and devices required for the Door Locking Control System equipment prior to bid. The Electrical Contractor shall include all costs for powering the Door Locking Control System equipment in the bid.

1.5 Submit six sets of manufacturer's cut sheets describing completely all equipment, and six sets of shop drawings showing all circuitry including terminal-to-terminal connections. The shop drawings shall provide a complete schematic of all components used on this project with their interconnecting circuitry. General manufacturer's data sheets are not acceptable.

PART 2 – PRODUCTS

2.1 Card Reader Controller: The controller shall be capable of controlling access to the doors shown on the drawings plus at least four more.

2.2 Personal Computer System: Provide a complete personal computer system with all hardware and software as required to program the proximity cards as well as to program and operate the locking control system. Provide all cables necessary for complete operation of the computer and peripherals. Minimum requirements for system components are provided as follows:

A. Central Processing Unit (CPU): The personal computer system CPU shall be dual core @ 2.4 GHz (Core Duo Intel processor or equivalent AMD). The system shall have at least 4 gigabytes of RAM and be equipped with at least a 250 gigabyte hard drive. The unit shall be furnished with a CD-RW drive and a DVD-RW drive. The CPU shall be equipped with at least two communications ports along with all other necessary hardware and software to support all components of the system. The system shall have a parallel port, a serial port, no less than three USB ports, and a 10/100/1000 Mbps (Gigabit) Ethernet port. The system shall have a graphics card with 512 megabytes video memory or higher and DVI/HDMI ports compatible with the provided monitor. The CPU, monitor, keyboard, and entire system shall be manufactured by Hewlett Packard, Dell, Toshiba, or Sony.

B. Monitor: The monitor shall be at least a 21" Flat Screen.

C. Keyboard: The keyboard shall be a standard QWERTY keyboard with numeric keypad on the

right side.

D. Mouse: The mouse shall be a Microsoft or Logitech three-button mouse. Track balls will not be accepted.

E. Software: The computer shall be furnished with the vendor's latest Windows-based software installed.

2.3 Power Supplies: The Power Supplies shall provide power to the Card Access Control Panel and the door locks and shall be provided with batteries for up to 24 hour operation in the event of a power outage.

2.4 Card Readers: Card readers shall be proximity type readers. They shall be suitable for indoor and outdoor use.

2.5 Biometric Readers: Biometric readers shall be a fingerprint type reader.

2.6 Cards: Furnish 200 proximity photoID cards for the Owner's use.

2.7 Provide camera and all equipment necessary for producing and installing color photographs on the cards. Provide supplies for 200 proximity cards.

2.8 Magnetic Locks: The magnetic door locks shall be rated for 1500 pounds holding force. Provide all brackets necessary for mounting on doors where magnetic locks are shown. Provide strikes on doors as required.

2.9 Motion Detectors: Provide passive infrared (PIR) motion detectors as required per NFPA 101.

2.10 Exit Pushbuttons with Timers: Each exit pushbutton shall be provided in a stainless steel wallplate on a flush-mounted single gang outlet box. They shall be of the double-pole, double-throw type and configurable with momentary or latching contact status. They shall operate within a temperature range of 32 degrees F to 158 degrees F.

2.11 Suppressor Kits: Provide two suppressor kits for each relay output. Install one suppressor kit at the Card Access Control Panel and one suppressor kit at the magnetic door lock.

2.12 Circuitry: Provide circuitry as required for optimum system performance, but meeting the following minimum requirements.

PART 3 - EXECUTION

3.1 All Door Lock Control System cabling shall be installed in raceways meeting the requirements of Specification 26 05 33 RACEWAYS.

3.2 Each cable passing from outside to inside the building shall be equipped with surge protectors at each end meeting the requirements of the manufacturer's specifications.

3.3 Provide fuses sized per manufacturers' instructions for all system components.

3.4 Test the entire system to ensure that it is completely operable prior to the pre-final inspection. Notify the General Contractor that you are to be present at the pre-final inspection.

3.5 Provide eight hours of instruction to the Owner on operation, maintenance, and modification of the system.

3.6 Provide a one-year warranty for the system and all components. The warranty shall begin at the

date of final acceptance of the building. During the warranty period, the system shall be repaired or replaced as necessary at no cost to the Owner. During the warranty period, a technician shall be on the job site within twenty-four hours of a problem report from the Owner.

END OF SECTION

SECTION 28 31 00 - FIRE ALARM SYSTEM

PART 1 – GENERAL

1.1 GENERAL

A. Furnish and install a complete and operable fire alarm system in accordance with the Contract drawings and all federal, state, and local codes. Equipment on the drawings represents the absolute minimum required for the project. Include costs for all other required devices and equipment required for a complete and operable code compliant system. Notify the engineer in writing of any devices required by code, but not shown, at least ten days prior to bid.

B. Comply completely with the latest edition of all applicable federal, state, and local codes including, but not limited to the following:

1) National Electrical Code (NFPA 70)
2) Life Safety Code (NFPA 101)
3) National Fire Alarm Code (NFPA 72)
4) The International Building Code
5) ANSI/ASME A17.1, Safety Code for Elevators and Escalators

1.2 SCOPE OF WORK

A. Provide all enclosures, hardware, software, devices, and all other components, material, and labor required to install, configure, and test the entire system to the satisfaction of the Engineer and all authorities.

B. All components of the system shall be manufactured by the same company. The system and its components shall be approved by UL and Factory Mutual.

C. All system components shall be installed by a franchised distributor of the fire alarm system having a repair and service department on call 24 hours a day, seven days a week. The repair and service department shall be located within 150 miles of the project.

D. Submit complete shop drawings showing all devices including mounting locations and heights and terminal-to-terminal connections. **Employ an independent third party testing agency that will be involved in certification of the system to review the shop drawings to ensure compliance with the contract documents and all applicable codes.**

PART 2 – PRODUCTS

2.1 Provide an intelligent, addressable fire alarm control panel complete with all equipment necessary to monitor and control the devices shown. **Note: The Historic Hospital Building is shown with a separate fire alarm control panel; however, it is preferred that this panel be a slave panel of the Fire Alarm Control Panel in the Police Administration Building.** The system shall sound a non-coded general alarm. Upon an alarm condition, the fire alarm control panel shall automatically report the alarm condition to a monitoring agency. Provide all telephone connections, circuitry, and conduit to perform this functionality back to the telephone backboard.

2.2 Provide an integral smoke evacuation system with all equipment necessary to supervise, activate, and monitor the smoke evacuation fans and system components. Provide a remote activation control panel at the main entrance for use by authorized personnel for the activation and monitoring of the smoke evacuation system.

2.3 Provide a NiCad battery sized to operate the control panel without normal power for 24 hours, and then to alarm the panel continuously for at least five minutes (or as required by codes). Submit battery sizing calculations with the manufacturer's cut sheets and shop drawings.

2.4 All devices shall be addressable and shall be electrically supervised.

2.5 Smoke detectors shall be of the photoelectric type.

2.6 Duct detectors shall be of the air sampling type. Furnish complete with sampling tubes and duct housings.

2.7 Smoke detectors mounted under raised computer floors shall be of the photoelectric type. They shall be UL listed for installation in plenums.

2.8 Pull stations shall be of metallic construction. They shall be furnished with lexan shields and warning horns.

2.9 Horns shall be rated a minimum of 85 dB at 10'.

2.10 Speakers shall be square. They shall be wall-mounted to a 4" square box. They shall produce a minimum sound level of 85dB at 10'. They shall have adjustable taps for volume level adjustment.

2.11 Strobes shall have a nominal rating of at least 75 Cd.

2.12 Combination horn-strobe units or speaker-strobe units shall meet the specified requirements of the individual horns, strobes, and speakers.

2.13 Monitor all sprinkler system flow switches at the facility. Provide an alarm upon flow indication.

2.14 Monitor all sprinkler system tamper and supervisory switches at the facility. Provide a trouble signal upon tamper indication.

2.15 Provide duct detectors in the return duct of all air units. If a fresh air intake duct is installed, all duct detectors shall be mounted upstream of the intake duct. For air units with flow ratings greater than 15,000 CFM, provide duct detectors in both the return and supply ducts.

2.16 Provide all necessary relays and circuitry, and shut down all air units upon an alarm condition of the fire alarm system.

2.17 **Police Administration Building Only:** Provide a Fireman's Smoke Evacuation System Control Panel. In automatic mode, the Smoke Evacuation Fans shall operate and the motorized damper on LVR-3 shall actuate upon an alarm condition of a smoke detector in the atrium or an alarm condition caused by a sprinkler flow switch serving the atrium. Also, the eight smoke dampers on the perimeter of the atrium shall actuate. The Fireman's Smoke Evacuation System Control Panel shall permit the firemen to override any and all automatic controls of the smoke evacuation fans or the motorized damper on LVR-3.

2.18 Provide all necessary equipment and circuitry for control of the elevator in accordance with ANSI/ASME A17.1, Safety Code for Elevators and Escalators.

2.19 Provide all necessary equipment and circuitry to automatically release the magnetic door locks upon an alarm of the Fire Alarm System **except those in areas where inmates are detained**.

2.20 Conductors shall be #14 AWG copper rated THHN/THWN. Provide larger conductors where required to compensate for voltage drop.

2.21 Provide all necessary equipment and circuitry to monitor and activate the smoke evacuation system.

2.22 Provide all necessary equipment to activate smoke evacuation fans.

PART 3 – EXECUTION

3.1 All components and circuitry shall be assembled and installed per the requirements of all applicable codes and the manufacturer's recommendations.

3.2 All devices shall be mounted with their boxes flush in the walls.

3.3 Smoke detectors shall be mounted at least 36" away from supply and return vents.

3.4 All outlet boxes, junction boxes, and cover plates shall be painted red.

3.5 All circuitry shall be in concealed conduit sized per the NEC, but no less than 3/4" EMT. All fire alarm conduits shall be painted red.

3.6 The Fire Alarm System Contractor shall employ an independent third party testing agency to test and certify all system components, including each smoke detector, duct detector, pull station, and the smoke evacuation system prior to the pre-final inspection. All systems shall be completely operable prior to the request for a pre-final site observation. The system shall be tested in the presence of the Owner, Architect, and Engineer at the prefinal site observation.

3.7 Provide a one-year warranty for the system and all components. The warranty shall begin at the date of final acceptance of the building. During the warranty period, the system shall be repaired or replaced as necessary at no cost to the Owner. During the warranty period, a technician shall be on the job site within twenty-four hours of a problem report from the Owner.

END OF SECTION

SECTION 31 05 00

TEMPORARY SILT FENCE

PART 1 GENERAL

1.01 STANDARD SPECIFICATION REFERENCE

Section 234 of the 1990 *Mississippi Standard Specifications for Road and Bridge Construction* and referenced sections is hereby referenced and amended as follows:

END OF SECTION

SECTION 31 11 00

SITE PREPARATION

PART I GENERAL

1.01 SCOPE

A. To be determined from the Contract Documents and an examination of the site. Include preparation for the work and protection of existing improvements and adjoining property and vegetation.

1.02 LAYOUT OF THE WORK

A. Accurately lay out the entire work. If interferences or problems arise, request instructions before proceeding. If it appears, in the professional opinion of the Contractor, that vegetation is in jeopardy and best to be removed prior to the beginning of construction, it should be reviewed on the site with the Architect for approval.

1.03 OWNER PROVIDED DOCUMENTS

A. The following are hereby designated as Contract Documents whether bound in with the other documents or separate. The inclusion with the Architect's documents is for convenience. The Architect does not guarantee their content as to accuracy, completeness, or suitability. These documents shall be the basis on the Contract for existing surface conditions.

B. Survey: As shown on S1 and prepared by Clearpoint Engineers.

C. Soil Borings provided by Burns Cooley Dennis, dated May 2012.

PART II EXECUTION

2.01 CLEARING

A. Removal: Remove trees, shrubs, grass, and other vegetation, improvements, or obstructions as indicated which interfere with new construction. Removal includes digging out stumps and roots.

B. Protection: Provide temporary fences, barricades, coverings, or other protection to preserve existing items indicated to remain and to prevent injury or damage to persons or properties as required. Temporary fences must be 6' high chain link with no top rail.

C. Traffic: Conduct site clearing operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Obtain permission from authorities having jurisdiction.

D. Protect Existing Trees & Vegetation: Protect all existing vegetation from physical damage. Do not store materials or equipment within tree drippings. Any trees which are shown to remain, but are destroyed, will be compensated for by the Contractor at the rate required for comparable replacement.

E. Air Pollution: Control air pollution caused by dust and dirt; comply with governing regulations.

2.02 DAMAGED WORK

A. Restore damaged work to condition existing prior to start of work, unless otherwise directed at Contractor's expense.

2.03 TOPSOIL

A. Strip and remove all topsoil and dirt from site.

2.04 FILLING AND GRADING

A. Fill below the grade areas and void resulting from demolition operations. Use satisfactory soil materials, placed in 6" deep horizontal layers with each layer thoroughly compacted.

B. Grade ground surface to conform to required contours and to provide surface drainage. A positive slope is to be provided away from the building at all locations. Minimum slopes shall be 1% at any location to prevent puddles.

END OF SECTION

SECTION 31 22 19

TOPSOIL

PART I GENERAL

1.01 STANDARD SPECIFICATION REFERENCE

A. Section 211 of the 1990 Mississippi Standard Specification for Road and Bridge Construction and referenced sections is hereby referenced and made a part of these specifications.

END OF SECTION

SECTION 312319: EARTHWORK FOR STRUCTURES-POLICE/COURT BUILDING

PART 1 GENERAL

1.1 RELATED SECTIONS

A. Division 1 Sections

1.2 REFERENCES

ASTM D422 – Standard Test Method for Particle-Size Analysis of Soils.

ASTM D698 – Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3).

ASTM D1556 – Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.

ASTM D3017 – Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

ASTM D4318 – Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.3 DEFINITIONS

A. Granular Subbase: Fill directly beneath slabs-on-grade.

B. Backfill: Fill immediately behind foundation elements or retaining walls.

C. Structural Fill: Fill under the structure other than the granular subbase.

1.4 SUBMITTALS

A. Upon request, submit soil test reports performed by the Structural Testing/Inspection Agency.

1.5 QUALITY ASSURANCE

A. Refer to the Structural Quality Assurance Plan in the Structural Drawings.

1.6 SURVEY

A. Prior to construction, have structure location staked and certified by a licensed surveyor. If discrepancies between actual lines and elevations exist, notify Architect/Structural Engineer before proceeding with layout of structure.

1.7 SUBSURFACE CONDITIONS

A. Copies of a subsurface investigation of the site will be made available upon request. The data is not intended as a representation or warranty of the continuity of such conditions. Owner will not be responsible for interpretation or conclusions drawn by the Contractor. The data is made available for the convenience of the Contractor and is not guaranteed to represent all conditions that may be encountered.

B. Contractor may examine the site and make his own subsurface explorations at no additional cost to the Owner. Notify Owner prior to making any subsurface explorations.

1.8 EXISTING UTILITIES

A. Locate existing underground utilities by careful hand excavation. If utilities are to remain in place, provide protection from damage during construction operations.

B. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Do not interrupt existing utility service facilities occupied and used by Owner or others, unless written permission is given by the Architect and then only after temporary utility services have been provided.

C. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult the Architect immediately for directions.

D. Repair damaged utilities to satisfaction of utility owner.

1.9 NOTICE

A. Notify the Architect/Structural Engineer 48 hours prior to the beginning of any excavation work.

PART 2 PRODUCTS

2.1 GRANULAR SUBBASE

A. Granular Subbase: Sound and free-draining, such as sand, gravel or crushed stone with less than 10% passing the 200 sieve. Maximum diameter shall be 1-1/2 inches.

2.2 BACKFILL

A. Backfill: Sound and free-draining, such as sand, gravel or crushed stone with less than 10% passing the 200 sieve. Maximum diameter shall be 1-1/2 inches.

2.3 STRUCTURAL FILL

A. Structural Fill: Clayey Sands with a plasticity index of 6 to 25, Lean clay with a plasticity index of 10 to 25. On site soils with a plasticity index of 10 to 25. Delineation of fat clays and lean clays of onsite soils should be performed in the field by a qualified geotechnical engineer or their representative, and could require additional laboratory resting. All structural fill shall have a Liquid limit less than 45.

B. Structural Fill shall be free of organics, debris and deleterious materials.

PART 3 EXECUTION

3.1 STRIPPING

A. Strip vegetation, topsoil, roots, and other unsuitable material to a depth determined by the Structural Testing/Inspection Agency but not less than one foot, nor less than 10 feet outside the perimeter of the structure.

B. Stockpile sufficient amounts of topsoil as required to cover areas to be landscaped with a minimum of six inches of material.

3.2 EXCAVATION

A. Excavation shall be considered unclassified. Excavations shall comply with U.S. Department of Labor, Occupation Safety and Health Administration (OSHA) regulations.

B. Perform excavation to the depths and limits on the Drawings and as specified herein.

C. Do not excavate to full depth when there is probability of frost forming or ground freezing in excavation before concrete is placed.

D. Ground water may be encountered during the foundation excavation. Provide a system for controlling the ground water to a level at least three feet below the lowest point of the excavation.

E. Keep excavations dry by sloping ground away from holes and trenches.

3.3 PROOFROLLING

A. After stripping or excavation and before any fill placement, fill areas shall be proofrolled with a minimum of two coverages of a loaded dump truck or scraper in each of two perpendicular directions.

B. Areas found to be soft or pumping shall have the soft soil removed and replaced with structural fill and compacted as outlined herein.

3.4 PLACEMENT OF STRUCTURAL FILL

A. Do not place structural fill on subgrade that contains frost, mud or is frozen.

B. Structural fill shall be placed and compacted in 6 to 9-inch thick loose layers.

C. Compact structural fill to 98 percent of the maximum dry density as measured by Standard Proctor, ASTM D698, with water content within +2/-2 percent of the optimum moisture content.

3.5 PLACEMENT OF BACKFILL

A. Backfill behind wall shall be placed in layers of 4 to 6- inches.

B. Compact backfill behind walls to 98 percent of the maximum dry density as measured by Standard Proctor, ASTM D698, with water content within +2/-2 percent of the optimum moisture content.

3.6 PLACEMENT OF GRANULAR SUBBASE

A. Do not place granular subbase on subgrade that contains frost, mud or is frozen.

B. Compact backfill behind walls to 95 percent of the maximum dry density as measured by Standard Proctor, ASTM D698, with water content within +2/-2 percent of the optimum moisture content.

3.7 CLEAN UP

A. Remove excess excavated materials from job site and upon completion leave site in clean condition.

END OF SECTION

SECTION 31 31 16

TERMITE CONTROL

PART I GENERAL

1.01 SCOPE

A. Provide soil treatment for termite control as herein specified.

B. Engage a bureau of Plant Industry licensed professional pest control operator for application of soil treatment solution.

1.02 WARRANTY

A. Furnish written contract guaranteeing property will be treated with a soil termiticide in compliance with Bureau of plant industry rules and regulations and, that if subterranean termite activity is discovered during warranty period, Contractor will re-treat soil and repair and/or replace damage caused by termite infestation.

B. Provide warranty for a period of five years from date of treatment, signed by Applicator and Contractor.

PART II PRODUCTS

2.01 SUBMITTAL

A. Protect area with a proper by-the-label application of any termiticide by the U.S. Environmental Protection Agency (EPA) and the Bureau of Plant Industry.

B. Protect existing structures with a complete proper by-the-label application under and around application of any termiticide registered by the U.S. EPA and the Bureau of Plant Industry.

C. Other solutions may be used as recommended by Applicator and if acceptable to the Bureau of Plant Industry and to Architect. Use only soil treatment solutions which are not injurious to planting.

PART III EXECUTION

3.01 APPLICATION

A. Do not apply soil treatment solution until excavating, filling and grading operations are completed, except as otherwise required in construction operations.

B. To insure penetration, do not apply treatment to frozen or excessively wet soils or during inclement weather. Comply with handling and application instructions of soil toxicant manufacturer.

C. Remove foreign matter which could decrease effectiveness of treatment on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and foundations. Toxicants shall be applied before placement of fill under slabs, if recommended by toxicant manufacturer.

D. Apply soil treatment solution at rates recommended by soil toxicant manufacturer.

E. Allow not less than 12 hours for drying after application before beginning concrete placement or other construction activities.

F. Post signs in areas of application warning workers that soil poisoning has been applied. Remove signs when areas are covered by construction.

G. Reapply soil treatment solution to areas disturbed by subsequent excavation or other construction activities following application.

END OF SECTION

SECTION 313421: AGGREGATE PIER SOIL REINFORCEMENT

PART 1 GENERAL

1.1 DESCRIPTION

A. Work shall consist of designing, furnishing and installing aggregate pier elements to the lines and grades designated on the project foundation plan and as specified herein. Aggregate piers shall be provided to reinforce the existing soils for support of shallow foundations as indicated in the Structural Drawings. The aggregate pier elements shall be constructed using vibratory methods, such as a down-hole vibratory probe, or by compacting aggregate in an excavated hole using special high-energy impact densification equipment.

1.2 AGGREGATE PIER INSTALLATION

A. Provide all equipment, casing, material, labor, and supervision to design and install aggregate pier elements.

B. Perform two (2) Modulus Tests.

1.3 RELATED SECTIONS

A. Section 312318 – Earthwork for Structures

B. Section 033000 – Cast-In-Place Concrete

1.4 REFERENCE STANDARDS

ASTM STP 399 – Dynamic Penetrometer Testing.

ASTM D422 – Standard Test Method for Particle-Size Analysis of Soils.

ASTM D1143 – Standard Test Method for Piles Under Static Axial Compressive Load.

ASTM D1194 – Full-Scale Load Testing (Individual Column or Column Groups) Modified for Size.

ASTM D1586 – Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils.

ASTM D3689 – Standard Test Method for Individual Piles Under Static Axial Tension Load.

ASTM D5778 – Cone Penetrometer Testing (CPT)

1.5 SUBSURFACE CONDITIONS

A. Copies of a subsurface investigation of the site will be made available upon request. The data is not intended as a representation or warranty of the continuity of such conditions. Owner will not be responsible for interpretation or conclusions drawn by the Contractor. The data is made available for the convenience of the Contractor and is not guaranteed to represent all conditions that may be encountered.

B. Contractor may examine the site and make his own subsurface explorations at no additional cost to the Owner. Notify Owner prior to making any subsurface explorations.

1.6 EXISTING UTILITIES

A. Contractor shall be responsible for locating and protecting all existing underground utilities and other structures during the installation of the Aggregate Piers. If utilities are to remain in place, provide protection from damage during construction operations.

B. Cooperate with Owner and utility companies in keeping their respective services and facilities in operation. Do not interrupt existing utility service facilities occupied and used by Owner or others, unless written permission is given by the Architect and then only after temporary utility services have been provided.

C. Should uncharted or incorrectly charted piping or other utilities be encountered, consult Architect immediately for directions.

D. Repair damaged utilities to satisfaction of utility owner.

1.7 CONFLICTS IN SPECIFICATIONS/REFERENCES

A. Where specifications and reference documents conflict, the Architect/Structural Engineer shall make the final determination of the applicable document.

1.8 SUBMITTALS AND CERTIFICATIONS

A. Aggregate Pier Contractor shall submit a list of at least five previously completed projects of similar size and scope for review by the Architect/Structural Engineer. The list shall include a description of the project, relative size, and contact person with phone number.

B. Aggregate Pier Contractor shall submit the following to the Architect/Structural Engineer a minimum of three weeks before the start of construction:
   1. Resumes of key management and supervisory personnel.
   2. Detailed design calculations and construction drawings prepared by the Aggregate Pier Engineer. All drawings and calculations shall be sealed by a Professional Engineer in the State in which the project is constructed. Drawings shall clearly indicate the spacing, location, and depth of aggregate piers required to achieve the performance criteria outlined in this specification.
   3. A ground improvement Quality Assurance plan as outlined in section 1.10 of this specification.
   4. Work procedures and control criteria.
   5. Load test detail and setup that confirms the modulus of the aggregate piers used in the design.
   6. A schedule of work tasks and time for completion.

C. Upon completion of the aggregate pier installation, the Aggregate Pier Contractor should submit a letter certifying the aggregate pies have been installed in general conformance with the approved aggregate pier submittal and the soils have been improved for allowable bearing pressures as stated in the contract documents.

1.9 QUALITY ASSURANCE

A. The design and installation of Aggregate Piers shall be performed by a specialty Aggregate Pier Contractor with a minimum of five continuous years of documented experience with the installation of Aggregate Piers and shall have completed at least 50 projects.

B. Aggregate Pier Contractor shall provide experienced management, supervisory and key personnel as required to implement and complete the installation of the Aggregate Piers as indicated on the Approved Aggregate Pier Submittal. The Project Manager shall have at least two years of continuous experience

with Aggregate Piers, with at least the last year in full-time employment of the Aggregate Pier Contractor. The superintendent shall have at least two years of experience with Aggregate Piers.

C. Aggregate Pier Contractor shall have a full-time quality control representative to verify and report all quality control installation procedures. Complete and accurate daily records of aggregate pier installation shall be submitted to the Contractor and the Special Inspector. The records shall include the following:
1. Footing and Aggregate Pier location or number.
2. Aggregate Pier length and drilled diameter.
3. Start and finish time of the Pier installation.
4. Planned and actual Aggregate Pier elevations at the top and bottom of the element.
5. Average lift thickness (where appropriate) for each Pier.
6. Backfill quantities for each Pier.
7. Soil types encountered at the bottom of each Pier and along the length of the element.
8. Depth to groundwater, if encountered.
9. Type and size of densification equipment used.
10. Any unusual conditions encountered.

Aggregate Pier Contractor shall immediately report any unusual conditions encountered during installation to the Contractor, Structural Engineer, and to Special Inspector.

D. Aggregate Pier Contractor shall submit any changes to the approved Aggregate Pier design, necessitated by a change in the subsurface conditions, to the General Contractor, the Architect/Structural Engineer and the Special Inspector.

E. Perform Modulus Tests. Refer to Paragraph 1.2.B for number of tests required.

F. Aggregate Pier Contractor shall submit a report documenting observations and results of the Modulus Test(s) to the Contractor and the Architect/Structural Engineer. Report shall certify that the design bearing pressure was achieved within the specified settlement tolerances and shall include a description of the installation equipment, installation records, complete test data, analysis of the test data and recommended design parameter values based on the modulus test results. Report shall be prepared under supervision of a registered professional engineer.

G. Refer to the Structural Quality Assurance Plan in the Structural Drawings for specific responsibilities of the Contractor and the Special Inspector.

1.10 BASIS OF PAYMENT

A. The preparation of construction drawings and specifications, installation of Aggregate Piers including casing as required, and performance of Modulus Tests shall be included in a lump sum bid. Refer to Paragraph 1.2.B for the number of Modulus Tests required.

B. Unit prices shall be provided for the following:
1. Additional Aggregate Piers.
2. Additional Mobilizations.
3. Additional Modulus Tests.

PART 2 PRODUCTS

2.1 BACKFILL MATERIALS

A. Backfill aggregate shall consist of hard, angular to sub-angular durable rock fragments with the majority of the particles in the range of 1/8 inch to 1-1/2 inches such as ASTM D448, size No. 67. The aggregate

shall be identical to that used for the successful modulus test. The Special Inspector shall approve the backfill aggregate.

2.2 EQUIPMENT

A. Down-hole Vibratory Probe: The vibratory probe shall be capable of producing horizontal vibrations from an energy source near the tip of the probe. Aggregate Pier Contractor shall use an electric probe capable of providing at least 80 HP of rated energy and a centrifugal force of 15 tons. An appropriate metering device shall be provided at such location that inspection of amperage increase may be verified during operation of the equipment. The metering device may be an ammeter directly indicating the performance of the probe tip.

B. Tamper: The tamper shall have a diameter that is at least 70 percent of the predrilled hole diameter, have beveled sides, and be long enough to reach the full depth of the predrilled hole. The energy shall be from a minimum 3,500 lb. class impact hammer.

PART 3 EXECUTION

3.1 AGGREGATE PIER PERFORMANCE CRITERIA

A. Aggregate Pier stiffness modulus value used for design shall be verified by the results of the Aggregate Pier modulus tests, described in this specification.

B. Aggregate Piers shall be designed in accordance with generally-accepted engineering practice and as required by these Specifications. The design shall meet the following criteria.

Minimum Allowable Bearing Pressure for Aggregate Pier Reinforced Soils:	See Sheet S0.1
Estimated Total Long-Term Settlement for Footings:	≤1-inch
31 Estimated Long-Term Differential Settlement of Adjacent Footings:	≤ ½-inch

C. The design submitted by the Aggregate Pier Contractor shall consider the bearing capacity and settlement of all footings supported by aggregate piers, and shall be in accordance with acceptable engineering practice and these specifications. Total and differential settlement shall be considered. The design life of the structure shall be 50 years.

D. Aggregate Pier system shall be designed to preclude plastic bulging deformations at the top-of–pier design stress and to preclude significant tip stresses as determined from the shape of the telltale test curve from telltales installed in modulus test piers.

3.2 PIER TOLERANCES

A. The center of each Aggregate Pier shall be within six inches of the plan locations indicated. The final measurement of the top of piers shall be the lowest point on the aggregate in the last compacted lift. Piers installed outside of the above tolerances and deemed not acceptable shall be rebuilt at no additional expense to the Owner.

3.3 REJECTED AGGREGATE PIERS

A. Aggregate Piers improperly located or installed beyond the maximum allowable tolerances shall be abandoned and replaced with new piers, unless the Designer approves other remedial measures. All material and labor required to replace rejected piers shall be provided at no additional cost to the Owner.

3.4 MODULUS TEST

A. Modulus test shall be performed by the Aggregate Pier Contractor to verify the parameter values selected for design. The modulus test shall be of the type and installed in a manner specified herein. Refer to Paragraph 1.2.B for the number of tests required.

B. Aggregate Pier Contractor shall provide and install all dial indicators and other measuring devices as required to perform the tests.

C. At the option of the Aggregate Pier Contractor, a telltale may be installed at the bottom of the test pier so that bottom-of-pier deflections may be determined. Acceptable performance is indicated when the bottom of the pier deflection is no more than 20% of the top of pier deflection at the design stress level.

D. ASTM D-1143 general test procedures shall be used as a guide to establishing load increments, load increment duration, and load decrements.

E. Hold-time for load increments (except as noted in paragraph E.) shall be a minimum of 15 minutes. The maximum hold-time shall not exceed 1 hour. Loads shall be held until the deflection rate has decreased to a maximum of 0.01 inch per hour, or less.

F. The load increment that represents approximately 115% of the design maximum stress on the Aggregate Pier shall be held for a minimum of 15 minutes. The maximum hold-time shall be 4 hours. The load shall be held until the deflection rate has decreased to a maximum of 0.01 inch per hour, or less.

G. A seating load equal to 5 percent of the total load shall be applied to the loaded steel plate prior to application of load increments and prior to measurement of deflections to compensate for surficial disturbance.

H. Aggregate Pier modulus testing shall be performed in accordance with the requirements outlined in the Design Submittal.

I. Locations of the Aggregate Pier modulus tests should be coordinated with the Structural Testing/Inspection Agency and the Architect/Structural Engineer.

3.5 PROTECTION OF THE WORK

A. Upon completion of the Aggregate Pier installation, the General Contractor shall be responsible for protection of the work. This includes, but is not limited to, proper site drainage to prevent the collection or ponding of water on or near completed Aggregate Piers and appropriate control and coordination of earthwork activities and/or subsequent drilling activities in order to prevent damage to completed rammed aggregate piers.

3.6 EXCAVATIONS

A. Contractor shall coordinate all excavations made subsequent to Aggregate Pier installations so that at least five feet of horizontal distance remains between the edge of any installed Aggregate Pier and the excavation. Protection of completed Aggregate Pier elements is the responsibility of the Contractor. In the event that utility excavations are required at horizontal distances of less than five feet from installed Aggregate Piers, the Contractor shall contact the Aggregate Pier Engineer to develop construction solutions to minimize impacts on the installed Aggregate Piers.

3.7 FOOTING SUBGRADE PREPARATION

A. Excavation and surface compaction of all footings shall be the responsibility of the Contractor.

B. Foundation excavations to expose the tops of Aggregate Pier elements shall be made in a workmanlike manner, and shall be protected until concrete placement, with procedures and equipment best suited to (1) prevent softening of the matrix soil between and around the Aggregate Pier elements before pouring structural concrete, and (2) achieving direct and firm contact between the dense, undisturbed Aggregate Pier elements and the concrete footing.

C. The following procedures shall be followed during subgrade preparation:
   1. Limit over-excavation below the bottom of the footing to 3-inches (including disturbance from the teeth of the excavation equipment).
   2. Compaction of surface soil and top of Aggregate Pier elements shall be prepared using a motorized impact compactor (“Wacker Packer,” “Jumping Jack,” or similar). Sled-type tamping devices shall not be used. Compaction shall be performed over the entire footing bottom to compact any loose surface soil and loose surface pier aggregate.
   3. Place footing concrete immediately after footing excavation is made and approved, preferably the same day as the excavation. Footing concrete must be placed on the same day if the footing is bearing on expansive or sensitive soils.
   4. If same day placement of footing concrete is not possible, place a minimum 3-inch thick lean concrete seal (‘mud mat”) immediately after the footing is excavated and approved.

D. The following foundation construction criteria shall be strictly adhered to:
   1. Water shall not be allowed to pond in the footing excavation at any time.
   2. The top of all Aggregate Pier elements within each footing shall be exposed in the footing excavation.
   3. Immediately prior to footing construction, the tops of all the Aggregate Pier elements exposed in each footing excavation shall be inspected and recompacted as necessary with mechanical compaction equipment, and the tops of any Aggregate Pier elements which may have been disturbed by footing excavation and related activity shall be recompacted to the original installed density.
   4. No excavations shall be made after installation of Aggregate Pier elements within a horizontal distance of five feet from the edge of any Pier, without the written approval of the Aggregate Pier Contractor/Engineer.

END OF SECTION

SECTION 31 91 00

LANDSCAPE WORK

PART I GENERAL

1.01 SCOPE

A. The work covered by these specifications consists of furnishing all plants and other materials, labor, equipment and services necessary to perform all operations in connection with the planting of trees, shrubs, groundcovers, and other such materials in compliance with these specifications and the applicable drawings, and subject to the terms and conditions of the Contract. **All disturbed areas inside the scope of work or construction limits shown on the Site Plan (Sheet A0.1) shall be sod.**

1.02 STANDARDS

A. The following standards, where applicable are to be considered a part of these specifications:
1. American Joint Committee on Horticulture Nomenclature, "Standard Plant Names," Latest Edition.
2. American Association of Nurserymen, Inc., "American Standard for Nursery Ctock," Latest Edition.
3. Mississippi Department of Agriculture and Commerce. "Mississippi Fertilizer Law," Rules and Regulations.
4. Mississippi Department of Agriculture and Commerce. "Mississippi Pure Seed Law", Rules and Regulations.
5. All other governing Federal, State and Local Laws, regulations and ordinances applicable to this project and the work described within these Contract Documents.

1.03 QUALITY ASSURANCE

A. Plants shall be subject to inspection and approval at the place of growth, or upon delivery to the site for quality, size, and variety. Such approval shall not impair the right of inspection and rejection at the site during progress of the work or after completion, for size and condition of form, balls or roots, latent defects, or injuries. Rejected plants shall be removed immediately from the site.

B. Plant materials shall comply with State and Federal Laws relating to inspection for diseases and insect infestation.

1.04 SUBMITTALS

A. Submit the following information:
1. Certificate of inspection of plant material as required by State and Federal authorities and manufacturer's or vendor's certified analysis for soil amendments and fertilizers.

2. Maintenance Distribution: Submit typewritten instructions recommending procedures to be established for maintenance of landscape work for one (1) full year.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery:

1. Notify Architect of delivery schedule in advance so that plant material may be inspected upon arrival at job site.
2. During shipping to the job site, all plant material shall be packed to provide adequate protection against climatic, seasonal, and breakage injury during transit. Tops shall be securely protected as necessary to minimize wind whipping and drying.
3. Where practical, do not deliver more plant materials than can be planted in one day.
4. Deliver all package material to site in original, unopened containers bearing the manufacturer's guaranteed chemical analysis, name of trademark and conformance to State law.

B. Storage

1. Plants that can not be planted immediately upon delivery shall be kept in shade and protected at all times from sun, drying winds, freezing and inclement weather, or damage as a result of construction operations and shall be kept well watered. Owner shall not be responsible for plant care during installation.

C. Packaged Materials:

1. Deliver packaged materials in containers showing weight, analysis and name of manufacturer. Protect materials from deterioration during delivery and while stored at site.

D. Handling:

1. Handle all plants so that roots are adequately protected at all times.
2. No plants shall be bound with rope or wire at any time so as to damage the bark, break branches, or destroy its natural shape.
3. Do not pick up container or balled plants by stems or trunks. Plants handled by stems or trunks shall be considered damaged and removed from the site.
4. Handle packaged material with care so as not to accidentally open containers or contaminate before time of actual use.

1.05 JOB CONDITIONS

A. Conduct planting operations under favorable weather conditions during the seasons which are normal for such work as determined by locally accepted practice, unless directed otherwise by the Landscape Architect.

B. Utilities: Determine location of underground utilities and perform work in a manner which shall avoid possible damage. Hand excavate, as required. Maintain grade stakes set by others until removal is mutually agreed upon by parties concerned.

C. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify Landscape Architect before planting.

1.07 GUARANTEE

A. Guarantee new or existing moved plant material for a period of one (1) year from date of final acceptance.

B. Plant Replacement:
1. Any plant not found in a healthy growing condition at the end of the guarantee period shall be removed from the site and replaced as soon as weather conditions permit.

2. All replacements shall be plants of the same kind and size as specified on the plant list. They shall be furnished, planted and mulched as specified under "Planting", at no additional cost to the Owner.
3. Final inspection at the end of the guarantee period shall be on planting, construction and all other incidental work pertaining to this Contract. Any replacement at this time of replacement and ending with the same inspection and acceptance shall conform as herein described.

1.08 SCHEDULES

A. Coordinate work with other trades and professions on the job site. Do not begin work if there is danger of conflict or damage to work by others and professions in the normal pursuit of their work.

B. Plant material shall be placed where and as indicated on plan. Notify Landscape Architect of any conditions on site at time of planting that are not shown on plans and which make placing adjustments necessary. The Landscape Architect shall furnish to the Contractor written or orally communicated corrected positions.

C. Planting Schedule: Prepare a proposed planting schedule. Schedule dates for each type of landscape work during normal seasons for such work in areas on site. Correlate with specified maintenance periods to provide maintenance from date of substantial completion. Once accepted, revise dates only as approved in writing, after documentation of reasons for delays.

D. Coordination With Lawns: Plant trees and shrubs after final grades are established and prior to planting of lawns, unless otherwise acceptable to Architect. If planting of trees and shrubs after lawn work, protect lawn areas and promptly repair damage to lawns resulting from planting operations.

PART II MATERIALS

2.01 PLANT MATERIALS

A. All plants shall be well-formed and shaped, true to type, and conform to the measurements specified in the plant list. Plants that meet the requirements specified in the plant list, but which do not possess a normal balance between height and spread shall not be accepted. All plants shall be freshly dug (where applicable), healthy, vigorous, well-branched and free of disease, insect eggs, and larvae, and shall have adequate root systems.

B. Plant names and labels shall conform to the current edition of: Standard Plant Names as adopted by the American Joint Committee on Horticulture Nomenclature. All plants shall be true to name, quality and size as indicated in plant list.

C. Plants shall not be pruned prior to delivery.

D. Plants shall be nursery grown, unless otherwise specified and shall have been growing under similar climatic conditions to these in locality of project. Plants larger than those specified may be used if approved by Architect, but use of such plants shall not increase the Contract price. Root spread or root balls shall be increased in proportion to the size of the plant.

E. Substitutions shall be permitted only if proof is submitted that specified plants or sizes are unobtainable. Proposals shall be considered for nearest equivalent size or variety with equitable adjustment of Contract price. Substitutions shall be acceptable only upon written notice.

F. Plants shall be tagged with durable, legible tags stated in weather resistance ink the plant name and size as specified in the plant list. Labels shall be securely attached to all plants, bundles or packages of plants of a single species and size. Labels shall be removed from plants immediately after final acceptance. Notify Landscape Architect of removal for project closing.

G. Digging and Handling: All plant stock shall be dug and handled with reasonable care and skill to prevent injuries to the trunk branches and roots, and shall be packed in an approved manner to insure arrival at the project site in good condition.

H. Balled and Burlapped Plants:
1. Dig plants with firm, natural balls of soil and of sufficient size to encompass the fibrous and feeding roots of the plant. No balled plant shall be planted if the ball is cracked or broken, unless approved by the Architect.
2. Wrap ball securely with burlap or strong biodegradable cloth and bind tightly with rope or wire.
3. Container grown plants shall be accepted as balled and burlapped provided the plants have been growing in containers for at least one full growing season prior to delivery to the job site, and that containers are adequate for the developing root system of the plant.
4. In hot weather, maintain stock in shade house for a minimum of one week to allow plants to recover from digging shock.
5. Minimum size of each ball shall be equal to that required for the next larger size nursery grown stock.

I. Specified Plants: Specimen plants shall be selected for shape and branching habit which at maturity shall produce a strong, full foliaged example of its species.

J. Container Grown Stock:

1. All container grown material shall be healthy, vigorous, well-rooted and established in the container in which it is sold. Tops shall be of good quality and in a healthy growing condition.
2. Containers shall be sufficiently rigid to hold the ball shape protecting the root mass during transit.
3. Plants shall be established in their containers sufficiently long enough for the fibrous roots to have developed so that the root mass shall retain its shape and hold together when removed from the container.
4. Plants shall have small stakes in containers where required to support the plants. Plant roots bound in containers shall not be acceptable.

2.02 TOPSOIL

A. Topsoil shall be a natural, fertile, friable soil of loamy character capable of sustaining vigorous plant growth. It shall be free of stones, lumps, plants, roots, obnoxious grass and weeds, and other foreign matter. It shall be of uniform composition throughout, not excessively acid or alkaline, nor contain substances which may be harmful to plant growth. Existing on-site soil may be utilized in planting mix if existing soil is of good quality to promote healthy plant growth and is approved by the Landscape Architect.

2.03 PLANTING SOIL

A. All plant beds and plant pits shall have the following soil mixtures: One (1) part approved topsoil, one (1) part shart masonry sand, and one (1) part pine bark soil conditioner mixed into a good friable material.

Locally available pre mixed “soil mix” is acceptable if sample is pre approved by Landscape Architect. All planting areas shall receive an application of approved pre-emergent herbicide incorporated thoroughly into planting beds prior to installation of plant material. Apply herbicide at manufacturer's rates and procedures. Notify Architect prior to application of pre-emergent.

2.04 FERTILIZER

A. Commercial fertilizer shall be a complete fertilizer, uniform in composition, dry and free flowing. Deliver fertilizer to site in original, unopened containers, each bearing the manufacturer's statement of analysis. Commercial fertilizer shall be 13-13-13 formula 13% nitrogen, 13% phosphoric acid, 13% potash. Fertilizer shall be dry, granular and bagged in manufacturer's original unopened container.

B. Fertilizer shall not be applied to planting beds or pits unless otherwise specified by the Architect. Instead, apply Fertilome Root Stimulator or approved equal to beds and pits in compliance with manufacturer's recommended rates and procedures.

2.05 MULCH

A. Mulch to be seasoned pine bark, brown in color and sample to be approved prior to installation by Landscape Architect.

2.06 TREE WRAPPING

A. Tree wrapping shall be double thick crepe paper cemented together with bituminous material. Wrapping shall be a minimum of 4" wide and secured with a lightly tarred medium of coarse sissel yarn.

2.07 GUYING AND STAKING MATERIAL

A. Staking to be as shown on drawings mfg. by Tree Staple, Inc or equal and installed as shown.

2.08 WATER

A. All water necessary for planting and maintenance shall be of satisfactory quality to sustain the growth of plants and shall not contain harmful, natural, or man-made elements detrimental to plants. Potable water meeting the above standard shall be furnished by the Contractor, and the Contractor shall be responsible to make arrangements for its use by tanks, hoses, sprinklers, etc. If such water is not available at the site, the Contractor shall provide such satisfactory water from sources off the site. The Contractor shall be responsible for watering the plants until date of final acceptance.

PART III EXECUTION

3.01 INSPECTION

A. Verify establishment of final grades prior to beginning planting operations. Inspect plants for injury and insect infestation. Do not begin planting or wrapping of trees until deficiencies are corrected or plants replaced.

B. Inspect soil conditions to determine if soil is free of rubbish or objectionable matter harmful to plant growth. If any adverse conditions are found, notify the Landscape Architect.

3.02 PREPARATION

A. Stake out locations for plants and outline of planting beds on ground. Do not begin excavation until staking locations and plant beds are approved by Architect.

B. Slight changes may be made in plant location which conflict with utility lines. Such relocation is subject to the approval of the Architect.

C. Topsoil, pine bark soil conditioner and sand may either be pre-mixed or mixed in place by spreading all materials evenly until a homogenous mixture is achieved to full depth of bed as required.

D. Reasonable care should be exercised to have pits and beds dug and soil prepared prior to moving plants to their respective locations for planting to ensure that they will not be unnecessarily exposed to drying elements or physical damage.

3.03 EXCAVATION FOR PLANTING

A. Plant pits shall be circular in outline with vertical sides and flat bottoms. Prepare all pits six inches deeper than ball or container size to be received. Shrub pits shall be a minimum of sixteen inched in depth, and tree pits shall be a minimum of 20 inches in depth. Shrub pits shall be a minimum of 1 1/2 times greater in diameter than plant ball. Tree pits shall be a minimum of twelve inches greater in diameter than ball for trees up to three inch caliper, and a minimum of eighteen inches greater for trees over three in caliper. Groundcover beds shall be prepared uniformly to a depth of nine inches. Shrub beds utilizing mass planting shall be uniformly excavated to the required depth. No such beds shall be prepared by digging pits each shrub.

3.04 PLANTING

A. Center plant in pit or place so required in bed and face for best effect. Place sufficient planting soil under plant as required to raise plant 1 1/2 to 2 inches above existing grade so that after settlement it bears same relation to finish grade as it bore to the grade of the soil which it was dug. Set plant plumb and hold rigidly in position until soil has been tamped firmly around root ball. Plant pit or bed shall be backfilled with planting soil in 1" layers, each carefully tamped in place to avoid injury to roots or two-thirds of depth, fill pit or bed with water to settle soil around roots. After soil settles, fill remainder of pit or bed with planting soil, water and tamped lightly to grade. Rake smooth to drain.

B. Balled plants shall be planted in pit on planting soil material that has been handtamped prior to placing plant. Set plumb and straight 1 1/2 inches above the existing grade as above. Cut burlap or cloth, ropes, wire, or other wrapping material and remove from top 1/3 of ball. Do not pull wrapping from under ball. Do not plant if ball is cracked or broken before or during planting process.

C. For container grown plants, cut cans on two sides with an acceptable can cutter, taking care not to damage root ball. Do not cut sides on knockout cans. Carefully remove plants so as not to damage root ball. After removing plant, scarify edge roots on three sides. Plant as above. For containers less than one gallon in size, place plants backfill and tamp by hand, leaving slight depression around base of plants. Cover root ball with a maximum of 1/4" of planting soil.

D. Build 4" saucer continuous around all plants or trees which stand alone and are not in larger mulched beds. Construct saucer of planting soil and tamp firmly in place to retain shape.

E. Spray Plants with anti-desiccant within 24 hours after planting.

3.05 MULCHING

A. Mulch all planting pits and beds immediately after planting, covering the entire area around each plant to the depth required. Water thoroughly immediately after mulching. (See "Water, this section, for Contractor's responsibility to water planted stock and "Maintenance".)

3.06 GUYING AND STAKING

A. Trees shall be staked with tree staple while planting. Trees shall stand plumb with tree staple for a period of one year.

3.07 PRUNING

A. Each tree (and shrub, if required) shall be pruned in accordance with standard horticultural practice to protect natural character of plant. Pruning shall be done with clean, sterile, sharp tools.

B. Prune new plant material as required to remove injured twigs and branches, deadwood and suckers. For newly planted trees, remove 1/3 to 1/4 of branching structure to compensate for root loss. Make all cuts flush with trunk or adjacent branch.

3.08 WRAPPING

A. Trees shall be wrapped immediately after planting, winding from the ground line to above the lowest main branches. Overlap wrapping approximately 2" and tie securely in place. Maintain in place for one year.

3.09 MAINTENANCE

A. All plants and planting included in this Contract shall be maintained by watering, cultivating, spraying, and other operations necessary to insure a healthy condition until Architect makes final acceptance and submits certificate for payment. Maintenance from this day forward shall be the responsibility of the Owner.

3.10 CLEAN-UP

A. As planting operations proceed, all rope, wire burlap, empty containers, rocks, clods and all other debris pertinent to this work shall not be allowed to accumulate but shall be removed daily and the site kept as neat as possible at all times.

END OF SECTION

SECTION 32 31 13
CHAIN LINK FENCES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fence framework, fabric, and accessories.

B. Excavation for post bases; concrete foundation for posts.

C. Vehicular Sliding Gates.

D. Manual gates and related hardware.

1.02 REFERENCE STANDARDS

A. ASTM A121 - Standard Specification for Metallic-Coated Carbon Steel Barbed Wire; 2013.

B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

D. ASTM F567 - Standard Practice for Installation of Chain-Link Fence; 2011.

E. ASTM F1083 - Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures; 2013.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

PART 2 PRODUCTS

2.01 MATERIALS

A. Posts, Rails, and Frames: ASTM F1083 Schedule 40 hot-dipped galvanized steel pipe, welded construction, minimum yield strength of 30 ksi.

B. Wire Fabric: ASTM F 668 polymer-coated steel chain link fabric.

C. Barbed Wire: Zinc-coated steel, complying with ASTM A 121 Type Z Coating Class 3; 3 strands of 0.099 inch diameter wire, with 4-pointed barbs at 5 inches on center.

D. Concrete: ASTM C 94/C 94M, ready-mixed; Normal portland Cement, 2,500 psi strength at 28 days, 3 inch slump;.5 inch nominal sized coarse aggregate.

2.02 COMPONENTS

A. Line Posts: 2.38 inch diameter.

B. Corner and Terminal Posts: 3.5 inch.

C. Gate Posts: 3.5 inch diameter.

D. Top and Brace Rail: 1.66 inch diameter, plain end, sleeve coupled.

E. Gate Frame: 1.66 inch diameter for welded fabrication.

F. Fabric: 2 inch diamond mesh interwoven wire, 9 gage thick, top selvage twisted tight, bottom selvage twisted tight. Fabric to be colored vinyl where called for in plans.

G. Tension Wire: 6 gage, 0.1620 inch thick steel, single strand.

H. Tension Band:.125 inch thick steel.

I. Tension Strap:.125 inch thick steel.

J. Tie Wire: Aluminum alloy steel wire.

2.03 ACCESSORIES

A. Caps: Cast steel galvanized; sized to post diameter, set screw retainer.

B. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings; steel.

C. Extension Arms: Cast steel galvanized, to accommodate 3 strands of barbed wire, single arm, sloped to 45 degrees.

D. Hardware for Single Swinging Gates: 180 degree hinges, 2 for gates up to 72 inches high, 3 for taller gates; fork latch with gravity drop and padlock hasp; keeper to hold gate in fully open position.

E. Hardware for Double Swinging Gates: 180 degree hinges, 2 for gates up to 72 inches high, 3 for taller gates; drop bolt on inactive leaf engaging socket stop set in concrete, active leaf latched to inactive leaf preventing raising of drop bolt, padlock hasp; keepers to hold gate in fully open position.

2.04 FINISHES

A. Components (Other than Fabric): Galvanized in accordance with ASTM A123/A123M, at 1.7 oz/sq ft.

B. Hardware: Hot-dip galvanized to weight required by ASTM A153/A153M.

C. Accessories: Same finish as framing.

2.05 SLIDING VEHICULAR GATES

A. A.Gate Panel and Lock
   1. Gate Panel:
      a. Utilize sealed ball bearing internal rollers that provide protection against tampering and inclement weather.
      b. Gate Material: Aluminum
      c. Hardware: Galvanized and Stainless Steel.
   2. Sliding Gate Lock:
      a. Waterproof, tamper-resistant, electrically operated with six tumbler mechanical release.
      b. Include Status Indication for locked or unlocked position monitoring.
   3. Catcher Assembly:
      a. Prevent deflection by pedestrian intrusion using providing gate design to resist deflection at ends.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install framework, fabric, accessories and gates in accordance with ASTM F567.

B. Place fabric on outside of posts and rails.

C. Set intermediate posts plumb, in concrete footings with top of footing 2 inches above finish grade. Slope top of concrete for water runoff.

D. Line Post Footing Depth Below Finish Grade: ASTM F567.

E. Corner, Gate and Terminal Post Footing Depth Below Finish Grade: ASTM F567.

F. Brace each gate and corner post to adjacent line post with horizontal center brace rail and diagonal truss rods. Install brace rail one bay from end and gate posts.

G. Provide top rail through line post tops and splice with 6 inch long rail sleeves.

H. Install center brace rail on corner gate leaves.

I. Do not stretch fabric until concrete foundation has cured 28 days.

J. Position bottom of fabric 2 inches above finished grade.

K. Fasten fabric to top rail, line posts, braces, and bottom tension wire with tie wire at maximum 15 inches on centers.

L. Attach fabric to end, corner, and gate posts with tension bars and tension bar clips.

M. Install bottom tension wire stretched taut between terminal posts.

N. Install support arms sloped outward and attach barbed wire; tension and secure.

O. Install Vehicular Sliding Gate as per manufacturer's recommendations.

P. Install gate with fabric and barbed wire overhang to match fence. Install hardware.

Q. Provide concrete center drop to footing depth and drop rod retainers at center of double gate openings.

3.02 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch.

B. Maximum Offset From True Position: 1 inch.

C. Components shall not infringe adjacent property lines.

END OF SECTION

SECTION 33 10 00
WATER DISTRIBUTION SYSTEMS

1.0 GENERAL

This item shall consist of furnishing all of the necessary materials, supervision, labor, tools, equipment and incidentals, and the installation of various types and sizes of water pipe and related items in accordance with the Contract Drawings and Specifications, as stated in the Proposal.

2.0 APPLICABLE PUBLICATIONS

The following publications form a part of these Specifications and where referred to by basic designation only, are applicable to the extent indicated. The latest editions of the publications referenced shall apply to the work.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

A 139 Electric-Fusion (Arc) welded steel pipe (sizes 4 inch and over).

A 252 Welded and Seamless steel pipe piles.

C 31 Making and Curing Concrete Compressive and Flexural Strength Test Specimens in the Field.

C 33 Concrete Aggregates

C 39 Test for Compressive Strength of Cylindrical Concrete Specimens.

D 2922 Density of Soil Aggregate in place by the Nuclear Method (shallow depths).

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

21.10 Gray Iron and Ductile Iron Fittings, 3 inch through 48 inch for Water and other Liquids.

21.11 Rubber Gasket Joints for Cast Iron and Ductile Iron Pressure Pipe and Fittings.

21.50 Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand-lined Molds, for Water or other Liquids.

AMERICAN WATER WORKS ASSOCIATION (AWWA)

C 104 Cement-Mortar Lining for Cast Iron Pipe and Fittings for Water and Other Liquids.

C 106 Cast Iron Pipe Centrifugally Cast in Metal Molds, for water and other Liquids.

C 110 Gray Iron and Ductile Iron Fittings, 3 inch through 48 inch, for Water and Other Liquids.

C 111 Rubber Gasket Joints for Cast Iron and Ductile Iron Pressure Pipe and Fittings.

C 150 Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or other Liquids.

AMERICAN ASSOCIATION OF STATE HIGHWAY & TRANSPORTATION OFFICIALS (AASHTO)

T-88 Particle Size Analysis of Soils.

T-89 Determining the Liquid Limit of Soils.

T-90 Determining the Plastic Limit and Plasticity Index of Soils.

T-99 Moisture Density Relations of Soils Using a 5.5 lb. Rammer and 12 inch Drop.

T-191 Density of Soil In-Place by the Sand-Cone Method.

3.0 SUBMITTALS

The following submittals shall be required for the respective materials used in the work. All submittals shall be submitted through the Contractor to the Engineer.

3.01 Ductile Iron Pipe: The following submittals shall be required for ductile iron pipe systems utilized on the project. The Contractor shall furnish manufacturer's certificates certifying that the pipe and fittings conform to the requirements as specified hereinafter under Article 4.0, Materials. In addition, the submittals shall include the following:

A. Joints: The following shall be required for ductile iron joints.

1. Drawings or Manufacturer's Catalogue data indicating dimensions and tolerance.

2. Gaskets shall be tested in accordance with the respective standards as indicated in ANSI 21.11 and results shall be included in the submittals. Test shall be for similar materials on the gaskets and be not more than one year old.

3. Mechanical Joints: Should the Contractor elect to use mechanical joints in lieu of push-on joints, manufacturer's data shall be submitted in accordance with the "Special Requirements for the Mechanical Joint" as stated in ANSI 21.11 (AWWA C 111).

B. Ductile Iron Pipe Submittal Shall Include the Results of:

1. Tension Test

2. Impact Test

3. Low Temperature Impact Test

Sampling procedure shall be as indicated in ANSI 21.51.

3.02 PVC PIPE

The Contractor shall furnish manufacturer’s certificates certifying that the pipe and fittings conform to the requirements of these specifications and appropriate construction drawings.

4.0 MATERIALS

A. Ductile Iron Pipe

Ductile iron pipe shall be designed in accordance with the latest revision of ANSI/AWWA C51/A21.51), rated working pressure of 350 psi plus a100 psi surge allowance; a 2 to 1 safety factor on the sum of working pressure plus surge pressure in Type 3 laying condition with a depth of cover as required per plans.

Pipe shall have standard asphaltic coating on the exterior. Pipe also shall have a cement mortar lining on the interior in accordance with the latest revision of ANSI/AWWA C104/A21.4. If corrosion protection is required, polyethylene encasement shall be installed prior to the pipes installation in accordance with ANSI/AWWA C105/A21.5-88.

All non-restrained pipe shall be furnished with push-on type joints such as "Fastite", or equal. Joints shall be in accordance with the latest revision of ANSI/AWWA C111/A21.11 and shall be furnished complete with all necessary accessories.

Where restrained joint pipe is required, "Fast Grip", "Flex-Ring", or "Field Flex-Ring" or approved equal shall be used. The length of restrained pipe shall be as tabulated or noted on the plans.

Ductile iron fittings shall conform to the latest revisions of either ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53. Fittings, linings, and coatings shall be as specified for the pipe above.

All pipe, fittings and accessories shall be installed and tested in accordance with the latest revision of AWWA C600. Newly installed ductile iron water mains shall be disinfected in accordance with the latest revision of AWWA C651 prior to placing in service.

B. PVC Pipe

PVC pipe for this project shall be PVC, either C-900, Class 200 for fire lines or SDR-26 for domestic water lines. PVC pipe shall bear the National Sanitation Foundation seal for potable water.

The pipe shall be equipped with a push on joint is a single elastomeric gasketed joint. It is assembled by positioning the elastomeric gasket in the annular groove of the bell and inserting the spigot end of the pipe into the bell. The spigot end of the pipe compresses the gasket radially to form a positive seal. The gasket and annular groove are designed, sized and shaped so that the gasket will resist displacement. Care shall be taken so that only the correct elastomeric gasket, compatible with the annular groove of the bell, is used. Insertion of the elastomeric gasket in the annular groove of the bell must be in accordance with the manufacturer's recommendations.

C. Gate Valves

Where indicated on the Plans or directed by the ENGINEER, the CONTRACTOR shall furnish and install gate valves as hereinafter specified.

All gate valves shall be cast iron mechanical joint, M.J., Mueller A-2380-20, equivalent or better.

All gate valves shall be furnished with O-ring packing and 2" square operating nut, AWWA 200lb., for cast iron water main.

Valve boxes shall be cast iron top and bottom. Extension pieces shall be provided as required.

Payment for furnishing and installing gate valves with box shall be made at the contract unit price per valve according to type and size as listed in the proposal.

All valves will be set at a perfect 90 degree angle from level pipe, (perpendicular) so as to be easily accessible through properly set valve box as per the specifications above.

The CONTRACTOR shall furnish and install either a two-piece or three-piece, slip type, cast iron valve box over each gate valve. Valve boxes will be set over valve operating nut, centered so as to be easily accessible with a valve operating wrench or key. They will be set to correspond with the finished grade of street, lot, or easement. No dirt will be left in box; box will not rest directly on valve body.

D. Fittings, Valves and Hydrants, Etc.

All fittings, valves and valve boxes, hydrants, and other appurtenances are to be set at the points indicated on the plans, or as directed by the ENGINEER and omission to do so shall be corrected by the CONTRACTOR without extra cost to the OWNER.

All fitting shall either be Ductile Iron Compact (ANSI/AWWA C153/A21.53) or Cast Iron (ANSI/AWWA-C110/A21-10) and shall have mechanical joint ends and mechanical joint restraints (Series 1120) and shall be incorporated in the design of the follower gland and shall include a restraining mechanism which, when actuated, imparts multiple wedging action against the pipe, increasing its resistance as the pressure increases. Flexibility of the joint shall be maintained after burial. Glands shall be manufactured of ductile iron conforming to ASTM A 536-80. Restraining devices shall be of ductile iron heat treated to a minimum hardness of 370 BHN. Dimensions of the gland shall be such that it can be used with the standardized mechanical joint bell and tee-head bolts conforming to ANSI/AWWA A21.11 and ANSI/AWWA C153/A21.53 of latest revision. Twist-off nuts shall be used to insure proper actuating of the restraining devices.

The mechanical joint restraint device shall have a working pressure of a least 250 psi with a minimum safety factor of 2:1 and shall be EBAA Iron, MEGALUG or equal.

To improve the sealing capacity, the gaskets for all mechanical joints conforming to the requirements of ANSI/AWWA C110/A/21.10, C111/A21.11, or C153/A21.53 shall be of a design that causes the gasket to deflect approximately 30% during assembly of the mechanical joint. The gasket material shall conform to the requirements of ANSI/AWWA C111/A21.11, Section 1-6.4 of the latest revision. Mechanical joint gaskets shall be EBAA Iron's EBAA Seal- Improved Mechanical Joint Gasket or approved equal.

Fittings (bends, tees, plus, and caps) shall be securely braced by mechanical joint restraints, as indicated on the Plans, to prevent the possibility of blowing off under pressure. And a full length of pipe shall be installed on each end of the fitting. Then cut pieces can be installed beyond the full lengths of pipe.

The prices bid furnishing and installing valves, fittings, etc., shall include compensation for furnishing mechanical joint restraints as required at beds, tees, plugs and caps. No separate or extra compensation will be allowed for any of the above specified incidental work or material.

E. Plugs and Caps

Where indicated on the Plans, or as directed by the ENGINEER, the CONTRACTOR shall install plugs for anticipated future extensions by placing a branch fitting (tee or cross) in the line and plugging the unused branch or branches. In general, such plugs will be located at street intersections where present plans provided lines

running in only two or three directions from the intersections and where, in the opinion of the ENGINEER, a connection may be required for future extension. Where "dead end" lines are installed, the ends of such lines shall be plugged or capped as required.

For the various hot taps required according to the plans, and up to 12 inches, the JCM 432, stainless Tapping Sleeve shall be required. The CONTRACTOR shall furnish all materials for these various taps and the OWNER will actually make the tap.

F. Casing Pipe

Steel pipe utilized as casing at locations shown on the Contract Drawings shall be new round piling pipe conforming to the requirements of ASTM A 252 or A 139. Casing diameter shall be adequate to allow pushing of the specified diameter of water pipe and make proper connections at the ends. Minimum Wall Thickness for steel casing is 0.375 inch. All casing shall have projection type non-metallic spacers constructed of preformed section of high density polyethylene. Spacers shall be RACI type spacers from Public Works Marketing, Inc. or approved equal.

G. Wash Gravel Bedding Material

Select Granular material for pipe bedding shall be coarse concrete aggregate. The coarse concrete aggregate shall conform to the gradation sizing Number 467 specified in Table 2 of ASTM Standard Specification C-33. (See Following Table)

SIZE NO. 467	
Nominal Size (Sieves w/Square Openings)	Percent Passing by Weight
2"	100
1 - 1/2"	95 - 100
3/4"	35 - 70
3/8"	10 - 30
No. 4	0 - 5

H. Stabilization Material:

Stabilization Material shall be a pit run mixture of sand and gravel. The sand shall be hard, sharp and durable particles. All gravel shall pass a 1 - 1/2" sieve.

I. Concrete

Concrete shall be in accordance with the requirements of Technical Specifications - CONCRETE

J. Select Backfill

General: The select material shall be composed of a natural or artificial mixture of sand, silt, clay or soil binder or other material of satisfactory cementing value. The sand shall be hard, sharp, and durable particles,

preferably siliceous. The binder shall be a grade of clay or other material having satisfactory cementing qualities and shall be homogenous in character, free from vegetable matter, clay balls or other deleterious substances that cannot be classed as serviceable base material.

Gradation: Any coarse aggregate contained in the material shall pass the one and one-half (1-1/2); sieve and not more than thirty-five percent (35%) shall be retained in the Number 10 sieve. The plasticity index (P.I.) shall not exceed 12 or less than 5, nor shall the liquid limit exceed 30.

The composite selected sand-clay material passing the Number 10 sieve shall conform to the following minimum and maximum gradation limits:

Sieve	Percent Passing by Weight
Number 40	40-85
Number 60	30-70
Number 270	8-29
Silt (.05 to .005mm)	3-14
Clay (Passing .005mm)	3-14

K. Backfill

All other backfill shall consist of excavated material removed from the trench.

5.0 CONSTRUCTION

EARTHWORK:

A. Site Preparation: Topsoil shall be stripped and stockpiled in accordance with other Technical Specifications.

All vegetation such as brush, heavy sod, heavy growth of grass, decayed vegetative matter, rubbish and any other unsuitable material within the area of trenching shall be stripped or otherwise removed before the trenching is started, and in no case shall such objectionable material be allowed in the trench.

Stripping operation shall be to a depth of not less than 6 inches in all cases.

B. Asphalt or Concrete Removal: Before trenching operations begin, the existing asphalt or concrete pavement shall be scored or cut to a proper depth to give a straight vertical edge when removed. The asphalt or concrete shall be disposed of offsite by the Contractor. While removing the asphalt or concrete in the trench line, never shall the adjacent asphalt be raised or pulled from its base.

C. Trenching: The Contractor shall determine all requirements for trench dimensions, alignment, and grades. The trench shall be excavated in conformance with all federal, state and local regulations for the protection of

the workmen. Shoring, sheeting and/or a moveable form shall be used as required to provide earth stability during the laying operations.

The final excavation of the trench for the pipe installation shall be as indicated on the Plans. Minor variations in horizontal (within the permanent easement) or vertical alignment during construction shall be made during construction (with the Engineer's approval) to facilitate ease of installation and operation (due to potential conflicts; i.e., utility conflict) at no additional cost to the Owner except for additional piping, if any. The trench from the top of the pipe down to the bottom of the bedding shall be of a consistent width as indicated on the plans. Should the excavated width of the trench be larger than the design width, the Engineer may direct that a higher type or class of bedding be used; or other adjustments be made to increase the load carrying capacity of the pipe.

The Contractor shall not excavate more trench in advance of pipe laying than is necessary to perform the work efficiently. No more than 100 feet of open trench shall be allowed unless approved by the Engineer.

Excavated material shall be place in a manner that will not obstruct sidewalks, driveways, or other structures. Excavated material shall not be placed so as to surcharge the walls and jeopardize trench stability.

D. Disposal: The Contractor shall satisfactorily dispose of all excess earth from excavations either in approved (by the Engineer) areas within the construction limits or away from the project in disposal sites obtained by the Contractor.

The Contractor will be permitted to mound excess earth over the trench to a maximum depth of 12 inches above the original ground surface or finished grade where the trench is located in unimproved property. Wasting of excess excavated material will not be permitted within any road ROW. All material within the construction limits shall be placed so that natural drainage is maintained and the surface shall be graded to a smooth and uniform appearance. The disposal of waste and excess excavating materials, including hauling, handling, grading, and surfacing shall be subsidiary obligation of the contractor and no separate payment will be made. Therefore, the cost of such work shall be included in the Contract Unit Price for installation of water pipe.

E. Dewatering: The site shall be kept free of surface water at all times. The Contractor shall install drainage ditches and dikes and shall perform all pumping and other work necessary to divert or remove rainfall and other accumulations of surface water from the excavations. The diversion and removal of surface water performed in a manner that will prevent the accumulation of water behind temporary structures or at any other locations within the construction area where it may be detrimental. The Contractor shall provide, install, and operate sufficient trenches, sumps, pumps, hoses, piping, well points, deep wells, etc., necessary to depress and maintain the ground water level at least one foot below the base of the excavation during all stages of construction operations. The ground water table shall be lowered in advance of excavation and maintained a minimum of one foot below the lowest excavation subgrade made until the structure has sufficient has sufficient strength and weight to withstand horizontal and vertical soil and water pressures.

Where groundwater is encountered, the Contractor shall make the effort necessary to secure a dry trench bottom before laying pipe. In sandy and in other suitable type soils, dewatering shall be done by well pointing. If, in the opinion of the Engineer, the Contractor has failed to obtain an absolutely dry trench bottom by

insufficient use of all known methods of trench dewatering, the Engineer may order the Contractor to excavate below grade and place not less than 6 inches of graded crushed stone fill material over the trench bottom to form trench drains to suitably located sumps and to remove the water by bailing or pumping. The graded crushed stone fill material shall be placed at the Contractor's own expense and shall be of such depth that there shall be not water in bell holes at the time of coupling pipe. All costs of equipment, labor, and materials required for dewatering shall be included in the bid price.

F. Bedding: The Contractor shall satisfactorily shape the trench area (to specified line, grade and cross section) to receive bedding material. The bottom of the trench shall be undisturbed soil. Should the Contractor over excavate the trench without direction from the Engineer, the trench shall be brought up to grade with select backfill and compacted to at least 90% of maximum laboratory density as measured by AASHTO T 99. Such additional work and materials for over excavation without direction of the Engineer shall be at the expense of the Contractor.

Holes for the bells shall be provided at each joint in the subgrade or in the granular fill bedding material as required. The holes shall be no larger than necessary for joint assembly and assurance that the pipe barrel will lie flat on the material. The Contractor shall install the proper bedding for the respective type of pipe and depth of installation as shown in the details and schedules on the plans. When depths vary in a particular run, the Contractor shall change bedding systems in accordance with the depth installation requirements.

1. Stabilization Materials: When the subgrade is found to be unstable or to include ashes, refuse, organic material, or other unsuitable material, the Engineer may direct that the subgrade be over excavated to remove such material. The depths of over excavation shall be as directed by the Engineer. Stabilization material shall be placed into the over excavated area of the trench and shall be paid for in accordance with these specifications. Stabilization shall be compacted to at least 90% of maximum laboratory density in six inch lifts.

2. Bedding Materials: As detailed in the plans, bedding material shall be placed to the specified depth below the pipe and tamped to a minimum of 90% of maximum laboratory density as determined in accordance with AASHTO T 99. Following placement of pipe, additional bedding material shall be placed and consolidated under the haunches of the pipe. Special tools shall be required to work the material into place and leave no voids beneath the pipe. The bedding material shall be tamped along the spring line (or along the top of the bedding material as indicated) of the pipe to sufficiently compact the material insofar as practical.

3. The Engineer may direct additional moisture be added to the bedding material to aid in the compaction effort. Mechanical tampers may be employed to aid the process depending on the particular bedding required, additional bedding shall be added and tamped to a minimum of 90% of maximum laboratory density, with AASHTO T-99.

4. Select Backfill: Select backfill shall be placed in 6 inch lifts and tamped to a minimum laboratory density with AASHTO T-99. Overall depth of the select backfill shall be as directed by the Engineer.

5. Normal Condition Bedding: Under normal conditions the trench bottom shall be undisturbed earth shaped to the specified line, grad, and cross section with proper bell holes at each joint to insure that pipe barrel lies flat on trench bottom. The bedding material will be selected native materials excavated

from the trench and placed in two lifts. The first lift being placed up to the spring line of the pipe and extending out to the trench walls and hand tamped to a minimum of 90% of maximum laboratory density. Special care shall be used in placing and tamping bedding to insure no voids under the haunches of the pipe. The second lift shall extend to approximately 6" above pipe (Material permitting) and hand tamped to 90% density.

6. Backfilling: Upon completion of placement of select material the excavated materials shall be immediately placed back into the trench. Specific requirements are:

    a. Backfill requirements for road crossings, parking lots, driveways, and sidewalks shall be in accordance with other Technical Specifications.

    b. Backfill requirements for unimproved areas (pastures, wooded areas) shall consist of placement and shaping of the soil in such a manner as to allow maximum natural consolidation. No compaction of the general backfill in the unimproved areas will be required, except that caused by conventional shaping equipment.

    c. No debris shall be used as backfill which has a volume in excess of one-half of one cubic foot or weight excess of 75 pounds.

2. Sheeting Removal: Wooden sheeting or other thick sheeting or shoring members which have been driven or otherwise placed along the trench walls to an elevation below the spring line of the pipe shall be cut off at the spring line or higher and left in place.

3. Grading and Grassing: Final grading and grassing shall be in accordance with Plans and Specifications.

PIPE HANDLING AND STORAGE:

Pipe shall be handled, staked, and stored in accordance with manufacturer's printed literature. The Contractor shall provide security as required to prevent damage by vandals. PVC pipe shall be shaded from sunlight for extended lengths of time. Pipe damaged during storage and handling shall be rejected.

PIPE LAYING:

Each pipe shall be laid true to line and grade and in such manner as to form a close concentric joint with the adjoining pipe and to prevent sudden offsets of the flow line. As the work progresses, the interior of the water shall be cleared of all dirt and superfluous materials of every description. Where cleaning after laying is difficult because of small pipe size, a suitable swab or drag shall be kept in the pipe and pulled forward past each joint immediately after the jointing has been completed. Trenches shall be kept free of water and pipe shall not be laid when the condition of the trench or the weather is unsuitable for such work. At times when work is not in progress, open ends of pipe and fittings shall be securely and satisfactorily closed so that no trench water earth or other substance will enter the pipe or fittings.

The water main shall maintain a minimum of 30 inches of cover at all times.

Pipe laying shall be performed in such a manner that no foreign material enters the pipe. The Engineer may require that before lowering pipe, heavy canvas bags be placed over each end, and left in place until joints are ready to be made. If water is in the trench, the seals shall remain in place until the trench is pumped completely

dry. If conditions are unsuitable, no pipe shall be laid until satisfactory laying conditions are obtained in accordance with the above specified requirements.

PIPE JOINTING:

Piping shall be jointed in accordance with the manufacturer's printed recommendations. Gaskets shall be firmly set within the bells and grooves as required. The manufacturer's recommended lubricant or an approved equal shall be applied for slip type joints.

Ductile Iron Pipe Joint Construction: The installation and jointing of ductile iron pipe shall generally conform to the applicable provisions of AWWA Standard Specifications C-600 for pipe laying.

Where mechanical joint pipe is used, the surfaces which come in contact with the gasket shall be thoroughly brushed with a wire brush just prior to assembly. The gasket should be brushed with soapy water prior to installation to remove loose dirt and to lubricate gasket as it is forced into its retaining space.

When tightening bolts, it is essential that the gland be brought up toward the pipe flange evenly. The bolts should be partially tightened; the bottom bolt first, then the top; next the bolts on either side; and last, the remaining bolts. Overstressing of bolts to compensate for poor installation will not be permitted. Bolt torque shall be in accordance with manufacturer's specifications.

All joints of whatever type shall be completely water tight after being subjected to the required tests.

BORINGS:

Borings shall be accomplished in accordance with Mississippi Department of Transportation Standards. The contractor shall provide all necessary sheeting, bracing, cribbing, supports and appurtenances to insure the proper line and grade throughout the entire length of the crossing.

A. Casing Pipe: Casing Pipe shall be installed as indicated on the Contract Drawings. Joints shall be completely welded to provide structural integrity and shall be watertight.

B. Carrier Pipe: Carrier pipe may be any of the allowed options of piping. However, the piping and joints shall be capable of withstanding the stress exerted by pushing the pipe within the casing.

C. Carrier Pipe Supports: Supports for the carrier pipe shall be as recommended by the manufacturer for such installation. Supports shall be spaced to adequately support the piping under all conditions.

D. Casing Seal: The annulus between the casing and carrier pipe shall be sealed at each end by installing WMSON Type U end seals, as manufactured by T.D. Williamson, Inc. Tulsa, Oklahoma, or equal, in accordance with the instructions of the manufacturer of the seals.

SEPARATION OF WATER AND SEWER MAINS:

The water and sewer specifications should state that the water line be constructed no less than 10 feet horizontally and 18" vertically with water line over sewer line. If those conditions cannot be met then they will be decided on a case by case basis.

6.0 TESTING

DUCTILE IRON PIPE:

A. Field Inspection: The Engineer shall perform visual inspection of the material prior to placement by the Contractor. The Engineer may make non-destructive tests to determine the soundness of the pipe. The Contractor shall assist the Engineer in handling and moving the pipe as required.

B. Material Test: Material test shall be conducted during the manufacturing process and the results shall be included as part of the submittals. No other material test shall be required.

STEEL CASING PIPE:

Material test shall be included as part of the submittal. No other material test shall be required.

COMPACTION TESTS:

Compaction tests shall be performed in accordance with AASHTO T 191 or ASTM D 2922. Maximum compaction shall be determined in accordance with AASHTO T 99. Compaction tests for water pipe related work shall not be less than as follows:

AASHTO T-99 or ASTM D 2922	AASHTO T-191
Stabilization Material	One per 100 CY
Bedding Material	One per 600 LF
Tamped Backfill	One per 600 LF

HYDROSTATIC TESTING:

After the pipe has been laid, all newly laid pipe or any valved section thereof shall be subjected to a hydrostatic pressure of at least 1.5 times the working pressure at the point of testing and not less than 1.25 times the working pressure along the test section, for a minimum of 2 hours.

And all tests shall be in accordance with AWWA Standard C600-82, Section 4.

Allowable leakage shall be no more than that determined by the following formula:

$$L = \frac{SD\sqrt{P}}{133{,}200}$$

In which:

L is the allowable leakage in gallons per hour;
S is the length of pipe tested in feet;
D is the nominal diameter of the pipe, in inches; and
P is the average test pressure during the leakage test in pounds per square inch.

These tests are to be made a the Contractor's expense and he is to provide all necessary fittings, equipment, appliances and any other necessary items to conduct the tests in a manner satisfactory to the ENGINEER. All costs incidental to conducting these tests are to be included in the prices bid for the various items of construction as no separate or extra compensation is to be allowed therefore. Record of testing is to be furnished to the OWNER.

CLEANING AND STERILIZING:

Before each section of work is placed in service, it shall be thoroughly flushed to remove any dirt or other foreign material from inside the lines; and the inside of the lines shall be sterilized by pumping into and though them as solution of chlorine of 50mg/l for 24 hours in such manner as to meet the requirements of the State Board of Health.

At least two (2) samples of chlorine free water, taken from each section shall be submitted to the State Board of Health for examination to determine if the system is free from organisms of the Coli-Aerogenes group. If such samples are not negative from organisms of the Coli-Aerogenes group, the system shall be disinfected and redisinfected in a manner meeting the requirements of the State Board of Health, until the system is freed of contamination.

All water mains will be flushed, chlorinated and rechlorinated until two (2) consecutive negative water samples are obtained by the Local Health Department. The samples shall be collected by the Certified Operator of the system or the Professional Engineer of the project.

The CONTRACTOR shall be responsible for the conduct of all of the above defined activities, and any and all costs incident thereto shall be included in the prices bid for the various items of construction as no separate or extra compensation is to be allowed therefore.

END OF SECTION

SECTION 33 14 00
SEWER/WATER UTILITY – TRACE WIRE SPECIFICATION

1.0 GENERAL

All trace wire shall have HDPE insulation intended for direct bury, color coated per APWA standard for the specific utility being marked. THHN is prohibited from use in the tracer wire system.

All trace wire, test stations and accessories shall be supplied by a single manufacturer and domestically made in the USA.

All tracer wire and accessories shall be installed per plan details and per manufacturers recommended installation methods. All wire and connectors shall be rated for direct bury applications.

2.0 MATERIALS

Copper Clad Steel (CCS) Trace Wire
Open Trench – 12 Gauge Copper Clad Steel with a Break Load of 452 pounds
Directional Drilling - 12 Gauge Copper Clad Steel with a Break Load of 1,150 pounds
Connectors
2-Way Splice Connector with Strain Relief
3-Way Connector
Termination/Access/Test Stations
Non-Roadway: Equal to Copperhead LD14TP
Concrete / Driveway: Equal to Copperhead CD14TP
Roadway: Equal to Copperhead RB14TP
Fire Hydrant: Equal to Copperhead T2-FLPKG
Grounding
Magnesium Anode: Equal to Copperhead ANO-12

3.0 TESTING

All new trace wire installations shall be located using typical low frequency (512Hz) line tracing equipment, witnessed by the contractor, engineer and facility owner as applicable, prior to acceptance of ownership.

This verification shall be performed upon completion of rough grading and again prior to final acceptance of the project. Continuity testing in lieu of actual line tracing shall not be accepted.

4.0 CONNECTORS

All mainline trace wires must be interconnected in intersections, at mainline tees and mainline crosses. At tees, the three wires shall be joined using a single 3-way lockable connector. Connectors shall be dielectric silicon filled to seal out moisture and corrosion, and shall be installed in a manner so as to prevent any uninsulated wire exposure.
Non-locking friction fit, twist on or taped connectors are prohibited.

5.0 TERMINATION/ACCESS/TEST STATIONS

All trace wire termination points must utilize an approved tracer wire access box, specifically manufactured for this purpose or as detailed on the plans

All grade level/in-ground access boxes shall be appropriately identified with “sewer” or “water” cast into the cap and be color coded (blue – water / green – sewer).

Test stations at dead ends shall be two-terminal.

Test stations in between dead ends shall be single terminal.

A minimum of 2 ft. of excess/slack wire is required in all trace wire access boxes after meeting final elevation.

Grounding anode wire shall be connected to the identified (or bottom) terminal on all access boxes.

Hydrants – Trace wire must terminate at an approved above-ground trace wire access box, properly affixed to the hydrant grade flange.

6.0 GROUNDING

Trace wire must be properly grounded at all dead ends/stubs.

Grounding of trace wire shall be achieved by use of a drive-in magnesium grounding anode rod with a minimum of 20ft of #12 red HDPE insulated copper clad steel wire connected to anode specifically manufactured for this purpose, and buried at the same elevation as the utility.
Where the anode wire will be connected to a trace wire access box, a minimum of 2 ft. of excess/slack wire is required after meeting final elevation.

7.0 SANITARY SEWER SYSTEM

A mainline trace wire must be installed, with all service lateral trace wires properly connected to the mainline trace wire, to ensure full tracing/locating capabilities from a single connection point.

Lay mainline trace wire continuously, by-passing around the outside of manholes/structures on the North or East side.

Trace wire on all sanitary service laterals must terminate at the cleanout and located directly above the service lateral at the edge of road right of way as detailed in the plans.

8.0 WATER SYSTEM

A mainline trace wire must be installed, with all service lateral trace wires properly connected to the mainline trace wire, to ensure full tracing/locating capabilities from a single connection point.

Lay mainline trace wire continuously, by-passing around the outside of valves and fittings on the North or East side.

Trace wire on all water service laterals must terminate at an approved trace wire access box color coded blue and located directly above the service lateral at the edge of road right of way.

Above-ground tracer wire access boxes will be installed on all fire hydrants.

All conductive and non-conductive service lines shall include tracer wire.

9.0 INSTALLATION

Trace wire systems must be installed as a single continuous wire, except where using approved connectors. No looping or coiling of wire is allowed.

Trace wire shall be installed at the bottom half of the pipe and secured (taped/tied) at 5’ intervals.

Trace wire on all service laterals/stubs must terminate directly above the utility, at the edge of the road right-of-way, but out of the roadway.

At all mainline dead-ends, trace wire shall go to ground using an approved connection to a drive-in magnesium grounding anode rod, buried at the same depth as the trace wire.

Mainline trace wire shall not be connected to existing conductive pipes. Treat as a mainline dead-end, ground using an approved waterproof connection to a grounding anode buried at the same depth as the trace wire.

All service lateral trace wires shall be a single wire, connected to the mainline trace wire using a mainline to lateral 3-way connector, installed without cutting/splicing the mainline trace wire.

In occurrences where an existing trace wire is encountered on an existing utility that is being extended or tied into, the new trace wire and existing trace wire shall be connected using approved splice connectors, and shall be properly grounded at the splice location as specified.

Trace wire on all water service laterals must terminate at an approved trace wire access box color coded blue and located directly above the service lateral at the edge of road right of way.

Above-ground tracer wire access boxes will be installed on all fire hydrants.

All conductive and non-conductive service lines shall include tracer wire.

SECTION 33 30 00
SANITARY SEWER

PART 1 - GENERAL

1.01 SECTION INCLUDES

This item shall consist of furnishing all of the necessary materials, supervision, labor, tools, equipment and incidentals, and the installation of various types and sizes of sewer pipe and related items in accordance with the Contract Drawings and Specifications, as stated in the Proposal.

1.02 APPLICABLE PUBLICATIONS

The following publications form a part of these Specifications and where referred to by basic designation only, are applicable to the extent indicated. The latest editions of the publications referenced shall apply to the work.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

A 139	Electric-Fusion (Arc)-Welded Steel Pipe (NPS 4 and Over)
A 252	Welded and Seamless Steel Pipe Piles
C 31	Making and Curing Concrete Test Specimens in the Field
C 33	Concrete Aggregates
C 39	Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
D 1248	Polyethylene Plastics Extrusion Materials For Wire and Cable
D 1784	Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
D 2412	Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
D 3034	Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
D 6938	Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
D 3212	Joints for Drain and Sewer Plastic Pipes using Flexible Elastomeric Seals.
F 477	Elastomeric Seals (Gaskets) for Joining Plastic Pipe
F 794	Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter

AMERICAN WATER WORKS ASSOCIATION (AWWA)

C 104 Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water

C 110 Gray Iron and Ductile Iron Fittings, 3 inch through 48 inch, for Water and Other Liquids

C 111 Rubber Gasket Joints for Cast Iron and Ductile Iron Pressure Pipe and Fittings

C 151 Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or other Liquids

AMERICAN ASSOCIATION OF STATE HIGHWAY & TRANSPORTATION OFFICIALS (AASHTO)

T-88 Particle Size Analysis of Soils

T-89 Determining the Liquid Limit of Soils

T-90 Determining the Plastic Limit and Plasticity Index of Soils

T-99 Moisture-Density Relations of Soils Using a 2.5-Kg (5.5-Lb) Rammer and a 305-mm (12-in.) Drop

T-191 Density of Soil In-Place by the Sand-Cone Method.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

Standard Specifications for Road and Bridge Construction, 2004 Edition

1.03 SUBMITTALS

The following submittals shall be required for the respective materials used in the work. All submittals shall be submitted through the Contractor to the Engineer.

A. Ductile Iron Pipe:

The following submittals shall be required for ductile iron pipe systems utilized on the project. The Contractor shall furnish manufacturer's certificates certifying that the pipe and fittings conform to the requirements as specified hereinafter under Part 2, Materials. In addition, the submittals shall include the following:

1. Joints: The following shall be required for ductile iron joints.

    a. Drawings or Manufacturer's catalog data indicating dimensions and tolerance.

    b. Gaskets shall be tested in accordance with the respective standards as indicated in AWWA C111 and results shall be included in the submittals. Test shall be for similar materials on the gaskets and be not more than one year old.

    c. Mechanical Joints: Should the Contractor elect to use mechanical joints in lieu of push-on joints, manufacturer’s data shall be submitted in accordance with the "Special Requirements for the Mechanical Joint" as stated AWWA C 111.

2. Ductile Iron Pipe Submittal Shall Include the Results of:

a. Tension Test

b. Impact Test

c. Low Temperature Impact Test

Sampling procedure shall be as indicated in AWWA C151.

B. PVC Pipe:

The Contractor shall submit manufacturer's certificate certifying that the pipe and fittings conform to the requirements as specified hereinafter under Part 2, Products. In addition, the Contractor shall submit the following:

1. PVC Piping: PVC Pipe shall be sampled, tested, and inspected in accordance with the provisions of ASTM D3034. Copies of test results shall be attached. Test results shall be similar material and not be more than one year old from the date of material delivery.

2. Joints: Certificate with test results for joints for compliance to ASTM D 3212. Gaskets shall conform to ASTM F 477. Test results shall be for similar material and not be more than one year old.

PART 2 - PRODUCTS

2.01 Gravity Sewer Pipe

Where the type of gravity sewer piping is not indicated on the plans, the Contractor shall furnish polyvinyl chloride (PVC) pipe.

The Contractor shall be restricted to furnishing the exact type of pipe material where indicated on the Contract Drawings.

The Contractor shall be limited to the use of only one type of pipe (so selected by the Contractor and indicated on the Proposal Form) and shall not change the type of gravity sewer pipe except as follows:

1. Where indicated on the plans, or

2. If permitted in writing by the Engineer.

A. Ductile Iron Pipe:

1. Ductile iron gravity sewer pipe shall conform to the requirements of AWWA C151 Class 50 for the respective nominal diameter size. Joints shall be push-on or mechanical, both in accordance with AWWA C 111. Fitting shall conform to AWWA C 110 with mechanical or standard push-on joints.

2. All ductile iron pipe and fittings shall be coated outside with standard bituminous coatings and lined inside with a 16 mil coal tar epoxy coating. All fittings are to be absorbed in the price of pipe.

B. PVC Pipe:

1. PVC gravity sewer pipe and fittings shall conform to the requirements of ASTM D 3034 with an SDR of 26 and a minimum stiffness of 115 psi. Joints for sewer pipe shall be either push-on or

mechanical conforming to the requirements of ASTM D 3212. Gaskets for sewer pipe shall conform to the requirements of ASTM F 477.

2. Approved adaptors shall be used for making connections between PVC pipe and concrete manholes.

C. Service Laterals:

1. Service laterals for local services shall consist of fittings, pipe lengths, and plugs for later connection of 6 inch or 4 inch pipe. The fittings, pipe lengths and plugs shall be of the same material as the run pipe unless otherwise indicated on the Contract Drawings. The modified sewer tees shall be an integral part of the run pipe. The remainder of the branch shall consist of standard fittings (elbows, reducers, and lengths of pipe) in accordance with the manufacturer's standard products and as specified. Pipe lengths and joint connections shall meet the specified requirements for the type materials used. Ends shall be plugged and identified with a 2" x 2" treated post.

2. All service lines shall extend a maximum of up to 5 feet from house fronts of residences and public buildings and up to the property lines of businesses.

2.02 Casing Pipe:

Steel pipe utilized as casing at locations shown on the Contract Drawings shall be new round piling pipe conforming to the requirements of ASTM A 252 or A 139. Casing diameter shall be adequate to allow pushing of the specified diameter of sewer pipe or force main and make proper connections at the ends. Minimum Wall Thickness for steel casing is 0.25 inch (Highway) and 0.28 inch (railroad).

2.03 Stabilization Material:

Stabilization Material shall be a pit run mixture of sand and gravel. The sand shall be hard, sharp and durable particles. All gravel shall pass a 1½" sieve.

2.04 Clay Gravel Material:

Clay Gravel Material shall meet MDOT Standards Class 6, Group C.

2.05 Wash Gravel Bedding Material:

Select granular material for pipe bedding shall be coarse concrete aggregate. The coarse concrete aggregate shall conform to the gradation sizing Number 467 specified in Table 2 of ASTM Standard Specification C-33. (See Following Table):

SIZE NO. 467	
Nominal Size (Sieves w/Square Openings)	Percent Passing by Weight
2"	100
1½"	95-100
3/4"	35-70

3/8"	10-30
No.4	0-5

2.06 Concrete:

Concrete shall be in accordance with the requirements of Section 03301, Incidental Concrete.

2.07 Select Backfill:

A. General:

The select material shall be composed of a natural or artificial mixture of sand, silt, clay or soil binder or other material of satisfactory cementing value. The sand shall be hard, sharp, and durable particles, preferably siliceous. The binder shall be a grade of clay or other material having satisfactory cementing qualities and shall be homogenous in character, free from vegetable matter, clay balls or other deleterious substances that cannot be classed as serviceable base material.

B. Gradation:

Any coarse aggregate contained in the material shall pass the one and one-half (1-1/2), sieve and not more than thirty-five percent (35%) shall be retained in the Number 10 sieve. The plasticity index (P.I.) shall not exceed 12 or be less than 5, nor shall the liquid limit exceed 30.

The composite selected sand-clay material passing the Number 10 sieve shall conform to the following minimum and maximum gradation limits:

Sieve	Percent Passing by Weight
Number 40	40-85
Number 60	30-70
Number 270	8-29
Silt (.05 to .005mm)	3-14
Clay (Passing .005mm)	3-14

2.08 Backfill:

All other backfill shall consist of excavated material removed from the trench.

PART 3 - EXECUTION

3.01 EARTHWORK:

A. Site Preparation:

Topsoil shall be stripped and stockpiled in accordance with **Technical Specifications - Restoration of Roads, Driveways, Fences, Lawns, and other Grassed Areas**.

All vegetation such as brush, heavy sod, heavy growth of grass, decayed vegetative matter, rubbish and any other unsuitable material within the area of trenching shall be stripped or otherwise removed before the trenching is started, and in no case shall such objectionable material be allowed in the trench.

Stripping operation shall be to a depth of not less than 6 inches in all cases.

B. Asphalt or Concrete Removal:

Before trenching operations begin, the existing asphalt or concrete pavement shall be scored or cut to a proper depth to give a straight vertical edge when removed. The asphalt or concrete shall be disposed of offsite by the Contractor. While removing the asphalt or concrete in the trench line, never shall the adjacent asphalt be raised or pulled from its base.

C. Trenching:

1. The Contractor shall determine all requirements for trench dimensions, alignment, and grades. The trench shall be excavated in conformance with all federal, state and local regulations for the protection of the workmen. Shoring, sheeting and/or a moveable form shall be used as required to provide earth stability during the laying operations.

2. The final excavation of the trench for the pipe installation shall be as indicated on the Plans. Minor variations in horizontal or vertical alignment during construction shall be made during construction (with the Engineer's approval) to facilitate ease of installation and operation (due to potential conflicts; i.e., utility conflict) at no additional cost to the Owner except for additional piping, if any. The trench from the top of the pipe down to the bottom of the bedding shall be of a consistent width as indicated on the plans. Should the excavated width of the trench be larger than the design width, the Engineer may direct that a higher type or class of bedding be used; or other adjustments be made to increase the load carrying capacity of the pipe.

3. The Contractor shall not excavate more trench in advance of pipe laying than is necessary to perform the work efficiently. No more than 100 feet of open trench shall be allowed unless approved by the Engineer.

4. Excavated material shall be place in a manner that will not obstruct sidewalks, driveways, or other structures. Excavated material shall not be placed so as to surcharge the walls and jeopardize trench stability.

D. Disposal:

1. The Contractor shall satisfactorily dispose of all excess earth from excavations either in approved (by the Engineer) areas within the construction limits or away from the project in disposal sites obtained by the Contractor.

2. The Contractor will be permitted to mound excess earth over the trench to a maximum depth of 12 inches above the original ground surface or finished grade where the trench is located in unimproved property. Wasting of excess excavated material will not be permitted within any road right-of-way. All material within the construction limits shall be placed so that natural drainage is maintained and the surface shall be graded to a smooth and uniform appearance. The disposal of waste and excess excavating materials, including hauling, handling, grading, and surfacing shall be subsidiary obligation of the contractor and no separate payment will be made. Therefore, the cost of such work shall be included in the Contract Unit Price for installation of sewer pipe.

E. Dewatering:

1. The site shall be kept free of surface water at all times. The Contractor shall install drainage ditches and dikes and shall perform all pumping and other work necessary to divert or remove rainfall and other accumulations of surface water from the excavations. The diversion and removal of surface water shall be performed in a manner that will prevent the accumulation of water behind temporary structures or at any other locations within the construction area where it may be detrimental. The Contractor shall provide, install, and operate sufficient trenches, sumps, pumps, hoses, piping, well points, deep wells, etc., necessary to depress and maintain the ground water level at least one foot below the base of the excavation during all stages of construction operations. The ground water table shall be lowered in advance of excavation and maintained a minimum of one foot below the lowest excavation subgrade made until the structure has sufficient strength and weight to withstand horizontal and vertical soil and water pressures.

2. Where groundwater is encountered, the Contractor shall make the effort necessary to secure a dry trench bottom before laying pipe. In sandy soils and in other suitable type soils, dewatering shall be done by well pointing. If, in the opinion of the Engineer, the Contractor has failed to obtain an absolutely dry trench bottom by insufficient use of all known methods of trench dewatering, the Engineer may order the Contractor to excavate below grade and place not less than 6 inches of graded crushed stone fill material over the trench bottom to form trench drains to suitably located sumps and to remove the water by bailing or pumping. The graded crushed stone fill material shall be placed at the Contractor's own expense and shall be of such depth that there shall be not water in bell holes at the time of coupling pipe. All costs of equipment, labor, and materials required for dewatering shall be included in the bid price.

F. Bedding:

1. The Contractor shall satisfactorily shape the trench area (to the specified line, grade and cross section) to receive bedding material. The bottom of the trench shall be undisturbed soil. Should the Contractor over excavate the trench without direction from the Engineer, the trench shall be brought up to grade with select backfill and compacted to at least 90% of maximum laboratory density as measured by AASHTO T 99. Such additional work and materials for over excavation without direction of the Engineer shall be at the expense of the Contractor.

2. Holes for the bells shall be provided at each joint in the subgrade or in the granular fill bedding material as required. The holes shall be no larger than necessary for joint assembly and assurance that the pipe barrel will lie flat on the material. The Contractor shall install the proper bedding for the respective type of pipe and depth of installation as shown in the details and schedules on the plans. When depths vary in a particular manhole run, the Contractor shall change bedding systems in accordance with the depth installation requirements.

3. Stabilization Materials: When the subgrade is found to be unstable or to include ashes, refuse, organic material, or other unsuitable material, the Engineer may direct that the subgrade be over excavated to remove such material. The depths of over excavation shall be as directed by the Engineer. Stabilization material shall be placed into the over excavated area of the trench and shall

be paid for in accordance with these specifications. Stabilization shall be compacted to at least 90% of maximum laboratory density in six inch lifts.

4. Bedding Materials:

   a. As detailed in the plans, bedding material shall be placed to the specified depth below the pipe and tamped to a minimum of 90% of maximum laboratory density as determined in accordance with AASHTO T 99. Following placement of pipe, additional bedding material shall be placed and consolidated under the haunches of the pipe. Special tools shall be required to work the material into place and leave no voids beneath the pipe. The bedding material shall be tamped along the spring line of the pipe to sufficiently compact the material insofar as practical.

   b. The Engineer may direct additional moisture be added to the bedding material to aid in the compaction effort. Mechanical tampers may be employed to aid the process. Depending on the particular bedding required, additional bedding shall be added and tamped to a minimum of 90% of maximum laboratory density, with AASHTO T-99.

5. Select Backfill: Select backfill shall be placed in 6 inch lifts and tamped to a minimum of 95% of laboratory density with AASHTO T-99. Overall depth of the select backfill shall be as directed by the Engineer.

6. Normal Condition Bedding: Under normal conditions the trench bottom shall be undisturbed earth shaped to the specified line, grade, and cross section with proper bell holes at each joint to insure that pipe barrel lies flat on trench bottom. The bedding material will be select native materials excavated from the trench and placed in two lifts. The first lift being placed up to the spring line of the pipe and extending out to the trench walls and hand tamped to a minimum of 90% of maximum laboratory density. Special care shall be used in placing and tamping bedding to ensure no voids under the haunches of the pipe. The second lift shall extend to approximately 6" above pipe (material permitting) and hand tamped to 90% density.

7. Backfilling: Upon completion of placement of select material the excavated materials shall be immediately placed back into the trench. Specific requirements are:

   a. Backfill requirements for road crossings, parking lots, driveways, and sidewalks shall be in accordance with other Technical Specifications.

   b. Backfill requirements for unimproved areas (pastures, wooded areas) shall consist of placement and shaping of the soil in such a manner as to allow maximum natural consolidation. No compaction of the general backfill in the unimproved areas will be required, except that caused by conventional shaping equipment.

   c. No debris shall be used as backfill which has a volume in excess of one-half of one cubic foot or a weight excess of 75 pounds.

8. Sheeting Removal: Wooden sheeting or other thick sheeting or shoring members which have been driven or otherwise placed along the trench walls to an elevation below the spring line of the pipe shall be cut off at the spring line or higher and left in place.

9. Grading and Grassing: Final grading and grassing shall be in accordance with other Technical Specifications.

3.02 PIPE HANDLING AND STORAGE:

Pipe shall be handled, staked, and stored in accordance with manufacturer's printed literature. The Contractor shall provide security as required to prevent damage by vandals. PVC pipe shall be shaded from sunlight if it is left outside for extended lengths of time. Pipe damaged during storage and handling shall be rejected.

3.03 PIPE LAYING:

A. Pipe laying shall proceed upgrade with the spigot ends of the bell-and-spigot pipe and tongue ends of the tongue and groove pipe jointing in the direction of flow. Each pipe shall be laid true to line and grade and in such a manner as to form a close concentric joint with the adjoining pipe and to prevent sudden offsets of the flow line. As the work progresses, the interior of the sewer shall be cleared of all dirt and superfluous materials of every description. Where cleaning after laying is difficult because of small pipe size, a suitable swab or drag shall be kept in the pipe and pulled forward past each joint immediately after the jointing has been completed. Trenches shall be kept free of water and pipe shall not be laid when the condition of the trench or the weather is unsuitable for such work. At times when work is not in progress, open ends of pipe and fittings shall be securely and satisfactorily closed so that no trench water, earth or other substance will enter the pipe or fittings.

B. Pipe laying shall be performed in such a manner that no foreign material enters the pipe. The Engineer may require that before lowering pipe, heavy canvas bags be placed over each end, and left in place until joints are ready to be made. If water is in the trench, the seals shall remain in place until the trench is pumped completely dry. If conditions are unsuitable, no pipe shall be laid until satisfactory laying conditions are obtained in accordance with the above specified requirements.

C. The Contractor shall utilize a commercial grade laser beam specifically manufactured to aid in maintaining grade and alignment of pipelines during installation. The primary unit shall be mounted on a heavy duty base and firmly anchored in the downstream manhole of the reach under construction. The maximum distance shall not exceed four hundred feet (400') per set-up.

D. Each joint of pipe shall be installed using an approved target to align the pipe with the projected laser beam. The methods and procedures shall be in strict accord with the manufacturer's recommendations and instructions. Proper ventilation shall be maintained at all times. Care shall be exercised in order to prevent bumping or misalignment of the projected bean. Sewer lines shall be laid such that the installed variation of invert elevations when compared with the construction plans does not exceed 0.05 feet. Sewer lines in which said variation exceeds 0.05 feet may be rejected. Sewer pipe shall be visually inspected for alignment by lamping, televising or by other appropriate means to determine alignment.

E. Whenever a movable steel box is used in place of sheeting, the Contractor shall take care to prevent the pipe from moving when the steel box is moved.

3.04 PIPE JOINTING:

A. Piping shall be jointed in accordance with the manufacturer's printed recommendations. Gaskets shall be firmly set within the bells and grooves as required. The manufacturer's recommended lubricant or an approved equal shall be applied for slip type joints.

B. PVC Pipe Joint Construction:

1. The bell and spigot ends of PVC sewer pipe shall be cleaned of all foreign material that could interfere with proper assembly of the joints. The spigot ends shall be cleaned one inch (1") beyond the joint assembly reference mark.

2. The spigot end of the pipe shall be thoroughly lubricated in accordance with the manufacturer's recommendations. The coating should be the equivalent of a brush coat of enamel paint and maybe applied by hand, cloth, pad sponge or glove.

3. The lubricated spigot end shall be inserted into the bell keeping the pipe length in proper alignment. The bell shall be braced while the spigot end is pushed in under the rubber ring, so that previously completed joints in the line will not be closed up. The spigot end shall be pushed into the bell until the reference mark is flush with the end of the bell.

4. Generally, the installation and jointing of PVC Pipe shall conform to the requirements of the latest edition of ASTM D-2321, “Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications ".

C. Ductile Iron Pipe Joint Construction:

1. The installation and jointing of ductile iron pipe shall generally conform to the applicable provisions of AWWA Standard Specifications C-600 for pipe laying.

2. Where mechanical joint pipe is used, the surfaces which come in contact with the gasket shall be thoroughly brushed with a wire brush just prior to assembly. The gasket should be brushed with soapy water prior to installation to remove loose dirt and to lubricate gasket as it is forced into its retaining space.

3. When tightening bolts, it is essential that the gland be brought up toward the pipe flange evenly. The bolts should be partially tightened; the bottom bolt first, then the top; next the bolts on either side; and last, the remaining bolts. Overstressing of bolts to compensate for poor installation will not be permitted. Bolt torque shall be in accordance with manufacturer's specifications.

4. All joints of whatever type shall be completely water tight after being subjected to the required tests.

D. Jointing Dissimilar Pipes:

1. Suitable adaptor couplings are required for connecting dissimilar pipes. The couplings shall be approved by the Engineer before installation.

3.05 STREAM CROSSING:

Ductile iron pipe Class 50 shall be used as shown on the Drawings. Granular fill, concrete, and concrete collars shall be placed or constructed as shown on the contract drawings.

3.06 SERVICE LATERALS (LINES):

Modified sewer tees shall be installed on the run pipe at the appropriate field locations. Service lines of the sizes specified shall be laid to a uniform grade so that the customer being served can be tied-in using good construction practices. All tamping and backfilling operations shall be performed the same as on main line pipe. Removable plugs shall be securely installed in pipe ends and a 2" x 2" treated post extending 12" above the ground line shall mark the pipe end location.

3.07 BORINGS:

A. Borings shall be accomplished in accordance with Mississippi Department of Transportation or Railroad Standards. The contractor shall provide all necessary sheeting, bracing, cribbing, supports and appurtenances to insure the proper line and grade throughout the entire length of the crossing.

B. Casing Pipe: Casing Pipe shall be installed as indicated on the Contract Drawings. Joints shall be completely welded to provide structural integrity and shall be water tight.

C. Carrier Pipe: Carrier pipe may be any of the allowed options of piping. However, the piping and joints shall be capable of withstanding the stress exerted by pushing the pipe within the casing.

D. Carrier Pipe Supports: Supports for the carrier pipe shall be as recommended by the manufacturer for such installation. Supports shall be spaced to adequately support the piping under surcharged sewage conditions.

E. Casing Seal: The annulus between the casing and carrier pipe shall be sealed at each end with a quick setting grout.

3.08 RELATION TO WATER MAINS

A. Water mains shall be laid at least 10 feet horizontally and 18 inches vertically from any sanitary sewer or manhole. The bottom of the water line should be at least 18 inches from the top of the sewer line. (Water lines should always be constructed above sewer line. Under extraordinary circumstances, the Division of Water Supply may approve the construction of a sewer line above a water line provided the design engineer meets special construction requirements as determined by the Division.

B. Where local conditions prevent adequate horizontal and vertical separation, the Division of Water Supply may allow the water line to be laid closer to the sewer line if supported by adequate data from the design engineer. Each situation will be reviewed on a case by case basis. A detailed drawing shall be included in the plans for the water line construction submitted to the Division of Water Supply for review an approval.

C. Where adequate horizontal and/or vertical separation cannot be maintained, the following requirements shall apply.

1. If the 10 foot horizontal separation between water and sewer lines cannot be maintained then the water line should be ductile iron with water line joints located at the maximum distance possible from sewer line joints. PVC pipe may be used if it is protected by a steel casing. Also the water and sewer lines must be in separate trenches with adequate space for maintenance. In some cases, special sewer line construction procedures may be required.

2. Where the 10 foot horizontal and 18 inch vertical separation cannot be maintained, condition I must be met and the sewer line shall be constructed according to water main standards.

3.09 TESTING

A. Ductile Iron Pipe:

1. Field Inspection: The Engineer shall perform visual inspection of the material prior to placement by the Contractor. The Engineer may make non-destructive tests to determine the soundness of the pipe. The Contractor shall assist the Engineer in handling and moving the pipe as required.

2. Material Test: Material test shall be conducted during the manufacturing process and the results shall be included as part of the submittals. No other material test shall be required.

B. PVC PIPING:

Material test shall be conducted during the manufacturing process and the results shall be included as part of the submittal. No other material test shall be required.

C. STEEL CASING PIPE:

Material test shall be included as part the submittal. No other material test shall be required.

D. BEDDING MATERIAL AND STABILIZATION MATERIAL:

Test for gradation and test for material passing the No. 40 sieve shall be as follows:

Gradation	- AASHTO T 88
Liquid Limit	- AASHTO T 89
Plasticity Index	- AASHTO T 90

One set of each test listed above will be required for every 500 cubic yards or major fraction thereof.

E. COMPACTION TESTS:

Compaction tests shall be performed in accordance with AASHTO T 191 or ASTM D 2922. Maximum compaction shall be determined in accordance with AASHTO T99. Compaction tests for sewer pipe related work shall not be less than as follows:

	(Number of Compaction Tests)	
	AASHTO T-99	AASHTO T-191or ASTM D 2922
Select Backfill Material OR Stabilization Material	1	One per 100 CY
Bedding Material	2	One per 600 LF
Tamped Backfill	2	One per 600 LF

F. INFILTRATION/EXFILTRATION TEST:

The Contractor shall provide all plugs, water supply, measuring devices, and all other equipment, material, labor and supervision to measure the infiltration and exfiltration tests as specified below. The Contractor shall perform the test in the presence of the Engineer. All gravity sewer pipe shall be tested in accordance with the following applicable requirements.

1. Infiltration Test: The infiltration test shall be conducted between adjacent manholes. The outlet pipe on the downstream manhole shall be plugged and tested for water tightness to the satisfaction of the Engineer. The accumulated depth of water in the downstream manhole shall be read at 12 hour intervals for two (2) days and the infiltration rate calculated from the data obtained. Any section exceeding an infiltration rate of 200 gallons/day/inch diameter/mile shall be relayed at the Contractor's expense. This means that the Contractor shall locate and repair leaks as necessary to pass the infiltration test. Infiltration test shall be utilized only when the ground water level is above the top of the pipe.

2. Exfiltration Test: The exfiltration test shall be conducted between adjacent manholes. The inlet pipes in the downstream and upstream manholes shall be plugged. The line being tested shall be filled with water until water depth becomes two (2) feet above top of pipe being tested in the upstream manhole. The water loss shall be measured in the upstream manhole at 12 hour

intervals for two (2) days and the exfiltration rate calculated from the data obtained. Any section exceeding an exfiltration rate of 200 gallons/day/inch diameter of pipe/mile shall fail the test. The Contractor shall locate and repair leaks as necessary to pass the exfiltration test. A low pressure air test conforming to ASTM F 1417 may be used in lieu of the exfiltration test.

G. DEFLECTION TESTS:

100% of the PVC gravity sewer shall be tested 30 days after the final backfill has been in place by the following method:

Use a "Go-, no-go" mandrel which is sized to such dimensions that it will not "go" when encountering a deflection greater than 5%. The instructions for its use are as follows:

1. Completely flush the line making sure the pipe is clean of any mud or debris that would hinder the passage of the mandrel.

2. During the final flushing of the line, attach a floating block or ball to the end of the mandrel, pull rope and float the rope through the line. (A nylon ski rope is recommended)

3. After the rope is threaded through the line, connect the pull rope to the mandrel and place the mandrel in the entrance of the pipe.

4. Connect a retrieval rope to the back of the mandrel to pull it back if necessary.

5. By hand, remove all the slack in the pull rope and place a tape marker on the top at the end of the pipe where the mandrel will exit, determining the location of the mandrel in the line.

6. By hand, draw mandrel through the sewer lines. If any irregularities or obstructions are encountered in the line, they shall be corrected by the Contractor.

7. If a section with excessive deflection is found, locate it; dig down and uncover the pipe; if any damaged pipe is found, replace it; if pipe is not damaged, replace and thoroughly tamp haunching and initial backfill; replace remainder of backfill.

8. Re-test this section for deflection.

END OF SECTION

SECTION 33 39 13
MANHOLES

PART 1 – GENERAL

1.01 This item shall consist of furnishing all materials, labor, supervision, tools, equipment and incidentals for the construction of standard manholes, in accordance with the Contract Drawings and Specifications. Included in the work are structural excavation, backfill, and disposal of excess material.

1.02 APPLICABLE DOCUMENTS:

The following publications form a part of this specification and where referred to by basic designation only, are applicable to the extent indicated. The latest editions of the publications referenced shall apply to the work.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

A 48 Gray Iron Casting

C 39 Test for Compressive Strength of Cylindrical Concrete Specimens

C 443 Joints for Circular Concrete Sewer and Culvert Pipe Using Rubber Gaskets

C 478 Precast Reinforced Concrete Manhole Sections

C 497 Standard Methods of Testing Concrete Pipe

C 2922 Density of Soil and Soil Aggregate in Place by the Nuclear Method (Shallow Depths)

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO):

T-99 Moisture Density Relations of Soils Using a 5.5 lb. Rammer and 12-Inch Drop

T-191 Density of Soil In-Place by the Sand-Cone Method.

1.03 SUBMITTALS

The following tests or data shall be submitted to the Engineer from the Contractor for approval prior to incorporation into the work:

A. Certificates: The Contractor shall furnish certificates from supplier certifying the products conform to the required specifications included herein for the following items:

1. Flexible Plastic Gaskets
2. Precast Manhole Bases
3. Precast Manhole Riser Sections
4. Manhole Steps
5. Manhole Frames and Covers (ASTM A 48)

6. Epoxy Grout

B. Catalogue Cuts or Brochures: The Contractor shall also submit catalogue cuts or product brochures providing descriptive data, recommended application and use, and installation procedure for the following items:

1. Manhole Frames and Covers

2. Epoxy Grouts

3. Manhole Steps

PART 2 – MATERIALS

2.01 Manhole Riser Sections: Manhole riser sections shall be precast reinforced sections conforming to ASTM C 478 and as shown on the Contract Drawings.

2.02 Joints: Joints for precast riser sections shall be concrete pipe type flexible plastic gaskets. Joint material shall be preformed conforming the requirements of AASHTO M-198. Installation shall be in accordance with manufacturer's recommendations.

2.03 Concrete Manhole Bases: Concrete manhole bases shall be precast or cast-in-place as follows:

A. Cast-In-Place Manhole Bases and Box Type Bases (if used): Concrete and reinforcing steel shall conform to the requirements of Section 03301, Incidental Concrete.

B. Precast Concrete Bases: Precast concrete bases shall conform to the requirements of ASTM 478 with reinforcing steel (size and spacing as indicated on the plans).

2.04 Manhole Steps: Manhole steps shall be plastic coated corrosion resistant and shall be installed as shown on the Contract Drawings.

2.05 Cement Grout: Cement grout shall be high strength, non-metallic conforming to Corps of Engineers CRD-C-588. The grout shall be V-3 by W. R. Meadows, Inc., Masterflow 713 by Master Builders or equal.

2.06 Manhole Frame and Covers: Manhole frame and covers shall conform to ASTM A 48 as well as to the following requirements.

A. Standard Manhole Cover and Frame - shall be as manufactured by Dews Foundry, Jackson Standard, Model DF-25 (7) or Vulcan Foundry, Model V-1115, 420 Pounds, marked "SEWER", domestic origin, or equal.

B. Water Tight Manhole Cover and Frame - shall be as manufactured by Vulcan Foundry, Model V2357, or Dews Foundry, Model DF-25(7)W.T., 410 pounds with neoprene gasket, four 5/8 inch stainless steel bolts recessed into cover. Cover labeled "SEWER", domestic origin, or approved equal.

2.07 Epoxy Grout: Epoxy Grout shall be high strength non-metallic, non-shrinking. The grout shall be as by EMBECO, Inc., SEAL-COAT or approved equal.

2.08 Drop Manholes: Concrete for drop manholes shall conform to the requirements of Section 03301, Incidental Concrete. Pipe and fittings shall be the same material and size as the incoming gravity sewer.

2.09 Flexible Connection: At all sewer connections to manholes, provide gasket flexible watertight connection that allows for differential settlement of the pipe and manhole wall.

2.10 All manholes: All manholes shall be lined inside with a sixteen (16) mil dry film thickness of an acceptable coal tax epoxy system.

PART 3 – CONSTRUCTION

3.01 EARTHWORK

A. General: Excavation shall be to the extent required to allow proper construction of the manhole. Shoring and sheeting shall be utilized where required by Federal, State and local codes and regulations for safe working conditions. In addition, shoring and sheeting shall be required to protect the integrity of adjacent structures or prevent adverse effects on surrounding areas. Dewatering shall be employed to the extent required to allow dry working conditions.

B. General Excavation: The Contractor shall "lay back" or employ shoring and sheeting as required to assure stability of the excavation. Material shall be stockpiled so as not to surcharge adjoining pipe trenches. Topsoil shall be separated so as to allow the maximum reuse in grassing operations.

C. Structural Excavation: The area immediately beneath the manhole bases shall be graded and compacted. Compaction shall be to 96% of maximum laboratory density as determined by AASHTO T 99. Should unsuitable material be encountered, the Engineer may direct that the area be over excavated and filled with stabilization material. Specification for stabilization material and payment for such shall be in accordance with Technical Specifications.

D. Backfilling: Backfill material shall consist of select backfill in accordance with Technical Specifications. Backfilling shall be uniformly placed around the structure in 10-inch layers and be compacted to 90% of maximum density to full depth in unimproved areas. Backfill in paved areas and within five feet to any edge of pavement shall be compacted to 95% of maximum laboratory density in 8-inch layers to the subgrade line. Refer to Technical Specifications.

E. Salvage: Manhole frames and covers removed during excavation shall remain the property of the Owner and shall be delivered to a location designated by the Owner.

3.02 Riser Installation: Precast concrete riser sections shall be installed plumb and in accordance with the details shown on the Contract Drawings. Joints shall be installed in accordance with manufacturer's recommendations.

The manhole invert channels shall be formed in the bases, smooth and semi-circular in shape conforming to the inside of the adjacent sewer section. Changes in the direction of flow shall be made with a smooth curve of as large a radius as the size of the manhole will permit. Changes in size and grade of the channels shall be formed directly in the concrete of the manhole base. The joint between the base and riser section shall be sealed with epoxy grout. Clean pea gravel shall be used as the epoxy grout filler.

Standard manhole cut-outs and lifting holes shall be sealed with epoxy grout.

3.03 Cast-In-Place Concrete: Bases, flat tops, and drop manhole risers shall be constructed in accordance with Section 03301, Incidental Concrete.

3.04 Manhole Steps: Manhole steps shall be installed during the manufacturing of the riser or cone sections. Risers and cones shall be joined so the steps are vertically aligned.

3.05 Manhole Frame and Covers: Manhole frame and covers shall be set and grouted in place with cement grout. For manholes located in roads or streets, the manhole cover shall be flush with pavement or surface course.

3.06 TESTING

A. General: The Contractor shall conduct (and bear the cost of) all testing (Laboratory Approved by the Owner) as directed by the Engineer and furnish results of such tests prior to incorporating the material into the work. All testing is subsidiary to Manhole Payment Items.

B. Cast-In-Place Concrete Items: The concrete quality testing for manhole bases, drop manholes, and valve boxes shall be tested in accordance with Section 03301, Incidental Concrete.

C. Manhole Risers and Precast Concrete Bases: Manhole risers and precast concrete bases shall be tested for concrete compressive strength. If the place of manufacture is local and reasonably available to the Engineer, Paragraph (a) shall be followed for testing requirements. Should the place of manufacture not be available, Paragraph (b) shall apply.

   The contractor shall prepare (in the presence of the Engineer) standard rodded concrete cylinder or cylinders compacted and cured in a similar manner to the manhole sections. Concrete for such cylinders shall be typical fresh concrete mix drawn from the actual casting operation of a riser or base. Cylinders shall be tested in accordance with ASTM C 39. The average compressive strength shall be equal to or greater than the specified design strength (4000 psi). Not more than 10% of the cylinders shall fall below the design strength (4000 psi). In no case shall any cylinder tested fall below 3200 psi. Number of such cylinder tests shall be as follows:

   1. One set of cylinders for each day's run castings or

   2. One set of cylinders for each 200 linear feet of riser sections manufactured.

   3. One set of cylinders per 20 bases or flat tops manufactured.

   The Engineer may require additional tests should compressive test results fail.

D. Earthwork Test: Maximum laboratory density shall be measured in accordance with AASHTO T-99. Field densities shall be determined in accordance with AASHTO T-191 or ASTM D 2992. Standard proctors and field densities shall be performed in accordance with the following schedule.

1. Standard proctor tests shall be required for earthwork associated with manhole construction. At least two (2) field density tests shall be conducted for earth work associated with each manhole construction.

E. Inspection for Watertightness: All manholes shall be inspected for watertightness prior to placing into service.

END OF SECTION

THE CITY OF HATTIESBURG

PUBLIC SAFETY COMPLEX

HISTORIC HOSPITAL BUILDING
POLICE AND COURT BUILDING

PROJECT MANUAL

VOLUME THREE

November 19, 2018

Albert & McCleskey Associates Architects
Hattiesburg, Mississippi

PROJECT MANUAL
FOR
THE CITY OF HATTIESBURG

PUBLIC SAFETY COMPLEX

HATTIESBURG, MISSISSIPPI

Corrected November 19, 2018



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SECTION 02200

EARTHWORK - BUILDINGS ONLY

PART 1 GENERAL

1.1 EXISTING SITE CONDITIONS

A. The Contractor shall visit the site and become familiar with the existing conditions and limitations of the work.

B. All utilities and services, whether shown on the drawings or not, shall be suitably protected and maintained, and any damages thereto shall be promptly repaired. The Owner shall be advised immediately of any damages sustained. If any extra expense is incurred due to the existence of buried utilities not shown on the drawings, or the location of which is not made known to the Contractor, the contract price shall be adjusted in accordance with the General Conditions.

C. The Contractor shall be responsible to raise or lower existing manholes, catch basins, and other existing structures to be compatible with the new earthwork slopes and elevations.

1.2 TESTS

A. All tests shall be made by a laboratory as provided by the Contractor.

B. Standard density tests shall be made as prescribed by ASTM D2922. One test will be required for each lift per 2,500 square foot of surface area in areas under the building. One test per lift will be required where any utility trench comes within the building footprint.

C. For selected fill material the mechanical analysis shall be by ASTM D422. The liquid and plastic limit determination shall be made by ASTM D4318.

1.3 DEFINITIONS

A. Excavation: Cutting, digging and removing all materials of every description, including foundations and rock, and of whatever substance encountered to the dimensions, limits, elevations and contours as shown on the drawings and as herein specified and subsequent disposal of materials removed.

B. Building Area: The term building area is defined as the interior plan area plus an exterior perimeter strip with a minimum width of 5 feet.

PART 2 PRODUCTS

2.1 BORROW

A. The Contractor shall furnish and place suitable material from off-site sources and shall fill and compact as required.

B. Select fill materials shall consist of sandy clays (CL), with a liquid limit less than 45, a plasticity index (PI) in range of 5 to 12. All fill materials shall be free of organic matter and debris.

PART 3 EXECUTION

3.1 DEWATERING

A. The Contractor shall be responsible for all surface drainage, rain, and snow entering the site and building excavation or foundation, and shall remove such water.

B. The Contractor shall keep the area graded at all times to facilitate the runoff of surface waters and maintain a dry working area. Existing earth or fill which becomes too wet from any cause shall be disked or otherwise reworked so as to allow drying and recompaction.

3.2 BUILDING EXCAVATION

A. The building area shall stripped to a sufficient depth to remove any organic laden surficial soils, vegetation, debris, or tree roots . After stripping, any noticeably weak surficial soils shall also be removed as required to expose firm and stable natural soils suitable for proper compaction. After completion of stripping in building areas, the top 12" of existing soils shall be scarified and compacted to not less than 95% of Standard Proctor maximum dry density with stability present. Stability is defined as the absence of significant pumping or yielding under normal dynamic field compaction. Rubber wheeled traffic should be kept to a minimum in the building area, to minimize the potential for pumping soils. Prior to scarifying and compaction efforts at the bottom of the excavated areas, the building area shall be proof-rolled with a loaded dump truck, making two passes over all areas, in the presence of the Owner's representative. Any areas that show signs of weakness, or lack of stability, shall be removed and replaced with select fill.

B. After placing fill, excavate for gradebeams. The bottom of all trenches cut for gradebeams shall be compacted with hand equipment to 98% of Standard Proctor Density.

3.3 FILLING

A. All fills shall be constructed at the locations and to the contours, elevations and sections shown on the drawings.

B. Any unsuitable material within the area upon which fill is to be placed shall be removed. Prepared surfaces on which compacted fill is to be placed shall be wetted or dried as may be required to obtain the compaction specified.

Contractor shall obtain stability on soil prior to placing fill materials. There shall be no significant pumping or yielding of soils under compactive efforts.

C. Fill shall be placed in 9-inch maximum loose lifts at moisture contents within 3 percent of optimum and compacted to not less than 95 percent of standard proctor peak dry density with stability present.

END OF SECTION

SECTION 03100

CONCRETE FORMWORK

PART 1 GENERAL

1.1 DESCRIPTION

A. Concrete formwork shall be in accordance with "Recommended Practice for Concrete Formwork" (ACI 347).

B. Furnish and install all concrete formwork as indicated on the drawings and as specified herein.

1.2 RELATED WORK

A. Patching concrete after form removal, Section 03301 - Cast-in-Place concrete.

PART 2 PRODUCTS

2.1 FORMS

A. Concrete forms shall conform to the shapes, lines and dimensions of the members called for on the drawings. All forms shall be true to line, plumb, level and with joints tight. They shall be properly braced and of sufficient strength to carry the load as a liquid, together with the movements of men and equipment, without appreciable deflection and with absolute safety. Forms shall be designed so that they may be removed in proper sequence. Forms shall be provided for all holes through the floor slabs which may be shown on the structural, mechanical or general drawings.

B. For concrete not exposed to the exterior view but exposed on the interior of the building and below finished grade, use a 3/4" break-off type snap tie with a minimum of 3/4" break-back point.

C. Forms for unexposed concrete shall be sound lumber, plywood or steel.

2.2 MISCELLANEOUS MATERIALS

A. Form coating shall be Creteban 30 form coating as manufactured by Chem-Masters Corporation or equal.

B. Anchor slot shall be felt or cardboard filled dovetailed slot constructed of 24-gauge galvanized sheet metal, as manufactured by Gateway Engineering Company, Chicago, Illinois, or equal.

C. Reglet shall be formed of 26-gauge fiber-filled galvanized sheet metal of such design as not to extend into concrete more than 3/4 inch.

PART 3 EXECUTION

3.1 FORMWORK

A. Design of formwork shall include consideration of the following factors:
   1. Rate and Method of Placing Concrete.
   2. Loads, including live, dead, lateral and impact.
   3. Selection of materials and stresses.
   4. Deflection, Camber, Eccentricity, and Uplift.
   5. Horizontal and Diagonal Shore Bracing.
   6. Shore Splices.
   7. Cross Grain Compression.
   8. Loads on Ground or on Previously-Placed Structure.

B. Forms shall be swept clean before reinforcing is placed. In warm weather, wet down with water before placing concrete.

C. After cleaning forms, coat forms for exposed concrete with form coating in accordance with the coating manufacturer's instructions.

D. Form surfaces shall be smooth and free from irregularities, dents, sags or holes when used for permanently exposed faces.

E. Bolts and rods used for internal ties shall be so arranged that, when the forms are removed, all steel shall be not less than one inch from the concrete surface.

F. Whenever bracing of wall forms is removed, temporary or permanent bracing shall be provided at both top and bottom of all walls to avoid lateral movement.

3.2 MISCELLANEOUS MATERIALS

A. Build-in all anchors, bolts, masonry anchors, reglets, and inserts required.

3.3 REMOVAL OF FORMS

A. No construction loads exceeding the structural design loads shall be supported upon any unshored portion of the structure under construction. No construction load shall be supported upon, nor any shoring removed from, any part of the structure under construction until that portion of the structure has attained sufficient strength to support safely its weight and the loads placed thereon.

B. Where the structure as a whole is adequately supported on shores, the forms for foundation walls after 24 hours, provided that the concrete is sufficiently strong not to be injured thereby.

END OF SECTION

SECTION 03200

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.1 DESCRIPTION

A. Furnish and install all concrete reinforcement as indicated on the drawings and in accordance with ACI Standard 318

1.2 SUBMITTALS

A. Submit shop drawings of bending diagrams and erection plans showing placing for all concrete reinforcement to the Architect for approval. Bar lists submitted without erection plans will be returned without checking.

PART 2 PRODUCTS

2.1 MATERIALS

A. Reinforcing steel shall conform to ASTM A615, Grade 60, for hard-grade steel bars, and shall be as scheduled on the drawings.

B. Wire mesh reinforcing shall be welded steel wire fabric conforming to ASTM A185-79.

C. Accessories: All accessories in slabs and beams such as chairs, screed bases, and slab bolsters shall have upturned legs, either plastic coated or stainless steel.

D. Cut reinforcing steel to lengths and bends as shown on the drawings and as scheduled.

E. Bundles of reinforcing steel shall be identified on stamped metal tags wired to steel.

PART 3 EXECUTION

3.1 ERECTION

A. Deliver all bars bent to conform accurately to details and approved shop drawings. Do not bend bars in a manner that will injure the material. Bend bars cold. Do not use bars with kinks or bends not shown on the drawings.

B. Clean forms of any foreign matter before placing of reinforcing.

C. Before placing, thoroughly clean reinforcing of mill and rust scale and of coatings that will destroy or reduce the bond. Replace any reinforcement appreciably reduced in section. Replace bars with excessive damage, as directed by Architect.

D. Accurately place reinforcement in accordance with the approved shop drawings and hold securely in place during placement of concrete by wires, spacers and chairs. Supports

shall be sufficient in numbers and size to comply with requirements of Concrete Reinforcement Steel Institute or more stringent requirements given on the drawings..

E. Reinforcement protection and clearance shall be in accordance with ACI 318.

END OF SECTION

SECTION 03301

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 REQUIREMENTS

A. Furnish and install all cast-in-place concrete as indicated on the drawings and as specified herein.

B. "Building Code Requirements for Reinforced Concrete" (ACI 318) and "Specifications for Structural Concrete for Buildings" (ACI 301) is hereby made a part of this section of the specifications except as modified and supplemented herein.

1.2 TESTING

A. All testing shall be performed by a testing laboratory employed by the Contractor.

B. Prepare four 6” diameter or 6 4” diameter test cylinders for each 100 cu. yd. or fraction thereof, of each mix design of concrete placed each day. In the event that concrete from two or more concrete placements are defective and require removal of concrete, from that time forward until 60 days has elapsed without any concrete tests of that particular mix falling more than 300 psi below the 28 day design strength, cylinders shall be taken from every truck delivering the particular mix of concrete, regardless of quantities placed.

C. Conduct a slump test on the first load of each class of concrete delivered each day and at any other time during the progress of the work when requested by the Architect.

Slump exceeding the specified maximum, in two consecutive tests on different portions of the sample, will be cause for rejection of the load.

D. Conduct air meter tests on regular weight concrete in accordance with the procedures outlined in ASTM C231 or in ASTM 173.

Test the first load delivered in the morning and in the afternoon for each segment of the project, when any change in consistency or appearance of the concrete indicates that a test should be made, and at any other time during the progress of the work when requested by the Architect.

E. The following laboratory test shall be conducted by a testing laboratory as outlined in Section 01400, Testing Laboratory Services.

Test each set of concrete cylinders for compressive strength. Test two 4” diameter or one 6” diameter cylinders at 7 days. If cylinder shows evidence of improper sampling, molding, or testing, discard and test an additional cylinder. Test two 6” diameter or 3 4” diameter cylinders at 28 days. If seven-day test did not require use of an additional cylinder, any cylinder at 28 days shows evidence of improper sampling, molding or

testing, test the remaining cylinder. If more than one cylinder in a test shows any of these defects, discard the entire test and investigate the conditions leading to such defects.

Submit the test reports to the Architect, Owner, and Engineer, within 48 hours of performing test.

1.3 EVALUATION OF CONCRETE STRENGTH

A. Concrete cylinders made on this project are for the benefit of the Owner, to determine if the in-place concrete meets the required strengths indicated on the plans and specifications. Any cylinders which fail to meet the 28-day compressive strength required shall be considered to be representative of the in-place concrete. Failure to meet the required strength will be grounds for rejection of the in-place concrete. In the event that the concrete does meet or exceed the required strength, removal and replacement will be required at no additional expense to the Owner. If structural analysis by the Engineer of Record indicates that a lower strength concrete will meet structural and serviceability requirements, concrete falling below strength requirements may be left in place without removal and replacement, if the Owner agrees.

B. If an inadequate number of tests are conducted, the strength of the concrete in place shall be considered questionable and shall be subject to further testing at the expense of the Contractor. If cylinder breaks indicate low concrete strengths, the strength of the concrete shall be considered questionable and shall be subject to further testing at the expense of the Contractor. If ongoing cylinder breaks indicate low concrete strengths, the strength of the concrete shall be considered questionable and further testing as deemed necessary by the Architect may be required and will be at the expense of the Contractor.

C. These additional tests of questionable concrete shall be conducted by an independent testing laboratory approved by the Architect. Cores of in-place concrete may be taken or load tests conducted and results evaluated in accordance with Chapter 2 of ACI 318.

D. Test results obtained by use of an impact hammer or sonoscope will not be considered conclusive in evaluating strengths of concrete.

1.4 TOLERANCES

A. Reinforcement:
   1. Bars shall meet following requirements for fabricating tolerances:
      a. Sheared length: Plus or minus one inch.
      b. Depth of truss bars: Plus 0, minus 1/2- inch.
      c. Overall dimension of stirrups, ties, and spirals: Plus or minus 1/2-inch.
      d. Other bends: Plus or minus one inch.
   2. Bars shall be placed to following tolerances:
      a. Concrete cover to formed surfaces: Plus or minus 1/4-inch.
      b. Minimum spacing between bars: Minus 1/4 inch.
      c. Top bars in slabs and beams:

1) Members eight inches deep or less: Plus or minus 1/4-inch.
2) Members more than eight inches but not over two feet deep: Plus or minus 1/2-inch.
3) Members more than two feet deep: Plus or minus one inch.

d. Crosswise members: Spaced evenly within two inches.
e. Lengthwise of members: Plus or minus two inches.

3. Bars may be moved as necessary to avoid interference with other reinforcing steel, conduits or embedded items. If bars are moved more than one bar diameter or enough to exceed above tolerances, resulting arrangement of bars is subject to approval of the structural Engineer.

B. Concrete:
1. Float and broom finish: Plane within 1/4-inch in 10-feet as determined by a 10-foot straightedge. .
2. Steel trowel finish: Plane within 1/8-inch in 10-feet.
3. Smooth hardened finish: For all rooms with sealed concrete floors.

PART 2 PRODUCTS

2.1 MATERIALS

A. Cement: Portland Cement shall conform to ASTM C- 150, Type I or II. Pozzolan conforming to ASTM C- 595 shall be blended with the Portland Cement in an amount not exceeding 20% of the combined volume.

B. Concrete Aggregates: Shall conform to "Specifications for Concrete Aggregates" (ASTM C- 33), with a maximum size aggregate of 3/4-inch.

Fine aggregate that conforms to Section 703 of the Mississippi Department of Transportation, and is in general use in the area, may be considered satisfactory. The determination of the satisfactory service record of any substituted aggregates shall be at the sole discretion of the Architect. See general notes on plans for further restrictions on aggregate size.

C. Water: from City water main.

D. Air-Entraining Agent: The air-entraining admixture shall be Adz-Air as manufactured by Chem-Masters Corporation, or equal.

E. Retardant: Pozzolith retardant as manufactured by Master Builders, or equal.

F. Expansion Joint Filler: Premoulded, closed-cell polyethylene, equal to Sonoflex Thickness as shown.

G. Storage of Materials: Cement and aggregate shall be stored in such a manner as to prevent their deterioration and the intrusion of foreign matter. Any material which has deteriorated or which has been contaminated will not be used for concrete work.

H. Vapor Barrier: Polyethylene sheet 10 mil thick minimum.

2.2 PROPORTIONING

A. Proportioning shall be by laboratory trial batches or on the basis of previous field experience for the selection of concrete proportions.

B. The Contractor shall establish a design mix to provide concrete of the strengths called for in the plans and specifications.

C. The proportion mix is to be submitted to the Architect for review and approval prior to use on the job.

D. Laboratory cylinders are to be made and compression tests performed , using representative materials supplied by the Contractor's ready-mix concrete company.

E. Control of mixes is to be maintained at the ready- mix plant and on the job and will be reviewed and checked by the above mentioned testing laboratory.

Mixes shall be controlled as follows:

1. The slump on all concretes will not exceed 5 inches.
2. Ready-mix concrete shall be used and shall be mixed and delivered according to the requirements of ASTM C-94. Proportions shall be made by weight and shall be uniformly and accurately controlled by the concrete supplier. Concrete of the correct slump will be delivered to job site. The delivery ticket shall indicate the allowable amount of water that can be added without exceeding water/cement ratios previously established. If water must be added to a load of concrete, it shall only be added by the contractor or the concrete supplier, each of whom assumes responsibility for the load of concrete.

F. After a design mix has been approved by the Architect, there shall be no change made without consent of the Architect in either the cement manufacturer, aggregate supplied, or any admixtures.

G. The proportions of aggregate to cement for any concrete mix shall be such as to produce a mixture which will work readily into corners and angles of the forms and around reinforcement with the method of placing employed on the work, but without permitting the materials to segregate or excess free water to collect on the surface.

H. Concrete of the strength and slump as called for on the plans and in the specifications shall be proportioned according to the American Concrete Institute's Recommended Practice 613 using normal Type I cement supplemented with air-entraining admixtures and set-controlling admixtures.

I. In determining water content for all mixes of concrete, as set forth in the plans, the surface water contained in the aggregates must be included as part of the mixing water in computing the water content. Any and all admixtures shall be proportioned with this factor accounted for in computing mixing water.

J. Rate of Hardening of Concretes: For the climatic conditions and types of construction indicated below, separate mixes shall be designed to produce the required rate of hardening.

Type of Construction	Climatic Conditions	Required Rate of Hardening
Structural Concrete	over 90 degrees F.	Retarded

K. Where controlled setting time and/or rate of hardening is required, the admixture shall be formulated to provide this control without increase in water/cement ratio or loss in strength when compared with normal setting formulation.

L. No other admixtures will be permitted unless specifically approved by the Architect.

M. Calcium chloride or admixtures containing calcium chloride shall not be used.

2.2 SUBMITTALS

Design mix submittals for each type and strength of concrete used.

PART 3 EXECUTION

3.1 CONSTRUCTION JOINTS

A. When stoppage of concreting operation occurs for any reason, place construction joints either horizontally or vertically as needed and as approved by the Architect. All construction joints will be adequately keyed so as to provide a firm tie between the adjacent concrete pour.

B. Concrete shall be allowed to set for 24 hours before an adjoining pour is started.

C. Slabs across the joints shall be level and surfaces shall not be feathered.

3.2 MIXING

A. Delivery tickets shall show class of concrete, batch number, mix by number or sack content with maximum size aggregates, admixtures, air content, slump, and time of loading.

B. Each batch shall be mixed for at least one minute for the first cubic yard and an additional 15 seconds for each additional yard. After all ingredients are in the mixer, then the entire content of the mixing drum shall be discharged before recharging.

C. Addition of water to mix at project site must be noted by testing laboratory, and delivery ticket shall be noted with amount of water, and signed by the party adding the water.

D. Retempering or remixing of concrete which has partially set will not be permitted.

E. Batch mixing on site will not be permitted.

F. Temperature of mixing water shall be a maximum of 55 degrees F. for cold weather concreting and a maximum of 90 degrees F. for concrete placed in hot weather. See paragraph 3.12 of this section.

3.3 PLACING

A. Non-agitating type transportation equipment for delivery to the site shall not be used.

B. Carts or buggies may be used in conjunction with temporary runways if runways do not bear on reinforcing or fresh concrete.

C. Concrete shall be discharged at the job within 1-1/2 hours after water has been added to the cement and aggregates, or cement batched with the aggregates, unless a longer time is specifically authorized by the Architect. During hot weather and under other conditions contributing to quick stiffening of concrete, or when high early-strength cement is being used, Architect may require a reduction in this elapsed time.

D. Deposit in uniform horizontal layers maximum 12 inches deep. Do not drop from conveyor or buggy a distance greater than 5 feet to a point of deposit. For greater heights use chutes.

E. Keep complete record at job of every concrete pour, itemizing date, location, quantity of pour, weather data, and number of test cylinders.

F. Place no concrete before embedded items are in place, nor before forms, reinforcing and affected work of other trades have been examined. Notify Architect and all trades affected as to when concrete will be placed, and allow adequate time for installation of all necessary parts.

G. Concrete shall be thoroughly compacted by means of a mechanical vibrator as approved by the Architect, to provide a dense concrete free of honeycombing, of the dimension and shape as shown on the plans. .

H. All concrete footings, slabs, walks, walls, etc. shall be mechanically vibrated. Vibrator will be selected according to the size of the forms and the spacing between the reinforcing steel.

I. Care shall be taken to see that all reinforcing steel and all formwork is kept a minimum of 3/4" clear of any form, either bottom or side.

J. No concrete shall be deposited when temperature is below 40 degrees F. or when the temperature is forecast to go below 30 degrees F. within the next 12 hours after placing. Whenever the temperature of surrounding areas is below 40 degrees or likely to drop, adequate equipment to provide for heating of concrete materials and for protecting concrete is required. All concrete and cement finishes, when placed, to have a temperature of between 40 degrees and 90 degrees F. and shall be maintained for at

least 72 hours, or for as much time as may be necessary to insure proper rate of curing. No antifreeze chemicals will be permitted.

K. Placing of concrete shall not be started until necessary preparations have been completed and the Architect's approval given. Preparation to consist of completing all formwork, placing of all reinforcing steel, pipes, conduit, hangers, sleeves, anchors, fastening devices, outlets, openings, and such other work that is to be built in and provided for in the section to be poured.

L. It shall be the responsibility of the General Contractor, or concrete sub-contractor, to notify concerned sub-contractors, including the mechanical and electrical sub-contractors, of his intention to pour concrete in the areas involved in sufficient time to allow for the concerned contractors to place necessary and required equipment and/or items of work. He should also notify them when he is going to actually place the concrete, and they shall have representatives on the job as needed to protect their items and accessories.

3.4 EMBEDDED ITEMS

A. Sleeves, conduit and other pipes passing through the floors, walls or beams shall be of such size and in such locations as not to impair significantly the strength of construction. All pipes, sleeves shall be at least equal to Standard Schedule 40 steel pipe and shall be spaced not less than 3 diameters on center.

3.5 FINISHES

A. Structural slab floors inside the building walls shall receive a hard trowel finish. Start troweling when the water has disappeared from the surface to first level the surface. Start final troweling when the concrete has set up to a point where it no longer shows indentations from finger pressure. Trowel to a hard, smooth surface free of marks. Dusting of the slab with cement will not be permitted. Surfaces may vary from a true plane by not more than 1/4" when tested with a 12' straight edge. Either grind or fill surfaces as required to produce a 1/4" tolerance.

B. Floors to receive ceramic tile shall be screeded and floated to an elevation which will allow proper space for setting beds, and the setting bed shall be sloped to the floor drains.

C. Slope floors to drains, where shown.

D. Outside Slabs: Shall be broom finished.

E. Exposed finish: Remove all fins and projections, fill all depressions for a smooth surface. Within 48 hours after form removal, wet concrete surfaces and rub with a Carborundum brick until uniform color and texture are achieved. Do not use a seperate grout mixture.

3.6 CURING AND PROTECTION

A. All concrete and cement finishes are to be maintained in a moist condition for at least the first seven days after placing. This may be accomplished by the application of:
   1. plastic sheeting and daily watering,
   2. burlap mats and daily watering, or
   3. A curing compound compatible with finish flooring products to be used.
   4. Burlene sheets

B. For concreting in hot weather due precautions are to be taken to prevent plastic cracking and premature set. Adequate wind brakes and additional curing water will be provided by the Contractor. When the temperature reaches 75 degrees F. and the relative humidity falls below 50%, additional water should be supplied to the fresh concrete by fogging or ponding. Wind brakes should be erected during the curing time to prevent excessive evaporation due to blowing winds. Normal curing means such as protective paper and/or additional eater should be maintained for a minimum period of five days after casting. Adequate forms may be assumed to constitute curing if watertight. Surface curing compounds and finishes are covered in other sections of this specification. Provisions shall be made by the Contractor for maintaining the concrete in a moist condition for at least five days after placement. All procedures used in hot weather concreting shall be in conformance with ACI Standard "Recommended Practice for Hot Weather Concreting", ACI 605-59.

3.7 PATCHING AFTER REMOVAL OF FORMS

A. After removal of forms, all concrete surfaces shall be inspected, and pressed joints, voids, stone pockets, and holes shall be at once patched before concrete is thoroughly dry.

B. Honeycombed and spalled areas shall be cut out to a depth at which sound concrete is exposed, with edges overcut.

C. Areas to be patched and surrounding concrete for at least 6" shall be wetted.

D. Patching material shall be of the same material and proportions as the concrete to be patched, if exposed to the exterior.

E. Patching material for all interior concrete shall be Embeco Non-Shrink Grout.

F. Patching materials shall use no coarse aggregates unless the patch is of a substantial nature.

G. A minimum amount of water to be used in patching mix.

H. Mortar for patching is to be mixed and allowed to stand and then re-mixed without adding water, and will be worked during the interval to prevent setting. Patching mixture will then be compacted into place. Interior tie holes shall be filled entirely. Patches shall be allowed to shrink for 1 to 2 hours and then finished to match surrounding areas. Patches shall be kept wet for at least 7 days or shall be covered with a prepared curing

compound as approved by the Architect.

I. Grind smooth any surface defects in slabs which will be visible through final floor covering system.

END OF SECTION

SECTION 05120

STRUCTURAL STEEL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Furnish and install all structural steel items as indicated on the drawings and as specified herein. Extent of structural steel work is shown on drawings, including notes and details to show size and location of members, typical connections, and type of steel required.

B. Structural steel is that work defined in AISC "Code of Standard Practice" and as otherwise shown on drawings.

C. Miscellaneous Metal Fabrications are specified elsewhere in Division 5.

1.2 REFERENCES

A. AISC "Code of Standard Practice for Steel Buildings and Bridges".

B. AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings", including the "Commentary" and Supplements thereto as issued.

C. AISC "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts" approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation.

D. AWS D1.1 "Structural Welding Code".

E. ASTM A 6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use".

1.3 PERFORMANCE REQUIREMENTS

A. Steel fabrication and erection shall be done in compliance with AISC code.

1.4 QUALITY ASSURANCE

A. All structural steel shall be checked by Architect's representative.

B. Provide certification that welders to be employed in work are AWS certified. Conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies. Inspect and test during erection of structural steel for compliance with AWS D1.1.

C. Correct deficiencies in structural steel work which inspections and laboratory test reports have indicated to be not in compliance with requirements. Perform additional tests, at Contractor's expense, as may be necessary to reconfirm any non-compliance of original work, and as may be necessary to show compliance of corrected work.

1.5 SUBMITTALS

A. Shop Drawings: Submit shop drawings including complete details and schedules for fabrication and assembly of structural steel members procedures and diagrams.

1. Include details of cuts, connections, camber, holes, and other pertinent data. Indicate welds by standard AWS symbols, and show size, length, and type of each weld.

2. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed by others.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials in a location and manner to keep mud, oil, and rust from contaminating product.

B. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete in ample time to not delay that work.

C. Store materials to permit easy access for inspection and identification. Keep steel members off ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.

D. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures.

PART 2 PRODUCTS

2.1 MATERIALS

A. High-Strength Low-Alloy Steel: ASTM A 242 or ASTM A 588.

B. Structural Steel Shapes, Plates and Bars: ASTM A 36, ASTM A992 for all wide flange beams and columns.

C. Cold-Formed Steel Tubing: ASTM A 500, Grade B.

D. Hot-Formed Steel Tubing: ASTM A 501.

E. Steel Pipe: ASTM A 53, Type E or S, Grade B.

F. Anchor Bolts: ASTM A 307, nonheaded type unless otherwise indicated.

G. Unfinished Threaded Fasteners: ASTM A 307, Grade A, regular low- carbon steel bolts and nuts. Provide hexagonal heads and nuts for all connections.

H. High-Strength Threaded Fasteners: Heavy hexagon structural bolts, heavy hexagon nuts, and hardened washers, as follows:
   1. For high-strength low-alloy steel, provide Type 3 fasteners of similar composition as members to be connected.

   2. For high-strength low-alloy steel, provide electrodes, welding rods and filler metals equal in strength and compatible in appearance with parent metal joined.

I. Structural Steel Primer Paint: Fabricator's standard rust-inhibiting primer, gray in color. **Do not paint any surfaces which will receive a sprayed-on fireproofing coating.**

J. Non-Metallic Shrinkage-Resistant Grout: Corps of Engineers CRD-C588, Type M, pre-mixed factory- packaged aggregate grouting compound.

2.2 FABRICATION

A. Shop Fabrication and Assembly: Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final shop drawings

2.3 FINISHES

A. Solvent clean prior to other cleaning to remove any oil or grease.

B. Hand clean with wire brushes or equal to remove all loose scale and paint.

C. Shop paint structural steel, except those members or portions of members to be embedded in concrete or mortar. Paint embedded steel which is partially exposed on exposed portions and initial 2" of embedded areas only. Any structural steel to receive a sprayed-on fireproofing coating shall not be painted.

D. Metal Surfaces, General: For fabrication of work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness. Remove such blemishes by grinding, or by welding and grinding, prior to cleaning, treating and application of surface finishes.

PART 3 EXECUTION

3.1 EXAMINATION

A. Visually determine that Project is ready to begin the work of this Section; beginning of work indicates acceptance of conditions. Notify Architect in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the Architect.

3.2 PREPARATION

A. Furnish templates and other devices as necessary for presetting bolts and other anchors to accurate locations.

B. Setting Bases and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of base and bearing plates.

3.3 INSTALLATION

A. Anchor Bolts: Furnish anchor bolts and other connectors required for securing structural steel to foundations and other in-place work.

B. Set loose and attached base plates and bearing plates for structural members on wedges or other adjusting devices.

C. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.

D. Pack grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.

E. Field Assembly: Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming a part of a complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

F. High-Strength Bolted Construction: Install high- strength threaded fasteners in accordance with AISC "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts" (RCRBSJ).

G. Welded Construction: Comply with AWS Code for procedures, appearance and

quality of welds, and methods used in correcting welding work.

3.4 TOLERANCES

A. Will be as per AISC recommendations.

3.5 ADJUSTING

A. Adjust members as necessary to be compatible with final product. Notify Architect before substantially altering any member.

3.6 CLEANING

A. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.

END OF SECTION

SECTION 05210

STEEL JOISTS AND TRUSSES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Furnish and install steel joists as shown on the drawings and accessories & bridging specified herein which is required by the Steel Joist Institute..

1.2 REFERENCES

A. Steel Joist Institute (SJI) "Standard Specifications, Load Tables and Weight Tables".

B. AWS D1.1 "Structural Welding Code".

1.3 PERFORMANCE REQUIREMENTS

A. Steel fabrication and erection shall be done in compliance with SJI specifications.

1.4 QUALITY ASSURANCE

A. All structural steel shall be checked by Architect's representative.

B. Provide certification that welders to be employed in work are AWS certified. Conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies. Inspect and test during erection of structural steel for compliance with AWS D1.1.

C. Correct deficiencies in structural steel work which inspections and laboratory test reports have indicated to be not in compliance with requirements. Perform additional tests, at Contractor's expense, as may be necessary to reconfirm any non-compliance of original work, and as may be necessary to show compliance of corrected work.

D. Provide joists fabricated in compliance with the following, and as herein specified.
   1. Steel Joist Institute (SJI) "Standard Specifications, Load Tables and Weight Tables".

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's specifications and installation instructions for each type of joist and accessories. Include manufacturer's certification that joists comply with SJI "Specifications".

B. Shop Drawings: Submit detailed drawings showing layout of joist units, special

connections, jointing and accessories. Include mark, number, type, location and spacing of joists and bridging.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials in a location and manner to keep mud, oil, and rust from contaminating product.

B. Store materials to permit easy access for inspection and identification. Keep steel members off ground, using pallets, platforms, or other supports.

C. Deliver, store and handle steel joists as recommended in SJI "Specifications". Handle and store joists in a manner to avoid deforming members and to avoid excessive stresses.

PART 2 PRODUCTS

2.1 MATERIALS

A. Steel: Comply with SJI "Specifications".

B. Steel Prime Paint: Comply with SJI "Specifications", except asphalt type paint not permitted.

2.2 FABRICATION

A. General: Fabricate steel joists in accordance with SJI "Specifications".

B. Extended Ends: Provide extended ends on joists complying with manufacturer's standards and requirements of applicable SJI "Specifications" and load tables.

C. Ceiling Extensions: Provide ceiling extensions in areas having ceilings attached directly to joist bottom chord. Provide either an extended bottom chord element or a separate unit, to suit manufacturer's standards, of sufficient strength to support ceiling construction. Extend ends to within 1/2" of finished wall surface unless otherwise indicated.

D. Bridging: Provide horizontal or diagonal type bridging for "open web" joists, complying with SJI "Specifications".

2.2 FINISHES

A. Apply one shop coat of primer paint to steel joists and accessories, by spray, dipping, or other method to provide a continuous dry paint film thickness of not less than 0.50 mil. **Do not paint any joists which will receive a sprayed-on fireproofing coating.**

PART 3 EXECUTION

3.1 EXAMINATION

A. Visually determine that Project is ready to begin the work of this Section; beginning of work indicates acceptance of conditions. Notify Architect in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the Architect.

3.2 INSTALLATION

A. Place and secure steel joists in accordance with SJI "Specifications", final shop drawings, and as herein specified.

B. Placing Joists: Do not start placement of steel joists until supporting work is in place and secured. Place joists on supporting work, adjust and align in accurate locations and spacing before permanently fastening.

C. Bridging: Install bridging simultaneously with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords where terminating at walls or beams.

D. Field weld joists to supporting steel framework in accordance with SJI "Specifications" for type of joists used. Coordinate welding sequence and procedure with placing of joists.

3.4 TOLERANCES

A. Will be as per SJI recommendations.

3.5 ADJUSTING

A. Adjust members as necessary to be compatible with final product. Notify Architect before substantially altering any member.

3.6 CLEANING

A. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.

END OF SECTION

SECTION 05300

METAL DECKING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Furnish all materials, equipment and labor for installation of metal decking, accessories and miscellaneous items that may be required, as specified herein or indicated on drawings.

1.2 REFERENCES

A. AWS D1.1 "Structural Welding Code".

1.3 QUALITY ASSURANCE

A. All decking steel shall be checked by Architect's representative.

B. Provide certification that welders to be employed in work are AWS certified. Conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies. Inspect and test during erection of structural steel for compliance with AWS D1.1.

C. Correct deficiencies in structural steel work which inspections and laboratory test reports have indicated to be not in compliance with requirements. Perform additional tests, at Contractor's expense, as may be necessary to reconfirm any non-compliance of original work, and as may be necessary to show compliance of corrected work.

1.4 SUBMITTALS

A. Submit shop drawings of metal decking showing erection layout and details for each building area for Architect's approval.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials in a location and manner to keep mud, oil, and rust from contaminating product.

B. Store materials to permit easy access for inspection and identification. Keep steel members off ground, using pallets, platforms, or other supports.

PART 2 PRODUCTS

2.1 MATERIALS

A. Decking shall be galvanized to comply with ASTM A525 and shall be equal to Vulcraft types as noted on the drawings.

2.2 FINISHES

A. All decking shall be galvanized.

PART 3 EXECUTION

3.1 EXAMINATION

A. Visually determine that Project is ready to begin the work of this Section; beginning of work indicates acceptance of conditions. Notify Architect in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the Architect.

3.2 INSTALLATION

A. The steel deck shall be placed in accordance with erection drawings. Each unit shall be placed on supporting steel framework and adjusted to final position before being permanently fastened. The unit shall be brought to proper bearing on the supporting members.

B. End laps shall be a minimum of 2" and side laps shall be one-half flute. Attach sheets to steel support by puddle welding or screwing through deck. Attachment spacing shall be 12” on center on each supporting member.

3.3 ADJUSTING

A. Adjust members as necessary to be compatible with final product. Notify Architect before substantially altering any member.

3.4 CLEANING

A. Clean underside of deck to remove any dirt, dust, oil, or other material.

END OF SECTION

SECTION 13122 – METAL BUILDING SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Clear span rigid frame, flush wall frame as shown – see drawings.

B. Eave heights are shown on building sections.

C. Bay spacing as shown on drawings.

D. Roof Slope: As shown on drawings.

E. Primary Framing: Rigid frame, flush wall frame consisting of rafter beams and columns, end wall columns and wind beams. See drawings.

F. Secondary Framing: Roof purlins, eave struts, flange bracing, and other items detailed.

G. Lateral Bracing: Horizontal loads not resisted by main frame action shall be resisted by portal frames and/or x-bracing in the end walls, sidewalls and roof. See the structural drawings for types and locations of bracing.

H. Wall and Roof System: Preformed steel panels, blanket insulation, and accessory components.

I. Accessories: Metal Doors, Metal Windows, Louvers, rake/eave extensions and canopies, soffit panels, etc as specified herein or as shown on drawings.

1.2 RELATED SECTIONS

A. Section 02201: Earthwork.

B. Section 03100: Concrete formwork.

C. Section 03200: Concrete Reinforcement.

D. Section 03301: Cast-In-Place Concrete.

E. Section 07900: Joint Sealants.

F. Section 08100: Metal Doors and Frames.

G. Section 08400: Storefront Frames.

H. Section 09900: Painting.

1.3 REFERENCES

A. AISI - *Specification for the Design of Cold-Formed Steel Structural* Members - 1996 Edition with 1999 Addendum.

B. AISC - *Specification for Structural Steel Buildings - Allowable Stress Design and Plastic Design,* .

C. AISC - Steel Design Guide Series 3 - Serviceability Design Considerations for Low-Rise Buildings, .

D. ASTM A36 - Specification for Carbon Structural Steel, .

E. ASTM A123 - Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products, .

F. ASTM A153 - Specification for Zinc Coating (Hot Dip) on Iron and steel Hardware, .

G. ASTM A307 - Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength, .

H. ASTM A325 - Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength, .

I. ASTM A463 - Specification for Steel Sheet, Aluminum-Coated, by the Hot-Dip Process, .

J. ASTM A475 - Specification for Zinc-Coated Steel Wire Strand.

K. ASTM A490 - Specification for Heat Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength, .

L. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes, .

M. ASTM A501 - Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing, 1999.

N. ASTM A529 - Specification for High-Strength Carbon-Manganese Steel of Structural Quality, .

O. ASTM A572 - Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel, .

P. ASTM A653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot-Dip Process, .

Q. ASTM A792 - Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process, .

R. ASTM A1011 - Specification for Steel Sheet and Strip Hot Rolled Carbon, Structural High Strength Low-Alloy and High Strength Low-Alloy with Improved Formability, .

S. ASTM C665 - Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing, .

T. ASTM D1494 - Test Method for Diffused Light Transmission Factor of Reinforced Plastic panels, .

U. ASTM E1514 - Specification for Structural Standing Seam Steel Roof panel Systems, .

V. ASTM E1592 - Test method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference, .

W. ASTM E1646 - Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference, .

X. ASTM E1680 - Test Method of Rate of Air Leakage through Exterior metal Roof Panel Systems, .

Y. AWS A2.4 - Standard Welding Symbols,.

Z. AWS D1.1 - Structural Welding Code - Steel ,.

AA. AWS D1.3 - Structural Welding Code - Sheet Steel, .

BB. MBMA Metal Building Systems Manual, .

CC. NAIMA 202 - Standard for Flexible Fiberglass Insulation Systems in Metal Buildings, .

DD. SSPC (Society for Protective Coatings) - SP-2 - Specification for Hand Tool Cleaning, (Part of Steel Structures Painting Manual, Vol. Two)

EE. SSPC - Paint 15 – Steel Joist Shop Primer; Society for Protective Coatings; (Part of Steel Structures Painting Manual, Vol. Two)

FF. SSPC – Paint 20 – Zinc-Rich Primers (Type I, “Inorganic”, and Type II, “Organic”); Society for Protective Coatings; (Part of Steel Structures Painting Manual, Vol. Two).

GG. UL 580 - Tests for Uplift Resistance of Roof Assemblies,.

1.4 DESIGN REQUIREMENTS

A. The building shall be designed by the Manufacturer as a complete system. Members and connections not indicated on the drawings shall be the responsibility of the Manufacturer and/or Contractor. All components of the system shall be supplied or specified by the same manufacturer.

B. Design Code:
Design load application shall be in accordance with IBC 2012 Edition.

C. Dead Loads:
The dead load shall be the weight of the Metal Building System and as determined by the system manufacturer.

D. Collateral Loads:
The collateral load shall be 5 psf. See structural drawings for drift limitation.

E. Live Loads:
The building system shall be capable of supporting a minimum uniform live load of 20 psf., reducible for frames per IBC.

F. Snow Loads:
The design ground snow loads shall be 5 psf .

G. Wind Loads:
The ultimate wind speed for the metal building system shall be 131 mph.

H. Seismic Loads:
Seismic load shall be determined based upon IBC 2012.

I. Rainfall Intensity: per IBC requirements.
All exterior gutters and downspouts shall be designed for rainfall intensity based upon a 5-year recurrence interval for a five-minute duration.

J. Deflections shall be limited as follows:

Primary Framing:
L/180 for dead load + live load..

Secondary Framing:
L/240 for roof dead load + roof live load; but not less than that required to maintain positive drainage for the greater of roof dead load + roof snow load .
L/240 for wind load on roof.
L/240 for roof snow load (but not less than 20 PSF) on sheeting.

K. Thermal Effects:
Standing Seam roof panels shall be free to move in response to the expansion and contraction forces resulting from a temperature variation. Assembly to permit movement of components without buckling, failure of joint seals, undue stress on fasteners or other detrimental effects, when subject to temperature range of 120 degrees.

1.5 SUBMITTALS

Note: All manufacturer drawings and design calculations shall bear the professional seal and signature of a licensed professional engineer registered in the state of Mississippi.

A. Submit anchor bolt placement plan, and column reactions in advance of erection drawings.

B. Product Data: Provide data on profiles, component dimensions, fasteners, and color selection.

C. Manufacturer's Installation Instructions: Indicate preparation requirements and assembly sequence.

D. Shop or Erection Drawings: Indicate assembly dimensions, locations of structural members, connections, attachments, openings, cambers, and loads; wall and roof system dimensions, panel layout, general construction details, anchorages and method of anchorage and installation; framing anchor bolt settings, sizes, and locations from datum, and foundation

loads; indicate field welded connections with AWS A2.4 welding symbols; indicate net weld lengths.

E. Grid numbers or letters used on shop drawings shall not repeat those shown on contract documents unless they are in the same position as those shown on contract documents. Use of numbers such as 1.1, or letters such as A.2 is acceptable. Failure to follow these provisions is basis for rejection of shop drawings.

1.6 QUALITY ASSURANCE

A. Fabricate structural steel members in accordance with MBMA Metal Building Systems Manual, and, for items not covered, AISC - Specification for Structural Steel Buildings.

1.7 QUALIFICATIONS

A. Manufacturer: The company manufacturing the products specified in this Section shall have a minimum of 10 years experience in the manufacture of steel building systems. The manufacturing company shall be certified under the American Institute of Steel Construction's Category MB Certification Program.

B. Structural framing and covering shall be the design of a licensed Professional Engineer experienced in design of this work.

C. Erector shall have specialized experience in the erection of steel building systems for a period of at least 10 years.

1.8 WARRANTY

A. Building manufacturer shall provide manufacturer's standard material warranty.

B. Manufacturer's guarantee: Twenty (20) year unlimited guarantee for water tightness covering material and workmanship on entire system.

C. Manufacturer's guarantee: Twenty (20) year guarantee against blistering, peeling, cracking, chipping or rust through with a maximum fade of 5 NBS and minimum chalk rating of #8.

D. Contractor's guarantee: Written guarantee agreeing to keep the roof free of leaks for a period of two (2) years beginning at the time of acceptance of the project by the Owner."

1.9 ADMINISTRATION

A. All nomenclature shall conform to the MBMA Metal Building Systems Manual.

B. Coordination and administration of the work shall be in accordance with the MBMA Metal Building Systems Manual – Common Industry Practices.

PART 2 - PRODUCTS

2.1 MATERIALS - ROOF SYSTEM

A. Roof Panels:

1. Equal to MBCI 16” BattenLok HS system with striations, 24 gage or thicker, steel.

2. Panel Finish – Exterior: Precoated steel of silicone polyester finish, color as selected by Architecture from Manufacture’s standard colors. Equal to MBCI Signature 200.

3. Panel Finish – Interior: Precoated steel with wash coat of polyester, manufacturer’s standard finish.

4. Length: Maximum possible to eliminate end splices.

5. Closures: Manufacturer’s standard type, closed cell or metal.

6. Fasteners: Manufacturer’s standard type. Size and design to maintain load and weather tightness requirements. Fasteners to be stainless steel, head and shank self drilling and tapping.

7. Accessories: Provide vented ridge cap, flashing connected to roofing or accessories, flashing support angles and frames, closures, curbs, clips, fasteners and other necessary devices as required to ensure a weather/water tight seal. Material shall be compatible and shall not cause a corrosive condition. Exposed fasteners shall be fitted with weather-seal washers of synthetic rubber (EPDM) with stainless steel unless otherwise indicated.

a. Gutters and trim in connection with metal roofing shall have a siliconized polyester finish, of manufacturer's standard color selected, on exterior face as selected by Architect.

b. Gutters shall have inside finish of factory applied polyester with a coating resistant to weathering, and shall have soldered outlet tubes for connection of downspouts included elsewhere.

c. Curbs shall be seamed-in-place type.

d. Sealants: As recommended by the manufacturer for each condition requiring sealant for watertight installation."

e. Clips shall be compatible with thermal blocks and thermal insulation.

f. Ridge Venting: Where shown, provide ridge vent (low profile) ridge flashing by same manufacturer as roof.

g. All flashing, trim, etc. to be same finish as roof. Architect to select color from manufacturer standard.

B. Soffit Panels:

1. Equal to MBCI Commercial/Industrial "R" panels.

2. Guage: 26 Guage

3. Panel Finish: Precoated steel of silicone polyester finish, color as selected by Architecture from Manufacture's standard colors. Equal to MBCI Signature 200.

C. Color Coordination: Roof and Soffit panel to be by same manufacture to match finish and color.

2.2 MATERIALS – WALL PANELS

A. Vertical Wall Panels:

1. Equal to MBCI Commercial/Industrial "PBC" panels.

2. Guage: 26 gauge

3. Panel Finish: Galvalume Plus (Standard Interior Finish)

4. Accessories: Install as recommended by panel manufacture including all required trim and accessories with finish to match panel.

B. Horizontal Wall Panels:

1. Equal to MBCI Commercial/Industrial “7.2” panels.

2. Guage: 26 Guage

3. Panel Finish - Exterior: Precoated steel of silicone polyester finish, color as selected by Architecture from Manufacture’s standard colors. Equal to MBCI Signature 200.

4. Accessories: Install as recommended by panel manufacturer including all required trim and accessories with finish to match panel.

2.2 MATERIALS - TRIM

A. Fascia, Flashings, Internal and External Corners, Closure Pieces, Infillsand caps: Same material and finish as adjacent material, profile to suit system. Color as selected by Architect from manufacturer's standards.

2.3 FABRICATION - PRIMARY FRAMING

A. Framing Members: Clean and prepare in accordance with SSPC-SP2 as a minimum, and coat with building manufacturer's standard primer.

B. Hot rolled members shall be fabricated in accordance with AISC Specification for pipe, tube, and rolled structural shapes and primed.

C. Fabricate built-up members in accordance with MBMA Metal Building Systems Manual, Common Industry Practices.

2.4 FABRICATION - SECONDARY

A. Framing Members: Clean and prepare in accordance with SSPC-SP2, as a minimum, and coat with building manufacturer's standard primer.

B. Cold Formed Members: Cold formed structural shapes shall be fabricated in accordance with MBMA Metal Building Systems Manual, Common Industry Practices.

C. The purlin spacing for the building shall be adjusted as necessary to provide adequate support for the roof decking at differing code dictated zones in the plane of the roof. Calculations submitted shall include the basis for the purlin spacing submitted for approval.

2.5 FABRICATION - GUTTERS, DOWNSPOUTS, FLASHINGS AND TRIM

A. Fabricate gutters, flashings and trims from manufacturer's standard. Color to be selected by Architect from manufacturer's standard offering.

B. Fabricate or furnish downspouts with elbows from manufacturer's standard. Color to be selected by Architect from manufacturer's standard offering.

C. Form gutters and downspouts of profile and size to collect and remove water. Fabricate with connection pieces.

D. Form flashing and trim sections in maximum possible lengths. Hem exposed edges. Allow for expansion at joints.

E. Fabricate or furnish gutter support straps of manufacturer's standard material, design and finish.

F. Fabricate or furnish downspout clips or support straps of manufacturer's standard material. Finish color as selected by Architect.

2.6 THERMAL INSULATION

A. Insulation: Provide glass fiber blanket insulation not less than 0.5 lb. per cubic foot density, 6” thickness with UL flamespread classification of 25 or less, and 2” wide continuous vapor tight edge tabs. R value to be R-19 in place. Provide thermal blocks.

B. Vapor Barrier: Vinyl film.

C. Retainer Strips: Provide 26 ga. formed galvanized steel retainer clips colored to match insulation facing.

D. Location: Locate insulation on underside of roof sheets, extending across top flange of purlin members and held taut and snug to roofing panels by retainer strips.

PART 3 - EXECUTION

3.1 EXECUTION

A. Verify site conditions.

B. Verify that foundation, floor slab, mechanical and electrical utilities, and placed anchors are in correct position and properly squared.

C. Provide access to the work as scheduled for owner provided inspections, if required. The cost of any required inspections is the responsibility of the owner.

D. Do not proceed until unsatisfactory conditions have been corrected.

3.2 ERECTION - FRAMING

A. Erect framing in accordance with MBMA Metal Building Systems Manual, Common Industry Practices.

B. Use templates for accurate setting of anchor bolts. Level bearing plate area with steel wedges or shims, and grout. Check all previously placed anchorages.

C. Erect building frame true and level with vertical members plumb and bracing properly installed. Maintain structural stability of frame during erection.

D. Ream holes requiring enlargement to admit bolts. Burned holes for bolted connections are not permitted without written approval by designer. Burned holes to be reamed.

E. Tighten bolts and nuts in accordance with "Specification for structural joints using ASTM A325 or A490 bolts" using specified procedure. Calibrated wrench tightening or direct tension indicator washers may be used to assure correct tightening.

F. The erector shall furnish temporary guys and bracing where needed for squaring, plumbing, and securing the structural framing against loads, such as wind loads acting on the exposed framing and seismic forces, as well as loads due to erection and erection operation, but not including loads resulting from the performance of work by others. Bracing furnished by the manufacturer for the metal building system cannot be assumed to be adequate during erection and are not to be used to pull frames into plumb condition. The temporary guys, braces, falseworks and cribbing

are the property of the erector, and the erector shall remove them immediately upon completion of erection.

G. Do not field cut or modify structural members without approval of the metal building manufacturer.

H. After erection, erector to prime welds, abrasions, and surfaces not shop primed, galvanized, or needing touch-up.

3.3 ERECTION - WALL AND ROOFING SYSTEMS

A. Install all wall and roofing systems in accordance with manufacturer's instructions and details.

B. Exercise care when cutting prefinished material to ensure cuttings do not remain on finish surface.

C. Fasten cladding system to structural supports, using proper fasteners aligned level and plumb.

D. Set purlins and girts at right angle and bolt to appropriate clips. Attach to clips as required to satisfy design loads and as shown on drawings.

E. Place screw down roof panels at right angle to purlins and girts. Attach and plumb wall panels as shown on drawings. Maintain consistent module coverage for entire length of wall. Predrill panels. Lap panel ends as recommended by manufacturer. Place end laps over purlins or girts. Apply butyl roof panel side and end lap sealant between panel ends and side laps to provide water-tight installation per details furnished.

F. Place Standing Seam Roof panels at right angle to purlins. Attach with sliding concealed clip where expansion and contraction must be accounted for. Lap panel ends as recommended by manufacturer. Place end laps above purlin with backup plate and cinch strap so panel end-lap fasteners do not penetrate purlin.

3.4 ERECTION - GUTTER, DOWNSPOUT, FLASHINGS AND TRIM

A. Install gutters and downspouts, flashings and trim in strict accordance with manufacturer's instructions, using proper sheet metal procedures.

B. The downspout to be connected to cast iron down spouts by general contractor and to storm sewer system by plumbing contractor.

3.5 INSTALLATION - ACCESSORIES

A. Install accessories in accordance with manufacturer's instructions.

B. All roof and wall accessories to be installed weathertight.

3.6 TOLERANCES

A. All work shall be performed by experienced workmen in a workmanlike manner to published tolerances.

B. Install Framing in accordance with MBMA Metal Building Systems Manual, Common Industry Practices.

3.7 INSPECTION

A. Installer of metal roofing must examine substrate and conditions under which roofing work is to be performed and must notify Contractor in writing of unsatisfactory conditions. Do not proceed with roofing work until unsatisfactory conditions have been corrected in manner acceptable to the installer.

3.8 INSTALLATION

A. General: Comply with instructions and recommendation of the metal roofing manufacturer, except to extent more stringent requirements are indicated. Secure as required for UL Class 90 Wind Uplift Classification.

B. Place roof panels, if possible, in full length pieces without splicing. Secure each panel to each support by means of a steel clip concealed between the adjacent male and female interlocking ribs and fastened to the panel's weather surface.

1. Endlaps, when required, shall be at least 6 inches, sealed with recommended sealants and fastened together by clamping plates.

C. Install edge trim, gutters and gutter supports in accordance with approved shop drawings and manufacturer's recommendations.

D. Penetrations through the roof panels by fasteners shall be limited to only those required at penetrations, eaves, endlaps, hips, valleys and ridge.

E. Make panel-to-panel connections with a positive, field-formed double lock standing seam, rolled 180 degrees by a special seaming device.

F. Make panel-to-panel connections by field seaming with a seaming device, and shall include factory applied side lap sealant.

G. Properly flash and seal at ends, ridges, hips, valleys, penetrations, and eaves to assure water tightness.

H. Seal all joints where water might penetrate to interior of building, including ridge and hip covers, roof flashings and curbs, ridge and hip channels, exposed joints of roof accessory openings, end laps, eave and edge flashing, and other locations required.

I. Thermal Insulation: Install insulation in accordance with manufacturer's published directions and concurrently with installation of panels. Install blankets straight and true in one-piece lengths with both sets of tabs sealed to provide a complete vapor barrier. Install retainer strips at each longitudinal joint, straight and taut, nesting with roof rib to hold insulation in place.

3.9 CLEANING:

A. Repair or replace any work which has been stained, marred or otherwise damaged during the work under this Section.

B. Upon completion remove unused materials, containers and equipment and clean up area.

END OF SECTION

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HATTIESBURG PUBLIC SAFETY COMPLEX
VEHICLE MAINTENANCE
HATTIESBURG, MISSISSIPPI
ERG P.N. 15.28.03

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SECTION 21 13 00

FIRE SUPPRESSION SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. These provisions specified herein apply to all Sections of Division 21.

B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to all Sections of Division 21.

1.2 WORK INCLUDED

A. Furnish all labor, materials, tools, and equipment to complete the automatic fire sprinkler system as hereinafter described, ready for service to the entire satisfaction of the Using Agency. Provide hydraulically calculated systems as defined in the adopted edition of NFPA 13 and in accordance with State Fire Marshall requirements.

B. This section is a performance specification section only. The design build fire protection contractor shall be fully responsible for the design and to provide necessary equipment and hardware per local fire protection codes.

C. Fire Sprinkler System Notes:

1. The automatic sprinkler system shall conform to the requirements of the adopted edition of UFC 3-600-01 and NFPA Standard 13.
2. Installation of the sprinkler system shall not be started until complete plans and specifications including water supply design information and type of existing sprinkler system, if any have been submitted and approved by the State Fire Marshal, Fire/Life Safety Section. At various stages and upon completion, the system must be tested in the presence of the Inspector of Record (IOR) and/or Authority Having Jurisdiction (AHJ).
3. Underground firewater and sprinkler system work shall conform to the requirements of NFPA 24 and NFPA 13n. Prior to installation of the underground fire water supply system, submit shop drawings and specifications of system, including water flow test data to the State Fire Marshal, Fire/Life Safety Section for approval. Submittal shall include thrust block location and size, type of piping and catalog cut sheets on all valves and fittings. An inspection of the underground installation, back flush and hydrostatic test shall be conducted and witnessed by the Professional, IOR and/or AHJ prior to backfill.

D. Verify electrical requirements of alarm valves, flow switches, valve supervision switches, alarm bells and pumps with electrical contractor.

1.3 RELATED WORK AND REQUIREMENTS

A. All Division 21 sections.

B. Section 23 00 10 – Mechanical General Provisions

C. Section 23 05 00 – Basic Mechanical Materials and Methods

1.4 REFERENCE STANDARDS

A. American National Standards Institute (ANSI)

1. B16.1 Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800
2. B16.3 Malleable-Iron Castings
3. B16.4 Cast-Iron Threaded Fittings Class 125 and 300
4. B16.5 Pipe Flanges and Flanged Fittings
5. B16.9 Factory-Made wrought Steel Butt welding Fittings
6. B16.11 Forged Fittings, Socket-Welding and Threaded
7. B16.22 Wrought Copper and Bronze Solder Joint Pressure Fittings
8. B16.25 Butt welding Ends

B. American Society for Testing and Materials (ASTM)

1. A36 Structural Steel
2. A47 Ferritic, Malleable Iron Castings
3. A53 Pipe, Steel, Black and Hot-Dipped, Zinc Coated
4. A135 Specification for Electric-Resistance-Welded Steel Pipe
5. A194 Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure and High-Temperature Service
6. A320 Specification for Alloy Steel Bolting Materials for Low-Temperature Service
7. A795 Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use
8. B88 Seamless Copper Water Tube

C. American Water Works Association (AWWA)

1. C104 Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
2. C110 Gray Iron and Ductile Iron Fittings
3. C111 Rubber Gasket Joints for Ductile-Iron and Grey-Iron Pressure: Pipe and Fittings
4. C151 Thickness of Ductile-Iron Pipe – Centrifugally Cast
5. C200 Steel Water Pipe 6” and larger
6. C503 Wet-Barrel Fire Hydrants

D. International Association of Plumbing and Mechanical Officials (IAPMO)

1. PS 31 Backflow Prevention Devices

E. National Fire Protection Association (NFPA)

1. 13 Installation of Sprinkler Systems

F. Underwriter’s Laboratory (UL)

1. 262 Gate Valves for Fire Protection Service
2. Indicator Post for Fire-Protection Service

G. Unified Facilities Criteria (UFC)

1. 3-600-01 Fire Protection Engineering for Facilities

1.5 DESIGN CRITERIA

A. Design sprinkler systems and obtain approval from AHJ.

B. Determine the static and residual pressure for the site as required for accurate determination of system requirements. Base system calculations on the lowest expected static and residual pressure for the area.

1. Test data for static and residual pressure shall be measured by the Contractor. Test shall be made within the presence of the Professional and at a time approved by the Professional and Using Agency.

C. It is the intent of these Specifications and Drawings to provide for a complete and operating automatic fire protection sprinkler system in full compliance with the standards of the National Fire Protection Association as set forth in NFPA Pamphlet No. 13 and UFC 3-600-01, currently adopted editions.

D. Review Architectural and Structural Drawings to determine the extent of construction and resultant fire protection coverage to comply with NFPA. Interstitial spaces, if utilized, will require sprinkler protection.

E. Provide fire sprinklers to protect all building overhangs greater than 4 feet wide, or as required by local authority.

F. Provide additional fire sprinklers where required to meet the requirements of NFPA13. Coordinate with the work of other trades especially when it may create interferences and or obstructions requiring special protection, additional piping and heads and drains.

G. The maximum permissible flow velocity through automatic sprinkler piping shall be 15 feet per second. The minimum starting pressure at the most remote sprinkler head shall be not less than the minimum required to operate the sprinkler head.

H. Reduction in area of operation when use of quick response sprinkler heads as defined in NFPA 13 will not be allowed.

I. Use of piping lighter than Schedule 10 is not allowed.

J. The initial building shall contain basic sprinkler coverage which can be modified and extended for the future build-out of unimproved spaces.

K. Design shall comply with the Using Agency’s Insurance Underwriters’ requirements.

1.6 COORDINATION/SPECIAL CONSIDERATIONS

A. Coordinate with other trades all equipment locations, pipe, duct and conduit runs, electrical outlets and fixtures, air inlets and outlets, and structural and architectural features. Provide information on location of piping and bracing to all other trades as required for a completely coordinated project.

B. Contract Drawings: All piping required for the sprinkler and standpipe systems is not shown, but general arrangement of system piping, required standpipes, outlets and valves, alarm valves and areas requiring sprinkler protection are shown.

C. Where heads are located at suspended ceiling, spacing shall be as required by NFPA 13, except as follows: In all locations, sprinkler heads shall be equidistant between lights, between wall and lights,

between lights and air diffusers, and between wall, lights, and air diffusers. Provide uniform and repetitive pattern for each room. Locate by reflected ceiling plan where shown.

D. Install sprinkler all sprinkler heads in center of ceiling tiles.

E. Provide approved dry pendant sprinkler heads in spaces subject to freezing.

F. Provide high temperature sprinkler heads in all electrical rooms or other areas with elevated temperatures such as mechanical rooms.

G. Coordinate Work among the trades in accordance with Section 01 31 00 to avoid any interference with the effectiveness of the fire protection system. Shop drawings shall include elevations of equipment and piping to assure coordination. The fire protection system shall be coordinated with other trades to assure that conflicts will not arise with structural, mechanical, electrical or architectural features of the building.

H. Coordinate with the fire alarm contractor to ensure full awareness of the location of control valves, flow switches, tamper switches, and alarm and signal switches.

1.7 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of fire protection products, of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer: A firm with at least five years of successful installation experience on projects with fire sprinkler piping similar to that required for this project.

C. Requirements of Regulatory Agencies:

1. Install fire protection systems in accordance with IBC – 2012 Edition, Chapter 9 “Fire Protection Systems”.
2. NFPA Compliance: Install fire protection systems in accordance with NFPA 13 "Standard for the Installation of Sprinkler Systems", 2010 Edition, and other pertinent NFPA requirements. Comply also with NFPA 14 for standpipes.
3. FM Compliance: Comply with Factory Mutual "Approval Guide".
4. UL Labels: Provide fire sprinkler piping products which have been approved and labeled by Underwriters' Laboratories.
5. Fire Marshal Compliance: Install fire protection systems in accordance with State Fire Marshal and Campus Fire Marshal.
6. Screw Thread Connections: Comply with local fire department/marshal regulations for sizes, threading, and arrangement of connections for fire department equipment to systems.

D. Fire stop penetrations with an approved material as prescribed in IBC – 2012 Edition, Chapter 7.

E. Installation of the sprinkler system shall not be started until complete plans and specifications (including water supply information and type of existing sprinkler system, if any) have been reviewed by the AHJ and the Using Agency’s Insurance Underwriter.

F. At various stages and upon completion, the system must be tested in the presence of the enforcing agency.

G. The fire extinguishing system shall be installed by a licensed fire systems contractor.

1.8 SUBMITTALS

A. See Section 01 33 00 – Shop Drawings, Product Data and Samples

B. See Section 23 00 10 – Mechanical General Provisions

C. Submittals shall include, but not be limited to, the following and shall clearly show the State Fire Marshal (SFM) listing numbers:

1. Pipe and fittings.
2. Valves.
3. Sprinkler heads.
4. Gauges.
5. Sleeves and Escutcheons.
6. Flow switches.
7. Tamper switches.
8. Alarm bells.
9. Pipe hangers and supports.
10. Identification signs.
11. Sprinkler head cabinets.
12. Hose Valve cabinets.

D. Submit shop drawings as follows:

1. Prepare and submit preliminary drawing to the Using Agency showing the proposed location of the fire sprinkler heads coordinated with and in relation to the ceiling tile pattern, light fixture and duct inlets/outlets. Review of this drawing and the Fire Marshal's review stamp thereon shall be a prerequisite for the preparation of further working plans.
2. Detailed working drawings and hydraulic calculations shall be prepared and submitted for approval before fabrication of the project. Working drawings shall be submitted in complete sets (partial submission will not be acceptable) and shall bear the Contractor's license stamp, identity of the system designer and computer program used in the calculation of hydraulic information.
3. Fire Marshal approval of submittals is for permission to proceed and does not authorize design, products or installation not conforming to referenced codes and standards and this specification. Substitutions or alternates require specific approval by the Using Agency.
4. Upon completion of the Work, the Contractor shall provide AutoCAD computer files and a set of Mylar film reproducible Record Drawings to the Professional. Refer also to Section 017800. Final approvals are subject to receipt of acceptable Record Drawings.

E. Submittals having any content that is incomplete or unclear will be returned without review or approval.

F. Deferred Approval Documents: Do not proceed with fabrication or installation of fire sprinkler system until deferred approval documents have been approved by AHJ and Professional.

1. General: Provide detailed drawings, specifications, and calculations prepared by a State of Mississippi licensed professional fire protection engineer per UFC 3-600-01. Drawings, specifications and calculations shall bear qualified Fire Protection Engineer's stamp. See UFC 3-600-01 for fire protection engineer's services and qualifications.
2. Fire Protection Engineer shall certify in writing that the design is in compliance with UFC 3-600-01.
3. Make additions, changes and corrections as directed by Professional and resubmit.
4. Agency Review: Submit documents to Using Agency and/or AHJ. Make additions, changes

and corrections required by Using Agency / AHJ at no cost to Using Agency and resubmit to Professional.

G. Provide all necessary information to ceiling suspension work of Division 09, Finishes, to provide coordinated submittals.

H. Discharge patterns and application data shall be included in submittals for sidewall, water curtain, and similar special purpose sprinklers.

I. Operating Instructions: Provide instruction charts describing operation and proper maintenance of system equipment per Section 01 78 00.

PART 2 - MATERIALS

2.1 MANUFACTURERS

A. Provide piping materials and factory-fabricated piping products of sizes, types, pressure rating, temperature ratings, and capacities as required. Provide sizes and types matching piping and equipment connections; provide fittings of materials that match pipe materials used in fire protection systems.

B. Equipment to be furnished under this specification shall be essentially standard product of manufacturer. Where two or more units of same class of equipment are required, these units shall be products of a single manufacturer. However, component parts of system need not be products of same manufacturer.

C. Manufacturers: Subject to compliance with requirements, manufacturer offering automatic sprinklers which may be incorporated in the work include the following:

1. Specialty Valves and Devices:

    a. Badger Fire Protection, Inc.
    b. Central Sprinkler Corp.
    c. Firematic Sprinkler Devices, Inc.
    d. Globe Fire Sprinkler Corp.
    e. Grinnell Corp.
    f. Reliable Automatic Sprinkler Co., Inc.
    g. Star Sprinkler Corp.
    h. Viking Corp.

2. Water-Flow Indicators and Supervisory Switches:

    a. Grinnell Corp.
    b. Potter Electric Signal Co.
    c. Reliable Automatic Sprinkler Co., Inc.
    d. Viking Corp.
    e. Watts Industries, Inc.; Water Products Div.

3. Sprinkler, Drain and Alarm Test Fittings:

    a. Central Sprinkler Corp.
    b. Grinnell Corp.
    c. Victaulic Co. of America.

4. Sprinkler, Branch-Line Test Fittings:

    a. Elkhart Brass Mfg. Co., Inc.
    b. Smith Industries, Inc.; Potter-Roemer Div.

5. Sprinkler, Inspector's Test Fittings:

    a. G/J Innovations, Inc.
    b. Triple R Specialty of Ajax, Inc.

6. Fire Department Connections:

    a. Badger Fire Protection, Inc.
    b. Elkhart Brass Mfg. Co., Inc.
    c. Firematic Sprinkler Devices, Inc.
    d. Grinnell Corp.
    e. Guardian Fire Equipment, Inc.
    f. Reliable Automatic Sprinkler Co., Inc.
    g. Smith Industries, Inc.; Potter-Roemer Div.

7. Sprinklers:

    a. Badger Fire Protection, Inc.
    b. Central Sprinkler Corp.
    c. Firematic Sprinkler Devices, Inc.
    d. Globe Fire Sprinkler Corp.
    e. Grinnell Corp.
    f. Reliable Automatic Sprinkler Co., Inc.
    g. Star Sprinkler Corp.
    h. Viking Corp.

8. Indicator Posts and Indicator-Post, Gate Valves:

    a. American Cast Iron Pipe Co.; Waterous Co.
    b. Grinnell Corp.
    c. McWane, Inc.; Clow Valve Co. Div.
    d. McWane, Inc.; Kennedy Valve Div.
    e. Nibco, Inc.
    f. Stockham Valves & Fittings, Inc.

9. Indicator Valves:

    a. Central Sprink, Inc.
    b. Grinnell Corp.
    c. McWane, Inc.; Kennedy Valve Div.
    d. Milwaukee Valve Co., Inc.
    e. Nibco, Inc.
    f. Victaulic Co. of America.

10. Fire-Protection-Service Valves:

    a. Central Sprink, Inc.
    b. Central Sprinkler Corp.
    c. Grinnell Corp.

d. McWane, Inc.; Kennedy Valve Div.
e. Nibco, Inc.
f. Stockham Valves & Fittings, Inc.
g. Victaulic Co. of America.

11. Press-Seal Fittings for Steel Piping:

a. Victaulic Co. of America

2.2 VALVE AND ALARM SYSTEM IDENTIFICATION

A. Provide identification complying with Section 23 05 53, Mechanical Identification section in accordance with the following listing:

1. Fire Protection Valves: Brass valve tags.
2. Fire Protection Signs: Provide the following signs:

a. At each sprinkler valve, including roof manifold, sign indicating what portion of system valve controls.
b. At each outside alarm device, sign indicating what authority to call if device is activated.

2.3 BASIC PIPES AND TUBES

A. Piping shall be new, designed for 300 psi working pressure, conforming to ASTM specifications and have the manufacturer's name or brand along with the pipe applicable ASTM standard marked on each length of pipe.

B. All piping shall be UL listed and FM approved.

C. Piping installed underground: Ductile Iron AWWA C111 and C151.

D. Piping installed above ground 2 inch and smaller shall be Schedule 40 black steel pipe. Pipe shall be manufactured in accordance with specifications ASTM A-135 and A-53.

E. Piping installed above ground 2-1/2 inch and larger shall be Schedule 10 black steel pipe. Pipe shall be manufactured in accordance with specification ASTM A 135.

F. All fire protection piping shall be provided with factory-applied antimicrobial coatings to inhibit Microbiologically-Influenced Corrosion (MIC). Allied Tube and Conduit "ABF II", Wheatland Tube Company "MIC Shield" or equal.

G. Sprinkler piping and fittings exposed to weather, used in a corrosive atmosphere or as noted on drawings shall be galvanized.

H. In-Building Risers shall be installed as indicated on the plans. Risers shall be composed of a single extended 90 degree fitting of fabricated 304 stainless steel tubing, maximum working pressure 300 psi. The fitting shall have a grooved-end connection on the outlet (building) side and a CIPS coupler on the inlet (underground) side. The In-Building Riser shall be an Ames Fire & Waterworks Series IBR (or approved equal).

2.4 PIPE AND TUBE FITTINGS

A. Cast-Iron Threaded Flanges: ASME B16.1.

B. Cast-Iron Threaded Fittings: ASME B16.4.

C. Ductile-Iron Fitting: AWWA C110, ductile-iron or cast-iron type; or AWWA C153, ductile-iron, compact mechanical-joint type. Include cement-mortar lining and seal coat according to AWWA C104 and glands, rubber gaskets, and bolts and nuts according to AWWA C111.

D. Ductlie-Iron Fittings: ASTM A47, malleable-iron or ASTM A 536 ductile-iron casting complying with AWWA pipe size; with ends factory grooved according to AWWA C606.

E. Malleable-Iron Threaded Fittings: ASME B16.3.

F. Steel, Threaded Couplings: ASTM A 865.

G. Steel Welding Fittings: ASTM A 234/A 234M, ASME B16.9, or ASME B16.11.

H. Steel Flanges and Flanged Fittings: ASME B16.5.

2.5 PIPING SPECIALTIES

A. Provide piping specialties complying with Section 23 05 00, Basic Mechanical Materials and Methods section in accordance with the following listing:

1. Pipe escutcheons
2. Dielectric unions
3. Pipe sleeves
4. Sleeve seals

2.6 JOINING MATERIALS

A. Refer to Section 23 05 00 - Basic Mechanical Materials and Methods for pipe-flange gasket materials and welding filler metals.

B. Grooved-End Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel pipe OD. Include ductile-iron housing with keys matching steel pipe fitting grooves, prelubricated rubber gasket listed for use with housing and steel bolts and nuts. Include listing for dry-pipe service for couplings for dry piping.

C. Steel, Grooved-End Fittings: UL-listed and FM approved, ASTM A47, malleable iron or ASTM A 536, ductile iron, with dimensions matching steel pipe and ends factory grooved according to AWWA C606.

D. Transition Couplings: AWWA C219, sleeve type, or other manufactured fitting the same size as, with pressure rating at least equal to, and with ends compatible with piping to be joined.

2.7 POLYETHYLENE ENCASEMENT

A. Polyethylene Encasement for Ductile-Iron Piping: ASTM A674 or AWWA C105 film, 0.008-inch minimum thickness, tube or sheet.

2.8 SUPPORTS AND ANCHORS

A. Provide supports and anchors complying with Section 23 05 00 - Basic Mechanical Materials and Methods section, in compliance with referenced standards.

B. Spacing and details of the support and bracing of fire sprinkler piping shall comply with the currently adopted edition of NFPA 13. U-hook hangers used as sway bracing must have legs bent out 10 degrees and must have a slenderness ratio not exceeding 200.

C. Concrete Inserts: Uni-Strut P-3200 continuous insert or M24 spot insert Kin-line or equal. Do not use powder actuated fasteners for support of overhead piping unless approved by Professional.

2.9 VALVES

A. Provide valves, UL listed and FM approved, in accordance with the following listing. Provide sizes and types which mate and match piping and equipment connections.

1. Gate Valves: Provide iron gate control valve, outside screw and yoke (OS&Y), 175-lb rated working pressure, of sizes indicated, to close by turning to the right and to be sealed with approved metal seals. Valves shall be iron body, bronze fitted. Valves 2 inches and smaller shall be screwed and valves over 2 inches shall be flanged. For reference purposes, Mueller A-2073-6. Grinnell, Kennedy, Stockham or equal.
2. Butterfly Valve: Provide UL listed FM approved butterfly valves (slow-close) with position indicators. Electric motor operated valves shall be normally open and shall fail in the open position. For reference purposes, Mueller B-3211. Grinnell, Kennedy, Stockham or equal.
3. Swing Check Valves: Provide UL listed flanged, swing type, iron body, bronze seat ring and disc ring, and 175 psi pressure rating. For reference purposes, Mueller A-2120-6, Grinnell, Kennedy, Stockham or equal.
4. Riser Drain Valves: Main Riser Drain valves shall be angle or globe type, bronze body, screwed, 200 psi pressure rating, 2 inches size, with renewable composition soft disc. For reference purposes, Grinnell 3210, Stockham, NIBCO, Fairbanks or equal.
5. Auxiliary Drain Valve: Valves for auxiliary drains and Using Agency's Test connections shall be globe type, bronze body, screwed, 200 psi pressure rating, 1 inch size, with a renewable composition soft disc, For reference purposes, Grinnell 3210, Stockham, NIBCO, Fairbanks or equal.
6. Indicating Valves, 2-1/2 inches and Smaller: UL 1091; butterfly or ball-type, bronze body with threaded ends; and integral indicating device.

    a. Indicator: Electrical 115-V AC, prewired, single-circuit, supervisory switch.

7. Indicator Posts: UL 789, vertical type, cast iron body, with windows for target plates that indicate valve position, extension rod and coupling, locking device, and red enamel finish.

    a. Operation: Hand wheel.

8. Swing Check Valves, 2 inches and Smaller: UL 312 or MSS SP-80, Class 150; bronze body with bronze disc and threaded ends.
9. Swing Check Valves, 2-1/2 inches and Larger: UL 312, cast-iron body and bolted cap, with bronze disc or cast-iron disc with bronze-disc ring and flanged ends.
10. Split-Clapper Check Valves, 4 inches and Larger: UL 312, cast-iron body with rubber seal, bronze-alloy discs, and stainless-steel spring and hinge pin.
11. For other valves not required to be UL listed and FM approved refer to Section 23 05 23 - Valves.

2.10 METERS AND GAUGES

A. Provide meters and gauges complying with Section 23 05 00 - Basic Mechanical Materials and Methods section or Piping Specialties, in accordance with the following listing:

1. Pressure gauges: UL 393, 3-1/2- to 4-1/2-inch- diameter dial with dial range of 0 to 300 psig

2.11 SPECIALTY VALVES

A. Sprinkler System Control Valves: UL listed or FMG approved, cast or ductile-iron body with flanged or grooved ends, and 175-psig minimum pressure rating.

1. Available Manufacturers:

   a. Central Sprinkler Corp.
   b. Firematic Sprinkler Devices, Inc.
   c. Globe Fire Sprinkler Corporation.
   d. Grinnell Fire Protection.
   e. Reliable Automatic Sprinkler Co., Inc.
   f. Star Sprinkler Inc.
   g. Victaulic Co. of America.
   h. Viking Corp.

2. Alarm Check Valves: UL 193, designed for horizontal or vertical installation, with bronze grooved seat with O-ring seals, single-hinge pin, and latch design. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber, and fill-line attachment with strainer.

   a. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.

3. Ball Drip Valves: UL 1726, automatic drain valve, NPS 3/4, ball check device with threaded ends.

2.12 FIRE PROTECTION SPECIALTIES

A. Provide fire protection specialties, UL listed, in accordance with the following listing. Provide sizes and types that match piping and equipment connections.

1. Install drains on main risers and auxiliary drains at all low points in the system.
2. One Owner’s test drain shall be installed for each sprinkler system.
3. Drains and Owner’s tests shall be at locations approved by the Professional.
4. Drains and Owner’s tests shall be installed at locations as shown on the Drawings.
5. Provide drain line to floor sink or to outside, as required, to suit Project conditions.
6. Five or fewer trapped heads will not require a drain valve but may be drained through a plugged fitting.
7. Drain valve shall be of the angle type. Install in accordance with the requirements of NFPA Pamphlet No. 13.
8. Pipe drain valves to a floor sink or to the outside of the building. Discharge shall be visible from sight drain fitting or open end drain pipe. Provide flushing connections at ends of all cross mains.
9. Flow Alarm: Furnish and install a flow alarm system for each main sprinkler riser as shown on the Drawings. The systems shall be complete with Grinnell F-620, Viking or equal, flow

switch. As part of Division 16, wire flow alarm to the fire alarm control panel. Provide 3/4-inch conduit and two #14 wires from the tamper switch to the fire department control panel.

10. Provide wiring between switch, bell, and junction box. Provide junction box under Division 26. Wiring shall meet the requirements of Division 26. All controls shall be identified by permanent metal tags or other approved means. Alarm switch shall be UL or FM approved and shall have adjustable retard mechanism and two sets of contacts. Wiring between electrical distribution panel and junction box will be provided under Division 26.
11. Water-Flow Indicators: UL 346; electrical-supervision, vane-type water-flow detector; with 250-psig pressure rating; and designed for horizontal or vertical installation. Include two single-pole, double-throw, circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
12. Pressure Switches: UL 753; electrical-supervision-type, water-flow switch with retard feature. Include single-pole, double-throw, normally closed contacts and design that operates on rising pressure and signals water flow.
13. Valve Supervisory Switches: UL 753; electrical; single-pole, double throw; with normally closed contacts. Include design that signals controlled valve is in other than fully open position, Grinnell Model F640, Viking or equal, with single pole double throw switch actuator installed to change switch position when OS&Y valve is being closed.
14. Indicator-Post Supervisory Switches: UL 753; electrical; single-pole, double throw, with normally closed contacts. Include design that signals controlled indicator-post valve is in other than fully open position.
15. As part of Division 26, wire supervisory switch to the fire alarm control panel. Provide 3/4-inch conduit and two #14 wires from the tamper switch to the fire department control panel.

2.13 AUTOMATIC SPRINKLERS

A. Provide automatic sprinklers in accordance with the following listing. Provide fusible links for 165 degrees F. unless otherwise noted; UL or FM approved.

B. Automatic Sprinklers: With heat-responsive element complying with the following:

1. UL 199, for applications except residential.
2. UL 1767, for early suppression, fast-response applications.

C. Type: Spray pattern type, automatic closed-type heads of ordinary degree temperature rating, except that sprinklers to be installed in vicinity of heating equipment shall be of temperature ratings required for such locations by the currently adopted edition of NFPA 13.

1. Flush ceiling sprinklers, including escutcheon.
2. Pendent, dry-type sprinklers.
3. Quick-response sprinklers.
4. Sidewall, dry-type sprinklers.
5. Upright sprinklers.
6. Concealed ceiling sprinklers, including cover plate.

D. Sprinkler heads shall be UL or FM listed.

1. Exposed Locations: Provide upright type heads at all areas with no finished ceilings.
2. Where heads are located at height of less than 8 feet above finished floor, or where heads are located in mechanical equipment areas, provide wire guards to protect heads from damage.
3. Concealed Locations: Provide upright-type heads or pendent-type heads.
4. Sidewall Locations: Where required and where approved by the Professional.

5. Finished Ceilings: Locate at all ceilings with lay-in acoustical tile ceiling and at plaster or gypsum board type ceilings. Provide satin chrome finish and adjustable chrome finish metal ceiling escutcheons. Provide fully recessed pendant type and white enamel metallic cover in hard ceilings of finished spaces.
6. Where fire sprinkler heads are located in rooms with surface mounted lights, provide 2 piece adjustable sprinkler escutcheon, with adjustment from 1-7/8" to 3-1/8" below finished ceiling. Fire sprinkler drop nipple should be mounted 2-1/4" below the finished ceiling surface.
7. Sprinkler heads in light hazard area shall be quick response type.
8. Extended coverage sprinklers shall not be used.

E. Sprinkler Finishes: Chrome-plated, bronze, and painted.

F. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

1. Ceiling Mounting: Chrome-plated steel, one piece, flat.
2. Sidewall Mounting: Chrome-plated steel, one piece, flat.

G. Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler.

H. Sprinkler Cabinet and Wrench: Furnish steel, baked red enameled, sprinkler box with capacity to store sprinklers and wrench sized to sprinklers. Spare sprinklers and wrenches called for under "Extra Stock."

2.14 SPECIALTY SPRINKLER FITTINGS

A. Specialty Fittings: UL listed and FM approved; made of steel, ductile iron, or other materials compatible with piping.

B. Press-Seal Fittings: UL 213, steel housing with butylene O-rings and pipe stop.

C. Locking-Lug Fittings: UL 213, ductile-iron body with locking-lug ends.

D. Mechanical-Cross Fittings: UL 213, ductile-iron housing with pressure-responsive gaskets, bolts, and threaded or locking-lug outlets.

E. Drop-Nipple Fittings: UL 1474, with threaded inlet, threaded outlet, and seals; adjustable.

F. Sprinkler, Drain and Alarm Test Fittings: UL-listed, cast- or ductile-iron body; with threaded inlet and outlet, test valve, and orifice and sight glass.

G. Sprinkler, Branch-Line Test Fittings: UL-listed, brass body; with threaded inlet and capped drain outlet and threaded outlet for sprinkler.

H. Sprinkler, Inspector's Test Fittings: UL-listed, cast- or ductile-iron housing; with threaded inlet and drain outlet and sight glass.

I. Flexible Hose Assemblies: FlexHead Industries flexible stainless steel hose assembly consisting of a mounting bracket and a one-piece, leak tested sprinkler drop. The mounting bracket shall be compatible with any suspended or gypsum board ceiling system and FM/UL approved sprinklers. Assembly shall be FM approved and UL listed for use intended. Lengths of assemblies shall be selected with minimum length required to connect sprinkler without loops, traps, etc.

2.15 FIRE DEPARTMENT CONNECTIONS

A. Exposed Inlet type, Fire Department Connections: UL 405, 175-psig minimum pressure rating; with corrosion-resistant-metal body with brass inlets, brass wall escutcheon plate, brass lugged caps with gaskets and brass chains, and brass lugged swivel connections. Include inlets with threads according to NFPA 1963 and matching local fire department sizes and threads, outlet with pipe threads, check devices or clappers for inlets, and escutcheon plate with marking similar to "AUTO SPKR."

1. Finish: Polished chrome-plated.

B. Exposed, Free-Standing type, Fire Department Connections: UL 405, 175-psig minimum pressure rating; with corrosion-resistant-metal body with brass inlets, brass wall escutcheon plate, brass lugged caps with gaskets and brass chains, and brass lugged swivel connections. Include inlets with threads according to NFPA 1963 and matching local fire department sizes and threads, outlet with pipe threads, check devices or clappers for inlets, and escutcheon plate with marking similar to "AUTO SPKR."

1. Finish: Polished chrome-plated.

PART 3 - EXECUTION

3.1 PRODUCT HANDLING AND PROTECTION

A. Deliver packaged materials in their original, unopened wrapping with labels intact. Protect materials from water, the elements and other damage during delivery, storage and handling.

3.2 PREPARATORY PROVISIONS

A. The Contractor shall be responsible for the examination and acceptance of all conditions affecting the proper construction and/or installation of the Work of this Section and shall not proceed until all unsatisfactory conditions have been corrected. Commencing work shall be construed as acceptance of all conditions by the Contractor as satisfactory for the construction and/or installation of the Work.

B. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations.

C. Report test results promptly and in writing

3.3 EARTHWORK

A. Refer to Division 31 Section "Trenching, Backfilling, and Compaction" for excavating, trenching, and backfilling.

3.4 PIPING APPLICATIONS

A. Do not use welded joints with galvanized steel pipe.

B. Flanges, unions, and transition and special fittings with pressure ratings the same as or higher than

system's pressure rating may be used in aboveground applications, unless otherwise indicated.

C. Piping between Fire Department Connections and Check Valves: Use galvanized, standard-weight steel pipe with threaded ends; cast- or malleable-iron threaded fittings; and threaded joints.

D. Underground Water Supply and Service-Entrance Piping: Use ductile-iron, mechanical-joint pipe and fittings and restrained joints. Include corrosion protective encasement. Use In-Building Riser for service-entrance piping

3.5 SPRINKLER SYSTEM PIPING APPLICATIONS

1. 1-1/2 inches and Smaller: Standard-weight black steel pipe with threaded ends, cast-or malleable-iron threaded fittings, and threaded joints.
2. 2 inch: Standard-weight black steel pipe with threaded ends, cast- or malleable-iron threaded fittings, and threaded joints.
3. 2 inch: Standard-weight black steel pipe with grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
4. 2-1/2 to 3-1/2 inches: Schedule 10 black steel pipe with threaded ends, cast- or malleable-iron threaded fittings, and threaded joints.
5. 2-1/2 to 3-1/2 inches: Schedule 10 black steel pipe with roll-grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
6. 2-1/2 to 3-1/2 inches: Schedule 30 black steel pipe with plain ends, steel welding fittings, and welded joints.
7. 4 inch: Schedule 40 steel pipe with threaded ends, cast-or malleable-iron threaded fittings, and threaded joints.
8. 4 inch: Schedule 40 black steel pipe with roll-grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
9. 4 inch: Schedule 40 black steel pipe with plain ends, steel welding fittings, and welded joints.
10. 5 and 6 inches: Standard-weight black steel pipe with threaded ends, cast- or malleable-iron threaded fittings, and threaded joints.
11. 5 and 6 inches: Standard-weight black steel pipe with grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
12. 5 and 6 inches: Standard-weight black steel pipe with plain ends, steel welding fittings, and welded joints.

3.6 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Fire-Protection-Service Valves: UL listed and FM approved for applications where required by NFPA 13.

   a. Shutoff Duty: Use gate valves.

2. General-Duty Valves: For applications where UL-listed and FM-approved valves are not required by NFPA 13.

   a. Shutoff Duty: Use gate, ball, or butterfly valves.
   b. Throttling Duty: Use globe, ball, or butterfly valves.

3.7 JOINT CONSTRUCTION

A. Refer to Section 23 05 00 - Basic Mechanical Materials and Methods for basic piping joint construction.

B. Threaded Joints: Comply with NFPA 13 for pipe thickness and threads. Do not thread pipe smaller than NPS 8 with wall thickness less than Schedule 40 unless approved by authorities having jurisdiction and threads are checked by a ring gage and comply with ASME B1.20.1.

C. Steel-Piping, Grooved Joints: Use Schedule 40 steel pipe with cut or roll-grooved ends and Schedule 30 or thinner steel pipe with roll-grooved ends; steel, grooved-end fittings; and steel, keyed couplings. Assemble joints with couplings, gaskets, lubricant, and bolts according to coupling manufacturer's written instructions. Use gaskets listed for dry-pipe service for dry piping.

D. Dissimilar-Metal Piping Joints: Construct joints using dielectric fittings compatible with both piping materials.

1. 2 inch and Smaller: Use dielectric couplings or nipples.
2. 2-1/2 to 4 inches: Use dielectric flanges.
3. 5 inch and Larger: Use dielectric flange insulation kits.

E. Dissimilar-Piping-Material Joints: Construct joints using adapters or couplings compatible with both piping materials. Use dielectric fittings if both piping materials are metal. Refer to Division 21 Section "Common Work Results for Fire Suppression" for dielectric fittings.

3.8 WATER SUPPLY AND SERVICE-ENTRANCE PIPING AND PIPING TO FIRE DEPARTMENT CONNECTION

A. Connect water supply piping to fire main; connect sprinkler piping to fire-service piping of size and in location indicated for service entrance to building.

B. Install shut-off valve, backflow preventer, pressure gage, and other accessories indicated at connection to water supply piping.

3.9 INSTALLATION OF FIRE SPRINKLER PIPING

A. General: Comply with the requirements of the Division 21 sections and referenced NFPA standards for installation of fire sprinkler piping material. Install fire sprinkler piping products where shown, in accordance with the manufacturer's written instructions, and in accordance with recognized industry practices to ensure that fire sprinkler piping complies with requirements and serves its intended purpose.

B. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Professional before deviating from approved working plans.

C. Coordination: Coordinate all piping, heads, and sprinkler work to Architectural, Structural, Mechanical, and Electrical Work. Conceal piping, except where so indicated otherwise or where absolutely necessary. Place exposed piping where required by the Professional. Provide any offsets or additional piping required to coordinate this system with all other Work.

1. If piping is installed such that it is exposed to view in any location normally available to the users of the building or the public, it shall be relocated and concealed to the Professional's satisfaction, and at no additional cost to the Using Agency.

D. Any differences or disputes concerning coordination, interference, head and pipe locations or extent of work shall be decided by Professional and his decision shall be final.

E. Supply System: Provide supply connections as required to service the sprinkler system.

1. Installation shall conform to the applicable requirements of NFPA 13 and IBC.
2. Make joints as specified herein and in a manner approved by Professional. Leave joints exposed until final inspection and tests have been made.
3. Brace or clamp bends in accordance with the requirements. The clamp rods at the flange and spigot piece shall be long enough to pass through the flange.
4. Before connection of sprinkler system to underground supply, flush supply connections out thoroughly in accordance with NFPA.

F. Piping and Fittings Above Ground:

1. Install pipe, fittings, and hangers in accordance with requirements of IBC – 2012 Edition, Chapter 9 "Fire Protection Systems".
2. Cutting structural members for passage of sprinkler piping or for pipe hanger fastening will not be permitted except on review of Professional for each specific case.
3. Holes through walls, floors, and ceilings shall be large enough to accommodate pipe expansion. Provide suitable plates at each hole to ensure the effectiveness of floor or wall as a fire stop. Foundation penetration shall have a 2-inch annular space around pipe sealed watertight.
4. Provide long runs of pipe with suitable means to permit free movement due to expansion and contraction.
5. Make reduction in pipe sizes with one-piece concentric tapered reducing fittings. Bushings will not be acceptable.
6. Couplings shall not be used except where the length of pipe between fittings exceeds 20 feet 0 inches.
7. Use flanged fittings in control valves and drain assembly and at the base of risers.
8. Use malleable iron unions of the ground joint type in looped sprinkler systems where pipe is 2 inches in diameter or smaller. Where loops larger than 2 inches are used, companion flanges shall be installed.
9. Special couplings approved for use in sprinkler systems may be used in place of unions and flanged connections where applicable.
10. Install sectional valves in inlet piping, at bottom of each riser, and in all loops as required.
11. Mount supervisory switches on each sectional valve.
12. Install pressure gages at top of each standpipe.
13. Install valved hose connections 3/4-inch size on sprinkler at ends of branch lines and cross mains.
14. Install Owner's test connection at most remote point from riser.

G. Install ductile iron underground water supply and service-entrance piping according to NFPA 24 and with restrained joints. Encase piping in corrosion-protective encasement.

H. Install unions adjacent to each valve in pipes 2 inches and smaller. Unions are not required on flanged devices or in piping installations using grooved joints.

I. Install flanges or flange adapters on valves, apparatus, and equipment having 2-1/2 inches and larger connections.

J. Install "Inspector's Test Connections" in sprinkler piping, complete with shutoff valve, sized and located according to NFPA 13.

K. Install sprinkler zone control valves, test assemblies, and drain risers adjacent to sprinkler risers when sprinkler branch piping is connected to sprinkler risers.

L. Install ball drip valves to drain piping between fire department connections and check valves. Drain to floor drain or outside building.

M. Install sectional valves in piping.

N. Mount supervisory switches on each sectional valve.

O. Install valved hose connections of the sizes indicated, or 3/4 inch size, if not otherwise indicated, on sprinklers at ends of branch lines and cross mains at locations where indicated.

P. Install drain piping at low points of fire sprinkler piping.

Q. Identification: Apply signs to control, drain, test and alarm valves to identify their purpose and function. Provide lettering size and style selected by Authority Having Jurisdiction.

R. Hangers and Supports: Comply with NFPA 13 for hanger materials and installation.

S. Install piping with grooved joints according to manufacturer's written instructions. Construct rigid piping joints, unless otherwise indicated.

T. Install new pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe, valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.

U. Fill wet-pipe sprinkler and standpipe system piping with water.

3.10 SPECIALTY SPRINKLER FITTING INSTALLATION

A. Install specialty sprinkler fittings according to manufacturer's written instructions.

3.11 VALVE INSTALLATION

A. Refer to Section 23 05 23 - Valves for installing general-duty valves. Install fire-protection specialty valves, trim, fittings, controls, and specialties according to NFPA 13, manufacturer's written instructions, and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Specialty Valves:

1. Alarm Check Valves: Install in vertical position for proper flow, including bypass check valve and retarding chamber and drain-line connections.

3.12 SPRINKLER APPLICATIONS

A. General: Use sprinklers according to the following applications:

1. Rooms with Suspended Ceilings: Concealed sprinklers.
2. Mechanical Rooms, Basement, and Central Plant: Upright sprinklers.
3. Wall Mounting: Sidewall sprinklers.
4. Spaces Subject to Freezing: Upright; pendent, dry-type; and sidewall, dry-type sprinklers.
5. Special Applications: Use extended-coverage, flow-control, and quick-response sprinklers were applicable.
6. Sprinkler Finishes: Use sprinklers with the following finishes:

a. Upright, Pendent, and Sidewall Sprinklers: Polished bronze in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view.
b. Concealed Sprinklers: Rough brass with white cover.

3.13 FIRE DEPARTMENT CONNECTION INSTALLATION

A. Install Exposed-Inlet wall type, fire department connections.

B. Install ball drip valve at each valve for fire department connection.

3.14 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Connect water-supply piping to fire-suppression piping. Include backflow preventer between potable-water piping and fire-suppression piping. Refer to Section 22 11 19 – Domestic Water Piping Specialties for backflow preventers.

D. Install ball drip valves at each check valve for fire department connection. Drain to floor drain or outside building.

E. Connect piping to specialty valves, hose valves, specialties, fire department connections, and accessories.

F. Connection of alarm devices to fire alarm system by Division 26 Contractor.

G. Ground equipment according to Division 26 Section, “Grounding and Bonding Systems”.

H. Connect wiring according to Division 26 Section ”Conductors”.

I. Tighten electrical connectors and terminals according to manufacturer’s published torque-tightening values. If manufacturer’s torque values are not indicated, use those specified in UL 486A and UL 486B.

3.15 SLEEVES AND FLASHINGS

A. All sleeves shall be properly anchored in place during pouring of slabs. All pipe sleeves through

water resistant floors shall extend at least 1-1/2 inches above the finished floor and shall be watertight with the pipes passing through the sleeves. Sleeves passing through all other floors shall be of sufficient length to be flush with bottom of slab and extend one inch above the finished floor, and shall be securely anchored to the slab.

B. All piping passing through membrane water resistant walls and floors shall be provided with a water resistant type pipe sleeve, with Schedule 40 pipe extension or equal. Pack water resistant sleeves with white oakum and mastic.

C. Wherever pipes are exposed and pass through walls, floors, partitions or ceilings, they shall be fitted with chromium plated cast steel escutcheons held in place with setscrews. Care shall be taken to protect the escutcheons during the course of construction.

D. Sleeves in masonry or other walls shall be put in place as the construction progresses, avoiding the cutting of completed work.

E. All piping passing through fire-rated assemblies shall be installed within fire-rated pipe sleeves.

3.16 INSPECTION

A. Examine areas and conditions under which fire protection materials and products are to be installed.

B. After completion of the fire protection installation and at the start of the guarantee period, execute the National Automatic Sprinkler and Fire Control Association, Inc. standard form of “Inspection Agreement”, at no increase in Contract Sum, calling for four inspections of the sprinkler system during the guarantee year, plus the following maintenance to be performed during the course of the fourth inspection.

1. Operating of all control valves.
2. Lubrication of operating stems of all control valves.
3. Operating of electrical alarms.
4. Cleaning of alarm valves.
5. Lubrication of Fire Department hose connection inlets.

C. Fill out “Inspection Agreement” in triplicate after each inspection and send copies to the Owner, Insurance Carrier and Fire Department.

D. Welding inspection of the sprinkler system is to be done by the Campus Fire Marshal.

3.17 INSTALLATION OF BASIC IDENTIFICATION

A. Install mechanical identification in accordance with Section 23 05 53.

B. Install fire protection signs on piping in accordance with NFPA requirements.

C. Paint all exposed piping and including fire protection riser, color shall be selected by the Professional. See Division 09 Painting – Non VOC Paint.

3.18 FIELD QUALITY CONTROL

A. Sprinkler Piping Flushing: Prior to connecting sprinkler risers for flushing, flush water feed mains,

lead-in connections, and control portions of sprinkler piping. After fire sprinkler piping installation has been completed and before piping is placed in service, flush entire sprinkler system as required to remove foreign substances under pressure as specified in NFPA 13. Continue flushing until water is clear, and check to ensure that debris has not clogged sprinklers.

B. Hydrostatic Testing: After flushing system, test fire sprinkler piping hydrostatically for period of 2 hours at not less than 200 psi or at 50 psi greater than system pressure where pressure is anticipated to be in excess of 150 psi. Check system for leakage of joints. Measure hydrostatic pressure at low point of each system or zone being tested.

C. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. Leave entire work in condition satisfactory to Professional. At completion, carefully clean and adjust equipment and trim that are installed as part of this work. Leave systems and equipment in satisfactory operating condition. Repair or replace piping system as required to eliminate leakage in accordance with NFPA standards for "little or no leakage," and retest as specified to demonstrate compliance.

3.19 EXTRA STOCK

A. Heads: For each style and temperature range required, furnish additional sprinkler heads, amounting to one unit for every 100 installed units but not less than 10 heads, in proportion to the total number of each style of head.

B. Wrenches: Furnish two sprinkler wrenches for each type and size of sprinkler connection.

C. Obtain receipt from Using Agency that extra stock has been received.

3.20 CLEANING AND PROTECTION

A. Clean dirt and debris from sprinklers and other equipment.

B. Remove and replace sprinklers having paint other than factory finish.

C. Protect sprinklers from damage until Substantial Completion.

3.21 COMMISSIONING

A. Verify that specialty valves, trim, fittings, controls, and accessories are installed and operate correctly.

B. Verify that specified tests of piping are complete.

C. Verify that potable-water supplies have correct types of backflow preventers.

D. Verify that hose connections and fire department connections have threads compatible with local fire department equipment.

E. Fill wet-pipe standpipe piping with water.

F. Verify that hose connections are correct type and size.

G. Energize circuits to electrical equipment and devices.

H. Adjust operating controls and pressure settings.

I. Coordinate with fire alarm tests. Operate as required.

END OF SECTION 21 13 00

SECTION 22 11 16 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. These Plumbing provisions specified herein apply to all Sections of Division 22.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 22.

1.2 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Domestic water piping for fixtures and equipment inside the building

B. Related Sections

1. Section 01 91 00 – Commissioning
2. Section 22 16 00 – Plumbing Specialties
3. Section 23 00 10 – Mechanical General Provisions
4. Section 23 05 00 – Basic Mechanical Materials and Methods
5. Section 23 05 23 – Valves
6. Section 23 05 16 – Piping Specialties

1.3 REFERENCE STANDARDS

A. ANSI/ASME B16.18 – Cast Copper Alloy Solder Joint Pressure Fittings

B. ANSI/ASME B16.22 – Wrought Copper and Copper Alloy Solder Joint Pressure Fittings

C. ANSI/ASME B16.24 – Bronze Pipe Flanges and Flanged Fittings

D. ANSI/ASTM B88 – Seamless Copper Water Tube

E. MSS SP-123 – Non Ferrous Threaded and Solder Joint Unions for Use with Copper Water Tube

1.4 SUBMITTALS

A. See Section 23 00 10 – Mechanical General Provisions

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Piping and fitting materials	R			R
Solder	R			

C. Water Samples: Specified in "Cleaning" Article in Part 3 of this section.

D. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.

C. Comply with NSF 61, "Drinking Water System Components--Health Effects," Sections 1 through 9 for potable-water piping and components.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Using Agency or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicating:

1. Notify Using Agency no fewer than seven days in advance of proposed interruption of water service.
2. Do not proceed with interruption of water service without Using Agency’s written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.2 COPPER TUBING

A. Soft Copper Tube: ASTM B 88, Types K and L (ASTM B 88M, Types A and B), water tube, annealed temper.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.
3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.

B. Hard Copper Tube: ASTM B 88, Types L and M (ASTM B 88M, Types B and C), water tube, drawn

temper.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.
3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.

2.3 VALVES

A. Refer to Section 23 05 23 - Valves for bronze and cast-iron, general-duty valves

B. Refer to Section 22 16 00 - Plumbing Specialties for balancing and drain valves

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate the work of other trades.

B. See Section 23 08 00 – Mechanical Commissioning

3.2 EXCAVATION

A. Refer to Division 02 for excavating, trenching and backfilling.

3.3 PIPING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

B. Flanges may be used on aboveground piping, unless otherwise indicated.

C. Domestic cold water; domestic hot water, and recirculating hot water, and industrial water, above ground:

1. Use Type L hard drawn copper with wrought copper fittings incorporating full solder cup. For sizes 2” and larger, joints shall be brazed with 1100 degree F melting point alloy with at least 5% silver. For sizes 1 ½” and smaller, may use lead free solder equal to 95/5.
2. Automatic faucets and flush valves shall be piped with copper tube or pipe. (No plastic tubing is allowed).

D. Domestic water below ground: Copper type K with brazed or silver solder joints.

E. Strainers for use in domestic water applications (copper pipe).

1. Strainers shall be based on Watts No. 777 or equal. Provide with a working water pressure (WWP) of 250 psi at 210qF, with a cast bronze body, threaded ends, solid retainer cap and a 20-mesh stainless steel screen (except the 3” size must have 3/64” perforations).

3.4 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shut-off Duty: Use bronze ball valves for piping NPS 3 and smaller. Use cast-iron butterfly or gate valves with flanged ends for piping NPS 3-1/2 and larger.
2. Throttling Duty: Use bronze ball or globe valves for piping NPS 2 and smaller. Use cast-iron butterfly valves with flanged ends for piping NPS 2-1/2 and larger.
3. Hot-Water-Piping, Balancing Duty: Calibrated balancing valves.
4. Drain Duty: Hose-end drain valves.

3.5 PIPING INSTALLATION

A. Refer to Section 23 05 00 - Basic Mechanical Materials and Methods for basic piping installation.

B. Extend domestic water service piping to exterior water distribution piping in sizes and locations to match service piping.

C. Domestic water piping beneath concrete slabs shall be avoided. Trap primer piping shall be type “L” copper tubing with no joints below slab. Piping penetrations shall be carefully detailed. Insulation through penetrations shall be continuous.

D. Exterior hose bibs shall be provided at new buildings and plazas to wash down walks, loading docks and drives if irrigation system cannot provide this function. Recessed wall box type with loose key stop and vacuum breaker shall be used on buildings.

E. Do not allow piping to contact gypsum board at any point. Provide a minimum ½ inch clearance.

F. Arrange system for complete drainage with ¾ inch hose end gate valves at low points.

G. Domestic water lines in sound-rated construction shall be insulated using Acousto-plumb, Elmdor Trisolator series 400/500 or equal.

3.6 JOINT CONSTRUCTION

A. Refer to Section 23 05 00 - Basic Mechanical Materials and Methods for basic piping joint construction.

B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

C. Brazed joint: 1100 degree F melting point alloy with minimum 5% silver.

3.7 WATER HAMMER ARRESTERS

A. Water hammer arresters shall be provided on both hot and cold water lines serving fixtures and equipment using flushometer valves or quick-closing valves. One water hammer arrester may serve more than one fixture. These devices must be installed in the upright position. Where utility access has not been provided, access panels shall be provided for access to maintain these devices.

B. At solenoid valves, make-up valves, washers, and flush valves or any other quick closing device,

provide a diaphragm type shock absorber.

C. Size and locate in accordance with Plumbing and Drainage Institute Manual WH-201. Show location on shop drawings and PDI size of water hammer arresters required.

3.8 CROSS CONNECTION

A. Cross connection is any connection or arrangement of piping between two otherwise separate piping systems, one of which contains potable water and the other non-potable water or industrial fluids of questionable safety. Cross connection may cause non-potable fluid to enter the potable water system by backflow, back pressure, or back siphonage, and this shall not be allowed.

B. Refer to approved backflow prevention device list in Section 22 16 00 - Plumbing Specialties

C. Locate reduced pressure backflow prevention devices so that they are accessible for testing and maintenance. Provide for an adequate drainage system near each device. Each device shall be located on a wall approximately 42” above the floor with 1’ clearance from walls (confirm with the current code). If reduced pressure device is installed more than 5’-0” above floor or grade, then a platform must be provided to test the device.

D. Provide atmospheric vacuum breakers for service sinks.

E. Backflow preventers shall be tested. Test Reports shall be submitted before Substantial Completion.

3.9 VALVE INSTALLATION

A. Install sectional valve close to water main on each branch and riser serving plumbing fixtures or equipment. Use ball valves for piping NPS 3 inches and smaller. Use butterfly or gate valves for piping NPS 3-1/2 inches and larger.

B. Install shutoff valve on each water supply to equipment and on each water supply to plumbing fixtures without supply stops. Use ball valves for piping NPS 3 inches and smaller. Use butterfly or gate valves for piping NPS 3-1/2 inches and larger.

C. Install drain valves for equipment, at base of each water riser, at low points in horizontal piping, and where required to drain water piping.

1. Install hose-end drain valves at low points in water mains, risers, and branches.
2. Install stop-and-waste drain valves where indicated.

D. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow.

3.10 HANGER AND SUPPORT INSTALLATION

A. Refer to Section 23 05 48 - Mechanical Sound and Vibration Control for sound and vibration devices

B. Refer to Section 23 05 29 - Hangers and Supports for pipe hanger and support devices. Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.

2. Individual, Straight, Horizontal Piping Runs: According to the following:

   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.

3. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Install supports according to Section 23 05 29 - Hangers and Supports

D. Support vertical piping and tubing at base and at each floor.

3.11 FIELD QUALITY CONTROL

A. Inspect domestic water piping as follows:

1. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

   a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
   b. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

B. Test domestic water piping as follows:

1. Provide permanent isolation valves to separate new and existing piping during testing.
2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
3. Leave uncovered and unconcealed new, altered, extended, or replaced domestic water piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
4. Cap and subject piping to hydrostatic water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials (minimum of 150 psig). Isolate test source and allow to stand for eight hours. Leaks and loss in test pressure constitute defects that must be repaired.
5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.12 ADJUSTING

A. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

1. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.
2. Adjust calibrated balancing valves to flows indicated.
3. Close drain valves, hydrants and hose bibs.
4. Open shutoff valves to proper setting.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Check plumbing specialties and verify proper settings, adjustments and operation.

3.13 CLEANING

A. Clean and disinfect service entrance piping and domestic water piping as follows:

1. Purge new piping and parts of existing water piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed, procedure described in either AWWA C651 or AWWA C652 or as described below:

    a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    b. Fill and isolate system according to either of the following:

        1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
        2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for 3 hours.

    c. Flush system with clean, potable water until chlorine is no longer in water coming from system after the standing time.
    d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows contamination.

B. Prepare and submit reports for purging and disinfecting activities.

C. Clean interior of piping system. Remove dirt and debris as work progresses.

3.14 COMMISSIONING

A. Fill water piping. Check components to determine that they are not air bound and that piping is full of water.

B. Perform the following steps before putting into operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
5. Remove and clean strainer screens. Close drain valves and replace drain plugs.
6. Check plumbing equipment and verify proper settings, adjustments, and operation. Do not operate water heaters before filling with water.

END OF SECTION 22 11 16

SECTION 22 13 16 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. These Plumbing provisions specified herein apply to all Sections of Division 22.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 22.

1.2 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Soil and waste, sanitary drainage and vent piping inside the building

B. Related Section

1. Section 01 91 00 – Commissioning
2. Section 22 16 00 – Plumbing Specialties
3. Section 23 00 10 – Mechanical General Provisions
4. Section 23 05 00 – Basic Mechanical Materials and Methods

1.3 REFERENCE STANDARDS

A. ASTM A74 – Standard Specification for Cast Iron Soil Pipe and Fittings

B. ASTM A888 – Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

C. ASTM C564 – Standard for Rubber Gaskets for Cast Iron Soil Pipe and Fittings

D. ASTM C1277 – Standard Specification for Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings

E. ASTM A666 – Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar

F. ANSI/ASME B16.18 – Cast Copper Alloy Solder Joint Pressure Fittings

G. ANSI/ASME B16.22 – Wrought Copper and Copper Alloy Solder Joint Pressure Fittings

H. ANSI/ASME B16.24 – Bronze Pipe Flanges and Flanged Fittings

I. ANSI/ASTM B88 – Seamless Copper Water Tube

J. MSS SP-123 – Non Ferrous Threaded and Solder Joint Unions for Use with Copper Water Tube

K. ASTM D2665 – Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic, Drain, Waste and

Vent Pipe and Fittings

L. ASTM D3311 – Standard Specification for Drain, Waste and Vent (DWV) Plastic Fittings Patterns

M. ASTM F409 – Standard Specification for Thermoplastic Accessible and Replaceable Plastic Tube and Tubular Fittings

1.4 SUBMITTALS

A. See Section 23 00 10 – Mechanical General Provisions

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Piping and fitting materials	R			R
Primer, solvent, cement	R			
Solder	R			
Couplings	R			

C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

B. Flexible Transition Couplings for Underground Nonpressure Piping: ASTM C 1173 with elastomeric sleeve. Include ends of same sizes as piping to be joined and include corrosion-resistant metal band on each end.

C. Transition Couplings for Underground Pressure Piping: AWWA C219 metal, sleeve-type coupling or

other manufactured fitting same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

D. Waste pipes larger than 1¼ inch diameter shall be supported with Elmdor Trisolator series 400/500 or equal, resilient attachments.

E. Waste pipe clamps in vertical runs shall be isolated using Mason SWM or equal, neoprene resilient pads.

F. Copper drain pipe wrapping shall be pipe-wrap tape by Lowry or equal.

2.2 CAST-IRON SOIL PIPING

A. Below Ground Hub-and-Spigot Pipe and Fittings: ASTM A 74, Service class.

1. Gaskets: ASTM C 564, rubber.

B. Above Ground Hubless Pipe and Fittings: ASTM A 888 or CISPI 301.

1. Couplings: ASTM C 1277 assembly of metal housing, corrosion-resistant fasteners, and ASTM C 564 rubber sleeve with integral, center pipe stop.

a. Heavy-Duty, Type 304, Stainless-Steel Couplings: ASTM A 666, Type 304, stainless-steel shield; stainless-steel bands; and sleeve similar to Husky 4000.

(1) NPS 1-1/2 to NPS 4: 3-inch wide shield with 4 bands.
(2) NPS 5 to NPS 10: 4-inch wide shield with 6 bands.

2.3 COPPER TUBING

A. Hard Copper Tube: ASTM B 88, Types L and M (ASTM B 88M, Types B and C), water tube, drawn temper.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end.
3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

2.4 PVC PIPE AND FITTINGS

A. PVC Pipe: ASTM D 2665, Schedule 40, solid-wall drain, waste, and vent

1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.

B. PVC Special Fittings: ASTM F 409, drainage-pattern tube and tubular fittings with ends as required for application.

C. PVC Schedule 40 DWV Foam Core pipe (ASTM F891) is unacceptable.

2.5 ENCASEMENT FOR UNDERGROUND METAL PIPING

A. Description: ASTM A 674 or AWWA C105, high-density, cross-laminated PE film of 0.004-inch minimum thickness.

B. Form: tube.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate with work of other trades.

B. See Section 23 08 00 - Mechanical Commissioning

3.2 EXCAVATION

A. Refer to Division 02 for excavating, trenching and backfilling.

3.3 PIPING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.

B. Flanges may be used on aboveground pressure piping, unless otherwise indicated.

C. Aboveground, Soil, Waste, and Vent Piping: Use any of the following piping materials for each size range:

1. NPS 1-1/4 and NPS 1-1/2: Copper DWV tube, copper drainage fittings, and soldered joints.
2. NPS 1-1/4 and NPS 1-1/2: PVC pipe, PVC socket fittings, and solvent-cemented joints.
3. NPS 1-1/4 and NPS 1-1/2: Hubless, cast-iron soil piping and the following:

    a. Couplings: Heavy-duty, Type 304, stainless steel.

4. NPS 2 to NPS 4: PVC pipe, PVC socket fittings, and solvent-cemented joints.
5. NPS 2 to NPS 4: Service class, cast-iron soil piping; gaskets; and gasketed joints.
6. NPS 2 to NPS 4: Hubless, cast-iron soil piping and one of the following:

    a. Couplings: Heavy-duty, Type 304, stainless steel similar to Husky 4000.

7. NPS 5 to NPS 6: PVC pipe, PVC socket fittings, and solvent-cemented joints.
8. NPS 5 and NPS 6: Service class, cast-iron soil piping; gaskets; and gasketed joints.
9. NPS 5 and NPS 6: Hubless, cast-iron soil piping and one of the following:

    a. Couplings: Heavy-duty, Type 304, stainless steel similar to Husky 4000.

D. Underground, Soil, Waste, and Vent Piping: Use the following piping materials for each size range:

1. NPS 2 and larger: PVC pipe, PVC socket fittings, and solvent-cemented joints.
2. NPS 2 and larger: Service class, cast-iron soil piping; gaskets; and gasketed joints or

Hubless, cast-iron soil piping and one of the following:

a. Couplings: Heavy-duty, Type 304, stainless steel similar to Husky 4000.

E. Indirect drain piping including cooling coil condensate drain: Use the following piping materials for each size range:

1. NPS 3/4 to NPS 4: Hard copper tube, Type L; wrought copper pressure fittings; and soldered joints.

3.4 PIPING INSTALLATION

A. Refer to Section 23 05 00 - Basic Mechanical Materials and Methods for basic piping installation.

B. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

C. Install cleanout fitting with closure plug inside the building in sanitary force-main piping.

D. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Refer to Section 23 05 00 Basic Mechanical Materials and Methods for sleeves and mechanical sleeve seals.

E. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Refer to Section 23 05 00 Basic Mechanical Materials and Methods for wall penetration systems.

F. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Encase underground piping with PE film according to ASTM A 674 or AWWA C105.

G. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

H. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

I. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
2. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

J. Install engineered soil and waste drainage and vent piping systems in locations indicated and as

follows:

1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
2. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.

K. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

L. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

M. Do not allow piping, plumbing or vent stacks to contact gypsum board at any point. Provide a minimum 1½ inch clearance.

3.5 JOINT CONSTRUCTION

A. Refer to Section 23 05 00 - Basic Mechanical Materials and Methods for basic piping joint construction.

B. Cast-Iron, Soil-Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Gasketed Joints: Make with rubber gasket matching class of pipe and fittings.
2. Hubless Joints: Make with rubber gasket and sleeve or clamp.

C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

D. PVC Nonpressure Piping Joints: Join piping according to ASTM D2665

3.6 VALVE INSTALLATION

A. Refer to Section 23 05 23 - Valves for general-duty valves.

B. Backwater Valves: Install backwater valves in piping subject to sewage backflow.

1. Horizontal Piping: Horizontal backwater valves.
2. Floor Drains: Drain outlet backwater valves, unless drain has integral backwater valve.
3. Install backwater valves in accessible locations.
4. Refer to Section 22 16 00 - Plumbing Specialties for backwater valves.

3.7 HANGER AND SUPPORT INSTALLATION

A. Refer to Section 23 05 29 - Hangers and Supports for pipe hanger and support devices. Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Individual, Straight, Horizontal Piping Runs: According to the following:

   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
   c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Install supports according to Section 23 05 29 - Hangers and Supports

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced 1 size for double-rod hangars, with 3/8-inch minimum rods.

E. Comply with International Plumbing Code or local plumbing codes where more stringent than the requirements of this section.

F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
2. NPS 3: 60 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
4. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

G. Install supports for vertical cast-iron soil piping every 15 feet.

H. Install supports for vertical steel piping every 15 feet.

I. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 72 inches with 3/8-inch rod.
2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
3. NPS 2-1/2: 108 inches with 1/2-inch rod.
4. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.

J. Install supports for vertical copper tubing every 10 feet.

K. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 to NPS 2: 48 inches with 3/8-inch rod.
2. NPS 3: 48 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
4. NPS 6: 48 inches with 3/4-inch rod.

L. Install supports for vertical PVC piping every 48 inches.

M. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.8 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code. Refer to Section 22 40 00 - Plumbing Fixtures
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code. Refer to Section 22 16 00 - Plumbing Specialties
4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

3.9 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 4 hours before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.10 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 22 13 16

SECTION 22 15 00 – COMPRESSED-AIR EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. These Plumbing provisions specified herein apply to all Sections of Division 22.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 22.

1.2 SUMMARY

A. This Section includes equipment and accessories for building compressed-air systems operating at

1. 200 psig and less.

B. Related Sections include the following:

1. Section 22 15 13 – Compressed Air Piping
2. Section 23 00 10 – Mechanical General Provisions
3. Section 23 05 00 – Basic Mechanical Materials and Methods
4. Section 23 05 53 – Mechanical System Identification

1.3 DEFINITIONS

A. Low-Pressure, Compressed-Air Systems: ASME B31.9, "Building Services Piping," for systems operating at pressure of 125 psig or less and at temperature of 200 deg F or less.

1.4 SUBMITTALS

A. Product Data: For each model indicated. Include rated capacities of air compressors, aftercoolers, air dryers, and accessories; shipping, installed, and operating weights; furnished specialties; and accessories. Indicate dimensions, required clearances, methods of assembly of components, and piping and wiring connections.

B. Wiring Diagrams: For each item of equipment with electric power supply. Include ladder-type wiring diagrams for interlock and control wiring required for final installation. Differentiate between factory-installed and field-installed wiring.

C. Coordination Drawings: For compressed-air equipment and piping, including relationship to other services that serve same work areas.

D. Certificates of Shop Inspection and Data Report: As required by ASME Boiler and Pressure Vessel Code.

E. Maintenance Data: For equipment to include in the maintenance manuals specified in Division 15.

1.5 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of compressed-air equipment and accessories and are based on specific types and models indicated. Other products with equal performance characteristics, made by specified manufacturers, may be considered. Refer to Division 1 Section "Substitutions and Product Options".

B. Electrical Component Standard: NFPA 70.

C. Provide listing/approval stamp, label, or other marking on equipment made to specified standards.

D. Listing and Labeling: Provide equipment and accessories specified in this Section that are listed and labeled.

1. Terms "Listed" and "Labeled": As defined in National Electrical Code, Article 100.
2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store equipment and large accessories on factory-installed shipping skids and small accessories in factory-fabricated fiberboard containers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Pressure-Lubricated, Reciprocating Air Compressors:

a. Champion
b. Gardner Denver
c. Ingersoll-Rand

2. Aftercoolers, Air Cooled:

a. Arrow Pneumatics, Inc.
b. Curtis-Toledo, Inc.
c. Hankison International.
d. Ingersoll-Rand Co.; Rotary-Reciprocating Compressor Div.
e. Saylor-Beall Manufacturing Co.
f. Van Air Systems, Inc.
g. Zeks Air Drier Corp.

3. Refrigerated Air Dryers:

a. Champion
b. Gardner Denver

c. Ingersoll-Rand

2.2 AIR COMPRESSORS

A. General: Factory-assembled and -tested packaged units; duplex; and with the following capacities, features, and electrical characteristics;

1. Model: Champion HR5D-12
2. Two, 5.0 HP, 208V, 3 phase high efficiency motor driven compressors.
3. 120 Gallon horizontal ASME stamped receiver.
4. 41.4 cfm displacement; 34.6 cfm delivery at 175 psi.

B. Construction of Equipment: ASME B19.1, "Safety Standard for Air Compressor Systems"; or ASME B19.3, "Safety Standard for Compressors for Process Industries," as appropriate.

C. Control Panels: Automatic control station with load control and protection functions. Comply with NEMA ICS 2, "Industrial Controls and Systems: Controllers, Contactors and Overload Relays, Rated Not More than 200 Volts AC or 750 Volts DC"; and UL 508, "Industrial Control Equipment."

1. Mounting and Wiring: Factory installed and connected as an integral part of equipment package.
2. Enclosure: NEMA ICS 6, "Industrial Control and Systems: Enclosures," Type 12 control panel, except where a higher degree of enclosure is specified.
3. Motor Controllers: Full-voltage, combination-magnetic type with undervoltage release feature and motor-circuit-protector-type disconnect and short-circuit protective device.

    a. Control Voltage: 120 V, ac or less, using integral control power transformer.
    b. Motor Overload Protection: Overload relay in each phase.
    c. Starting Devices: Hand-off-automatic selector switch in cover of control panel, plus pilot device for automatic control as indicated.

4. Instrumentation: Include air-receiver pressure gage, discharge-line pressure gage, air-filter maintenance indicator, hour meter, compressor discharge air and coolant temperature gage, and control transformer.

D. Receiver Tanks: ASME Boiler and Pressure Vessel Code, Section VIII, "Pressure Vessels" construction and bear appropriate code symbols, with pressure gage, pressure-reducing valve, and automatic drain.

E. Factory Prepiping: Entire unit, except where otherwise indicated.

2.3 SAFETY VALVES

A. Safety Valves: Poppet type complying with ASME Boiler and Pressure Vessel Code, Section VIII, bear appropriate labeling, and factory sealed after testing.

2.4 RECIPROCATING AIR COMPRESSORS

A. Description: Horizontal tank-mounted, splash lubricated, belt driven, duplex reciprocating air compressors, each with inlet silencer filter, safety valve, discharge pressure gage, pressure

regulator, and shutoff valve, low oil sensing switch and low oil pressure shut down switch. Include vibration isolation pads.

B. Receiver Tank Orientation: Horizontal.

2.5 AFTERCOOLERS

A. Aftercoolers, Air-Cooled: Tubular, rated at 250 psig and leak tested at 350-psig minimum air pressure, in capacities indicated. Size units to cool compressed air in compressor-rated capacities to 20 deg F above summertime maximum ambient temperature.

2.6 ACCESSORIES

A. General: Include accessories with working-pressure rating not less than system pressure at location where used, and compatible with equipment and piping system used.

B. Intercoolers: Air-cooled, fixed-bundle, tubular intercoolers, rated at 250psig and leak tested at 350-psig minimum air pressure, in capacities indicated. Size units to cool compressed air in compressor-rated capacities to 20 deg F above summertime maximum ambient temperature.

C. Receivers: ASME stamped; cylindrical, horizontal installation as indicated; galvanized steel; with safety valves in sizes, working pressures, and temperatures indicated, and with drain connection.

1. Pressure Rating: Not less than maximum discharge pressure.

2.7 SPECIALTIES

A. Safety Valves: ASME Boiler and Pressure Vessel Code, Section VIII, "Pressure Vessels" construction, National Board certified, labeled, and factory sealed; constructed of bronze body with poppet safety valve for compressed-air service.

1. Pressure Settings: Higher than discharge pressure and same or lower than receiver pressure rating.

B. Automatic Drain Valves: Corrosion-resistant metal body and internal parts, rated for 200-psig minimum working pressure, capable of automatic discharge of collected condensate.

C. Pressure Regulators: Bronze body, direct acting, spring loaded, manual pressure setting adjustment and rated for 250-psig (1725-kPa) inlet pressure, except where otherwise indicated.

D. Filters: 2-stage, mechanical-separation type, air-line filters in sizes and ratings indicated. Equip with deflector plates; resin-impregnated-ribbon-type filters with edge filtration, 40 micron thick; and drain cock.

E. Coalescing Filters: Capacities and types indicated. Equip with activated carbon capable of removing water and oil aerosols, with color-change dye to indicate when carbon is saturated and warning light to indicate when selected maximum pressure drop has been exceeded.

2.8 REFRIGERATED AIR DRYER, NON-CYCLING

A. General: Factory assembled and tested package unit. Performance data shall be obtained using methods complying fully with CAGI Standard No. ADF100- "Refrigerated Compressed Air Dryers - Methods for Testing and Rating" and National Fluid Power Association (NFPA) Standard NFPA T3.27.2.

B. Basis of Design: Champion CRN-35A1.

Capacity:	scfm	35
	EAT	250°Fdb
	LAT	50°F (dewpoint)
	Pressure	175 psi
	Ambient Air	130°Fdb
	Max. P.D.	5.0 psi (total filter and dryer)
	Motor	0.5HP, 115 VAC, single phase

C. Instrumentation: Include trap, refrigerant analyzes gauge, on-off switch, power "on" light, high inlet temperature light, air outlet pressure gauge, dew point temperature bar graph indicator.

D. Accessories: Include ambient air filter and Type "F" vibration isolators.

PART 3 - EXECUTION

3.1 CONCRETE BASES

A. Install concrete bases of dimensions indicated for air compressors and accessories. Refer to Division 3 Section "Cast-in-Place Concrete" and Section 23 05 00 - Basic Mechanical Materials and Methods.

3.2 EQUIPMENT INSTALLATION

A. Installation of Equipment: Comply with ASME B19.1 or ASME B19.3 as appropriate.

B. Install air compressors, intercoolers, aftercoolers, air-receiver tanks, and dryers on concrete bases. Set and connect units according to manufacturers' written instructions. Install units plumb, level, and firmly anchored in locations indicated. Maintain manufacturers' recommended clearances. Orient so equipment, controls, and devices needing service are accessible.

C. Anchor air compressors, receivers, and other equipment to substrate.

D. Support air compressors using vibration-control devices.

1. Install tank-mounted compressors, more than 5 hp, with concrete inertia base and spring isolators.

E. Install accessories and specialties as indicated. Set and connect units according to manufacturers' written instructions. Install units plumb, level, and firmly anchored in locations indicated. Maintain manufacturers' recommended clearances. Orient so controls needing service are accessible.

3.3 INSTALLATION OF BASIC IDENTIFICATION

A. Install mechanical identification in accordance with Section 23 05 53.

3.4 CONNECTIONS

A. Install piping next to equipment and accessories to allow service and maintenance.

B. Connect air piping to equipment and accessories with unions and shutoff valves. Install with strainers where indicated.

1. Install thermometers on compressor discharge piping, on receiver tanks, and where indicated.
2. Install pressure gages on compressor discharge piping, on receiver tanks, and where indicated.
3. Install safety valves in receiver tanks, in quantity and size to relieve capacity not less than that of connected compressor.
4. Install automatic drain valves on intercoolers, aftercoolers, separators, receivers, dryers, and other locations indicated. Discharge condensate over nearest floor drain.
5. Install accessories as indicated.
6. Ground equipment.

    a. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

7. Arrange for electric-power connections to equipment that requires power. Electric power, wiring, and disconnect switches are specified in Division 16 Sections.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Provide services of a factory-authorized service representative to supervise the field assembly of components and installation of equipment, including piping and electrical connections, and to report results in writing.

B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.6 COMMISSIONING

A. Perform the following final checks before startup:

1. Verify that specified tests of piping systems are completed.
2. Check for piping connection leaks.
3. Check for lubricating oil in lubricated-type equipment.
4. Check V belts for proper tension.
5. Check that compressor inlet filters and piping are clear.
6. Check for equipment vibration-control supports and flexible pipe connectors and that equipment is properly attached to substrate.
7. Check safety valves for correct settings. Ensure settings are greater than air-compressor discharge pressure, but not greater than rating of system components.
8. Test operation of equipment safety controls and devices.

9. Drain receiver tanks.
10. Check for adequate room ventilation.

B. Starting Procedures: Follow manufacturer's written instructions. If no instructions are prescribed by manufacturer, proceed as follows:

1. Energize circuits.
2. Start and run equipment through complete sequence of operations.
3. Check for excessive vibration and noise. Correct problems.
4. Check air pressures.
5. Manually operate safety valves.
6. Adjust operating controls, including pressure settings.

C. Operate and adjust operating and safety controls. Replace damaged and malfunctioning controls and equipment discovered by service representative.

3.7 DEMONSTRATION

A. Startup Services: Engage a factory-authorized service representative to perform startup services and to demonstrate and Using Agency's maintenance personnel as specified below.

1. Train Using Agency's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance. Refer to Section 23 00 10 – Mechanical General Provisions
2. Review data in the operation and maintenance manuals. Refer to Section 23 00 10 – Mechanical General Provisions

END OF SECTION 22 15 00

SECTION 22 15 13 - COMPRESSED-AIR PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. These Plumbing provisions specified herein apply to all Sections of Division 22.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 22.

1.2 SUMMARY

A. This Section includes piping and specialties for building compressed-air systems operating at 200 psig and less.

B. Related Sections include the following:

1. Section 22 15 00 – Compressed Air Equipment
2. Section 23 00 10 – Mechanical General Provisions
3. Section 23 05 00 – Basic Mechanical Materials and Methods
4. Section 23 05 53 – HVAC System Identification

1.3 DEFINITIONS

A. Low-Pressure, Compressed-Air Piping: ASME B31.9, "Building Services Piping," for piping operating at pressure of 125 psig or less and at temperature of 200 deg F or less.

B. PTFE: Polytetrafluoroethylene.

1.4 SUBMITTALS

A. Coordination Drawings: For compressed-air equipment and piping, including relationship to other services that serve same work areas.

1.5 QUALITY ASSURANCE

A. Provide listing/approval stamp, label, or other marking on equipment made to specified standards.

B. Listing and Labeling: Provide equipment and accessories specified in this Section that are listed and labeled.

1. Terms "Listed" and "Labeled": As defined in National Electrical Code, Article 100.
2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Compressed-Air, General-Duty Valves:

a. Conbraco Industries, Inc.; Apollo Div.
b. Crane Co.; Valve Div.
c. Grinnell Corp.
d. Hammond Valve.
e. Milwaukee Valve Co., Inc.
f. Nibco, Inc.
g. Stockham Valves & Fittings, Inc.

2. Compressed-Air-Service, Locking-Handle, Safety-Exhaust Valves:

a. Conbraco Industries, Inc.; Apollo Div.
b. Hammond Valve.
c. Milwaukee Valve Co., Inc.
d. Nibco, Inc.

3. Quick Connect/Disconnect Hose Couplings:

a. Aeroquip Corp.; Industrial Products Group.
b. Bowes Manufacturing, Inc.
c. DeVilbiss Air Compressor Products.
d. Foster Manufacturing Co., Inc.
e. Milton Industries, Inc.
f. OBAC Corp.
g. Parker Hannifin Corp.; Quick Coupling Div.
h. Schrader, Inc.
i. Snap-Tite, Inc.
j. Tuthill Corp.; Hansen Coupling Div.

2.2 PIPING, GENERAL

A. ASME Code Compliance: Provide compressed-air piping components complying with ASME B31.9, "Building Services Piping."

B. ASME Code Compliance: Provide compressed-air piping components complying with the following:

1. Low-Pressure, Compressed-Air Piping: ASME B31.9, "Building Services Piping."

2.3 PIPING

A. Steel Pipe: ASTM A 53, Type E, Electric-Resistance Welded or Type S, Seamless, Grade B, Schedule 40, black or hot dipped, zinc coated.

2.4 PIPE FITTINGS

A. Malleable-Iron Pipe Fittings: ASME B16.3, Class 150, threaded, plain or galvanized.

B. Malleable-Iron Pipe Unions: ASME B16.39, Class 150, threaded.

C. Wrought-Steel Pipe Fittings: ASME B16.9, Schedule 40, butt welding.

D. Forged-Steel Pipe Fittings: ASME B16.11, socket type.

E. Steel Pipe Flanges: ASME B16.5, Classes 150 and 300, carbon steel.

2.5 JOINING MATERIALS

A. Refer to Section 23 05 00 - Basic Mechanical Materials and Methods for joining materials not in this Section.

2.6 VALVES

A. General-Duty Valves: Refer to Section 23 05 23 Valves for compressed-air-service valves not specified in this Section and for valves for other fluids.

B. Special-Duty, Compressed-Air Valves: Include PTFE seats and comply with the following:

1. Ball Valves, 2-Inch NPS and Smaller: MSS SP-110; 2-piece bronze body with blowout-proof stem; regular or full port; chrome-plated, solid-brass or -bronze ball; threaded ends; and 600-psig minimum WOG pressure rating.
2. Butterfly Valves, 2-1/2-Inch NPS and Larger: MSS SP-67; Type I (bubble tight); single-flange (lug-type), cast-iron body with ductile-iron disc, and 200-psig minimum WOG pressure rating.
3. Check Valves, 2-Inch NPS and Smaller: MSS SP-80; Type 4 or nonstandard T-pattern, swing check; Class 125, bronze body with composition-to-metal seat and threaded ends.
4. Check Valves, 2-1/2-Inch NPS and Larger: MSS SP-71, Type II full-waterway or Type IV clear-waterway, cast-iron body with composition-to-metal seat and flanged ends.
5. Globe Valves, 2-Inch NPS and Smaller: MSS SP-80, Class 125, Type 2, bronze body with composition-to-metal seat and threaded ends.

2.7 SPECIALTIES

A. Safety Valves: ASME Boiler and Pressure Vessel Code, Section VIII, "Pressure Vessels" construction, National Board certified, labeled, and factory sealed; constructed of bronze body with poppet safety valve for compressed-air service.

1. Pressure Settings: Higher than discharge pressure and same or lower than receiver pressure rating.
2. Pressure Regulators: Bronze body, direct acting, spring loaded manual pressure-setting adjustment, and rated for 250-psig, except where otherwise indicated.

    a. Type: Diaphragm operated.

3. Pressure Regulators: Aluminum alloy or plastic body, diaphragm operated, direct acting, spring loaded, manual pressure-setting adjustment, and rated for 250 psig inlet pressure, except where otherwise indicated.
4. Filters: 2-stage, mechanical-seperation type, air-line filters in sizes and ratings indicated. Equip with deflector plates; resin-impregnated-ribbon-type filters with edge filtration, 40 micron thick; and drain cock.

5. Coalescing Filters: Capacities and types indicated. Equip with activated carbon capable of removing eater and oil aerosols, with color-change dye to indicate when carbon is saturated and warning light to indicate when selected maximum pressure drop has been exceeded.
6. Automatic Drain Valves: Corrosion-resistant metal body and internal parts, rated for 200-psig minimum working pressure, capable of automatic discharge of collected condensate.
7. Hose, Clamps and Couplings: Provide compatible hose, hose clamps, and hose couplings, suitable for compressed-air service, of nominal diameter, and rated for 300-psig minimum working pressure, except where otherwise indicated.

    a. Quick Connect/Disconnect Hose Couplings: One-way, automatic shutoff, brass body, with O-ring or gasket seal, and stainless steel or nickel-plated steel operating parts. Select socket end with threaded inlet that is considered the fixed end and has one-way valve.
    b. Hose Adapter Couplings: One-piece, brass or stainless-steel fitting, with serrated ends.
    c. Hose: Reinforced, single or double-braid, neoprene-covered hose for compressed air service.
    d. Hose Clamps: Stainless steel, clamps, bands, or wire.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. ASME Code Compliance: Provide compressed-air piping components complying with ASME B31.9, "Building Services Piping."

B. ASME Code Compliance: Provide compressed-air piping components complying with the following:

    1. Low-Pressure, Compressed-Air Piping: ASME B31.9, "Building Services Piping."

C. Install flanges, unions, transition and special fittings, and valves with pressure ratings same or higher than system pressure rating used in applications below, except where otherwise specified.

D. Low-Pressure, Compressed-Air, Distribution Piping: Use the following:

1. 2-Inch NPS and Smaller: Black steel pipe; threaded, malleable-iron fittings; and threaded joints.
2. 2-1/2- to 4-Inch NPS: Black steel pipe; threaded, malleable-iron fittings; and threaded joints.

3.2 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball or butterfly valves.
2. Throttling Duty: Use globe or butterfly valves.
3. Compressed-Air Supply to Equipment: Locking-handle, safety-exhaust ball valves.
4. Do not use check valves in piping between reciprocating air compressors and air receivers.

3.3 PIPING INSTALLATION, GENERAL

A. Refer to Section 23 05 00 - Basic Mechanical Materials and Methods for basic piping installation.

B. Install air and drain piping with one percent slope downward in direction of airflow.

C. Install eccentric reducers where pipe is reduced in size in direction of airflow, with bottoms of both pipes and reducer flush.

D. Connect branch air piping to mains from top of main. Provide drain leg and drain trap at end of each main, branch, and low point in piping.

E. Install supports and anchors according to Section 23 05 00 - Basic Mechanical Materials and Methods. Do not exceed the following spacing between pipe hangers:

F. Steel Pipe: 12 feet horizontal and 15 feet vertical.

G. Install valves according to Section 23 05 23 – Valves.

H. Install expansion joints and anchors according to Division 15 Section "Basic Mechanical Materials and Methods".

I. Install thermometers and pressure gages according to Section 23 05 16 – Piping Specialties

J. Install plumbing specialties according to Section 22 16 00 - Plumbing Specialties

3.4 JOINT CONSTRUCTION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint

construction.

B. Dissimilar Material Piping Joints: Make joints using adapters compatible with both piping materials.

3.5 INSTALLATION OF BASIC IDENTIFICATION

A. Install mechanical identification in accordance with Section 23 05 53.

B. Paint all exposed piping with two coats of specified paint, color shall be selected by the Professional. See Section 09 90 00 – Painting – Non VOC Paint and Section 23 00 10 – Mechanical General Provisions.

3.6 CONNECTIONS

A. Install piping next to equipment and accessories to allow service and maintenance.

B. Connect air piping to equipment and accessories with unions and shutoff valves. Install with strainers where indicated.

C. Install safety valves in receiver tanks, in quantity and size to relieve capacity not less than that of connected compressor.

D. Install automatic drain valves on intercoolers, aftercoolers, separators, receivers, dryers, and other locations indicated. Discharge condensate over nearest floor drain.

E. Install specialties as indicated.

3.7 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Provide services of a factory-authorized service representative to supervise the field assembly of components and piping, and to report results in writing.

B. Test and adjust piping safety controls. Replace damaged and malfunctioning controls.

C. Piping System Tests: Test new piping. Cap and fill compressed-air piping with oil-free, dry air, or gaseous nitrogen to pressure of 50 psig (345 kPa) above system operating pressure, but not less than 150 psig (1035 kPa). Isolate test source and let stand for 4 hours to equalize temperature. Refill system, if required, to test pressure and hold pressure for 2 hours with no drop in pressure.

1. Repair leaks and defects with new materials and retest system until satisfactory results are obtained.

3.8 COMMISSIONING

A. Perform the following final checks before startup:

1. Verify that specified tests of piping are completed.
2. Check for piping connection leaks.
3. Check for lubricating oil in lubricated-type equipment.
4. Check V belts for proper tension.
5. Check that compressor inlet filters and piping are clear.
6. Check for equipment vibration-control supports and flexible pipe connectors and that equipment is properly attached to substrate.
7. Check safety valves for correct settings. Ensure settings are greater than air-compressor discharge pressure, but not greater than rating of system components.
8. Test operation of equipment safety controls and devices.
9. Drain receiver tanks.
10. Check for adequate room ventilation.

B. Starting Procedures: Follow manufacturer's written instructions. If no instructions are prescribed by manufacturer, proceed as follows:

1. Energize circuits.
2. Start and run equipment through complete sequence of operations. 3. Check for excessive vibration and noise. Correct problems.
3. Check air pressures.
4. Manually operate safety valves.
5. Adjust operating controls, including pressure settings.

C. Operate and adjust operating and safety controls. Replace damaged and malfunctioning controls and equipment discovered by service representative.

END OF SECTION 22 15 13

SECTION 22 16 00 – PLUMBING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. These Plumbing provisions specified herein apply to all Sections of Division 22.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 22.

1.2 SUMMARY

A. This Section includes the following plumbing specialties:

1. Backflow preventers
2. Water regulators
3. Balancing valves
4. Strainers
5. Outlet Boxes
6. Water supply outlets
7. Trap seal primer valves
8. Drain valves
9. Miscellaneous piping specialties
10. Sleeve penetration systems
11. Cleanouts
12. Floor drains
13. Floor sinks
14. Roof drains

B. Related Sections include the following:

1. Section 23 00 10 – Mechanical General Provisions
2. Section 23 05 00 – Basic Mechanical Materials and Methods
3. Section 23 05 16 – Piping Specialties

1.3 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping systems with following minimum working-pressure ratings, unless otherwise indicated:

1. Domestic Water Piping: 150 psig
2. Sanitary Waste and Vent Piping: 10-foot head of water
3. Storm Drainage Piping: 10-foot head of water

1.4 SUBMITTALS

A. Product Data: Include rated capacities and shipping, installed, and operating weights. Indicate materials, finishes, dimensions, required clearances, and methods of assembly of components; and piping and wiring connections for the following:

1. Backflow preventers and water regulators.
2. Balancing valves, water filters, and strainers.
3. Thermostatic water mixing valves and water tempering valves.
4. Water hammer arresters, air vents, and trap seal primer valves and systems.
5. Drain valves, hose bibbs, hydrants, and hose stations.
6. Outlet boxes and washer-supply outlets.
7. Backwater valves, cleanouts, floor drains, floor sinks, open receptors, trench drains, and roof drains.
8. Vent caps, vent terminals, and roof flashing assemblies.
9. Sleeve penetration systems.

B. Shop Drawings: Diagram power, signal, and control wiring

C. Field test reports

D. Maintenance Data: For plumbing specialties to include in maintenance manuals. Include the following:

1. Backflow preventers and water regulators
2. Water filters
3. Thermostatic water mixing valves and water tempering valves
4. Trap seal primer valves and systems
5. Hose stations and hydrants

E. Refer to Section 23 00 10 – Mechanical General Provisions for additional submittal requirements

1.5 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of plumbing specialties and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

B. Plumbing specialties shall bear label, stamp, or other markings of specified testing agency.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for piping materials and installation.

E. NSF Compliance:

1. Comply with NSF 61, "Drinking Water System Components--Health Effects, Sections 1 through 9," for potable domestic water plumbing specialties.

PART 2 - PRODUCTS

2.1 BACKFLOW PREVENTERS

A. Manufacturers:

1. Ames Co., Inc.
2. Watts Industries, Inc.; Water Products Div.
3. Zurn Industries, Inc.; Wilkins Div.

B. General: ASSE standard, backflow preventers.

1. NPS 2 and Smaller: Bronze body with threaded ends.
2. NPS 2-1/2 and Larger: Bronze, cast-iron, steel, or stainless-steel body with flanged ends.

    a. Interior Lining: AWWA C550 or FDA-approved, epoxy coating for backflow preventers having cast-iron or steel body.

3. Interior Components: Corrosion-resistant materials.
4. Exterior Finish: Polished chrome plate if used in chrome-plated piping system.
5. Strainer: On inlet, if indicated.

C. Pipe-Applied, Atmospheric-Type Vacuum Breakers: ASSE 1001, with floating disc and atmospheric vent.

D. Hose-Connection Vacuum Breakers: ASSE 1011, nickel plated, with nonremovable and manual drain features, and ASME B1.20.7, garden-hose threads on outlet. Units attached to rough-bronze-finish hose connections may be rough bronze.

E. Intermediate Atmospheric-Vent Backflow Preventers: ASSE 1012, suitable for continuous pressure application. Include inlet screen and two independent check valves with intermediate atmospheric vent.

F. Reduced-Pressure-Principle Backflow Preventers: ASSE 1013, suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet; test cocks; and pressure-differential relief valve with ASME A112.1.2 air-gap fitting located between two positive-seating check valves.

1. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.

G. Antisiphon-Pressure-Type Vacuum Breakers: ASSE 1020, suitable for continuous pressure application. Include shutoff valves, spring-loaded check valve, spring-loaded floating disc, test cocks, and atmospheric vent.

1. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.

H. Reduced-Pressure Detector Assembly Backflow Preventers: ASSE 1047, FM approved or UL listed, and suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet. Include test cocks; pressure-differential relief valve with ASME A112.1.2 air-gap fitting located between two positive-seating check valves; and bypass with displacement-type water meter, valves, and reduced-pressure backflow preventer.

1. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.

I. Dual-Check-Valve-Type Backflow Preventers: Watts Series 7C or equal, ASSE 1024, suitable for continuous pressure application. Include union inlet and two independent check valves. BfP-1 is to be ½" NPS.

J. Double-Check-Valve-Type Backflow Prevention Assemblies: ASSE 1015, suitable for continuous pressure application. Include shutoff valves on inlet and outlet, strainer on inlet; test cocks; and two positive-seating check valves. Equal to Watts 007M2QT-S.

1. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.

K. Double-Check Detector Assembly Backflow Preventers: ASSE 1048, FM approved or UL listed, and suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet. Include test cocks; two positive-seating check valves; and bypass with displacement-type water meter, valves, and double-check backflow preventer.

1. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.

L. Hose-Connection Backflow Preventers: ASSE 1052, suitable for at least 3-gpm flow and applications with up to 10-foot head of water back pressure. Include two check valves; intermediate atmospheric vent; and nonremovable, ASME B1.20.7, garden-hose threads on outlet.

M. Back-Siphonage Backflow Vacuum Breakers: ASSE 1056, suitable for continuous pressure and backflow applications. Include shutoff valves, check valve, test cocks, and vacuum vent.

2.2 WATER REGULATORS

A. Manufacturers:

1. Watts Industries, Inc.; Water Products Div.
2. Zurn Industries, Inc.; Wilkins Div.
3. Or equal

B. General: ASSE 1003, water regulators, rated for initial working pressure on 150 psig minimum. Include integral factory installed or separate field-installed, Y-pattern strainer.

1. NPS 2 and Smaller:

a. General-Duty Service: Single-seated, direct operated, unless otherwise indicated.
b. Booster Heater Water Supply: Single-seated, direct operated with integral bypass.

2. NPS 2-1/2 and Larger:

a. Type: Single-seated, direct operated.
b. Type: Pilot-operated, single- or double-seated, cast-iron body main valve, with bronze-body pilot valve.

3. Interior Components: Corrosion-resistance materials
4. Exterior-Finish: Polished chrome plate if used in chrome-plated piping system.

2.3 BALANCING VALVES

A. Calibrated Balancing Valves: Adjustable, with two readout ports and memory setting indicator. Include manufacturer’s standard hoses, fittings, valves, differential pressure meter, and carrying case.

1. Manufacturers:

    a. Armstrong Pumps, Inc.
    b. ITT Industries; Bell & Gossett
    c. Watts Industries, Inc; Water Products Div.

2. NPS 2 and Smaller: Bronze, Y-pattern body with adjustment knob and threaded ends.

2.4 STRAINERS

A. Strainers: Y-pattern, unless otherwise indicated, and full size of connecting piping. Include ASTM A666, Type 304, stainless steel screens with 3/34-inch round perforations, unless otherwise indicated.

1. Pressure rating: 125 psig minimum steam working pressure, unless otherwise indicated.
2. NPS 2 and smaller: Bronze body, with female threaded ends.
3. NPS 2-1/2 and Larger: Cast-iron body, with interior AWWA C550 or FDA-approved, epoxy coating and flanged ends.

2.5 OUTLET BOXES

A. Manufacturers

1. Guy Gray Manufacturing Co., Inc.
2. Acorn Engineering Company
3. Zurn Industries, Inc.

B. General: Recessed-mounting outlet boxes with supply fittings complying with ASME A112.18.1M. Include box with faceplate, services indicated for equipment connections and wood-blocking reinforcement. Boxes shall be metallic

C. Washing Machine Outlet Boxes: Guy Gray stainless steel washing machine outlet box with quarter turn valves

D. Icemaker Outlet Boxes: Guy Gray stainless steel ice maker box

2.6 HOSE BIBBS & WALL HYDRANTS

a. Refer to Section 22 40 00 – Plumbing Fixtures

2.7 TRAP SEAL PRIMER VALVES

A. Trap Seal Primer System: Factory-fabricated, ASSE 1044:

1. Manufacturers (or equal):

    a. Precision Plumbing Products, Inc.
    b. Sloan
    c. Zurn

2. Trap Priming Manifold Type

   a. Piping: NPS 3/4, ASTM B 88, Type L (ASTM B 88M, Type B); copper, water tubing inlet and manifold with number of NPS 1/2 outlets as indicated.
   b. Cabinet: Steel box with stainless-steel cover.
   c. Water Hammer Arrester: ASSE 1010.
   d. Vacuum Breaker: ASSE 1001.

3. Fixture Flush Pipe-Fed Type

   a. One-piece, chrome-plated, vacuum breaker trap primer flush connection with integral water deflector
   b. Cast-brass
   c. NPS 3/8 minimum, elbow and flexible connector to wall
   d. Wall flanges and fittings to connect to NPS 1/2 pipe

2.8 DRAIN VALVES

A. Hose-End Drain Valves: MSS SP-110, NPS 3/4 ball valve, rated for 400-psig minimum CWP. Include two-piece, copper-alloy body with standard port, chrome-plated brass ball, replaceable seats and seals, blowout-proof stem, and vinyl-covered steel handle.

   1. Inlet: Threaded or solder joint.
   2. Outlet: Short-threaded nipple with ASME B1.20.7, garden-hose threads and cap.

B. Stop-and-Waste Drain Valves: MSS SP-110, ball valve, rated for 200-psig minimum CWP or MSS SP-80, Class 125, gate valve; ASTM B 62 bronze body, with NPS 1/8 side drain outlet and cap.

2.9 MISCELLANEOUS PIPING SPECIALTIES

A. Water Hammer Arresters: ASSE 1010 or PDI-WH 201, metal-bellows type with pressurized metal cushioning chamber. Sizes indicated are based on ASSE 1010 or PDI-WH 201, Sizes A through F.

   1. Manufacturers:

      a. Josam Co.
      b. Smith, Jay R. Mfg. Co.
      c. Zurn Industries, Inc.; Specification Drainage Operation.
      d. Or equal

B. Optional Water Hammer Arresters: ASSE 1010 or PDI-WH 201, piston type with pressurized metal-tube cushioning chamber. Sizes indicated are based on ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

   1. Manufacturers (or equal):

      a. Josam Co.
      b. Precision Plumbing Products, Inc.
      c. Watts Industries, Inc.; Drainage Products Div.
      d. Zurn Industries, Inc.; Wilkins Div.

C. Air Vents: Float type for automatic air venting.

1. Bolted Construction: Bronze body with replaceable, corrosion-resistant metal float and stainless-steel mechanism and seat; threaded NPS 1/2 minimum inlet; 125-psig minimum pressure rating at 140 deg F; and threaded vent outlet.
2. Welded Construction: Stainless-steel body with corrosion-resistant metal float, stainless-steel mechanism and seat, threaded NPS 3/8 minimum inlet, 150-psig minimum pressure rating, and threaded vent outlet.

D. Open Drains: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting, joined with ASTM C 564, rubber gaskets.

E. Deep-Seal Traps: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap seal primer valve connection.

1. NPS 2: 4-inch- minimum water seal.
2. NPS 2-1/2 and Larger: 5-inch- minimum water seal.

F. Deep Seal Traps (with Open Funnel): Same as “Deep Seal Trap” specified above except that a bronze funnel is required. (Smith Figure 3822 or equal).

G. Floor-Drain Inlet Fittings: Cast iron, with threaded inlet and threaded or spigot outlet, and trap seal primer valve connection.

H. Backwater valve: Smith 7150 flapper-type backwater valve with cast iron body and extendable access cover.

I. Fixed Air-Gap Fittings: Manufactured cast-iron or bronze drainage fitting with semiopen top with threads or device to secure drainage inlet piping in top and bottom spigot or threaded outlet larger than top inlet. Include design complying with ASME A112.1.2 that will provide fixed air gap between installed inlet and outlet piping.

J. Stack Flashing Fittings: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.

K. Vent Caps: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and set-screws to secure to vent pipe.

L. Vent Terminals: Commercially manufactured, shop- or field-fabricated, frost-proof assembly constructed of galvanized steel, copper, or lead-coated copper. Size to provide 1-inch (25-mm) enclosed air space between outside of pipe and inside of flashing collar extension, with counterflashing.

M. Expansion Joints: ASME A112.21.2M, assembly with cast-iron body with bronze sleeve, packing gland, and packing; of size and end types corresponding to connected piping.

2.10 SLEEVE PENETRATION SYSTEMS

A. Manufacturers:

1. ProSet Systems, Inc.
2. Or equal.

B. Description: UL 1479, through-penetration firestop assembly consisting of sleeve and stack fitting with firestopping plug.

1. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
2. Stack Fitting: ASTM A 48 (ASTM A 48M), gray-iron, hubless-pattern, wye-branch stack fitting with neoprene O-ring at base and gray-iron plug in thermal-release harness in branch. Include PVC protective cap for plug.

a. Special Coating: Include corrosion-resistant interior coating on fittings for plastic chemical waste and vent stacks.

2.11 FLASHING MATERIALS (COORDINATE WITH ROOFING SPECIFICATIONS)

2.12 CLEANOUTS

A. Service: Sanitary, soil and waste piping

B. Manufacturers;

1. Zurn
2. J.R. Smith
3. Josam
4. Cresline
5. Or equal

C. Cleanouts shall be the same size as pipe except that cleanouts larger than 4 inches are not required. Install cleanouts and/or test tees at the foot of all soil, waste and drain stacks; and on each building drain outside of building. Cleanouts shall be installed every 50 feet or less on all horizontal drain lines.

D. At ends of horizontal lines in unfinished areas: Wye fitting with cast brass plugs, threaded

E. At base of vertical lines in unfinished areas and hard piped downspouts. Wye fitting with cast brass plugs, threaded

F. Cleanouts shall be as follows:

1. Vertical Lines Concealed: Josam 58600-COT-20.
2. Vertical Lines Exposed: Josam 58910.
3. Horizontal Lines Exposed and/or Above Accessible Ceilings: Josam 58900-20.
4. Horizontal Lines Concealed Under Floors with Tile, Vinyl, Terrazzo and/or Concrete Finish: Josam 555000Z-2.
5. Horizontal Lines Concealed Under Floors with Carpet Finish: Josam 55000Z-2-14.
6. Cleanouts for PVC piping shall be equal to Cresline DW75A.

G. Cleanouts to Grade (exterior cleanout): Josam 58900, cast iron floor cleanout with round heavy duty cover. Locate cleanout set in concrete yard box with cast iron cover marked “sewer”, Brooks 3Cl, Christy or equal large enough for two-way clean out assemblies.

H. Cleanouts for PVC piping shall be equal to Cresline DW75A.

2.13 FLOOR DRAINS & AREA DRAINS

A. Manufacturers:

1. J.R. Smith
2. Zurn
3. Wade
4. Josam

B. See Plumbing Fixture Schedule in the Construction Documents.

C. Provide trap primers to all floor drains and floor sinks, unless otherwise indicated.

2.14 ROOF DRAINS & OVERFLOW DRAINS

A. Manufacturers:

1. J.R. Smith
2. Zurn
3. Wade
4. Josam

B. See Plumbing Fixture Schedule in the Construction Documents.

C. Provide all roof & overflow drains with suitable flashing, extending a minimum of 10 inches beyond outer dimensions of the roof drain in all directions. Coordinate with roofing and waterproofing specifications and drawing details.

2.15 DOMESTIC HOT WATER RECIRCULATION PUMPS

A. Manufacturers:

1. Bell & Gossett
2. Taco
3. Grundfos
4. Or equal

B. Description: Furnish and install domestic hot water recirculation pumps of the size and capacity shown in the Construction Documents.

C. Pump Construction:

1. Housing: Bronze
2. Impeller: Bronze, closed type
3. Shaft: Stainless Steel
4. Mechanical Seal: Stainless Steel

5. Motor: Open dripproof type with sleeve bearings and built-in automatic thermal overload protection, 1725 RPM

D. Provide and install strap-on aquastat to hot water recirculation line to control pump.

2.16 DOMESTIC WATER PACKAGED BOOSTER PUMPS

A. Manufacturers:

1. Variable-Speed Drive, Packaged Booster Pumps

a. Grundfos Hydro Multi-E Duplex
b. ITT Bell & Gossett
c. FlowTherm
d. Armstrong

B. Description: Factory-assembled and –tested, packaged booster pump units; complying with UL 778; suitable for potable-water service.

C. Minimum Pressure Rating: 175 psig.

D. Pump Arrangement: Duplex, with two equal-size pumps.

1 Pumps, in-line vertical multi-stage, ANSI Class 250 flange
2 Pump Construction:

a. Suction/discharge base, pump head, motor stool: cast iron
b. Impellers, diffuser chambers, outer sleeve: 304 stainless steel
c. Shaft: 316 stainless steel
d. Impeller wear rings: 304 stainless steel
e. Shaft journals and chamber bearings: Silicon Carbide
f. O-rings: EPDM

E. Integrated Variable Frequency Drive Motors

1 All motors shall be of the integrated variable frequency drive design consisting of a motor and a VFD with a built-in pump system controller. The complete VFD/motor assembly shall be manufactured and tested as one unit.
2 The integrated VFD/motor combination shall be UL recognized.

F. Motors: Comply with Section 23 05 13 – Motors and Controllers

G. Piping: ASME B31.9 for materials and installation

1 NPS 4 and Smaller: ASTM B88, Type L (ASTM B88M, Type B), drawn, copper, water tube with copper, solder-joint, pressure fittings and brazed joints.
2 NPS 5 and Larger: ASTM A53, Schedule 40, galvanized-steel pipe with threaded, cast-iron fittings and threaded joints.
3 Suction and discharge manifolds shall be constructed of 316 stainless steel.
4 Header End Connections NPS 2 and Smaller: Threaded.
5 Header Connections NPS 2-1/2 and Larger: Flanged.

H. The base frame shall be constructed of corrosion resistant 304 stainless steel. Rubber vibration isolation dampers shall be fitted between each pump and base frame for vibration isolation.

I. Pump isolation valves shall be provided on the suction and discharge of each pump

J. Shutoff Valves, NPS 2 and Smaller: MSS SP-110, 600-psig minimum CWP, bronze ball valve with ends matching piping.

K. Shutoff Valves, NPS 2-1/2 and Larger:: MSS SP-70, Class 125, bronze-trim, OS&Y, cast-iron gate valve with flanged ends or MSS SP-67, Type 1 for tight shutoff, 175 psig CWP, single flanged, cast-iron butterfly valve.

L. Check Valves: Spring-loaded non-slam type check valve on the discharge of each pump.

M. Dielectric Fittings: Assembly or fitting with insulating material isolating joined dissimilar metals, to prevent galvanic action and to stop corrosion.

1 NPS 2 and Smaller: Factory-fabricated union assembly, for 250 –psig minimum working pressure at 180 deg F.
2 NPS 2-1/2 and Larger: Factory-fabricated, companion-flange assembly; for 150- or 300-psig minimum working pressure as required to suit system pressures.

N. Sensors:

1 A pressure switch shall be installed on the suction manifold and shall be wired to the primary controller. When the inlet pressure falls below 3 psig for a period of five seconds, all pumps shall be switched off and a system alarm shall be indicated.
2 A pressure transducer shall be factory installed on the discharge manifold.

O. Control Panel: Automatic, with load control and protection functions. Comply with NEMA ICS 2 and UL 508.

1 Mounting and Wiring: Factory installed and connected as an integral part of unit.
2 Enclosure: NEMA ICS 6, Type 12.
3 Factory disconnect switch for each pump and motor. Disconnect switch shall have a NEMA 3R enclosure.
4 Motor Controller: Adjustable speed drive for each unit
5 Motor Overload Protection: Overload relay in each phase.
6 Duplex, Automatic Alternating Controls: Switches lead pump to lag main pump and to two-pump operation.
7 Triplex, Sequence (Lead-Lag-Lag) Controls: Switches lead pump to one lag main pump and to three-pump operation.
8 Instrumentation: Bourdon tube pressure gauge, 2.5 inch diameter, shall be placed on the suction and discharge manifolds.

P. Finish: Manufacturer’s standard paint applied to factory-assembled and –tested units before shipping.

Q. Manufacturer’s Preparation for Shipping: Clean flanges and exposed machined metal surfaces and treat with anti-corrossion compound after assembling and testing. Protect flanges, pipe openings and nozzles.

R. Testing

1 The entire pump package shall be factory performance tested as a complete unit prior to shipment. A verified performance test report shall be made available from the system manufacturer.
2 The system unit shall undergo a hydrostatic test of 250 psig for a minimum of 15 minutes prior to shipment.
3 Engage a factory-authorized representative startup packaged booster pump.

S. Warranty

1 The warranty period shall be a non-prorated period of 24 months from date of installation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Section 23 05 00 - Basic Mechanical Materials and Methods for piping joining materials, joint construction, and basic installation requirements.

B. Examine roughing-in of water distribution piping to verify actual locations of connections before plumbing specialty or pump installation.

C. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
3. Do not install bypass piping around backflow preventers.

D. Install pressure regulators with inlet and outlet shutoff valves and balance valve bypass. Install pressure gages on inlet and outlet.

E. Install strainers on supply side of each control valve, pressure regulator, and solenoid valve.

F. Install trap seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

G. Install backwater valves in building drain piping where required. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

H. Install expansion joints on vertical risers, stacks, and conductors if indicated.

I. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless

larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

J. Install strainers on supply side of each control valve, pressure regulator, and solenoid valve.

K. Install cleanout deck plates with top flush with finished floor, for floor cleanouts for piping below floors.

L. Install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall, for cleanouts located in concealed piping.

M. Install flashing flange and clamping device with each stack and cleanout passing through floors with waterproof membrane.

N. Install vent flashing sleeves on stacks passing through roof. Secure over stack flashing according to manufacturer's written instructions.

O. Install floor drains at locations shown on architectural drawings. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:

    a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
    b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
    c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.

3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

P. Install roof drains at locations shown on architectural drawings according to roof membrane manufacturer's written installation instructions.

1. Install roof-drain flashing collar or flange so no leakage occurs between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
2. Position roof drains for easy access and maintenance.

Q. Fasten wall-hanging plumbing specialties securely to supports attached to building substrate if supports are specified and to building wall construction if no support is indicated.

R. Fasten recessed-type plumbing specialties to reinforcement built into walls.

S. Install individual shutoff valve in each water supply to plumbing specialties. Use ball, gate, or globe valve if specific valve is not indicated. Install shutoff valves in accessible locations. Refer to Section 23 05 23 - Valves for general-duty ball, butterfly, check, gate, and globe valves.

T. Install air vents at piping high points. Include ball, gate, or globe valve in inlet [and drain piping from outlet to floor drain].

U. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

V. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 PACKAGED BOOSTER PUMP INSTALLATION

A. Install concrete bases for packaged booster pumps. Refer to Division 03 for cast-in-place concrete, Section 23 00 10 – Mechanical General Provisions and 23 05 00 – Basic Mechanical Materials and Methods.

B. Install packaged booster pumps according to manufacturer's written instructions and with access for periodic maintenance, including removing motors, impellers, couplings and accessories.

C. Support packaged booster pumps using the following vibration-control devices, unless otherwise indicated. Refer to Section 23 05 48 – Mechanical Sound and Vibration Control.

1. Install units with total of 7.5 hp or less, with rubber-isolator mount or spring-isolator vibration isolators.
2. Install units with total of more than 7.5 hp, with concrete filled, inertia-base vibration isolation bases and spring-isolator vibration isolators.

D. Support connected piping so weight of water distribution piping is not supported by packaged booster pumps.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Connect plumbing specialties to piping specified in other Division 22 Sections.

D. Ground equipment.

E. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

F. Connect plumbing specialties and devices that require power according to Division 26 Sections.

3.4 PACKAGED BOOSTER PUMP CONNECTIONS

A. Piping installation requirements are specified in Section 22 11 16 – Domestic Water Piping. Drawings indicate general arrangement of piping and specialties. The following are specific connection requirements:

1. Connect water distribution piping to pumps. Install suction and discharge pipe equal to or greater than size of unit suction and discharge headers.
2. Install flexible pipe connectors on piping connections to unit suction and discharge headers. Install flexible pipe connectors same size as piping. Refer to Section 23 05 00 – Basic Mechanical Materials and Methods.
3. Install shutoff valves on piping connections to unit suction and discharge headers. Install valves same size as unit suction and discharge headers. Refer to Section 23 05 23 – Valves.

B. Install electrical connections for power, controls and devices
C. Electrical wiring and connections are specified under Division 26.
D. Ground equipment

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.5 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each backflow preventer, thermostatic water mixing valve, water tempering valve, trap seal primer system.

1. Text: Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.
2. Refer to Section 23 00 10 – Mechanical General Provisions and Section 23 05 53 - Mechanical Systems Identification for nameplates and signs.

3.6 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled trap seal primer systems and their installation, including piping and electrical connections. Report results in writing.

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.7 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

3.8 PACKAGED BOOSTER PUMP COMMISSIONING

A. Before operating pumps, perform the following checks:

1. Check piping connections for tightness.
2. Controls: Set for automatic starting, stopping, sequential, and alarm operations.
3. Final Checks before Starting: Perform the following preventative maintenance operations:

    a. Lubricate bearings.
    b. Verify that each pump is free to rotate by hand and that pump for handling hot liquids is free to rotate with pump hot and cold. Do not operate pump if it is bound or drags, until cause of problem is determined and corrected.
    c. Verify that pump controls are correct for required application.

B. Starting procedure for pumps is as follows:

1. Prime pumps by opening suction valves and closing drains and prepare pump for operation.
2. Open valves if pumps should not be operated against dead shutoff.
3. Start motors.
4. Open discharge valves slowly.
5. Check general mechanical operation of pumps and motors.
6. Close valves once there is sufficient flow though pumps to prevent overheating.

3.9 DEMONSTRATION

A. Engage a factory-authorized service representative to train Using Agency’s maintenance personnel to adjust, operate, and maintain backflow preventers, pumps, and mixing valves. Refer to Secton 23 00 10 – Mechanical General Provisions.

END OF SECTION 22 16 00

SECTION 22 34 00 - FUEL-FIRED, COMMERCIAL WATER HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section. These Plumbing provisions specified herein apply to all Sections of Division 22.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 22.

1.2 SUMMARY

A. This Section includes the following for domestic water systems:

1. Tankless, gas water heaters.
2. Compression tanks.
3. Accessories.

1.3 SUBMITTALS

A. See Section 23 00 10 – Mechanical General Provisions.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Water heater	R	R		R
Water heater accessories	R	R		R
Boiler controls	R	R		

C. Water heater

1. Certified dimensioned shop drawings
2. Materials of construction, thickness of tubes, shell, boilerplate and insulation
3. Firing and combustion air control systems
4. Electrical requirements
5. Safety devices
6. Minimum and maximum gas pressure at burner
7. Controls
8. Wiring diagrams
9. Field mounted equipment and devices

D. Manufacturer's instructions for:

1. Installation
2. Operation
3. Maintenance and repair

E. Within warranty indicating full compliance with Paragraph 1.6

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain same type of water heaters through one source from a single manufacturer.
B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction, and marked for intended use.
C. ANSI Compliance: Provide gas water heaters that comply with ANSI standards for gas water heaters and related products and that bear AGA certification label.
D. ASHRAE Standards: Comply with performance efficiencies prescribed for the following:

1. ASHRAE 90.1-2010, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings," for commercial water heaters.

E. ASME Compliance:

1. Where ASME-code construction is indicated, fabricate and label commercial water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.

F. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9" for all components that will be in contact with potable water.

1.5 COORDINATION

A. Coordinate size and location of concrete bases with Architectural and Structural Drawings.

1.6 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive the Using Agency of other rights the Using Agency may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
B. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of water heaters that fail in materials or workmanship within specified warranty period.

1. Failures include rusty water or heating surfaces due to lime scale build-up.
2. Warranty Period: From date of acceptance by the Using Agency.

a. Burner Assemblies: 1 Year complete parts, labor and freight; additional four (4) years parts.
b. Heat Exchanger: Five (5) years warranty.

3. Heater shall have a five (5) year non-prorated limited warranty against leaks or production of rusty water, including a three (3) year non-prorated limited warranty covering failure of heating surfaces due to lime scale build-up. Warranty shall include a one year cost free service policy including labor and freight for service due to factory defect. The manufacturer's written warranty shall be part of the submittals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 TANKLESS, GAS WATER HEATERS

A. Description: AGA certified; tankless, temperature controlled, continuous flow, water heaters for natural-gas fuel.

1. Manufacturers:

a. Rinnai Corporation
b. Takagi
c. Or equal

B. Construction: Without hot-water storage.

1. Working-Pressure Rating: 150 psig.
2. Tappings: ASME B1.20.1, pipe thread.
3. Interior Finish: Materials complying with NSF 61, barrier materials for potable-water tank linings.
4. Jacket: Aluminum or steel, with enameled finish, or plastic.

C. Burner: Direct vent, forced combustion for natural-gas fuel.

1. Temperature Control: Adjustable remote thermostat.
2. Safety Control: Flame failure, boiling protection, remaining flame (OHS),thermal fuse, automatic frost protection, combustion fan rpm check, overcurrent and automatic unit temperature control default to 100 deg F. (anti-scald).
3. Automatic Ignition: ANSI Z21.20, automatic battery-sparked gas-ignition system and components.

D. Capacities are scheduled on the drawings.

2.3 COMPRESSION TANKS

A. Description: Steel, pressure-rated tank, ASME-constructed with welded joints and factory-installed, butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.

1. Manufacturers:

a. Amtrol, Inc.
b. Smith: A.O. Smith; Aqua-Air Div.
c. Wessels
d. Elbi

B. Construction: 150-psig (1035-kPa) working-pressure rating.

C. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1, pipe thread.

D. Tank Interior Finish: Materials and thicknesses complying with NSF 61, barrier materials for potable-water tank linings. Extend finish into and through tank fittings and outlets.

E. Air-Charging Valve: Factory installed.

2.4 STORAGE TANKS

A. Fabricated and stamped in accordance with the ASME BPV Code Section VII, Division 1 with a stamped MAWP of 125 psig and a maximum design temperature of 500 °F and suitable for Potable Water Systems.

1. Manufacturers:

a. John Wood
b. Taco
c. Wessels

B. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.

1. NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
2. NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.

C. Vertical insulated storage tank.

D. Materials of Construction: Carbon Steel

E. Outside Finish: Urethane Paint

F. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.

G. Lining: Glass complying with NSF 61 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.

H. Furnished with magnesium anode rods.

I. Dip Tube: Provide unless cold-water inlet is near bottom of tank.

J. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.

K. Insulation: Comply with ASHRAE/IESNA 90.1-2010. Surround entire storage tank except connections.

L. See drawings for tank capacities.

2.5 WATER HEATER ACCESSORIES

A. Gas Shutoff Valves: ANSI Z21.15, manually operated. Furnish for installation in piping.
B. Gas Pressure Regulators: ANSI Z21.18, appliance type, factory or field installed. Include pressure rating, capacity, and pressure differential required for water heater and gas supply.

C. Vent System: Provide complete concentric combination combustion air intake and exhaust vent piping system including, but not limited to the following: vertical discharge adaptor, vertical concentric piping, vent pipe clamps, condensate collector, roof flashing assembly, roof disharge terminal and fittings.

D. Water Heater Mounting Brackets: Water heater manufacturer's factory-fabricated steel bracket for wall mounting and capable of supporting water heater and water.

E. Piping Manifold Kits: Water heater manufacturer's factory-fabricated inlet and outlet piping arrangement for multiple-unit installation. Include piping and valves for field assembly that is capable of isolating each water heater and of providing balanced flow through each water heater.

F. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1-2010.

G. Controls: Provide complete operating system with multiple unit controllers, controllers to select and change hot water supply temperature and non-polarized two-core cable. Controller shall have capability to rotate lead water heater to equalize multiple water heater operation time.

H. Aquastat: Provide aquastat as required to control water heater operation and recirculation pump. Provide aquastat per manufacturer’s recommendations.

PART 3 - EXECUTION

3.1 WATER HEATER INSTALLATION

A. Install water heater, level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

B. Anchor water heaters to substrate.

C. Install and connect gas water heaters according to NFPA 54.

1. Install appliance, gas pressure regulators on gas-burner inlets of water heaters without pressure regulators.
2. Install vent piping from gas-train pressure regulators and valves to outside of building where required. Terminate vent piping with brass-screened vent cap fitting. Do not combine vents except with approval of authorities having jurisdiction.

D. Install combination temperature and pressure relief valves in water piping for water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

E. Install water heater drain piping as indirect waste to spill into open drains or over floor drains. Install hose-end drain valves at low points in water piping for water heaters that do not have tank drains. Refer to Division 22 Section "Plumbing Specialties" for drain valves.

F. Install thermometers on water heater and storage tank inlet and outlet piping. Refer to Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.

G. Assemble and install inlet and outlet piping manifold kits for multiple water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each water heater. Include shutoff valve and thermometer in each water heater inlet and outlet, and throttling valve in each water heater outlet. Refer to Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty valves and to Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.

H. Arrange for insulation on equipment and piping not furnished with factory-applied insulation. Fill water heaters with water.

I. Charge compression tanks with air.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow service and maintenance.

C. Connect hot- and cold-water piping with shutoff valves and unions.

D. Connect gas piping to gas burner with drip leg, tee, shutoff valve, and union; minimum size same as inlet connection.

E. Make connections with dielectric fittings where piping is made of dissimilar metal.

F. Gas, Water Heater Vent Connections: Connect to vent system. Include draft hoods and diverters where required. Use vents same size as or larger than water heater outlets, but not smaller than indicated unless smaller vent size has been calculated according to NFPA 54. Comply with gas utility requirements for sizing.

G. Electrical Connections: Power wiring and disconnect switches are specified in Division 26 Sections. Arrange wiring to allow unit service.

H. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

A. Engage a factory-authorized service representative to perform startup service.

B. In addition to manufacturer’s written installation and startup checks, perform the following:

1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment and retest until satisfactory results are achieved.
2. Verify that piping system tests are complete.
3. Check for piping connection leaks.
4. Check for clear relief valve inlets, outlets, and drain piping.
5. Test operation of safety controls, relief valves, and devices.
6. Energize electric circuits.
7. Adjust operating controls.
8. Adjust hot-water-outlet temperature settings. Do not set above 135 deg F unless piping system application requires higher temperature.

3.4 FIELD QUALITY CONTROL

A. Engage a factory-authorized service representative to train Owner’s maintenance personnel to adjust, operate, and maintain water heaters.

1. Train Using Agency’s maintenance personnel on procedures for starting and stopping troubleshooting, servicing, and maintaining equipment. Refer to Division 22 Section “Plumbing General Provisions”.
2. Review date in maintenance manuals. Refer to Division 22 Section “Plumbing General Provisions”.
3. Schedule training with Using Agency, through Professional, with at least seven days’ advance notice.

END OF SECTION 22 34 00

SECTION 22 40 00 – PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. These Plumbing provisions specified herein apply to all Sections of Division 22.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 22.

1.2 WORK INCLUDED

A. This Section includes plumbing fixtures and related components.

1.3 RELATED WORK AND REQUIREMENTS

A. Requirements of General Conditions, Division 1

B. Section 01 91 00 - Commissioning

C. Section 22 16 00 - Plumbing Specialties

D. Section 23 00 10 – Mechanical General Provisions

E. Section 23 08 00 - Mechanical Commissioning

1.4 DEFINITIONS

A. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.

B. Fitting: Device that controls flow of water into or out of plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

1.5 SUBMITTALS

A. See Section 01 33 23 - Shop Drawings, Product Data and Samples

B. See Section 23 00 10 – Mechanical General Provisions

C. Product Data: Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports and indicate materials and finishes, dimensions, construction details, and flow-control rates for each type of fixture indicated. All product data for plumbing fixtures shall be submitted to the Using Agency for review and approval.

D. Shop Drawings: Diagram power, signal, and control wiring and differentiate between manufacturer-

installed and field-installed wiring.

E. Maintenance Data: For plumbing fixtures to include in maintenance manuals specified in Division 1.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.

1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act".

D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

E. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

F. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

G. Comply with the following applicable standards and other requirements specified for plumbing fixtures:

1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
2. Hand Sinks: NSF 2 construction.
3. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.
4. Stainless-Steel Fixtures Other Than Service Sinks: ASME A112.19.3M.
5. Vitreous-China Fixtures: ASME A112.19.2M.
6. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.
7. Water-Closet, Flushometer Tank Trim: ASSE 1037.

H. Comply with the following applicable standards and other requirements specified for sink faucets:

1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
2. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
3. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
4. Faucet Hose: ASTM D 3901.
5. Faucets: ASME A112.18.1M.
6. Hose-Connection Vacuum Breakers: ASSE 1011.
7. Hose-Coupling Threads: ASME B1.20.7.
8. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
9. NSF Materials: NSF 61.
10. Pipe Threads: ASME B1.20.1.
11. Sensor-Actuated Faucets and Electrical Devices: UL 1951.

12. Supply and Drain Fittings: ASME A112.18.1M.

I. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:

1. Atmospheric Vacuum Breakers: ASSE 1001.
2. Brass and Copper Supplies: ASME A112.18.1M.
3. Manual-Operation Flushometers: ASSE 1037.
4. Plastic Tubular Fittings and Piping: ASTM F 409.
5. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.
6. Tubular Brass Drainage Fittings and Piping: ASME A112.18.1M.

J. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Disposers: ASSE 1008 and UL 430.
2. Floor Drains: ASME A112.21.1M.
3. Grab Bars: ASTM F 446.
4. Hose-Coupling Threads: ASME B1.20.7.
5. Hot-Water Dispensers: ASSE 1023 and UL 499.
6. Off-Floor Fixture Supports: ASME A112.6.1M.
7. Pipe Threads: ASME B1.20.1.
8. Plastic Toilet Seats: ANSI Z124.5.
9. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.7 COORDINATION

A. Coordinate roughing-in and final plumbing fixture locations, and verify that fixtures can be installed to comply with original design and referenced standards.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General:

1. Provide fixtures and trim complete for proper installation as described in the manufacturer's catalog with the modifications as shown on Plumbing Fixture Schedule in the plans or specifications.
2. All fixtures, specified to be of vitreous ware, shall be of a quality known commercially as "twice fired" vitreous chinaware of the best quality, nonabsorbent, burned so that the whole mass is thoroughly fused and vitrified producing a material white in color, which when fractured will show a homogeneous mass, close-grained and free from pores. The glazed and vitreous china fixtures shall be white, thoroughly fused and united to the body, without discoloration, chips, or flaws and shall be free from cracks. Warped or otherwise imperfect fixtures will not be acceptable.
3. Factory grind back and bases of fixtures smooth.
4. Enamelware to be white cast iron with acid-resisting enamel.
5. Unless otherwise specified, water closets to have a waste passage to pass a 2-1/2 inch ball minimum. Bolt water closets to flanges with a 1-inch thick rubber foam gasket.
6. Fixture trim and exposed metal items shall be polished chrome-plated unless otherwise noted, and pipes passing through walls shall have polished chrome-plated escutcheon

plates. All stainless steel shall be satin brushed (US32D) finish unless noted otherwise.

7. Fixtures shall be free from imperfections, true as to line, angles, curves, and color; smooth, watertight and practically noiseless in operation.
8. Exposed Pipe, Trim Including Fittings, Traps, Escutcheons, Valves, Valve Handles, and Accessories: Above and Below Fixtures:

    a. Polished chrome plated CP brass.
    b. Set-screw cast brass escutcheons for piping.
    c. Traps: Cast brass with cleanout plugs.
    d. Covering tubes not permitted.
    e. Provide Hudee stainless steel rims, as applicable, for non-selfrimming counter mounted fixtures.

9. Supply Fixtures With:

    a. Renewable seats or replaceable internal units.
    b. Compositional washers.

2.2 MANUFACTURERS

A. Manufacturers for fixtures and trim:

1. Fixtures (vitreous china): Toto, Zurn, Kohler, American-Standard
2. Sinks (stainless steel): Just, Elkay, Kohler, American Standard
3. Floor and roof drains, carriers, etc.: Zurn, J.R. Smith, Josam
4. Sink and lavatory trim: Zurn, Kohler, Delta
5. Electric water coolers: Haws, Elkay, or Equal
6. Safety eyewash and shower: Haws, Encon Safety Products or equal
7. Flush Valves: Water closets and urinals shall be manual **[battery sensor operated] [hard-wired sensor operated]** flush type. Sensor operated water closet flush valves shall have manual over-ride button.

2.3 FLUSH VALVE PLUMBING FIXTURES

A. Provide vacuum breakers and angle control-stop valves for each flush valve. Vacuum breakers shall conform to ASSE 1001. Exposed to view and pressure containing components of flush valves, vacuum breaker, angle control-stop valve, tail pieces, slip nuts, escutcheon plates, and wall plates shall be chromium-plated copper alloy or polished stainless steel. Water flushing volume of the flush valve shall not exceed the gallons per flush required below, and is factory set as required by the fixture. Mount flush valves not less than 11 inches above neither the fixture nor more than 44 inches above the floor for ADA accessible fixtures. For ADA accessible water closets, controls for flush valves shall be located on the wide side of the toilet area.

B. Water Closets (WC): See plumbing fixture schedule on Drawings

C. Urinals (U): See plumbing fixture schedule on Drawings

2.4 LAVATORIES AND SINKS

A. Lavatories (L): See plumbing fixture schedule on Drawings

B. Mop Basin (MB): See plumbing fixture schedule on Drawings

2.5 ELECTRIC WATER COOLERS

A. Electric Drinking Fountain (EDF): See plumbing fixture schedule on Drawings

2.6 SHOWERS

A. SHOWERS (SH): See plumbing fixture schedule on Drawings

2.7 TUB/SHOWER

A. TUB SHOWER (TB): See plumbing fixture schedule on Drawings

2.8 PLUMBING FIXTURE FAUCETS, TRIM AND FITTINGS

A. ASME A112.18.1M for plumbing fixture faucets. The finish of plumbing fixture faucets, trim, valves, and fittings exposed to view shall be chromium-plate or polished stainless steel except as modified herein. Bolts, nuts, and screws shall be copper alloy or stainless steel. Provide ball valves or 4 turn angle valve connections in each supply to each faucet; chromium-plated finish is not required if not exposed to view. Supply risers shall be chrome plated copper flex riser style smooth surface. Faucets shall be the washerless type and shall have threaded type end connections, coupling nuts, or union connections. Provide washers and lock nuts to secure faucets to lavatories and sinks.

B. Traps: Provide P-traps for each plumbing fixture that do not have integral traps. Provide 1.5 inch brass adjustable P-traps, 16 gauge tubing with slip nuts and gaskets; chromium-plated finish is required if exposed.

C. Continuous Waste: Tubular brass, 0.045-inch wall thickness, with slip-joint inlet and size to match equipment.

D. Indirect Waste: Tubular brass, 0.045-inch wall thickness, with slip-joint inlet and size to match equipment.

E. FHB-1 Freezeproof Hose Bibb: Nonfreeze concealed-outlet wall hydrants, ASSE 1019, self-drainable with flush-mounting box with cover, integral nonremovable hose-connection vacuum breaker, cast bronze casing and operating rod to match wall thickness, concealed outlet, and wall clamp. ASME A112.21.3M, key-operation hydrant with pressure rating of 125 psig. Inlet NPS 3/4 threaded or solder joint. Outlet ASME B1.20.7, garden hose threads. Operating keys, one with each key-operation hydrant.

1. Classification: Type A, for automatic draining with hose removed or Type B, for automatic draining with hose removed or with hose attached and nozzle closed.
2. Box and Cover Finish: polished nickel bronze.
3. Manufacturer: Woodford B65, Josam, Watts, Zurn

F. Hose Bibbs: Bronze body with replaceable seat disc complying with ASME A112.18.1M for compression-type faucets. Include NPS 1/2 or NPS 3/4 threaded or solder-joint inlet, of design

suitable for pressure of at least 125 psig; integral [or field-installed,] nonremovable, drainable hose-connection vacuum breaker; and garden-hose threads complying with ASME B1.20.7 on outlet.

1. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
2. Finish for Service Areas: Chrome or nickel plated.
3. Finish for Finished Rooms: Chrome or nickel plated.
4. Operation for Equipment Rooms: Operating key.
5. Operation for Service Areas: Operating key.
6. Operation for Finished Rooms: Operating key.
7. Include operating key with each operating-key hose bibb.
8. Include wall flange with each chrome- or nickel-plated hose bibb.

2.9 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Guard: Manufactured, plastic covering or enclosure for hot- and cold-water supplies and trap and drain piping and complying with ADA requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water soil and for waste piping systems and supports to verify actual locations and sizes of piping connections and that locations and types of supports match those indicated, before plumbing fixture installation. Use manufacturer's roughing-in data if roughing-in data are not indicated.

B. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Include supports for plumbing fixtures according to the following:

1. Heavy-Duty Chair Carriers: For accessible lavatories and other fixtures where indicated.

B. Include fitting insulation kits for accessible fixtures according to the following:

1. Lavatories: Cover Hot-and cold-water supplies, stops and handles, drain, trap, and waste to wall.
2. Fixtures with Offset Drain: Cover hot-and cold-water supplies, offset drain, trap, and waste to wall.
3. Other Fixtures: Cover exposed fittings below fixture.

3.3 FIXTURE INSTALLATION

A. Assemble fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. For wall-hanging fixtures, install off-floor supports affixed to building substrate.

1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.

C. Install back-outlet, wall-hanging fixtures onto waste fitting seals and attach to supports.

D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate. Closet flanges shall be anchored to the floor per manufacturer's recommendations.

E. Install wall-hanging fixtures with tubular waste piping attached to supports.

F. Install counter-mounting fixtures in and attached to casework.

G. Install fixtures level and plumb according to manufacturers' written instructions and roughing-in drawings.

H. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

1. Exception: Use ball, gate, or globe valve if stops are not specified with fixture.
2. Refer to Section 23 05 23 - Valves for general-duty valves.

I. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

J. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.

K. Install toilet seats on water closets.

L. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

M. Install water-supply, flow-control fittings with specified flow rates in fixture supplies at stop valves.

N. Install faucet, flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

O. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.
2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

P. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Refer to Section 23 05 00 - Basic Mechanical Materials and Methods for escutcheons.

Q. Seal joints between fixtures and walls, floors, and counters using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Refer to Division 7 Section "Joint Sealants" for sealant and installation requirements.

3.4 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 and Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect water supplies from water distribution piping to fixtures.

C. Connect drain piping from fixtures to drainage piping.

D. Supply and Waste Connections to Plumbing Fixtures: Connect fixtures with water supplies, stops, risers, traps, and waste piping. Use size fittings required to match fixtures. Connect to plumbing piping.

E. Supply and Waste Connections to Fixtures and Equipment Specified in Other Sections: Connect fixtures and equipment with water supplies, stops, risers, traps, and waste piping specified. Use size fittings required to match fixtures and equipment. Connect to plumbing piping.

F. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

G. Arrange for electric-power connections to fixtures and devices that require power. Electric power is specified under Division 26.

3.5 FIELD QUALITY CONTROL

A. Verify that installed fixtures are categories and types specified for locations where installed.

B. Check that fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

E. Install fresh batteries in sensor-operated mechanisms.

3.6 ADJUSTING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Adjust water pressure at faucets, and flushometer valves to produce proper flow and stream.

C. Replace washers and seals of leaking and dripping faucets and stops.

3.7 CLEANING

A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:

1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
2. Remove sediment and debris from drains.

3.8 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of fixtures for temporary facilities unless approved in writing by Using Agency.

END OF SECTION 22 40 00

SECTION 23 00 10 – MECHANICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. These heating, ventilating and air conditioning (HVAC) provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.2 DIVISION OF WORK

A. This section delineates the division of work between Divisions.

B. Consult all other Sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable installation. This section is provided to assist the Contractor in coordination of work scope but shall not be construed to limit Contractor's scope of work encompassed by the contract documents.

C. Coordination with other Trades: The following table is intended to assist the Contractors in coordinating the scope of work between Division 23 (Indicated as 23 in table), Section 23 09 00 Energy Management & Control System (indicated as 23C), and other Divisions as indicated. However, the General Contractor is ultimately responsible for coordination among his subcontractors regardless of what is listed in this Section.

INTERFACE/RESPONSIBILITY MATRIX						
System		Division under which the following is specified				Remarks
		Equipment	Installation	Power Wiring [1]	Control & Interlock Wiring [1]	
A. FIRE SPRINKLER SYSTEM						
1.	Flow switches	21	21	26	26	
2.	Valve monitors	21	21	26	26	
3.	Post indicating valves	21	21	26	26	
B. FIRE & LIFE SAFETY SYSTEMS						
1.	Fire alarm and smoke control systems	26	26	26	26	
2.	Duct mounted & in-direct mounted smoke detectors	26	23	26	26/ 23C	[2]
3.	Other smoke detectors	26	26	26	26	
4.	Smoke dampers with electric actuators	23	23	26	26	
5.	Smoke and fire damper end switches	23	23	26	26	[3]

INTERFACE/RESPONSIBILITY MATRIX						
System		Division under which the following is specified				Remarks
		Equipment	Installation	Power Wiring [1]	Control & Interlock Wiring [1]	
C. MECHANICAL EQUIPMENT						
1.	Packaged mechanical equipment	23	23	26	23C	[4]
2.	Chillers	23	23	26	23C	[4], [7]
3.	Boilers	23	23	26	23C	[4], [8]
4.	Variable speed drives, field mounted	23	26	26	23C	
5.	Motors, 3 phase	23	23	26	-	
6.	Motor starters, 3 phase	23	23	26	23C	[5]
7.	Motors, 1 phase	23	23	26	23C	[6]
8.	Other powered equipment	23	23	26	23C	
9.	Disconnects	26/23	26/23	26	26	[9]
10.	Refrigerant leak detector	23	23	26	23C	[10]
11.	Cooling tower vibration switch	23	23	-	23C	
12.	Water treatment systems (open and closed systems)	23	23	26	23C	
D. ENERGY MANAGEMENT & CONTROL SYSTEM						
1.	Central control workstations & servers	23C	23C	26	23C	
2.	Control system network backbone	23C	23C	23C	23C	
3.	Control panels	23C	23C	23C	23C	[11]
4.	Control devices	23C	23C	23C	23C	
5.	Lighting relay panels	23C	26	26	23C	[12]
6.	Janitor’s switches	23C	23C	23C	23C	
7.	Lighting relay panel low voltage override switches	26	26	26	26	[13]
8.	Lighting occupancy sensors	26	26	26	26	
9.	Daylighting sensors and controls	26	26	26	26	
10.	Power monitoring sensors and gateway	26	26	26	26 23C	[14]
E. EMERGENCY POWER SUPPORT SYSTEMS						
1.	Muffler	26	26	-	-	
2.	Exhaust piping	26	26	-	-	
3.	Radiator cooling, outdoor generator	26	26	-	-	
4.	Generator monitoring and alarm points	26	26	-	23C	[15]
5.	Generator fuel system	26	26	26	23C	[16]
F. IRRIGATION SYSTEM						
1.	Controllers	32	32	26	32	
2.	Control valves	32	32	32	32	
3.	Flow meters	23C	32	23C	23C	
G. PLUMBING SYSTEMS						

INTERFACE/RESPONSIBILITY MATRIX						
	System	Division under which the following is specified				Remarks
		Equipment	Installation	Power Wiring [1]	Control & Interlock Wiring [1]	
1.	DHW heater venting and combustion air	23	23	-	-	
2.	Condensate drains including traps, primers	22	22	-	-	[17]
3.	Condensate pumps	23	23	23	-	
4.	Make-up water to hot/chilled/condenser water including backflow prevention	22	22	-	-	[18]
5.	Natural gas connections, pressure reducing station, gages	22	22	-	-	[19]
6.	Gas and water flow meters	23C	22	23C	23C	
7.	Recirculation pumps or heat tape	22	22	26	23C	
8.	Pipe gauges, thermometers, test plugs	22	22	-	-	
9.	Self-powered valves, pressure relief valve, liquid level controllers, etc.	22	22	-	-	
10.	Sensor wells, meters and other pipe-mounted control devices	23C	22	23C	23C	
11.	Test plugs	22	22			[20]
H. HVAC HYDRONIC SYSTEMS						
1.	Pipe gauges, thermometers, test plugs	23	23	-	-	
2.	Self-powered valves, refrigerant powered head pressure control valves, pressure relief valves, liquid level controllers, etc.	23	23	-	-	
3.	Relief valve vent piping, equipment drain piping, etc. from equipment to floor drains/sinks	23	23	-	-	
4.	Automatic isolation and control valves	23C	23	23C	23C	
5.	Sensor wells, meters and other pipe-mounted control devices	23C	23	23C	23C	
6.	Test plugs	23	23			[20]
I. HVAC SHEET METAL						
1.	Duct mounted sensors	23C	23	23C	23C	
2.	Filter gauges	23C	23C	-	-	
3.	Grease hoods (kitchen hoods)	23	23	26	23C	[21]
4.	Grease duct rated enclosures or fire wrap					
5.	Control dampers	23	23	23C	23C	[22]
6.	Control damper actuators	23C	23C	23C	23C	[22],[23]
J. LABORATORY HVAC SYSTEMS						
1.	Exhaust hood air valves, actuators and controls	23	23	23	23	[24]
2.	Supply air valves, actuators, and controls	23	23	23	23	[24]
3.	HW and CHW valves, actuators, and	23	23	23	23	[24]

INTERFACE/RESPONSIBILITY MATRIX						
	System	Division under which the following is specified				Remarks
		Equipment	Installation	Power Wiring [1]	Control & Interlock Wiring [1]	
	controls					
4.	Gateway/router to EMCS	23	23	23	23	[24]
5.	Supply air fan-coils with controls transformer	23	23	26	23	[24]
K. HVAC TERMINAL BOXES						
1.	Terminal box control transformer panel	23C	23C	23C	23C	[11]
2.	Terminal box with damper	23	23	-	-	
3.	Digital controller and damper actuator	23C	23	23C	23C	[25]
4.	Air-flow measurement pickup and piping	23	23	-	-	
5.	Air-flow measurement transducer and wiring	23C	23C	23C	23C	[25]
6.	Wall sensor module	23C	23C	23C	23C	
7.	Terminal fan, including contactors & control transformer	23	23	26	23	[26]
8.	Electric heating coil, including transformer, safeties & contactors	23	23	26	23	[26]
9.	HW control valve and actuator	23C	23	23C	23C	
L. MISCELLANEOUS						
1.	Trenching, backfilling, boring, soil compaction, saw-cutting, patching and paving for underground piping	31	31	-	-	
2.	Roofing, including cant strips and counterflashing at the sides of roof curbs	7	7	-	-	
3.	Thermal and acoustical insulation in and on partitions and ceilings	7	7	-	-	
4.	Window switches	23C	23C	-	23C	
5.	Louvers	23	8	-	-	
6.	Combination louver/damper	23	23	23C	23C	
7.	Concrete housekeeping pads, curbs, pedestals and inertia base fill etc. for equipment	3	3	-	-	[27]
8.	Equipment, ductwork, and piping steel supports and frames	23	23	-	-	
9.	Rooftop unit curbs	23	23	-	-	[28]
10.	Painting of exposed piping, HVAC equipment, etc.	23	23	-	-	
11.	Fire-stopping around pipe and duct penetrations in floor and walls	23	23	-	-	
12.	Framing of walls and ceilings to accept air outlets, fire dampers, etc.	9	9	-	-	[29]

INTERFACE/RESPONSIBILITY MATRIX						
System		Division under which the following is specified				Remarks
		Equipment	Installation	Power Wiring [1]	Control & Interlock Wiring [1]	
13.	Ceiling and wall access doors	23	8	-	-	[30]

NUMBERED REMARKS::

[1] Wiring includes raceway, fittings, wire, boxes and related items, all voltages

[2] Wiring of interlock of duct smoke detectors to shut off supply fans upon detection of smoke is specified under Section 23 09 00 Energy Management & Control System. All other smoke control/fire alarm related control wiring is specified under Division 26 Electrical.

[3] End switch required only for monitoring position of damper. See HVAC drawings and Division 23 smoke and fire damper specifications to see where required.

[4] Factory installed starters and variable speed drives are specified under Division 23 HVAC. Prewired control panel is specified under Division 23 HVAC, single point power connection (unless otherwise noted on drawings) specified by Division 23 HVAC. Packaged mechanical equipment specified with BACnet communication cards/gateways shall be provided by Division 23 HVAC. Packaged mechanical equipment vendor to provide all necessary technical assistance to Division 23C Contractor in mapping across equipment points to the EMCS.

[5] Applies to motors that are not covered by note 3. Integral starter control devices such as HOA switches, 120V control transformers and time delay relays (from high to low speed) for two speed motors specified under Division 26 Electrical.

[6] Single phase 120V motors with integral motor overload protection specified under Division 23 HVAC. Line voltage control device such as thermostat or switch specified under 23 09 00 Energy Management & Control Systems; wiring and conduit between control device and motor specified under Division 26 Electrical.

[7] Chilled and condenser water flow switches (where required by chiller manufacturer) specified under Division 23 HVAC; wiring and conduit specified under Section 23 09 00 Energy Management & Control System; bi-directional (read/write) BACnet communication card/gateway between the EMCS and chiller control panels specified with chiller under Division 23 HVAC; chiller vendor to provide all necessary technical assistance to Division 23C Contractor in mapping across chiller points to the EMCS

[8] BACnet communication card/gateway between the EMCS and boiler control panel specified with boiler under Division 23 HVAC; boiler vendor to provide all necessary technical assistance to Division 23C Contractor in mapping across boiler points to the EMCS

[9] Disconnects are specified under Division 23 HVAC where specifically called for in equipment schedules or specifications to be factory installed with equipment. Otherwise all disconnects are specified under Division 26 Electrical.

[10] Emergency override switches, status lights, and other refrigerant machinery room controls as required by ASHRAE Standard 15 and IMC is specified under Division 23 HVAC.

[11] Power to all EMCS control panels is specified under Section 23 09 00 Energy Management & Control Systems, coordinate with Division 26 contractor for available circuits.

[12] Line-voltage controlled circuit connections to and from lighting panel relays and 120V power are specified under Division 26 Electrical. Programming and time scheduling specified under Section 23 09 00 Energy Management & Control Systems.

[13] Interface device required in light control relay panels to accept low-voltage switch inputs are

INTERFACE/RESPONSIBILITY MATRIX					
System	Division under which the following is specified				Remarks
	Equipment	Installation	Power Wiring [1]	Control & Interlock Wiring [1]	
specified under Section 23 09 00 Energy Management & Control Systems. [14] Power measuring sensors, installation and wiring to a central controller with Modbus interface specified under Division 26 Electrical. Modbus gateway and network connection from gateway to EMCS specified under Section 23 09 00 Energy Management & Control Systems. Power monitoring control vendor to provide all necessary technical assistance to Section 23 09 00 Energy Management & Control Systems Contractor in mapping across power monitoring control points to the EMCS. [15] Generator monitoring sensors and central controller with Modbus gateway specified under Division 26 Electrical. Gateway and network connection from gateway to EMCS specified under Section 23 09 00 Energy Management & Control Systems. Generator vendor to provide all necessary technical assistance to Section 23 09 00 Energy Management & Control Systems Contractor in mapping across monitoring control points to the EMCS. Modbus connection point will be located in room XXXXX. [16] Generator with skid tank or day tank, including transfer pump and controls, is specified under Division 26 Electrical. Connecting alarms to the EMCS, including conduit and wire for controls, is specified under Section 23 09 00 Energy Management & Control Systems. Fuel supply system and all power connections for fuel pumps and panel controls are specified under Division 26 Electrical. [17] Coordinate piping from condensate pans to the sewer system including trap and final connections is specified under Division 22 Plumbing. Piping from auxiliary drain pans where provided at air handling equipment in furred spaces is specified under Division 23 HVAC. [18] Domestic make-up water, including shut-off valve, backflow prevention, rough-in and final connection to hot water, chilled water, condenser water and any other HVAC systems requiring make-up water is specified under Division 22 Plumbing. Pressure reducing valves with bypass valve and shut-off valves at each closed-system make-up water connection are specified under Division 23 HVAC. [19] Pressure reducing valves to deliver gas at the pressure required by mechanical equipment, including final connections and shut-off cock, is specified under Division 22 Plumbing. All other gas control and regulating devices provided under the Section providing the gas-fired equipment. Venting of gas regulating devices and other equipment gas-train devices where required is specified under Division 22 Plumbing. [20] Test plugs mounted adjacent to all temperature well (for calibration) specified under Division 23 [21] Hoods, including all fire protection devices (e.g. dampers at outlets), are specified under Division 23 HVAC. Duct connection to hood from collar on the exhaust fan specified under Division 23 HVAC. Decorative duct enclosures to hide exhaust duct from view where required is specified under Division 23 HVAC. All related control wiring, switches, etc. specified under Section 23 09 00 Energy Management & Control Systems. [22] Duct access doors required for access to control devices where required specified under Division 23 HVAC. [23] Actuators for motorized dampers supplied with fans or hood where scheduled on HVAC drawings are specified under Division 23 HVAC, mounted and wired.					

INTERFACE/RESPONSIBILITY MATRIX					
System	Division under which the following is specified				Remarks
	Equipment	Installation	Power Wiring [1]	Control & Interlock Wiring [1]	
[24] Laboratory controls including all temperature and airflow controls specified under Division 23 HVAC; BACnet router/gateway to EMCS specified under Division 23 HVAC; with network connection specified under Section 23 09 00 Energy Management & Control Systems. Laboratory control vendor shall provide all necessary technical assistance to Division 23C contractor in mapping laboratory control points to the EMCS. [25] Section 23 09 00 Energy Management & Control Systems contractor to coordinate with Division 23 HVAC contractor to have controller and actuator factory mounted. [26] Factory wired control transformer, safeties and contactors with single point power wiring connection specified under Division 23 HVAC. [27] Shop drawings showing dimensions of all curbs, bases, etc. specified under Division 23 HVAC. [28] Shims to level curb specified under Division 6. Curb insulation specified under Division 23 HVAC. All roof curbs shall be approved by roofing manufacturer. [29] Additional T-bar or spline and cut ceiling tile as required to accept air outlets is specified under Division 9. [30] Dimensioning of access doors to mechanical equipment and coordination with Professional and Division 8 specified under Division 23.					

D. HVAC/Electrical Design Coordination

1. The power ratings of motors and other HVAC equipment and the electrical characteristics of electrical systems serving them, as specified herein and indicated on the Drawings, have been established as minimums which will allow that equipment to satisfactorily function while producing the required capacities. These power ratings include a safety factor deemed appropriate to accommodate common differences between design parameters and field construction practices. Under no circumstances shall equipment with power ratings less than those indicated on the Drawings or specified herein be provided.

2. Reasonable efforts have been made to coordinate the electrical requirements of the HVAC equipment with the electrical systems serving that equipment. Differences among manufacturers of HVAC equipment make it impossible to produce a single electrical design which will satisfy the varying electrical requirements of those manufacturers. Consequently, the Contractor shall coordinate the electrical requirements of the HVAC equipment actually furnished on this Project and provide the electrical systems required by that equipment. This coordination effort shall be completed prior to the installation of either the HVAC equipment or the electrical systems serving that equipment. Electrical system revisions required to coordinate with the HVAC equipment actually furnished shall be provided at no additional cost to the Using Agency.

E. Related Work Specified Elsewhere

1. Utilities five feet beyond building line unless noted otherwise: See Division 33 Utilities

2. Structural steel (except as specified herein): See Division 5 Metals.
3. Grates and railings protecting mechanical shaft and other floor openings: see Division 5 Metals.
4. Miscellaneous lumber and framing work, such as for framing, soffits and support of mechanical materials and equipment. See Division 6 Wood, Plastics, and Composites.
5. Undercutting of doors and door louvers: See Division 8 Openings.
6. Painting (except as specifically indicated): See Division 9 Finishes
7. Fire resistant enclosures around ducts and at fire dampers such as at the bottoms of shafts. See Division 9 Finishes.
8. Electric power, interlock and control wiring, except as specified herein.
9. Installation of starters, contactors, thermal overload switches, and remote push buttons, except as specified herein.
10. Fire alarm initiating devices, control modules, and monitoring modules.
11. Curbs, flashing, and pitch pockets for equipment on roof, except as specified herein.
12. Manhole construction.
13. Louvers and screens, except as specified herein.
14. Concrete equipment pads.

1.3 REFERENCE STANDARDS

A. Reference to codes, standards, specifications and recommendation of technical societies, trade organizations and governmental agencies shall mean that latest edition of such publications adopted and published prior to submittal of the bid. Such codes or standards shall be considered a part of this Specification as though fully repeated herein.

B. Work shall be performed in accordance with all applicable requirements of the latest edition of all governing codes, rules and regulations including but not limited to the following minimum standards, whether statutory or not.

C. Requirements of Regulatory Agencies

1. In accordance with the requirement of Division 1 General Requirements.
2. Nothing in contract documents shall be construed to permit work not conforming to current and applicable laws, ordinances, rules and regulations.
3. Where contract documents exceed requirements of applicable laws, ordinances, rules and regulations, comply with documents establishing the more stringent requirement.
4. It is not the intent of contract documents to repeat requirements of codes except where necessary for completeness or clarity.
5. Comply with the Safety Orders issued by OSHA and any other safety, health or environmental regulations of the State of Mississippi and any districts having jurisdictional authority. Where an omission or conflict appears between OSHA requirements and the Drawings and Specifications, OSHA requirements shall take precedence.
6. Applicable codes as listed below, in addition to others specified in individual sections.

    a. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) – Standard 90.1-2010 “Energy Standard for Buildings Except Low-Rise Residential Buildings”.
    b. International Building Code (IPC) – 2012.
    c. International Mechanical Code (IMC) – 2012.
    d. International Plumbing Code (IPC) - 2012.
    e. NFPA 1 – 2012, Fire Code
    f. NFPA 70 - 2008, National Electric Code
    g. NFPA 90A - 2009, Installation of Air Conditioning and Ventilating Systems

D. Published specifications, standards, tests or recommended method of trade, industry or governmental organizations as listed below apply to all work in Division 23 HVAC, in addition to other standards which may be specified in individual sections.

E. All base material shall meet ASTM and ANSI standards.

F. All Gas Fired Devices: Comply with standards and bear label of AGA.

G. All Pressure Vessels, Relief Valves, Safety Relief Valves and Safety Valves: Comply with standards, ASME stamped.

H. All Electrical Devices and Wiring

a. Conform to standards of NEC
b. All devices UL or ETL listed and identified

I. Guidelines and Standards: The latest edition of guidelines and standards published by the following govern the Mechanical Systems and associated support system design. The systems shall be designed to meet or exceed these guidelines and standards.

AABC	Associated Air Balance Council
ADC	Air Diffuser Balance Council
AGA	American Gas Association
AMCA	Air Movement and Control Association, Inc.
ANSI	American National Standards Institute
ARI	Air Conditioning and Refrigeration Institute
ASC	Adhesive and Sealant Council
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASSE	American Society of Sanitary Engineers
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
AWS	American Welding Society
ETL	Interlek Semko (Formerly Electrical Testing Laboratories)
GISO	General Industry Safety Orders
HI	Hydraulic Institute
ICBO	International Conference of Building Officials
IEEE	Institute of Electrical and Electronic Engineers
NBS	National Bureau of Standards
NEBB	National Environmental Balancing Bureau
NEC	National Electric Code
NEMA	National Electrical Manufacturer’s Association
NFPA	National Fire Protection Association
OSHA	Occupational Safety and Health Act
PDI	Plumbing and Drainage Institute
SMACNA	Sheet Metal and Air Conditioning Contractors National Association, Inc.
UL	Underwriter’s Laboratories, Inc.

1.4 QUALITY ASSURANCE

A. Supply all equipment and accessories in compliance with the applicable standards listed in Paragraph 1.3C and with all applicable national, state and local codes.

B. All equipment and accessories shall be new and the product of a manufacturer regularly engaged in its manufacturer.

C. All items of a given type shall be the products of same manufacturer.

D. All work in Division 23 HVAC shall be commissioned. See Section 01 91 00 Commissioning and Section 23 08 00 Mechanical Commissioning.

E. Workmanship, material and equipment shall be in accordance with Specifications and Drawings and in some instances the requirements exceed those required by codes and standards. Where not exceeded, the codes and standards shall be considered as absolute minimum requirements.

1.5 SUBMITTALS

A. No work may begin on any segment of this Project until the related submittals have been reviewed for conformance with the design intent and the Contractor has responded to all comments to the satisfaction of the Using Agency.

B. Submit drawings, product data, samples and certificates of compliance required as hereinafter specified. See also Division 1 – Shop Drawings, Product Data and Samples. Conditions in this Section take precedence over conditions in above referenced Section.

C. Submit no later than 35-days after signing of Contract, or as otherwise indicated by Professional. Submit a schedule indicating the proposed submission date of each submittal specified herein. Schedule shall anticipate the submittal review time, the possible need for resubmittals, and the time required for fabrication, shipping and integration into the construction sequence. Professional will advise of any conflicts in reviewing submittals that the proposed schedule presents.

1. Complete schedule of submittals for equipment and layout shop drawings. Allow 15-working days for review, unless Professional agrees to accelerated schedule.
2. List of all proposed substitutions: See Paragraph 1.7
3. Designate in schedule dates for submission and dates that reviewed shop drawings, product data and samples will be needed.
4. Provide submittals promptly in accordance with schedule and in such sequence as to cause no delay in work or in work of any other division.

D. Submit drawings, product data, samples and certificates of compliance required hereinafter specified.

1. See also Division1 Shop Drawings, Product Data and Samples. Conditions in this Section take precedence over conditions in above referenced Section.
2. Provide submittals promptly in accordance with schedule and in such sequence as to cause no delay in work or in work of any other division.
3. Submittals for each specification section shall be submitted in a single package. However, it is not required (nor desired) for all products to be submitted concurrently. Rather, submittals may be staggered based on schedule and required equipment release dates.
4. Allow 15-working days for review, unless the Professional agrees to accelerated schedule.
5. For substitutions, list any features or characteristics that are not strictly in compliance with specifications. If none are listed with the submittal, Contractor is guaranteeing that substituted product is functionally equivalent to the specified product in accordance with Paragraph 1.7.

6. Submittal reviews by the Professional are intended to assist the Contractor in complying with the design intent and requirements of the drawings and specifications. Reviews do not relieve the Contractor from compliance with these requirements and comments or lack thereof do not constitute approval of changes in these requirements.

E. Submission and Resubmission Procedure

1. Each submittal shall have a unique serial number that includes the associated specification section followed by a number for each sub-part of the submittal for that specification section, such as “SUBMITTAL 23 xx xx-01”.
2. Each resubmittal shall have the original unique serial number plus revision number such as “SUBMITTAL 23 xx xx-01 REVISION 1”.
3. Submit in format specified below. Submissions made in wrong format will be returned without action.

    a. Product Submittals: One copy in word-searchable electronic format per Paragraph 1.7A.4.b. Submit each specification section in a separate file named with unique name and number described above.
    b. Shop Drawings:

        1) One copy in electronic format .dwg, .dwf, or .pdf
        2) Two and only two copies on paper; any additional copies will not be returned without review

    c. Samples: As indicated in each specification section.

4. Professional will return a memo or mark-up of submittal with comments and connections noted where required.
5. Make corrections

    a. Revise initial submittal to resolve review comments and corrections.
    b. Indicate any changes that have been made other than those requested.
    c. Clearly identify resubmittal by original submittal number and revision number.

6. Resubmit revised submittals until no exceptions are taken.
7. Once submittals are accepted and stamped with no exceptions taken, provide

    a. Complete submittal of all accepted products in a single electronic file for each specification section.
    b. Photocopies for coordination with other trades, if and as required by the Contractor or Professional. Photocopies will serve as submittal for record and coordination.

F. Product Data Submittals

1. Contents

    a. Manufacturer’s name and model number
    b. All information required to completely describe materials and equipment and to indicate compliance with drawings and specifications, including, but not limited to:

        1) Schedule when more than one of each item is covered by submittal
        2) Physical data, as applicable

            a) Dimensions

b) Weight
c) Finishes and colors
d) Dimensional shop drawings

3) Performance data, as applicable

a) Rated capacities
b) Performance curve
c) Operating temperature and pressure
d) Efficiency

4) Flow and wiring diagrams as applicable
5) Description of system operation

c. All other pertinent information requested in individual sections

2. Format

a. See Division 1 Shop Drawings, Product Data and Samples
b. Identify clearly if submittal is substitution: Refer to Paragraph 1.8
c. Reference specification Division, Section, Title, Paragraph and Page number or drawing number as applicable
d. Use same nomenclature, legend, symbols and abbreviations on submittal material as used in contract documents

G. Layout Shop Drawings

1. Drawings shall be developed in format compatible with AutoCAD version 2010 or later.
2. Shop fabrication, coordination and installation drawings by the Contractor, are for the Contractor's use and shall be the Contractor's responsibility. These Drawings indicate where the Contractor intends to install the material and equipment as required by the Contract Documents. Do not submit shop fabrication documents unless requested. Use of contract documents or electronic files of contract documents for shop drawings is not sufficient.
3. Prepare and submit Shop Drawings for all Work deviating from that indicated on Contract Drawings. Clearly indicate deviations.
4. Review is not intended to verify dimensions or quantities, or to coordinate items shown on these Drawings. Review is for general conformance with design concept of the Project and general compliance with the information given in the Contract Documents. Contractor is responsible for dimensions, which shall be confirmed and correlated at the Jobsite, for fabrication processes and techniques or construction, for coordination of Work with that of all other trades and the satisfactory performance of Work.
5. Prepare and submit layout drawings, sections and details for following areas, minimum 1/4 inch scale:

a. Mechanical equipment rooms

6. Prepare layout shop drawings for all areas; minimum 1/4 inch scale.
7. Layout drawings, as a requirement of Division 23 HVAC, shall indicate, superimposed, Work of all Sections involved in congested area, including ductwork, piping, electrical work, ceiling work, etc. Include all mechanical rooms. Identification of space problems without solutions is not acceptable.
8. Individual coordinated trade layout drawings are to be prepared for all deviations from design documents.
9. Contractor is to assure that each trade has coordinated work with other trades, prior to

submittal where submittal is required.

a. Include stamp on each submittal indicating that layout shop drawing has been coordinated:
b. No layout shop drawing will be reviewed without stamped and signed coordinated assurance by Contractor.

10. All changes shall be clearly marked on each submitted layout drawing.
11. Drawings shall show work of all trades including but not limited to:

a. Ductwork
b. Piping: All Trades, including Fire Sprinklers and electrical installations
c. Mechanical Equipment

1) For fire and smoke dampers, tag each damper with a unique tag, starting with the tag on the drawings but adding a 4 digit number: xyzz where

a) x= AC or AH unit that serves the damper
b) y= floor
c) zz= unique consecutive number

d. Electrical Equipment
e. Main Electrical conduits and bus ducts
f. Equipment supports and suspension devices
g. Structural and architectural constraints
h. Show location of

1) Valves: manual and automatic
2) Piping specialties
3) Dampers: fire/smoke, automatic and manual volume, etc.
4) Access doors
5) Control and electrical panels
6) Others as required for clear coordination

12. Drawings shall indicate coordination with work specified in other Divisions which must be coordinated with work specified under Division 23 Mechanical, including, but not limited to:

a. Irrigation equipment and piping
b. Elevator equipment
c. Building vacuum cleaning systems
d. Pneumatic tube systems
e. Cable trays
f. Computer equipment
g. Others as required

13. Submission of drawings

a. See Division 1 – Shop Drawings, Product Data and Samples
b. Submit to other trades for review of space allocated to all trades
c. Revise drawings to compensate for requirements of existing conditions and conditions created by other trades
d. Ensure that each trade has coordinated work with other trades
e. Submit with stamps of General and all other applicable Contractors, initialed and signed certifying

1) Review of submittal
2) Verification of products, field measurements and field construction criteria
3) Coordination of information in submittal with requirements of work of this Division and other divisions of Contract Documents

f. No layout shop drawing will be reviewed without stamped and signed coordination assurance by the Contractor

H. Samples

1. Submit as required in each specification section

1.6 COMPLETION REQUIREMENTS

A. Procedure

1. Until the documents required in this section are submitted and approved, the system will not be considered “accepted”
2. Before requesting acceptance of work, submit one set of Completion Documents for review and approval of Professional
3. After review, furnish quantity of sets indicated below to Using Agency
4. Format

a. See Paragraph 1.6H for required format of Completion Documents
b. Paper copies; assemble in chronological order following alpha-numeric system used in specification, in heavy three-ring binder
c. Where electronic copies are called for in Paragraph 1.5H, comply with the following:

1) Provide in word-searchable electronic format; acceptable formats are MS Word, Adobe Acrobat (pdf) and HTML; submit other formats for review and approval prior to submission; scanned paper documents not acceptable
2) For submittals, provide separate file for each type of equipment
3) For Test & Balance report, provide separate files for each air handling system
4) Record drawings shall be in original format

B. Operating and Maintenance (O&M) Manual

1. See O&M Manual requirement herein

C. Record Drawings

1. Keep up-to-date during progress of job one set of Mechanical Drawings indicating the Record installation. In addition to changes made during course of Work, show following by dimension from readily obtained base lines

a. Fully illustrate all revisions made by all crafts in course of work
b. Include all field changes, adjustments, variances, substitutions and deletions, including all Change Orders
c. Exact location, type and function of concealed valves, dampers, controllers, piping, air vents and piping drains
d. Exact size, invert elevations and location of underground and under floor piping and ducts

1) Progress drawing set shall be available for inspection by Professional weekly
2) Update engineering design drawings and shop drawings to reflect revisions and additional data listed above at completion of Project

e. Original engineering design drawings will be provided to Contactor in electronic format compatible with AutoCAD version 2010 or later
f. Both shop and engineering design drawings shall be in format compatible with AutoCAD version 2010 or later
g. Drawings required to be updated if revisions were made

1) Floor plans
2) Shop drawings required by Paragraph 1.5G
3) Sections
4) Riser diagrams

D. Test and Balance Reports

1. See Section 23 05 93 – Testing, Adjusting and Balancing

E. Commissioning Reports

1. See Section 23 08 00 – Mechanical Commissioning and 23 09 00 – Energy Management & Control Systems

F. Training Materials

1. See Training Materials requirements herein

G. Miscellaneous Certificates

1. Pressure and Leakage Test documentation/certificates
2. Training/Instruction completion certificates
3. Fire Marshal and Fire Department approvals of system, as required
4. Final inspection certificate signed by governing authorities
5. Warranty period, including start and end period
6. Field test report, including as applicable
7. Start up documents with date and name of technician
8. Piping pressure tests
9. Flex coupled pump alignment verification
10. Duct leakage and pressure tests
11. Drain pan drainage tests
12. Letters from manufacturers certifying their supervision of equipment installation and start-up procedures
13. Machinery vibration test reports
14. Certificates of sterilization/chlorination of plumbing systems
15. Others as specified herein and in other Division 23 – Mechanical sections

H. Format of Completion Documents

1. Provide the type and quantity of media listed in table below
2. Optical media shall be readable on Operator Workstation: See Section 23 09 00 – Energy Management & Control Systems
3. Where indicated in table, the electronic files shall be stored on the EMCS systems' Operator Workstation and hyperlinked to the front-end DDC controls graphics so operators can get the

details of a certain device or balance reports by clicking on the link: See Section 23 09 00 – Energy Management & Control Systems

	Document	Paper (Binder or bound)	Electronic	
			Read only optical disk	Loaded Onto Operator Workstation
1	O&M Manuals	3	1	1
2	Record Drawings	2 Full size 2 Half size	1	1
3	Original issue EMCS software & manuals	1	1	1
4	Control sequences	1	1	1
5	Test and Balance Report	5	1	-
6	Commissioning Reports	5	1	-
7	Miscellaneous Certificates	1	-	-
8	Warranty documents	1	-	-
9	Training materials	1 per trainee	1	1

1.7 SUBSTITUTIONS AND PRODUCT OPTIONS

A. Contractor's Options

1. For products specified only by reference standard, select product meeting that standard, by any manufacturer
2. For products specified by naming one product or manufacturer, submit request for substitutions for any product or manufacturer which is not specifically named in accordance with substitutions clause
3. Wherever catalog numbers and specific brands or trade names are used, they are used to establish standards of quality, utility and appearance required

1.8 DESCRIPTION OF BID DOCUMENTS

A. The Contractor shall be responsible for becoming thoroughly acquainted with all Contract Document contents that affect his work under this contract. Work required under this section includes, but is not limited to, all material, equipment transportation, services and labor required to complete the entire mechanical system as required by the Contract Documents.

B. The Specifications and the associated Drawings are complimentary and any portion of the work described in one shall be provided as if described in both.

C. Specifications

1. Specifications, in general, describe quality and character of materials and equipment.
2. Specifications are of simplified form and include incomplete sentences.
3. Words or phrases such as "The Contractor shall," "shall be," "furnish," "provide," "a," "an," "the," and "all" have often been omitted from specifications for brevity.

D. Drawings

1. Drawings are diagrammatic in nature and, unless explicitly dimensioned, indicate approximate locations of apparatus, equipment, ductwork and piping. Changes in the location, and offsets, of same which are not shown on the Drawings but are necessary in order to accommodate building conditions and coordination with the work of other trades, shall be made during the preparation of coordination drawings and prior to initial installation, without additional cost to the Using Agency. Contractor shall install all system components in such a manner as to conform to the structure, avoid obstructions, preserve headroom, keep openings and passageways clear and maintain required servicing clearances without further instructions or additional cost to the Using Agency.
2. Scaled and figured dimensions are approximate and are for estimating purposes only. Indicated dimensions are limiting dimensions where noted. Duct and piping elevations are indicated for initial coordination; final requirements shall be determined by the Contractor after final coordination with other trades.
3. Before proceeding with work, check and verify all dimensions in field.
4. Assume all responsibility for fitting of materials and equipment to other parts of equipment and structure.
5. Make adjustments that may be necessary or requested in order to resolve space problems, preserve headroom and avoid architectural openings, structural members and work of other trades.
6. It is intended that all mechanical, plumbing and fire protection devices, piping, etc. be located symmetrically with all architectural elements. Refer to Architectural, Structural, Plumbing, Fire Protection, Mechanical and Electrical Specifications and Drawings in completing the required coordination.
7. The Contractor shall fully inform himself regarding any and all peculiarities and limitations of the spaces available for the installation of all work and materials furnished and installed under this Contract. He shall exercise due and particular caution to determine that all parts of his work are made readily accessible.
8. The Contractor shall study all drawings and specifications to determine any conflict with all applicable ordinances and statutes. Any discrepancies shall be reported to the Using Agency and any changes shall be shown on the as-built drawings with the additional work performed at no cost to the Using Agency.
9. The submittal of his bid shall indicate the Contractor has examined the site, drawings and specifications and has included all required allowances in his bid. No allowance shall be made for any error or omission resulting from the Contractor's failure to visit job site and to review drawings and specifications. The Contractor's bid shall include costs for all required drawings and changes as outlined above at no cost to the Using Agency.
10. Provide access to equipment and apparatus requiring operation, service or maintenance throughout the life of the system.

E. Do not use equipment exceeding dimensions indicated on drawings or equipment or arrangements that reduce required clearances or exceed specified maximum dimensions.

F. If any part of Specifications or Drawings appears unclear or contradictory, apply to Professional for an interpretation and decision prior to as early as possible.

1 Do not proceed with work without the decision of the Professional.

1.9 ALTERNATES

A. Refer to Section 01900 – Alternates for possible effect on this Section.

1.10 DEFINITIONS

A. In addition to those defined in Division 1 Specification 01090 – Reference Standards, the following additional definitions shall apply. Definitions of term used in Division 23 HVAC may differ from those given in general and supplementary conditions and take precedence over them.

B. “Provide”: to furnish, supply, install and connect up complete and ready safe and regular operation of particular work referred to unless specifically noted.

C. “Supply”: to purchase, procure, acquire and deliver complete with related accessories.

D. “Work”: includes labor, materials, apparatus, controls, equipment services and all related accessories necessary for the proper and complete installation of complete systems.

E. “Piping”: includes pipe, tube, fittings, flanges, valves, controls, strainers, hangers, supports, unions, traps, drains, insulation and all related accessories.

F. “Wiring”: includes raceway, fittings, wire, boxes and all related accessories.

G. “Concealed”: not in view, installed in masonry or other construction, within furred spaces, double partitions, hung ceiling, trenches, crawl spaces, or enclosures.

H. “Exposed”: in view, not installed underground or “concealed” as defined above. Exposed piping, conduit, or ductwork is that which can be seen when the building is complete without opening or removing access doors or panels or accessible ceiling components.

I. “Control or Actuated Devices”: includes automatic sensing and switching devices such as thermostats, pressure, float, flow, electro-pneumatic switches and electrodes controlling operation of equipment.

J. “Indicated,” “shown” or “noted”: as indicated, shown or noted on drawings or specifications.

K. “Reviewed,” “approved,” or “directed”, as reviewed, approved or directed by or to Using Agency.

L. “Motor Controllers”: starter, variable speed drives and other devices controlling the operation of motors.

1.11 PROJECT CONDITIONS

A. Examine site related work and surfaces before starting work of any Section.

1 In case of conflict, the most stringent takes precedence.
2 For purposes of clarity and legibility, Drawings are essentially diagrammatic to extent that many offsets, bends, unions, special fittings, exact locations of items are not indicated, unless specifically dimensioned. Especially note a number of required duct and pipe offsets to coordinate with structure and not shown. Coordinate dimensioned conditions, including invert elevations, with other trades prior to installation by any trade.
3 Exact routing of piping, ductwork, etc. shall be governed by structural conditions and other obstructions. Not all offsets in ductwork or piping are shown on the Drawings. Determine which item to offset or relocate. Maintain required slope in piping. Make use of data in Contract Documents. In addition, Professional reserves right, at no additional cost to the Using Agency, to make any reasonable change in location of mechanical items, exposed at ceiling or on walls, to group them into orderly relationships or increase their utility. Verify Using Agency’s requirements in this regard prior to rough-in.

4 Take dimensions, location of doors, partitions, similar physical features from Architectural Drawings. Verify at Site under this Division. Consult Architectural Drawings for exact location of outlets to center with Architectural features, panels, etc., at the appropriate location shown on Mechanical Drawings.
5 Mounting heights of brackets, outlets, etc., as required.
6 Report to Professional, in writing, conditions which will prevent proper provision of this work.
7 Beginning work of any Section without reporting unsuitable conditions to Professional constitutes acceptance of conditions by Contractor.
8 Perform any required removal, repair or replacement of this work caused by unsuitable conditions at no additional cost to the Using Agency.

B. Coordination

1 Work out all “tight” conditions involving Work specified under this Division and work in other Divisions in advance of installation, if necessary, and before Work proceeds in these areas, prepare supplementary Drawings under this Division for review showing all Work in congested area. Provide supplementary Drawings, additional Work necessary to overcome congested conditions, at no additional cost to the Using Agency.
2 Conflicts: Difference or disputes concerning coordination, interference or extent of Work between sections shall be decided as follows:

a. Install mechanical and electrical systems in the following order of preference (those trades listed below another must reroute to resolve the conflict):

1) Drain piping required by code to be sloped
2) Supply air and exhaust air ductwork connected to fans
3) Electrical conduit 4 inches and larger
4) Hydronic piping connected to pumps
5) Domestic water piping
6) Fire sprinkler piping
7) Electrical conduit smaller than 4 inches
8) Transfer ducts and other ductwork not connected to fans
9) Control system piping and wiring

b. Continued disputes shall be decided by Contractor and Contractor’s decision, if consistent with Contract Document requirements, shall be final.

3 Supervision: Personally or through an authorized and competent representative, constantly supervise the work from beginning to completion and, within reason, keep the same foreman and workmen on the Project throughout the Project duration.
4 Provide templates, information and instructions to other Divisions to properly locate hides and openings to be cut or provided.
5 The drawings govern in matters of quantity, and the specifications govern in matters of quality. In the event of conflict within the drawings involving quantities, or within the specifications involving quantities, or within the specifications involving quality, the greater quantity and higher quality shall apply. Such discrepancies shall be noted and clarified in the Bid. No additional allowances will be made because of errors, ambiguities, or omissions that reasonably should have been discovered during the preparation of the Bid.

C. Equipment Rough-in

1 Rough-in locations shown on Mechanical Drawings for equipment furnished by the Using Agency and for equipment furnished under other Divisions are approximate only. Obtain exact rough-in locations from following sources.

a. From Shop Drawings for equipment provided under this contract
b. From Professional for Using Agency furnished-Contractor installed equipment
c. From existing equipment where such equipment is relocated under this Contract

2 Verify mechanical characteristics of equipment before starting rough-in. Where conflict exists between equipment and rough-in shown on Drawings obtain clarification from Professional and provide as directed by the Professional at no additional cost to the Using Agency.
3 Make final connections

1.12 CLEARANCE FROM ELECTRICAL EQUIPMENT

A. Piping, equipment or ductwork

1 Prohibited, except as noted in:

a. Electric rooms and closets over equipment, as restricted by NEC.
b. Telephone rooms and closets
c. Elevator machine rooms
d. Elevator shafts
e. Electrical switchboard room

2 Prohibited, except as noted, over or within 5 feet of:

a. Transformers
b. Substations
c. Switchboards
d. Motor control centers
e. Standby power plant
f. Bus ducts
g. Electrical panels
h. Variable frequency drives
i. Starters

B. Drip pans under piping

1 Where piping is located over any electrical equipment listed above; reroute piping if possible rather than use drip pan
2 28 gage galvanized steel
3 18 gage copper
4 Reinforced and supported
5 Watertight
6 With 1-1/4 inch drain outlet piped to floor drain or service sink

C. Electrical Working Space: Dimensions of the working space shall be a minimum depth of 42" horizontally, the width of the equipment or 30", whichever is greater, and the height of the equipment or 78", whichever is greater. Minimum depth shall be increased to 60" for equipment rated over 600 V.

1.13 PRODUCT DELIVERY, HANDLING AND STORAGE

A. See Division 1 Product Requirements

B. Deliver equipment in its original package to prevent damage or entrance of foreign matter. Provide materials on factory provided shipping skids and lifting lugs if required for handling. Provide protective coverings during construction.

C. Handle and ship in accordance with manufacturer's recommendations

D. Identify materials and equipment delivered to Site to permit check against approved materials list, reviewed with no exceptions taken Shop Drawings

E. Protect from loss or damage. Replace lost or damaged materials and equipment with new at no additional cost to Using Agency

F. Where necessary, ship in crated sections of size to permit passing through available space

1.14 PROJECT MANAGEMENT AND COORDINATION SERVICES

A. See Division 1 Project Coordination

B. Overview: Provide a project manager/engineer for the duration of the Project to coordinate the Division 23 HVAC work with all other trades. Coordination services, procedures and documentation responsibility shall include, but shall not be limited to the items listed in this section.

C. Review of shop drawings prepared by other subcontractors

1. Obtain copies of all shop drawings for equipment provided by others that require electrical service connections or interface with Division 23 HVAC work.
2. Perform a thorough review of the shop drawings to confirm compliance with the service requirements contained in the Division 23 HVAC contract documents. Document and discrepancy or deviation as follows:

    a. Prepare memo summarizing the discrepancy
    b. Provide a copy of the specific shop drawing, indicating via cloud, the discrepancy

3. Prepare and maintain a shop drawing review log indicating the following information

    a. Shop drawing number and brief description of the system/material
    b. Date of you review
    c. Indication if follow-up coordination is required

D. Request for information (RFI)

    a. See Division 1 Request for Information

1.15 REVIEW OF CONSTRUCTION

A. Work may be reviewed at any time by representatives of the Using Agency and/or Professional.

B. Advise Using Agency that work is ready for review at the following times

1. Prior to backfilling buried work.
2. Prior to concealment of work in walls and above ceilings.

3. When all requirements of Contract have been completed.
4. When testing will be performed.

C. Do not backfill or conceal work without Professional's consent.

D. Maintain on site, one set of Specifications and Drawings for use by Using Agency and/or Professional.

1. Include all change orders

E. Contactor is responsible for construction methods, sequences and safety precautions

1.16 SCHEDULE OF WORK

A. In accordance with Division 1 Contract Schedules and as follows:

1. Arrange work to conform to schedule of construction established or required to comply with Contract Documents
2. In scheduling, anticipate means of installing equipment through available openings in structure

B. Confirm in writing to Professional, within 35-days of signing of contract, anticipated number of days required to perform test, balance, acceptance testing and commissioning of mechanical systems. Schedule test balance and acceptance testing of mechanical systems as follows:

1. Submit for review at this time, names and qualifications of test and balancing agencies to be used
2. Test, Adjusting and Balancing and commissioning must occur after completion of mechanical systems, including all control calibration and adjustment, and requires substantial completion of the building, including closure, ceilings, lighting, partitioning, etc.
3. Allow 21-days after test and balance for system commissioning and life safety testing (where applicable)
4. Complete and test all systems early enough to enable completion of commissioning prior to Using Agency move-in.

1.17 CUTTING AND PATCHING

A. See Division 1 Cutting, Patching and Matching

1.18 UTILITY CONNECTIONS

A. Utilities include but are not limited to, water, sanitary sewer, storm sewer, natural gas, fire protection water, chilled water, heating water, steam, Energy Management and Control System, etc.

B. See Paragraph 1.2E.1

C. Connect to utility company mains as required. Include all meters and other ancillary components required by serving utility company.

D. Connect to on-site piping mains

E. Contractor shall be responsible for payment of all service charges

F. Contractor shall be responsible for provisions for temporary utilities

G. (Others as required)

1.19 WARRANTY

A. In accordance with Division 1 Guarantees, Warranties, Bonds, Service & Maintenance Contracts and as follows.

B. Warranty all materials, equipment, apparatus and workmanship to be free of defective materials and faulty workmanship for a period of one year from and after date of acceptance of completed contract.

C. Provide new materials, equipment, apparatus and labor to replace that determined by Professional to be defective or faulty.

D. This guarantee also applies to services including instructions, adjusting, testing, noise, balancing, etc.

E. Furnish Manufacturer's standard Warranties in excess of one year.

F. Refrigerant compressors to have an additional four year parts warranty.

G. Nothing herein intends or implies that guarantee shall apply to work which has been abused or neglected by the Using Agency or the Using Agency's successor in interest.

1.20 PERMITS

A. Obtain all permits, certificates of inspections, patent rights and licenses that are required for the performing of this work by all laws, ordinances, rules and regulations or orders of any officer and/or body. Provide all notices necessary in connection therewith, and pay all fees relating thereto and all costs and expenses incurred on account thereof. No work shall be covered before inspection by the jurisdiction authorities and observation by the Professional.

1.21 CONTINUITY OF EXISTING SERVICE AND SYSTEMS

A. Schedule work so existing systems will not be interrupted. Obtain approval from the Using Agency and Professional at least 14 days prior to any utility interruption or connection.

B. Perform work at such time and in such a manner as to cause minimum inconvenience to the Using Agency and as approved by the Professional. No allowance will be made for lack of knowledge of existing conditions.

C. Connections to existing work:

1 Install new work and connect to existing work with minimum interference to existing facilities.
2 Connect new work to existing work in neat and acceptable manner. Restore existing disturbed

work to original condition.

D. Removal and relocation of existing work.

1 Disconnect, remove or relocate piping, ductwork, conduit, and other work noted or required by alterations, modifications or changes in existing construction.
2 Plug or cap affected active lines behind or below finished walls and/or floors.
3 Dispose of removed piping and material.

E. Special Traffic Requirements:

1 Maintain emergency and service entrances so they are usable for pedestrian, truck and emergency vehicles at all times.
2 Where trenches are cut, provide adequate bridging for above-mentioned traffic.

1.22 PROVISION FOR FUTURE ADDITIONS

A. The design contemplates future additions. Provisions for these additions are indicated on the Drawings. All work conducted as part of this contract shall be completed with the future additions accounted for. Rework associated with system components installed in locations that will disrupt the future additions shall be performed at no cost to the Using Agency.

1.23 PROCEDURE OF WORK

A. Before any of the work within the scope of this contract is begun, the Contractor shall confer with the Professional and agree on a sequence of procedure for performing the work.

B. The Contractor is hereby cautioned that although he will be permitted to conduct his work during regular working hours (see exceptions below), his work shall be performed in such a manner so as not to interfere with the conduct of regular business unless approval for such interference has been obtained from the Using Agency and Professional. No reimbursement shall be made to the Contractor for losses sustained due to delays and interruptions of his work to accommodate the operation and business of the Using Agency.

C. Regular working hours exceptions: Extended utilities shutdowns and/or major equipment changeouts.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Listed “Acceptable Manufacturers” are those considered capable of manufacturing products or equipment conforming to detailed Specifications and Schedules, and as such, are invited to compete provided the offering is comparable in every respect to scheduled or specified products and actually conforms to the detailed Specifications and Schedule requirements. Listing herein as “Acceptable Manufacturers” does not imply “Accepted”, “Approved”, “Prior Approval” or any other connotation. All product offerings must be submitted for approval after Contract Award.

B. Alternate manufacturers as identified in each section will be considered under conditions specified in Paragraph 1.5 of this section.

C. Identify materials, equipment by manufacturer's name, nameplate data. Remove unidentified materials, equipment from Site.

D. Equipment specified by manufacturer's number shall include all accessories, controls, etc., listed in catalog as standard with equipment. Furnish optional or additional accessories as specified.

E. Where no specific make of material or equipment is mentioned, any first class product of reputable manufacturer may be used, provided it conforms to requirements of system and meets with acceptance.

F. Provide an authorized representative to constantly supervise work of this Division, check all materials prior to installation for conformance with Drawings, Specifications, reviewed Submittals and reviewed Shop Drawings.

G. Conform to conditions shown and specified. Coordinate with other trades for best possible assembly of combined Work. Relocate equipment when necessitated by failures to coordinate Work or to advise Professional of conflicts in writing.

H. Material and Equipment-General Requirements

1. New
2. Approved for use by State Fire Marshal and local building inspection department when applicable
3. Testing agency labeled or with other identification wherever standards have been established
4. Professional reserves right to reject items not in accordance with Specification either before or after installation
5. Comprised to render complete and operable systems; provide additional items needed to complete installation to realized design
6. Compatible with space allocated; modifications necessary to adjust items to space limitations at Contractor's expense
7. Installed fully operating and without objectionable noise or vibration
8. Design of mechanical systems is generally based on product of the first named manufacturers cited. Where systems for product installed necessitate modification of systems shown on drawings, Contractor is responsible for installation of systems appropriate to product installed.

I. Electrical Requirements

1. Electrical Work performed under Division 23 – Mechanical shall conform to requirements of Division 26 Electrical
2. Provide weatherproof devices and installation for out-of-doors work

2.2 PAINTING

A. Finish painting (other than factory applied) of mechanical equipment and associated piping and ductwork shall be as specified in Division 09 “Painting” Section(s). Provide touch up painting of prefinished mechanical products.

1 All equipment, ductwork, piping conduit and associated supports, attachments, hardware and connectors exposed to the weather shall be properly coated, painted or otherwise protected from corrosion caused by the elements (sun, wind, rain, snow, ice, etc.).

B. Surfaces shall be left clean, debris shall be removed, and equipment shall be furnished in prime coat finish ready for finish coats.

1 Piping, Ductwork and Equipment: Clean exterior of piping, ductwork and equipment removing rust, plaster and dirt by wire brushing. Remove grease, oil and similar materials by wiping with clean rags and suitable solvents.
2 Motors, Pumps and Other Items with Factory Finish: Remove grease and oil and leave surfaces clean and polished.

C. Cleaning operations may be supplemented by more detailed instructions in various other Sections of this Specification.

D. Paint for high temperature piping and equipment shall be high temperature resistant, designed for the temperatures at which the system will operate.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify that conditions are satisfactory for the installation of materials and equipment. Notify Professional if conditions are not satisfactory and do not commence work until conditions have been corrected.

3.2 INSTALLATION

A. Install materials and equipment in compliance with governing codes.

B. Use printed descriptions, specifications and recommendations of manufacturers as a guide for installation of Work. Follow in all cases where manufacturers' of articles used furnish directions covering points not specified or shown.

C. Equipment

1. See Division 1 – Supporting From Building Structure
2. Assemble equipment which is required to be field assembled under the direct supervision of the manufacturers' agent
3. Prior to the final acceptance submit letters from the manufacturers that equipment has been assembled under the direct supervision of the manufacturers' agent
4. Accurately set and level equipment with supports neatly placed and properly fastened
5. Properly fasten equipment in place with bolts to prevent movement
6. Coordinate the installation of equipment with openings in structure
7. Coordinate and fully dimension steel supports for mechanical equipment where shown on drawings with installing contractor
8. Provide all roof curbs for roof mounted fans, flues, piping and duct penetrations, etc.
9. Concrete

a. Concrete work, include forming, steel bar reinforcing, cast-in-place concrete, finishing and grouting is specified under Division 3 Concrete
b. Coordinate and fully dimension concrete housekeeping pads and curbs with installing

contractor; dimensions shall be as required for structural requirements, see Section 23 05 48 – Mechanical Sound and Vibration Control

c. Coordinate inertia base fill with installing contractor

D. Electrical

1. See Division 26 Electrical
2. Install electrical devices with code required clearances and access
3. Assist the electrical contractor in the proper connecting of all electrical wiring and equipment required for mechanical equipment

E. Sleeves, Chases and Concrete Inserts

1. Provide all required sleeves, chases, concrete inserts, anchor bolts, etc.
2. Sleeves, chases are prohibited in structural members, except where shown or as directed by Professional in writing
3. Embed no piping in concrete or masonry

F. Waterproof Construction

1. Comply with Division 7 – Thermal and Moisture Protection
2. Include membrane clamps, sheet metal flashing, counter flashing, caulking and sealant as required for waterproofing of mechanical penetrations and sealing penetrations in or through fire walls, floors, ceiling slabs and foundation walls
3. All penetrations through vapor barriers at slabs on grade shall be taped and made vapor tight
4. Provide galvanized sheet metal weather protection canopies, hoods or enclosures over all out-of-doors equipment, the operation or maintenance of which would be impaired by rain water; this requirement applies to damper operators and bearing, damper motors, controls and instruments; see other Sections in this Division for application of this requirement to motors, drive, ducts and fans

G. Restoration of Damage

1. Repair or replace, as directed by Professional, materials and parts of premises which become damaged
2. Remove replaced parts from premises at no additional cost to the Using Agency

H. Review architectural drawings and coordinate with Professional and other contractors to be sure that all architectural shafts, plenums, rated duct enclosures etc. required for mechanical systems are properly located and dimensioned.

I. Access Panels and Doors

1. Product specified under Section 23 05 00 – Basic Mechanical Materials and Methods

   a. Coordinate size requirements and exact location with Contractor who will install access doors
   b. Minimum Sizes: 18 inches by 18 inches unless otherwise shown on Drawings or approved by Professional

2. Provide where shown, or required by Regulatory Agencies, for access of all concealed equipment such as terminal units, valves, fire/smoke dampers, etc., for Mechanical Work:

a. Equipment shall be located wherever practical over accessible ceilings or rooms to avoid access doors
b. Access doors shall not be used solely for access to balancing dampers; use instead remote control devices specified under Section 23 33 00 – Duct Accessories

J. Openings

1. Coordinate and fully dimension all openings in walls, floors, roofs and structural elements required for mechanical work
2. Provide all required fire-stopping around pipe, duct and other penetrations required for mechanical work in rated partitions where required by code
3. Fire damper openings: Contractor shall provided damper UL installation requirements to contractor installing partitions to ensure construction complies with listing
4. Air outlet openings

a. Contractor shall coordinate exact locations of air outlets in floors, walls and ceilings with contractor installing partition
b. Contractor shall coordinate additional T-bar or spline required to accept air outlets with contractor providing and installing ceiling and associated materials

3.3 PROTECTION OF EQUIPMENT AND MATERIALS DURING CONSTRUCTION

A. See Division 1 – Product Requirements

B. Provide protective covers, skids, plugs or caps to protect equipment and materials from damage or deterioration during construction.

C. Store equipment and material under cover, and off the ground or floors exposed to rain.

D. For outdoor storage, protective covers of 10 mil thick black sheet plastic shall be fitted over equipment and materials. Covers shall be reinforced to withstand wind and precipitation. Set equipment and material on skids or platforms of height to avoid damage or deterioration from spattering and ground water.

E. Protect coils against damage by installing temporary closure panels over exposed coil faces. Panels shall be minimum 24 gauge sheet metal or 0.375" plywood.

F. Completely cover motors and other moving machinery to protect from dirt and water during construction

G. Close open ends of fans, air valves, terminal units, energy recovery units, air handling units, and ductwork with temporary closures of sheet plastic taped in place.

H. Plug ends of pipes when work is stopped to prevent debris from entering the pipes.

I. Provide dust and debris protection for ductwork, coils, fans, equipment, motors, and bearings operated during construction up to date of substantial completion.

J. Cover open ends of exhaust and return ducts with temporary filter media while fan systems are operating.

K. Material, equipment or apparatus damaged because of improper storage or protection will be rejected

1. Remove from site and provide new, duplicate, material, equipment or apparatus in replacement of that rejected
2. Any porous materials, such as duct liner, insulation or flexible ductwork that becomes wet; for example, due to rain shall be replaced; drying is not sufficient (due to possible microbial contamination)

L. Perform Work in manner precluding unnecessary fire hazard

3.4 ADJUSTMENT

A. Preliminary Operation

1. Operate any portion of installation for Using Agency's convenience if so requested by Professional. Such operation does not constitute acceptance of Work as complete but does constitute beneficial use, see Paragraph 1.19B. Cost of utilities, such as gas and electrical power, will be borne by the Using Agency if operation is requested by Using Agency.

B. Startup Service

1. Prior to startup, ensure that systems are ready, including checking the following: Proper equipment rotation, proper wiring, auxiliary connections, lubrications, venting fan balance, controls and installed and properly set relief and safety valves. See pre-function tests in Division 23 – Mechanical.
2. Start and operate all systems
3. Provide services of factory trained technicians for startup of major equipment and systems including boilers, chillers, fire pumps, etc.
4. Adjusting: See Section 23 05 93 – Testing, Adjusting and Balancing
5. Functional Testing: See Section 23 09 00 – Energy Management & Control Systems
6. Life Safety Testing

    a. Assist Division 26 Electrical contractor in testing fire alarm controls, including control of smoke dampers and shut-off of fan systems
    b. Correct any problems related to equipment supplied under Division 23 – Mechanical
    c. Complete the control matrix with details such as fan tags, FSD tags, etc. based on control matrix provided with Life Safety Report
    d. Assist Life Safety System commissioning agent in testing and commissioning Life Safety System
    e. Provide all tests, air balance and start-up personnel required to start and commissioning the system and for assisting the design/construct team in demonstrating system compliance with the local fire district and building department

C. Noise

1. Cooperate in reducing any objectionable noise or vibration caused by mechanical systems to the extent of adjustments to specified and installed equipment and appurtenances
2. Completely correct noise problems caused by failure to make installation in accordance with Contract Documents, including labor and materials required as a result of such failure, at no additional cost to the Using Agency

3.5 SPECIAL TOOLS

A. Furnish to Using Agency at completion of work

1. One set of any special tools required to operate, adjust, dismantle or repair equipment furnished under any section of this Division
2. Pressure gage and temperature sensor for piping test plug

3.6 CLEANING

A. Cleaning

1. See Division 1 – Closeout Procedures, Final Cleaning and Extra Material

B. Thoroughly clean equipment, fans, pumps, motors, piping and other materials under this Division free from all rust, scale and all other dirt before any covering or painting is done, or the systems put in operation; leave in condition satisfactory to Professional

C. At all times keep the premises free from accumulation of waste material and debris caused by his employees. At the completion of the Project, and at other times as Professional may direct, remove refuse from within and around the building. All tools, scaffolding and surplus materials shall also be removed, leaving the Site of his Work clean.

D. Completely cover all plumbing fixtures and all motors and other moving machinery to prevent entry of dirt and water during construction

E. Effectively cap all openings into ducts and pipes to keep moisture and foreign matter out during construction

F. Clean and polish identification plates

G. Clean equipment, ductwork, insulation, piping, conduit, and room surfaces from dust and dirt and maintain in a clean condition from date of substantial completion until final completion of work and corrective work.

3.7 PAINTING

A. Cleaning

1. See Division 1 – Closeout Procedures, Final Cleaning and Extra Material

B. Painting

1. Piping exposed to outdoors and where indicated elsewhere

a. One coat primer
b. Two coat alkyd oil paint, UV resistant for PVC piping, color as indicated
c. Not required for copper, galvanized steel, or insulated piping

2. Steel hangers and supports exposed to outdoors

a. One coat primer

b. Not required for galvanized steel

3. Interior of ductwork and duct accessories, including insulation stick pins, at air outlets as far back as visible from occupied spaces

a. Flat black

4. Marred surfaces of factory painted equipment

a. Spot coat to match adjacent coat

5. Insulation exposed to sunlight: See Section 23 07 00 – Mechanical Insulation

C. Execution

1. Protect flooring and equipment with drip cloths
2. Paint and materials stored in location where directed
3. Oily rags and waste removed from building every night
4. Wire brush and clean off all oil, dirt and grease areas to be painted before paint if applied
5. Workmanship

a. No painting or finishing shall be done with

1) Dust laden air
2) Unsuitable weather conditions
3) Space temperature below 60 degrees Fahrenheit

b. Pipes painted containing no heat and remain cold until paint is dried
c. Paint spread with uniform and proper film thickness showing no runs, sags, crawls or other defects
d. Finished surfaces shall be uniform in sheen, color and texture
e. All coats thoroughly dry before succeeding coats are applied, minimum 24 hours between coats
f. Priming undercoat of slightly different color for inspection purposes

6. Piping continuously painted in all exposed areas

D. Paint

1. High gloss medium or long alkyd paint
2. Best grade for its purpose
3. Deliver in original sealed containers
4. Apply in accordance with manufacturers instructions

E. Colors

1. Colors as directed by Professional unless specified herein.
2. Interior of ductwork as far back as visible from outside: flat black
3. Uncoated hangers, supports, rods and insets: dip in zinc chromate primer

F. Factory finish

1. Ceiling and wall mounted air outlets in acoustical tile ceilings: Baked white enamel

2. Aluminum air outlets that are not to be painted: anodized
3. Exposed fan coil units: baked enamel
4. Unit ventilators and unit heaters: baked enamel
5. Fans, pumps, compressors, tanks and like items
6. Air handlers, pumps, water heaters and like items where exposed

G. Marred surfaces of prime coated equipment and piping: spot prime coat to match adjacent coat

H. Properly prepare Work under this Division to be finish painted under Division 9 Painting

I. Provide moisture resistant paint for exterior painting and heat resisting paint for hot piping, equipment and materials

J. For the following, provide factory prime coat. Also, provide factory finish painting on each if not specified in Painting Division

1. Other air outlets

K. Paint all equipment out-of-doors and equipment supports with two coats of weather resistant enamel

L. Protect all finished surfaces of fixtures with heavy paper pasted thereon, or by other means, throughout the period of construction

M. Refinish Work supplied with final finish under this Division if damaged under this Division to satisfaction of Professional

3.8 FIELD QUALITY CONTROL

A. See Division 1 – Quality Control

B. Tests

1. Perform as specified in individual sections and as required by authorities having jurisdiction
2. Perform commissioning work

a. Perform pre-function tests as specified in Division 23 – Mechanical
b. Perform functional and post-occupancy tests. See Section 23 09 00 – Energy Management & Control Systems

3. Duration as noted

C. Provide required labor, material, equipment and connections
D. Furnish written report and certification that tests have been satisfactorily completed
E. Repair or replace defective work, as directed by Professional in writing, at no additional cost to the Using Agency
F. Restore or replace damaged work due to tests as directed by Professional in writing, at no additional cost to the Using Agency
G. Restore or replace damaged work of others, due to tests, as directed by Professional in writing, at no additional cost to the Using Agency
H. Remedial work shall be performed to the satisfaction of the Professional, at no additional cost to the Using Agency, including

1. Work related to all Division 23 – Mechanical pre-functional tests
2. Division 23 – Mechanical work related to Section 01 91 00 – Commissioning
3. Division 23 – Mechanical work related to Section 23 05 93 – Testing, Adjusting and Balancing
4. Division 23 – Mechanical work related to Section 23 08 00 – Mechanical Commissioning

I. Remedial work shall include performing any commissioning or other tests related to remedial work an additional time at no additional cost to the Using Agency

3.9 EXISTING EQUIPMENT AND SYSTEMS

A. Material and equipment which has been removed and not accepted by the Using Agency shall become the property of the Contractor and shall be removed from the site.

B. Material and equipment which has been removed shall not be used in the new work, except as specified herein.

C. Where existing piping, ductwork and equipment is indicated on the Drawings, its size and location shall be verified.

3.10 EQUIPMENT AND INSTALLATION REQUIREMENTS

A. Air systems shall operate without aerodynamic noise generated from the faulty installation of ductwork or any component of the air distribution system.

B. Equipment shall be installed and connected as specified herein or indicated on the Drawings in accordance with the manufacturers' instructions and recommendations for this Project. Furnish and install auxiliary piping, water seals, valves, and electrical connections recommended by the manufacturer for operation.

C. Provide roughing, fittings, accessories, and connecting piping, and make final connections to all equipment. Coordinate carefully with equipment vendor prior to starting rough-in work.

D. In unfinished areas designated for future build-out, install piping, ductwork, conduit and equipment tight against the structure to maximize future ceiling height.

E. Motor quantities, sizes and equipment wattage ratings specified herein or indicated on the Drawings are the minimum requirements, unless noted otherwise. Motor quantities, sizes and equipment wattage ratings less than those specified herein or indicated on the Drawings are not acceptable. Larger motor sizes and equipment wattage ratings may only be provided if necessary to meet the prescriptive requirements specified herein or indicated on the Drawings. Where multiple motors or motor sizes or equipment wattage ratings larger than specified herein or indicated on the Drawings are furnished, provide and coordinate the corresponding increased number or capacity of feeders and other electrical equipment serving them, at no additional cost to the Using Agency.

F. Fans, drive sheaves, motors, and pumps shall be statically and dynamically aligned and balanced. Each shall have steady state radial vibration levels which do not exceed the following:

Equipment	Peak-to-Peak Displacement (mils)
Fans, drive sheaves, and motors	
under 600 rpm	4

600 to 1000 rpm	3
1000 to 2000 rpm	2
over 2000 rpm	1
Pumps and motors	
over 1800 rpm	1
under 1800 rpm	2

G. Field-installed equipment controls or sensor wiring shall be installed in conduit. Low voltage control and sensor wiring shall be installed in conduits separate from line voltage control wiring and power wiring.

H. Where water connection sizes at equipment vary from the pipe size indicated on the Drawings, provide appropriate reducers/increasers directly adjacent to the pipe-equipment unions. Unless otherwise specified herein or indicated on the Drawings, the size of the valves and accessories dedicated to the equipment shall not be less than the pipe size to which they are connected.

I. Install all work so that parts requiring periodic inspection, operation, maintenance and repair are readily accessible and with the manufacturer's minimum required clearances provided. Minor deviations from the drawings may be made to accomplish this, but changes of substantial magnitude shall not be made without written approval.

1 Group concealed valves, controls and equipment requiring access, so as to be freely accessible through access doors.

3.11 EXCAVATION AND BACKFILLING

A. In accordance with the requirements of Division 31 for excavating, trenching, and backfilling.

B. Provide barricades, signs, lanterns, shoring, sheeting and pumping as part of Work in this Division as required to ensure safe conditions. Comply with OSHA requirements

C. Dig trenches straight, true to line and grade with sides and bottoms smoothed of any rock points

1 Excavate 6 inches below grade of pipe
2 Fill with sand properly packed
3 Support pipe for entire length on packed sand
4 Shape or pack bottom of trenches for pipe, duct fittings, hubs, couplings, etc., using templates to fit outside periphery of lower third of piping and ductwork
5 Provide piping outside building with 36-inch minimum cover from top of pipe to finished grade
6 Minimum width 16 inches

D. Dispose of all surplus excavation material and seepage water as directed by the Professional

E. Backfill

1 After piping has been installed, tested and approved, backfill all excavation, tamp and compact by compressed air tampers
2 Backfill to 6-inches above crown of pipe with unwashed sand, with remainder of trench back-filled and mechanically tamped in 6-inch maximum layers of selected excavated materials, free from organic matter, rocks, etc. Provide 90-percent compaction in accordance with ASTM D 1557-58T; 95-percent compaction for trenches below building slabs.

F. In any asphalt or concrete paved areas, backfill only to subgrade level

G. When piping is installed, prior to backfilling, advise Professional; do not backfill without acceptances of Professional

H. Replace to original condition all paving, curbs, gutters, walks, etc., which become disturbed by trenching

3.12 OPERATION AND MAINTENANCE MANUALS

A. These operation and maintenance manual requirements supplement operation and maintenance manual documentation requirements of other Sections of these specifications.

B. Operation and maintenance documentation, in hardback 3-ring loose-leaf binders except full size drawings and CDs, shall cover the HVAC and building automation systems. Documentation shall include an operations and maintenance documentation directory, emergency information, operating manual, maintenance manual, test reports, and construction documents.

C. Initial Submittal: The operation and maintenance documentation package shall be submitted as one comprehensive package to the Using Agency 1 month before systems start-up, and shall be updated, revised and completed at completion of construction.

D. Final Submittal: Provide four (4) complete manuals.

1. Correct or modify each manual to comply with Professional's comments. Submit Final manuals shall be submitted 15 working days prior to demonstration and training of Using Agency's personnel. Manuals are to be used in training sessions by Using Agency's personnel.

E. Compile and coordinate the documentation for equipment and systems installed. Unless otherwise indicated, organize each manual into a separate section for each system and subsystem and a separate section for each piece of equipment not part of a system. Documentation shall be typewritten and shall contain, at a minimum, the following information.

1. Introduction:

   a. Project name, contractors' and subcontractors' names, addresses, telephone numbers, email addresses and facsimile numbers. Indicate the portion of the work for which each subcontractor was responsible.
   b. List of Documents
   c. List of systems
   d. List of equipment
   e. Table of Contents.

2. Operations and Maintenance Documentation Directory:

   a. Explanation of the identification system used, including lists of systems, equipment, and component identifiers and names. Use the same system, subsystem and equipment designation as used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

3. Manual Organization: Unless otherwise indicated, organize each manual and into a separate

section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

a. Title page
b. Table of contents
c. Manual contents

4. Manual Title Page: Enclose title page in transparent plastic sleeve. Include the following information:

   a. Project name, contractors' and subcontractors' names, addresses, telephone numbers, email addresses and facsimile numbers. Indicate the portion of the work for which each subcontractor was responsible.
   b. Subject matter included in manual
   c. Name and address of Project
   d. Name and address of Using Agency
   e. Date of submittal
   f. Name, address, telephone number, fax number and email address of Contractor
   g. Name and address of Professional and other Professionals
   h. Cross-reference to related systems in other operation and maintenance manuals.

5. Manual Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume and cross-referenced to Specification Section number in Project Manual.

   a. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table for all volumes in each volume of the set.

6. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem and equipment. If possible, assemble instructions for subsystems, equipment and components of one system into a single binder.

   a. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2 x 11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

      1) If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
      2) Identify each binder on front and spine, with printed title “OPERATION AND MAINTNANCE MANUAL,” Project title or name, project number and subject matter contents. Indicate volume number for multiple-volume sets and six-digit Section number on bottom of spine.

   b. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the system on each divider, cross-referenced to Specification Section number and title of Project Manual.
   c. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
   d. Supplementary Text: Prepared on 8-1/2 x 11-inch, 20-lb/sq.ft. white bond paper.

e. Drawings: Attached reinforced, punched binder tabs on drawings and bind with text.

1) If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
2) If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual or reduced drawings. DO NOT USE BINDER POCKETS. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents and drawing locations.

f. Provide color photographs instead of drawings where necessary to demonstrate unusual or complex installations.

7. Emergency Information:

a. Information for technical and nontechnical personnel about actions recommended during emergency situations to protect life and property and to minimize disruption to the building occupants. Emergencies shall, at a minimum, include:

1) Fire.
2) Security breach.
3) Water outage.
4) Power failure.
5) Refrigerant release.
6) Heating failure.
7) Cooling failure.

3.13 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency
2. Emergency instructions
3. Emergency procedures

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment and component:

1. Fire
2. Flood
3. Gas leak
4. Water leak
5. Power failure
6. Water outage
7. System, subsystem or equipment failure
8. Chemical release or spill
9. Sub-freezing weather conditions

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages and similar codes and signals. Include responsibilities of Using Agency's operating personnel for notification of Installer, supplier and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following as applicable:

1. Instructions on stopping
2. Shutdown instructions for each type of emergency
3. Operating instructions for conditions outside normal operating limits
4. Required sequences for electric or electronic systems
5. Special operating instructions and procedures

3.14 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem and equipment descriptions
2. Performance and design criteria if Contractor is delegated design responsibility
3. Operating standards
4. Operating procedures
5. Operating logs
6. Wiring diagrams
7. Control diagrams
8. Piped system diagrams
9. Valve tag lists
10. Precautions against improper use
11. License requirements including inspection and renewal dates

B. Descriptions: Include the following:

1. Product name and model number
2. Manufacturer's name
3. Equipment identification with serial number of each component
4. Equipment function
5. Operating characteristics
6. Limiting conditions
7. Performance curves for pumps, fans and heat exchangers
8. Engineering data and tests
9. Complete nomenclature and number of replacement parts

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures
2. Equipment of system break-in procedures
3. Routine and normal operating instructions
4. Regulation and control procedures
5. Instructions on stopping
6. Normal shutdown instructions
7. Seasonal and weekend operating instructions
8. Required sequences for electric or electronic systems
9. Special operating instructions and procedures

D. Systems and Equipment Controls: Describe the sequence of operation and diagram controls as installed.

E. Piped Systems: Diagram piping as installed and identify color-coding where required for identification.

3.15 PRODUCT MAINTENANCE MANUAL

A. Content: Organize manual into a separate section for each product, material and finish. Include source information, product information, maintenance procedures, repair materials, warranty information and bond information as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address and telephone number of Installer or supplier and maintenance service agent. Cross-reference Specification Section number and title in Project Manual.

C. Product Information: Include the following as applicable:

1. Product name and model number
2. Manufacturer's name
3. Color, pattern and texture
4. Material and chemical composition
5. Reordering information for specialty manufactured products

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures
2. Types of cleaning agents to be used and methods of cleaning
3. List of cleaning agents and methods of cleaning detrimental to product
4. Schedule of routine cleaning and maintenance
5. Repair instructions

E. Repair Materials and Sources: Include list of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of executed warranties and bonds and lists of circumstances and conditions that would effect validity of warranties and bonds.

1. Include procedures to follow and required notifications for warranty claims.

3.16 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

A. Content: For each system, subsystem and piece of equipment not part of a system, include source information, product information, maintenance procedures, repair materials, warranty information and bond information as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address and telephone number of Installer or supplier and maintenance service agent. Cross-reference Specification Section number and title in Project Manual.

C. Manufacturer's Maintenance Documentation: Manufacturer's maintenance documentation including the following information for each component part or piece of equipment:

1. Standard printed maintenance instructions and bulletins
2. Drawings, diagrams and instructions required for maintenance including disassembly and component removal, replacement and assembly.

3. Identification and nomenclature of parts and components
4. List of items recommended to be stocked as spare parts

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions
2. Troubleshooting guide
3. Precautions against improper maintenance
4. Disassembly: component removal, repair and replacement and reassembly Instructions
5. Aligning, adjusting and checking instructions
6. Manufacturer's demonstration and training videotape or DVD, if available.

E. Maintenance and Service Schedule: Include service and lubrication requirements, list of required lubricants for equipment and separate schedules for preventative and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual and annual frequencies
2. Maintenance and Service Record: Include manufacturer's forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturer's maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of executed warranties and bonds and lists of circumstances and conditions that would effect validity of warranties and bonds.

1. Include procedures to follow and required notifications for warranty claims.

NOTE: Where manuals contain manufacturer's standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data includes more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

3.17 TEST REPORTS AND CERTIFICATIONS

A. Provide copies of tests and certifications performed during manufacture and construction, including but not limited to the following:

1. Results of variable frequency drive burn-in tests.
2. Certification of installation of vibration isolation.
3. Receipt for spare fuses.
4. Receipt for instruction of operating personnel.
5. Certification of installation of underground steam system.
6. Certification of installation of underground chilled water system.
7. Certification of hydronic and steam system cleaning.
8. Certification of chiller installation and safety and control check-out.
9. Receipt for extra mechanical seals for pumps.
10. Certification of alignment of pumps.

11. Certification of EMCS system calibration and testing.
12. Receipt for EMCS system training.
13. Receipt acknowledging no EMCS system failures during test period.
14. Certification of ductwork testing results.
15. Seasonal adjustment reports.
16. Warranty certificates
17. Inspection certificates
18. Test, adjust and balance report
19. Commissioning report

3.18 DIAGRAMS

A. Frame and mount the following information:

Information	Location
HVAC diagrams, start-stop procedures, and valve schedules.	Appropriate mechanical rooms.
Energy Management control diagrams and sequences.	Adjacent to each control panel.
Appropriate control and interface drawings, including a simplified guide to local programming through the digital display unit, a directory of I/O points connected to that panel, and variables which may be displayed.	Posted on the inside cover of each EMCS panel.

B. Diagrams shall be computer generated.

C. Diagrams shall be as-built, and shall include interfaces and interlocks with other equipment.

D. Diagram framing system: 0.125" thick acrylic with satin finish aluminum frames.

3.19 MAINTENANCE

A. Equipment operated prior to the date of substantial completion shall be maintained in accordance with manufacturer's recommendations. In addition, provide complete water treatment for hydronic and steam systems operated prior to date of substantial completion.

B. Prepare and submit a lubrication chart listing for each piece of equipment:

1. Points requiring lubrication.
2. Recommendations for a single manufacturer's lubricants with brand name and designation.
3. Frequency of lubrication required.

C. Lubricate each item of apparatus requiring lubrication prior to start-up in accordance with the manufacturer's recommendations.

3.20 DEMONSTRATION AND TRAINING FOR MECHANCIAL SYSTEMS AND EQUIPMENT

A. Submittals

1. Instruction Program: Submit to the Professional copies of instructional program outline for demonstration and training, including a schedule of proposed dates, times, length of instruction and instructors' names for each training module. Include learning objective and outline for each training.

    a. At completion of training, submit two (2) complete training manuals for Using Agency's use.

2. Qualification Data: Include lists of completed projects with project names and addresses, names and addresses of Professionals and Using Agency and other information specified.
3. Attendance Record: For each training module, submit list of participants and length of instruction time.
4. Evaluations: For each participant and each training module, submit results and documentation of performance-based test.
5. Demonstration and Training DVD's: Submit two copies of each DVD within seven (7) days of recording.

    a. Format: Provide high quality color DVDs
    b. Identification: On each DVD, provide an applied label with the following information:

        1) Name of project
        2) Name and address of photographer
        3) Name of Engineer
        4) Name of Contractor
        5) Date DVD was recorded
        6) Description of vantage point, indicating location, direction (by compass point) and elevation or construction story

    c. Transcript: Prepared on 8-1/2 x 11" (A4) paper, punched and bound in heavy-duty, 3-ring, vinyl-covered binders. Mark appropriate identification on front and spine of each binder. Include a cover sheet with the same label information as the corresponding DVD. Include name of Project and date of DVD on each page.

B. Quality Assurance

1. Instructor Qualifications: A factory-authorized service representative experienced in operation and maintenance procedures and training.
2. Photographer Qualifications: An individual of established reputation who has been regularly engaged as a professional video photographer for not less than five years.
3. Pre-instruction Conference: Review methods and procedures related to demonstration and training including, but not limited to the following:

    a. Inspect and discuss locations and other facilities required for instruction.
    b. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment and facilities needed to avoid delays.
    c. Review required content of instruction.
    d. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

C. Coordination

1. Coordinate instruction schedule with Using Agency's operations. Adjust schedule as required to minimize disrupting Using Agency's operations.

2. Coordinate instructors, including providing notification of dates, times, length of instruction and course content.
3. Coordinate content of training modules with content of approved emergency, operation and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Professional.

D. Instruction Program

1. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections and as follows:

    a. Heat generation including boiler, pumps and heating water distribution piping.
    b. Gas-fired heating equipment.
    c. Refrigeration system including chillers, pumps, ice storage tanks and chilled water piping.
    d. HVAC system including air-handling equipment, unit heaters, power ventilators, heat exchangers, piping specialties, etc.
    e. Building Automation System
    f. All control end-devices and sensors
    g. Variable Frequency Drives

2. Training Modules (Basis of System Design, Operational Requirements and Criteria): Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participants are expected to master. For each module, include instruction for the following (this will be provided through the Professional):

    a. System, subsystem and equipment descriptions
    b. Performance and design criteria
    c. Operating standards
    d. Regulatory requirements
    e. Equipment function
    f. Operating characteristics
    g. Limiting conditions
    h. Performance curves

3. Training Modules (Documentation): Review the following items in detail:

    a. Emergency manuals
    b. Operations manuals
    c. Maintenance manuals
    d. Project record documents
    e. Submittal manual
    f. Identification systems
    g. Warranties and bonds
    h. Maintenance service agreements and similar continuing commitments

4. Emergencies: Include the following as applicable:

    a. Instructions on meaning of warnings, trouble indications and error messages
    b. Instructions on stopping
    c. Shutdown instructions for each type of emergency
    d. Operating instructions for conditions outside of normal operating limits
    e. Sequences for electric or electronic systems
    f. Special operating instructions and procedures

5. Operations: Include the following as applicable:

    a. Startup procedures
    b. Equipment or system break-in procedures
    c. Routine and normal operating instructions
    d. Regulation and control procedures
    e. Control Sequences
    f. Safety procedures
    g. Instructions on stopping
    h. Normal shutdown instructions
    i. Operating procedures for emergencies
    j. Operating procedures for system, subsystem or equipment failure
    k. Seasonal and weekend operating instructions
    l. Required sequences for electric or electronic systems
    m. Special operating instructions and procedures

6. Adjustments: Include the following:

    a. Alignments
    b. Checking adjustments
    c. Noise and vibration adjustments
    d. Economy and efficiency adjustments

7. Troubleshooting: Include the following:

    a. Diagnostic instructions
    b. Test and inspection procedures

8. Maintenance: Include the following:

    a. Inspection procedures
    b. Types of cleaning agents to be used and methods of cleaning
    c. List of cleaning agents and methods of cleaning detrimental to product
    d. Procedures for routine cleaning
    e. Procedures for preventative maintenance
    f. Procedures for routine maintenance
    g. Instructions on use of special tools

9. Repairs: Include the following:

    a. Diagnosis instructions
    b. Repair instructions
    c. Disassembly: component removal, repair and replacement and reassembly instructions
    d. Instructions for identifying parts and components
    e. Review of spare parts needed for operation and maintenance

E. Instruction

1. Facilitator: The Professional will serve as facilitator to assist the Contractor in preparation of instruction program and training modules, to coordinate instructors and to coordinate between Contractor and Using Agency for number of participants, instruction times and location.

2. Engage qualified instructors to instruct Using Agency's personnel to adjust, operate and

maintain systems, subsystems and equipment not part of a system.

a. Professional will furnish an instructor to describe basis of system design, operational requirements, criteria and regulatory requirements.
b. Using Agency will furnish an instructor to describe Using Agency's operational philosophy.
c. Using Agency will furnish Contractor with names and positions of participants.

3. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

a. Schedule training with Using Agency, through Professional, with at least forty-five (45) days advance notice.

4. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a written performance-based test.

5. Demonstration and Training DVD: Record each training module separately. Include classroom instructions and demonstrations, board diagrams and other visual aids, but not student practice.

a. At beginning of each training module, record each chart containing learning objective and lesson outline.

6. Cleanup: Collect used and leftover educational materials and give to Using Agency. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

F. Demonstration and Training DVDs

1. Demonstration and Training DVDs: Record instruction of Using Agency's personnel in the operation and maintenance of equipment and systems. Edit DVDs to remove non-instructional conversation. Photographer shall select vantage points to best show equipment, systems and procedures demonstrated.

END OF SECTION 23 00 10

SECTION 23 05 00 BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. These mechanical provisions specified herein apply to all Sections of Division 22 and Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.2 SUMMARY

A. This Section includes the following basic mechanical materials and methods to complement other Division 23.

1. Temporary operation of mechanical equipment
2. Piping materials and installation instructions common to most piping systems
3. Concrete base construction requirements
4. Sleeves
5. Escutcheons
6. Dielectric fittings
7. Flexible connectors
8. Mechanical sleeve seals
9. Wall and ceiling access panels
10. Nonshrink grout for equipment installations
11. Field-fabricated metal equipment supports
12. Prefabricated roof curbs and equipment supports
13. Installation requirements common to equipment specification sections
14. Cutting and drilling
15. Touchup painting and finishing

B. Pipe and pipe fitting materials are specified in Division 23 piping system Sections.

1.3 DEFINITIONS

A. Refer to Section 23 00 10 – Mechanical General Provisions

B. The following are industry abbreviations for plastic materials:

1. PE: Polyethylene plastic
2. PVC: Polyvinyl chloride plastic

C. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber

1.4 SUBMITTALS

A. See Section 23 00 10 – Mechanical General Provisions

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. "R" means required.
2. "R2" means required only for products and equipment differing for the specified manufacturer and model and for "or equals" where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Sleeves	R			
Escutcheons	R			
Dielectric fitting	R			
Flexible connectors	R			R
Mechanical sleeve seals	R	R		R
Access panels	R			R
Prefabricated roof curbs and equipment supports	R			R

1.5 QUALITY ASSURANCE

A. Equipment Selection: Equipment of higher electrical characteristics, physical dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. Additional costs shall be paid by this Contractor for these increases. If minimum energy ratings or efficiencies of equipment are specified, equipment must meet design and commissioning requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt, debris, and moisture.

B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.

C. Protect flanges, fittings, and piping specialties from moisture and dirt. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 SEQUENCING AND SCHEDULING

A. Coordinate mechanical equipment installation with other building components.

B. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.

C. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.

D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning before closing in building.

E. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

F. Coordinate requirements for access panels and doors if mechanical items requiring access are concealed behind finished surfaces.

G. Coordinate installation of identifying devices after completing covering and painting, if devices are applied to surfaces. Install identifying devices before installing acoustical ceilings and similar concealment.

1.8 TEMPORARY OPERATION OF MECHANICAL EQUIPMENT

A. The Contractor shall notify the Professional in writing fourteen (14) days in advance to request temporary operation of the building HVAC systems.

B. The Professional will schedule a site-visit to observe the site conditions to ensure all the items described below have been met prior to temporary operation.

C. The Contractor shall submit in writing an operation and maintenance plan for temporary use of the building HVAC systems. At a minimum the O&M plan shall address:

1. Equipment, system, and filter maintenance
2. Temporary filter installation locations
3. Daily, weekly, monthly, etc. cleaning procedures to ensure indoor cleanliness.
4. Describe in detail how the system will be controlled and indoor conditions monitored. Procedures for shutting down equipment or isolation of areas where dust, dirt, or particulate producing activities occur.

D. At a minimum the following building components and activities shall be completed prior to operation of the building HVAC systems

1. Dust or particulate generating construction activities completed.
2. All dirt, dust, and debris have been removed from the Mechanical Room.
3. Piping insulation is fully completed and all seams, openings, etc. have been sealed.
4. All HVAC system equipment utilized for temporary heating and cooling shall have been started up per specifications. All startup and warranty information (including checklists) shall be completed and submitted to the Professional.
5. All temporary air filters in place of types and installed in locations specified in 23 40 00 Air Cleaning Devices. All return air distribution devices and openings shall be covered and protected with filter material specified in 23 40 00 Air Cleaning Devices. All temporary filters shall be continually monitored and replaced periodically when required.

E. Upon completion of the Professional's site visit, review of site conditions and temporary operation plan, the Professional reserves the right to refuse temporary startup and operation if site conditions and plan do not meet specifications. No additional time will be given to the Contractor due to unapproved startup and temporary operation conditions.

F. The building indoor environmental conditions shall be continuously maintained within the following limits:

1. Maximum indoor temperature: 85 ˚F dry bulb
2. Minimum indoor temperature: 60 ˚F dry bulb
3. Maximum indoor relative humidity: 80% RH

G. Temperature and humidity dataloggers shall be installed throughout the facility to record indoor condition data. Datalogger quantity and locations shall be approved by Professional. Data from dataloggers shall be submitted to the Professional every two weeks for review. Data shall be submitted in .csv format or other format agreed upon by Professional.

H. Contractor shall have either spedified or temporary controls in place and fully operational to maintain the specified indoor environmental conditions above. Contractor shall provide all required temporary building services for temporary operation at no additional cost to the Using Agency.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Dielectric Flanges:

   a. Capitol Manufacturing Co.
   b. Central Plastics Co.
   c. Epco Sales Inc.
   d. Watts Industries, Inc.; Water Products Div.

2. Dielectric-Flange Insulating Kits:

   a. Calpico, Inc.
   b. Central Plastics Co.
   c. Or equal

3. Dielectric Couplings:

   a. Calpico, Inc.
   b. Or equal

4. Dielectric Nipples:

   a. Grinnell Corp.; Grinnell Supply Sales Co.
   b. Perfection Corp.

c. Victaulic Co. of America

5. Mechanical Sleeve Seals:

a. Calpico, Inc.
b. Metraflex Co.
c. Thunderline/Link-Seal

6. Access Panels:

a. Williams Brothers
b. Acudor
c. J.R. Smith
d. Or Equal

7. Prefabricated Roof Curbs and Equipment Supports:

a. Custom Curb, Inc.
b. Thybar
c. Or Equal

2.2 PIPE AND PIPE FITTINGS

A. Refer to individual Division 23 piping Sections for pipe and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 23 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness, unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

E. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

F. Solder Filler Metals: ASTM B 32.

1. Alloy Sn95 or Alloy Sn94: Approximately 95 percent tin and 5 percent silver, with 0.10 percent lead content.
2. Alloy E: Approximately 95 percent tin and 5 percent copper, with 0.10 percent maximum lead content.
3. Alloy HA: Tin-antimony-silver-copper zinc, with 0.10 percent maximum lead content.
4. Alloy HB: Tin-antimony-silver-copper nickel, with 0.10 percent maximum lead content.

G. Brazing Filler Metals: AWS A5.8.

1. BCuP Series: Copper-phosphorus alloys.
2. BAg1: Silver alloy.

H. Solvent Cements

1. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

I. Plastic Pipe Seals: ASTM F 477, elastomeric gasket

J. Flanged, Ductile-Iron Pipe Gasket, Bolts, and Nuts: AWWA C110, rubber gasket, carbon-steel bolts and nuts.

K. Couplings: Iron-body sleeve assembly, fabricated to match OD of plain-end, pressure pipes.

1. Sleeve: ASTM A 126, Class B, gray iron.
2. Followers: ASTM A 47 (ASTM A 47M) malleable iron or ASTM A 536 ductile iron.
3. Gaskets: Rubber.
4. Bolts and Nuts: AWWA C111.
5. Finish: Enamel paint.

2.4 DIELECTRIC FITTINGS

A. General: Assembly or fitting with insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.

B. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld-neck end types and matching piping system materials.

C. Insulating Material: Suitable for system fluid, pressure, and temperature.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

E. Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig minmum working pressure as required to suit system pressures.

F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 °F.

G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain or threaded ends; and 300-psig minimum working pressure at 225 °F.

2.5 FLEXIBLE CONNECTORS

A. General: Fabricated from materials suitable for system fluid and that will provide flexible pipe connections. Include 125-psig minimum working-pressure rating, unless higher working pressure is indicated, and ends according to the following:

B. Bronze-Hose, Flexible Connectors: Corrugated, bronze, inner tubing covered with bronze wire braid. Include copper-tube ends or bronze flanged ends, braze welded to hose.

C. Stainless-Steel-Hose/Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include steel nipples or flanges, welded to hose.

D. Rubber, Flexible Connectors: CR or EPDM elastomer rubber construction, with multiple plies of NP fabric, molded and cured in hydraulic presses. Include 125-psig minimum working-pressure rating at 220 °F. Units may be straight or elbow type, unless otherwise indicated.

2.6 MECHANICAL SLEEVE SEALS

A. Description: Modular design, with interlocking rubber links shaped to continuously fill annular space between pipe and sleeve. Include connecting bolts and pressure plates.

1. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Stainless steel. Include two for each sealing element.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.7 PIPING SPECIALTIES

A. Sleeves: Sleeves shall be standard weight steel pipe except sleeves for concealed piping through floors not in structural members, and through interior drywall construction may be formed from 24 gauge galvanized sheet metal lapped and pop riveted.

1. Sleeves through grade slabs, basement or exterior wall shall be steel or cast iron pipe with water stop flange, set flush with finished surfaces and an expansion seal (see Mechanical Sleeve Seal herein.)
2. Sleeves in wet or potentially wet floors, exterior walls or spaces such as mechanical equipment rooms or sprinklered areas other than those requiring fire stopping, shall be Schedule 40 galvanized steel pipe with water stop flange and with the top of the sleeve projecting 2-inches above the finished floor or beyond the inside wall surface and expansion seal installed.

B. Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type if required to conceal protruding fittings and sleeves.

1. ID: Closely fit around pipe, tube, and insulation of insulated piping
2. Completely cover opening
3. Cast Brass: One piece, with set screw.

    a. Finish: Polished chrome-plate.

4. Cast Brass: Split casting, with concealed hinge and set screw.

    a. Finish: Polished chrome-plate.

5. Cast-Iron Floor Plate: One-piece casting.

2.8 GROUT

A. Nonshrink, Nonmetallic Grout: ASTM C 1107, Grade B

1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psig, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.9 ACCESS PANELS

A. Access panels shall be provided for all concealed valves, controls, dampers, and other mechanical equipment and devices where occasional access for adjustment or repairs will be necessary. Panels shall have cam and cylinder lock with two keys. All locks shall be keyed alike. Label panels as in accordance with Section 23 05 53 – Mechanical System Identification.

B. Size of panels to be large enough to permit servicing or replacement of devices, controls, valves, etc.; minimum size to be 18"x18". Submit schedule with submittal package indicating location and size.

C. General:

1. Fabricate units of all welded steel construction.
2. The frame and panel assembly for fire rated access panels shall be manufactured under the Factory Inspection Service of Underwriters Laboratories, Inc., and shall bear a label reading: "Frame and Fire Door Assembly, Rating 1-1/2 Hr. (B), Temperature Rise 30 Minutes, 250ºF, Maximum".
3. Access panels used in toilets, kitchens, and other areas expected to experience high relative humidity are to be constructed of stainless steel.

D. Flush Panel Access Panels: Model WB-GP.

1. Frame and door shall be of one piece unit body construction and 14 gauge steel. Body shall be 18 gauge steel with a return edge around door opening.
2. Flange shall be 1-3/4” wide.
3. Hinges shall be concealed, piano type, opening to 175 degrees. Number of hinges will vary with size of door.

4. Locks shall be flush, key operated cylinder lock. Number of locks will vary with size of door.
5. Finishes shall be factory applied with a rust inhibiting phosphated undercoat; finish to be chemically bonded oven baked white enamel.
6. For installation in masonry openings, units shall be furnished with flexible metal anchor straps welded to the body.

E. Flush Access Panel for Drywall or Plaster: Model WB-DW and WB-PL:

1. Body and flange shall be 16 gauge steel. Door shall be 14 gauge steel.
2. Hinges shall be concealed, piano type, opening to 175 degrees. Number of hinges will vary with size of door.
3. Locks shall be flush, key operated cylinder lock. Number of locks will vary with size of door.
4. Finish shall be factory applied oven baked grey enamel with rust inhibiting phosphated undercoat.
5. Plaster models shall have 2-1/2” of 24 gauge galvanized expanded wing casting surrounding door.
6. Drywall models shall have a 1-1/8” perforated drywall bead on all four sides.

F. Fire Rated “B” Label Access Panel: Model WB-FR

1. Frame and door shall be of one piece unit body construction and 14 gauge steel. Door shall be sandwich type filled with 2" thick thermafiber felt insulation and back enclosure of 22 gauge steel. Body shall be 16 gauge steel.
2. Flange shall be 1-3/4” wide.
3. Hinge shall be continuous steel piano type mounted on long side of doors, opening to 180 degrees and equipped with a spring mechanism for automatic closure.
4. Lock assembly shall be self-latching with key operated cylinder lock and shall have a mechanism to release the latch bolt from the inside.
5. Finish shall be factory applied oven baked grey enamel with rust inhibiting phosphated undercoat.
6. For installation in masonry openings, units may be furnished with flexible metal anchor straps welded to the body.

2.10 PREFABRICATED ROOF CURBS AND EQUIPMENT SUPPORTS

A. Contractor shall provide all curbs, adaptor curbs and supports required for pipe penetrations of roof and equipment installation; the General Contractor shall install and flash.

B. Roof curbs and equipment supports shall be constructed as required such that the top is level and plumb.

C. Prefabricated curbs and equipment supports shall be Custom Curb, Inc., Thybar or equal as follows (Exception: packaged rooftop unit and power ventilator curbs are provided with equipment):

1. Equipment Supports

a. CES-1 or CES-2 Series: Check roof construction before ordering.

2. Pipe Penetrations

a. CPBA-1 or CPBA-2 Series: Check roof construction before ordering.

3. Equipment Platforms

a. CPF-1 or CPF-2 Series: Check roof construction before ordering.

D. Standard Construction - CES Series: Minimum of 18 gauge galvanized steel construction, fully mitered, welded corners, 3 inch cant, internal bulkhead reinforcing, 2x4 wood nailer and 18 gauge counter flashing. Equipment supports shall span a minimum of two joists. No load shall be applied to a cantilever section exceeding 1'-0" in length.

E. All curbs, pipe supports, etc. shall be a minimum of 14" high.

F. All exposed roof curbs, equipment supports, and flashing shall be factory or field painted to match roof color. Coordinate color with Professional.

G. Installation shall be in strict accordance with manufacturer's printed instructions and as detailed on drawings. Curb manufacturer shall coordinate fabrication with Mechanical and General Contractors.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. General: Install piping as described below, unless piping Sections specify otherwise. Individual Division 23 piping Sections specify unique piping installation requirements.

B. General Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, unless deviations to layout are approved on Coordination Drawings.

C. Install piping at indicated slope.

D. Install components with pressure rating equal to or greater than system operating pressure.

E. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.

F. Install piping free of sags and bends.

G. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.

H. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.

I. Install piping to allow application of insulation plus 1-inch clearance around insulation.

J. Locate groups of pipes parallel to each other, spaced to permit valve servicing.

K. Install fittings for changes in direction and branch connections.

L. Install couplings according to manufacturer's written instructions.

M. Verify final equipment locations for roughing-in.

N. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

O. Install sleeves for pipes passing through concrete and masonry walls, and concrete floor and roof decks.

1. Cut sleeves to length for mounting flush with both surfaces.

    a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Build sleeves into new walls and slabs as work progresses.
3. Install sleeves large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

    a. Steel Pipe Sleeves: For pipes smaller than 6”. Steel, Sheet-Metal Sleeves: For pipes 6” and larger, penetrating gypsum-board partitions.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants. Refer to Division 7 Section "Sealants" for materials.
5. Use Type S, Grade NS, Class 25, Use O, neutral-curing silicone sealant, unless otherwise indicated.

P. Aboveground, Exterior-Wall, Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches in diameter and larger.
3. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.

Q. Underground, Exterior-Wall, Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.

R. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestopping materials. Refer to Division 7 Section "Firestopping” for materials.

S. Verify final equipment locations for roughing-in.

T. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

U. Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings according to the following:

1. Uninsulated Piping Wall Escutcheons: Cast brass, chrome plated, with set screw.
2. Uninsulated Piping Floor Plates in Utility Areas: Cast-iron floor plates.
3. Insulated Piping: Cast brass; with concealed hinge, spring clips, and chrome-plated finish.
4. Piping in Utility Areas: Cast brass, with set-screw or spring clips.

V. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping specification Sections:

1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
3. Soldered Joints: Construct joints according to AWS's "Soldering Manual," Chapter "The Soldering of Pipe and Tube."
   Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
4. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

   a. Note internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
   b. Apply appropriate tape or thread compound to external pipe threads, unless dry seal threading is specified.
   c. Align threads at point of assembly.
   d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
   e. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

5. Welded Joints: Construct joints according to AWS D10.12, "Recommended Practices and Procedures for Welding Low Carbon Steel Pipe," using qualified processes and welding operators according to "Quality Assurance" Article. Clean welds and paint with oil-based primer.
6. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.
7. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join pipe and fittings according to the following:

a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
b. PVC Nonpressure Piping: ASTM D2855.

W. Piping Connections: Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping 2-inch and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch or smaller threaded pipe connection.
2. Install flanges, in piping 2-1/2-inch and larger, adjacent to flanged valves and at final connection to each piece of equipment with flanged pipe connection.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling, unions, and nipple fittings to connect piping materials of dissimilar metals.

3.2 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to provide maximum possible headroom, if mounting heights are not indicated.

B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Professional.

C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

D. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

E. Install equipment giving right of way to piping installed at required slope.

F. Install flexible connectors on equipment side of shutoff valves, horizontally and parallel to equipment shafts if possible.

3.3 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer’s written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit. Edges to be chamfered.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section Cast-in-Place Concrete.

3.4 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

B. Field Welding: Comply with AWS D1.1, "Structural Welding Code--Steel."

3.5 CUTTING AND DRILLING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of trades involved.

B. All fire-rated walls, floors, partitions, ceiling and other surface penetrations shall be fire-stopped per Fire-Stopping specifications.

3.6 GROUTING

A. Install nonmetallic, nonshrink, grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's written instructions.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placing of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases to provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout according to manufacturer's written instructions.

END OF SECTION 23 05 00

SECTION 23 05 13 - MOTORS AND CONTROLLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. These heating, ventilating and air conditioning (HVAC) provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.2 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Motors
2. Variable speed drives
3. Motor controllers where provided as part of mechanical equipment

B. Related Sections

1. Section 23 00 10 – Mechanical General Provisions
2. Section 23 00 50 – Basic Mechanical Materials and Methods

1.3 REFERENCE STANDARDS

A. ABMA 9 – Load Ratings and Fatigue Life for Ball Bearings

B. ABMA 11 – Load Ratings and Fatigue Life for Roller Bearings

C. ANSI/IEEE 112 – Test Procedure for Polyphase Induction Motors and Generators

D. ANSI/NEMA MG 1 – Motors and Generators

E. ANSI/NFPA 70 – National Electrical Code

F. IEEE – Standard 519-1992, IEEE Guide for Harmonic Content and Control

G. NEMA – ICS 7.0, AC Adjustable Speed Drives

H. Underwriters laboratories – UL508C

1.4 DEFINITIONS

A. VSD: Variable speed drive

B. ECM: Electrically Commutated Motor

1.5 SUBMITTALS

A. See Section 23 00 10 – Mechanical General Provisions

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. "R" means required.
2. "R2" means required only for products and equipment differing for the specified manufacturer and model and for "or equals" where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Motors	R	R		R
Belts and Drives		R		
Variable Speed Drives	R	R		R
Motor Controllers/Starters	R	R		R

C. Submittals shall include certification from the motor manufacturer certifying compliance with NEMA MG-1, part 31 for motors that are driven by variable speed drives.

D. Submit a site specific harmonic analysis showing total voltage harmonic distortion and total current harmonic distortion is in compliance with IEEE 519. If the analysis indicates that additional external devices or filters are required to meet the power quality requirements of the VSD, provide the devices or filters at no additional cost to the Using Agency. See Paragraph 2.3B.2.

1.6 WARRANTY

A. Special Warranty: VSD warranty shall be 24 months from date of start-up certification including all parts, labor, travel time, and expenses.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Motors

1. MagnaTek
2. Century Electric Co.
3. General Electric
4. Lincoln Electric Co.
5. Gould Inc.
6. Baldor

B. Variable speed drives

1. Yaskawa
2. Trane

3. ABB
4. Danfoss

C. Motor controllers/starters

1. ABB
2. Allen-Bradley
3. Cerus
4. Crouse-Hinds
5. Cutler-Hammer
6. GE
7. Square D
8. Siemens

2.2 MOTORS

A. General

1. In accordance with NEMA, IEEE, and ANSI C50 standards
2. Capacity
    a. Minimum horsepower indicated
    b. To operate driven devices under all conditions without overload
3. Squirrel-cage induction type, NEMA Type "B: insulation class, continuous duty
4. Speed
    a. 1750 RPM, unless otherwise indicated
    b. See schedules on drawings for other speeds
5. NEMA KVA locked rotor CODE LETTER: "G" or better
6. Service factor: 1.15
7. Type unless otherwise scheduled on Drawings
    a. Voltage: As scheduled on Drawings. Contractor shall verify actual site voltage prior to procurement.
    b. 1/2 horsepower and smaller
        (1) Single-phase phase, 60 hertz
        (2) With built-in auto-reset thermal overload protection
    c. 3/4 horsepower and larger
        (1) Three-phase, 60 hertz
        (2) Motors 50 horsepower and over: Reduced voltage start, suitable for star-delta starting or as scheduled on Drawings
    d. Electrically Commutated Motor (ECM)
        (1) Where scheduled on Drawings or equipment Specifications
        (2) Equal to GE ECM version 2.2 or greater
        (3) Programmed with fan curve for “constant airflow”
8. Bearings, unless otherwise scheduled on Drawings or equipment Specifications

a. Provide motors with double shielded, grease lubricated, ball bearings, with grease pockets on each side for regreasing in service. Provide inlet and outlet grease connections in motor housings for each bearing. Provide factory sealed permanently lubricated ball bearings on roof mounted equipment. Similar bearing may be provided on fractional horsepower motors. Provide sleeve bearings where so specified.
b. Ball type, unless otherwise noted
c. Sealed, permanently lubricated, unless otherwise noted or not available in motor size

B. Enclosure

1. Open drip-proof (ODP)

a. Provide ODP motors unless otherwise indicated

2. Totally enclosed (TEFC)

a. Motors outside the building or otherwise exposed to the weather
b. Non-ventilated: under 1/2 horsepower
c. Fan-cooled: 1/2 horsepower and larger

3. See schedules on drawings for other enclosures

C. Belt-connected motors

1. Foundation slide base
2. Shaft as required for aligning pulleys

D. Motors 1 horsepower and larger shall be NEMA Premium labeled and have guaranteed efficiencies equal to or exceeding NEMA Table 12-6D.

E. Multi-speed motors

1. Two speed motors shall be single winding 1800/900 rpm unless otherwise specified or indicated
2. Provide 1800/1200 rpm multi-speed motors of separate winding, variable torque type, unless otherwise specified or indicated.

F. Motors driven by variable frequency drives

1. Shall meet the requirements of NEMA MG-1 part 31.40.4.2
2. Where used for pumps or fans shall be capable of operating at 10 percent speed indefinitely

G. Electrically Commutated Motors (ECMs)

1. Brushless DC type with electronic commutation from 115 volt or 277 volt single phase power to a DC signal
2. Speed controllable from a minimum of 20% or less to 100% of full speed
3. Minimum 80% efficiency at all speeds
4. Provide one of the following as indicated on Drawings or Specifications

a. Where scheduled only: Potentiometer dial mounted on the exterior of the motor housing
b. Unless otherwise noted: 0-10 VDC control signal input and 0-10 VDC speed feedback output with pre-wired contacts. Motor shall shut off when speed signal is below

minimum.

2.3 VARIABLE SPEED DRIVES

A. All variable speed drives other than those that are factory packaged with equipment shall be supplied by one manufacturer.

B. Electrical Characteristics

1. Efficiency shall be not less than 97 percent at rated voltage, current, and frequency and fundamental power factor shall not be less than 98 percent at all speeds and loads
2. VSD shall maintain line noise (voltage harmonics) on the input electrical system at or below levels specified in IEEE 519 for a “General System.” Manufacturer shall include in submittals a harmonic distortion analysis (IEEE 519, 3 percent) for this particular jobsite. Provide as a minimum 5% impedance line reactors. The 5% impedance may be from dual (positive and negative DC bus) reactors or 5% AC line reactors. VSDs with only one DC reactor shall include AC line reactors.
3. VSD shall include EMI/RFI filters that allow the VSD assembly to be CE Marked and meet product standard EN 61800-3 for the First Environment restricted level.

C. Features and Accessories

1. Plain language LCD display (code numbers not acceptable); all set-up parameters, indications, faults, warnings, and other information must be displayed in words, not codes
2. Displays and meters for the following: Output voltage, output frequency, motor rpm, motor current, motor watts, speed signal input, last three faults
3. Hand-Off-Auto keyboard function with manual speed control, including bump-less transfer of speed reference when switching between Hand and Auto modes.
4. Input line fuses
5. Adjustable or multiple carrier frequencies up to 12 kHz. Include a carrier frequency control circuit that reduces the carrier frequency based on actual VSD temperature that allows the highest carrier frequency without derating the VSD or operating at high carrier frequency only at low speeds.
6. Isolated 4-20 mA or 0-10 Vdc speed signal input. If the input reference is lost the VSD shall, based on user selectable option, either (1) stopping and displaying a fault, (2) running at a programmable preset speed, (3) hold the speed based on the last good reference received, or (4) cause a warning to be issued.
7. Analog outputs for kW and speed; kW shall be accurate to ±3%
8. Digital outputs for alarm and motor on/off status; latter shall be based on field adjustable motor current that can indicate broken belt or coupling
9. Ability to automatically restart after an over-current, over-voltage, under-voltage, or loss of input signal protective trip. The number of restart attempts, trial time, and time between attempts shall be programmable for each fault type.
10. Controls

    a. Provide a minimum of two digital outputs that can be programmed for multiple purposes and also controlled through the DDC network interface device by the DDC system independent of other VSD functions or status. Control sequence possibilities shall include:

        (1) Contact to open fan discharge damper either with fan start or independent of fan operation, controlled via the DDC system and wait for the damper end switch to make before starting the drive; this shall function in the normal drive mode, bypass mode, and life safety mode (if part of smoke control system).

b. For fans used as part of IBC smoke control system, include:

(1) Programmable digital input that, when external contact is closed by life safety control system, causes VSD to start and operate at a preset adjustable speed, overriding automatic speed and on/off controls, manual speed settings and all keypad and HOA commands

(2) "Run to destruct" option so that when the digital input is closed, all internal and external safeties that might prevent the VSD from operating at the preset speed will be ignored or overridden

c. Provide built-in PID control loop, allowing connection of a pressure or flow signal to the VSD for closed loop control.

d. Provide factory installed BACnet/MSTP or Modbus RTU network interface that allows all VSD control points to be communicated to EMCS. See Section 23 09 00 Energy Management & Control Systems. At a minimum, the following points shall be provided:

(1) Read only: Speed feedback, output speed, current, % torque, kW power, kilowatt hours (resettable), operating hours (resettable), drive temperature, digital input status, analog input values, all diagnostic warning and fault information, keypad "Hand" or "Auto" selected, deceleration rate, and acceleration rate

(2) Read/write: On/off, output speed, digital output open/close, analog output values, remote fault reset, PID setpoint and gains, force the unit to bypass, maximum speed, and minimum speed

11. Enclosure

a. NEMA 3R enclosure for outdoor installation or unconditioned space

b. NEMA 1 enclosure for indoor installation in conditioned space or indirectly conditioned space such as return air plenum

c. UL Type 12 for wet mechanical rooms.

d. UL listed as plenum rated where located in supply, return, or outdoor air stream.

12. Thermostatically controlled cooling fans shall be provided where required to meet ambient operating conditions. Fans shall be designed for replacement without requiring removal of the VSD from wall mount or removal of circuit boards. Fan sound power shall be no greater than local noise sources where VSD is installed.

13. 3-contactor, constant speed bypass shall be provided to allow the motor to run across the line in the event of VFD shutdown. The transfer from the VFD to the line shall be accomplished manually by means of a selector switch. The bypass circuitry shall be enclosed in a separate well-mounted NEMA 1 cabinet. The bypass cabinet shall include a door interlocked input circuit breaker, a VFD output contactor, and a full voltage starting contactor (both contactors electrically interlocked), a thermal overload relay to provide motor protection, and a control power transformer. Mounted on the cabinet door shall be the bypass selector switch, motor fault light, power ON light, motor on VFD light, and motor on line light.

D. Equipment Protection and Safeties

1. VSDs short-circuit interrupting rating shall equal or exceed that fault current available at the drive.

2. VSD shall protect itself against all normal transients and surges in incoming power line, any grounding or disconnecting of its output power, and any interruption or run away of incoming speed signal without time delay considerations. Protection is defined as normal shutdown with no component damage.

3. The VSD shall be capable of sensing a loss of load (broken belt / broken coupling) and signal the loss of load condition. The VSD shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communications bus. Relay output shall include programmable time delays that will allow for drive acceleration from zero speed without signaling a false underload condition.
4. VSD shall protect itself against all phase-to-phase or phase-to-ground faults.
5. VSD shall be able to start into a rotating load at all speeds (forward or reverse) without trip.
6. Anti-regeneration circuit shall match the deceleration rate of the drive to that of the motor to prevent high bus voltage shutdown common to high inertia loads, such as fans.
7. VSD shall ride through an input power dip of 3 cycles without trip.
8. VSD shall operate properly at a -35% +30% voltage fluctuation from rated voltage.
9. VSD shall operate properly at a 10 percent frequency variation from rated frequency.
10. VSD shall employ three current limit circuits to provide trip-free operation: slow current regulation, rapid current regulation, and current limit switch-off limit. VSD shall be designed so that overcurrent trip shall be at least 315 percent of the drive's current rating.
11. VSD shall have the ability to set a maximum current available to the motor.
12. VSD shall withstand unlimited switching of the output under full load, without damage to the VSD. Operation of a disconnect switch between the motor and VSD shall not have an adverse effect on the VSD, whether the motor is operating or not. Controls conductors between the disconnect and the VSD shall not be required for the safe and reliable operation of the VSD.
13. The VSD shall withstand switching of the input line power up to 20 times per hour without damage to the VSD.
14. The VSD shall be capable of operating continuously at full load in the following service conditions

    a. Ambient temp: 30 to 104 degrees Fahrenheit
    b. Relative humidity: 0 to 95 percent, non-condensing

E. Warranty shall be 24 months from date of start-up certification including all parts, labor, travel time, and expenses.

2.4 MOTOR CONTROLLERS/STARTERS

A. General:

1. Manual reset, Class 20, thermal type overload protection for each phase, in accordance with NEMA ICS 2-2000 (R2005).
2. NEMA 3R enclosures for exterior application.
3. Equipment furnished with factory-installed starters shall also be equipped with individual motor disconnect and thermal magnetic circuit breakers or fuses as specified herein with lugs sized to receive a feeder as indicated on the Electrical Drawings.
4. 120 V secondary control power transformer with fused primary and secondary circuit in the enclosure.
5. Unused auxiliary contacts (installed on each contactor): 1 normally open, and 1 normally closed.

B. Motor starters shall be provided with provisions for interfacing with the Energy Management and Control System (EMCS) or other control and interlocking requirements.

1. For all magnetic starters, a minimum of one set of field reversible auxiliary contacts shall be provided with the starter.

C. For 3-phase motors, unless otherwise specified herein:

1. Combination magnetic type and thermal magnetic circuit breaker with:

    a. Circuit breakers having minimum AIC rating as specified in Division 26.
    b. External operating handle capable of being locked in the off or open position.
    c. Hand-off-automatic switch, except those manually controlled.
    d. Starters for motors 50 hp and larger shall be solid-state, reduced-voltage type.

D. For 1-phase, unless otherwise specified herein:

1. Manual starting switch with thermal overload protection and pilot light.
2. Magnetic across-the-line starters with overload protection and Hand-Off-Automatic switch, except for manually controlled equipment.

E. Provide control transformers for equipment with voltage above 240 volts, or as required for complete, operable systems.

F. Coordinate with DIVISION 26: ELECTRICAL

G. Refer to individual equipment sections for factory-provided controllers

1. Installed on equipment by manufacturer
2. Supplied with equipment by manufacturer for field installation

PART 3 - EXECUTION

3.1 INSTALLATION

A. See Section 23 05 48– Mechanical Sound and Vibration Control

B. Coordinate with work of other trades

C. Install in accordance with manufacturer's written installation instructions

D. Drives for packaged equipment shall be mounted and wired by equipment manufacturer

E. Mounting and power wiring of field mounted variable speed drives and other motor controllers is specified under Division 26 Electrical:

1. Where wall space is not available for mounting VSDs or other motor controllers, provide mounting struts securely mounted to the floor, roof, or adjacent structure
2. Where VSD has disconnect switch, locate VSD within sight of equipment served so that switch complies with NEC requirements

F. Set overload devices to suit motors provided in accordance with NEC

3.2 INSPECTION

A. Verify that adequate clearance between motor, controllers and adjacent walls or equipment is available to permit maintenance and repairs.

B. Check that motor and controller are properly supported and allows for proper alignment and tension adjustments as necessary for application.

3.3 PRE-OPERATING CHECKS

A. Before operating motors and controllers

1. Check for proper and sufficient lubrication
2. Check for correct rotation
3. Confirm alignment and re-align if required
4. Check for proper adjustment of vibration isolation.

3.4 STARTUP, TESTING, AND ADJUSTING

A. Start and test motors and controllers in accordance with manufacturers written installation instructions.

B. After starting motors

1. Check for high bearing temperatures
2. Check for motor overload by taking ampere reading at maximum operating conditions, with all valves open and individual motor running
3. Check for objectionable noise or vibration; correct as needed at no additional cost to the Using Agency

C. Variable speed drives

1. Certified factory start-up shall be provided. A certified start-up form shall be filled out for each VSD with a copy to the Professional and a copy kept on file by the manufacturer.
2. See Section 23 09 00 – Energy Management and Control Systems for points to be mapped from the drive controller to the EMCS; coordinate information addresses and other information required with the Section 23 09 00 – Energy Management and Control Systems contractor.
3. Set variable speed ramp-up rates on variable air volume systems slow enough to prevent high pressure trips and/or damage to duct systems. Coordinate with Section 23 09 00 EMCS contractor.
4. Set minimum speed for all applications in accordance with procedure indicated in Section 23 09 Energy Management and Control Systems.
5. Set maximum current limit setpoint to the motor to the motor's full load amps.
6. Set voltage to speed ratio (V/f) to “squared”.
7. For fans such as relief fans and cooling tower fans: Run fan through entire speed range and program out speeds that cause fan vibration.
8. After VSD is fully configured and programmed, all settings shall be documented and included with commissioning documentation in electronic format per Section 23 00 10 Mechanical General Provisions. The intent is to allow replacement drive electronics to be readily configured.

D. Motor Controllers/Starters

1. Provide starters, push buttons, thermal overload switches, and contactors for equipment covered in Division 23 unless otherwise specified herein. Installation of starters, push buttons, and thermal overload switches, not factory installed, is specified under Division 23.
2. Provide 120 V secondary control power transformers for control circuits where equipment is

served at 208 V or higher.

E. See Section 23 05 93– Testing, Adjusting, and Balancing

3.5 TRAINING

A. See Section 23 00 10 – Mechanical General Provisions

B. VSD manufacturer to provide one of the following:

1. 8-hours of customer training
2. Interactive Computer based training on VSD installation, start-up, programming, and trouble shooting
3. Professionally produced video cassette on VSD installation, start-up, programming, and trouble shooting in digital format

END OF SECTION 23 05 13

SECTION 23 05 16 - PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. These heating, ventilating and air conditioning (HVAC) provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.2 SUMMARY

A. Section Includes: Materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Expansion tanks
2. Storage tanks
3. Air separators
4. Bypass chemical feeders
5. Strainers
6. Suction diffusers
7. Thermometers
8. Pressure gauges
9. Test plugs
10. Flanges
11. Flex connectors

B. Related Sections

1. Section 01 91 00 – Commissioning
2. Section 23 00 10 – Mechanical General Provisions
3. Section 23 05 00 – Basic Mechanical Materials and Methods

1.3 SUBMITTALS

A. See Section 23 00 10 – Mechanical General Provisions

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing

Escutcheons	R			
Expansion tanks	R	R		R
Air separators	R			R
Bypass chemical feeders	R			R
Strainers	R			
Suction diffusers	R			
Thermometers	R	R		
Pressure gages	R	R		
Test plugs	R			

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Expansion tanks

1. Bell and Gossett ITT
2. Amtrol Inc.
3. Taco Inc.
4. Wessels
5. Or equal

C. Storage tanks

1. John Wood
2. Wessels
3. Or equal

D. Coalescing Air/dirt separators

1. Spirotherm
2. Bell & Gossett
3. Armstrong
4. Or equal

E. Bypass chemical feeders

1. J.L. Wingert Co.
2. Industrial Chemical Corporation
3. Or equal

F. Strainers

1. C.M. Bailey
2. Red-White
3. Armstrong

4. McAlear
5. Sarco
6. Steamflo
7. Mueller
8. R.P. & C. Company
9. Or equal

G. Suction Diffusers

1. Bell and Gossett ITT
2. Taco Inc.
3. Or equal

H. Thermometers

1. Weksler
2. Ashcroft
3. Trevice
4. Marsh
5. Or equal

E. Pressure gauges

1. Weksler
2. Dresser Industries, Ashcroft
3. H. O. Trerice Company
4. Weiss Instruments, Inc.
5. Or equal

F. Pressure-temperature test plugs

1. Peterson Engineering Company
2. Taco, Inc.
3. Or equal

G. Flexible Connectors

1. Flexicraft Industries
2. Flex-Weld, Inc.
3. General Rubber Corp.
4. Grinnell Corp.
5. Mason Industries
6. Mercer Rubber Co.
7. Metraflex Co.
8. Or equal

2.2 EXPANSION TANKS

A. Bladder type

1. Welded Steel
2. Working pressure: 125 pounds per square inch
3. Cleaned, prime coated
4. Steel base for floor mounted tanks

5. ASME Code
6. Bladder
7. Site glass
8. With required tappings
9. Precharge as indicated on drawings

2.3 AIR/DIRT SEPARATORS

A. Coalescing type

1. ASME construction: 125 pounds per square inch operating pressure
2. Steel tank
3. Drain and air vent connections
4. Inline air and dirt separators: inline coalescing/barrier medium tank type, capable of handling the water flow indicated on the Drawings, and constructed for 150 psig working pressure. All units shall include an integral copper tube bundle to serve as the turbulence suppressive coalescing medium which must completely fill the fitting's internal area. Units are to remove free entrained air during system start up and continue to eliminate dissolved air and dirt through continual circulation and the coalescing action of the tubes. Each fitting is to have a separate air and venting chamber to prevent system contaminants from harming the float and venting valve operation. At the top of the venting chamber shall be an integral float actuated brass air vent. There shall be no restriction in the connection from the venting chamber to the vent. The fittings are to include a valved side tap to flush floating dirt or liquids and for quick bleeding of large amounts of air during system fill or refill. Unit shall have the bottom of the vessel extended for dirt separation with the system connection nozzles equidistant from the top and bottom of the vessel and include a blowdown connection and valve. Unit shall also include a removable lower head to facilitate removal of tube assembly for cleaning and be of the size required to meet pressure drop and velocity criteria.

2.4 BYPASS CHEMICAL FEEDER

A. Batch feeder for closed circulating water systems
B. Capacity: 5 gallons
C. Steel shell and heads
D. Cap: Cast iron with Buna N "O" ring: Quarter-turn to open
E. 3/4 inch tappings for water in and out and drain
F. Operating pressure and temperature

1. Minimum rated operating pressure up to 125 pounds per square inch
2. Minimum rated operating temperature up to 250 °F
3. Design and installation as indicated

G. Wingert Model HD or equal

2.5 STRAINERS

A. Sizes

1. Screwed ends: to 2 inch
2. Flanged 2-1/2 inch and larger

B. Body

1. To 100 psi: 125 lb. wsp class, cast iron
2. 100 psi to 250 psi: 250 lb. wsp class, cast iron
3. Over 250 psi: 300 lb. wsp class, forged steel or cast steel

C. Screen

1. 304, 316 stainless steel or Monel, reinforced
2. Free area not less than 2-1/2 times inlet area
3. Perforations

    a. Water

        (1) To 8 inch: 1/8 inch
        (2) 10 inch and larger: 5/32 inch

D. Y-Type

1. Cast iron or bronze body as indicated
2. Screwed

    a. Faced cap, straight thread and gasket
    b. Mueller Steam Specialty or equal

        (1) Steel piping No. 1MFCB
        (2) Copper piping No. 35-1/2 M

3. Flanged

    a. Bolted cover
    b. Mueller Steam Specialty or equal

        (1) Steel - 125 psi steam, 200 psi water on gauge (WOG) - No. 751
        (2) Steel - 250 psi steam, 500 psi water on gauge (WOG) - No. 752
        (3) Copper - 150 psi steam, 225 psi water on gauge (WOG) - No. 851
        (4) Copper - 300 psi steam, 500 psi water on gauge (WOG) - No. 852

E. Basket type

1. Bolted cover, bottom drain connection
2. Mueller Steam Specialty Muessco No. 165 or equal

F. Provide Hubbell, Refrigerant Specialties, or equal on refrigeration system

2.6 SUCTION DIFFUSER

A. Angle type suction guide fitting

1. Flanged cast iron body
2. 125 pounds per square inch
3. Steel or cast iron guide vanes
4. Stainless steel orifice cylinder
5. Bronze start-up strainer
6. Free area five times cross section area of pump suction opening

7. Vane length no less than 2-1/2 times pump connection diameter
8. Adjustable support foot to carry weight of suction
9. System side connection size same as incoming pipe size

B. Use product manufactured by associated pump manufacturer if available

2.7 THERMOMETERS

A. Digital, self-powered

1. Display: Minimum 3/8" LCD digits, swivel mount for 360º viewing adjustment
2. Range: 0 to 300ºF
3. Sensor: Glass passivated thermistor
4. Accuracy: 1% of reading or 1ºF, whichever is greater
5. Resolution: 0.1 ºF between 0 and 200ºF
6. Recalibration: Internal potentiometer
7. Lux Rating: 10 Lux (one foot-candle)
8. Waterproof cover for outdoor installations
9. Ambient Operating Range:

    a. Temperature: -30/140°F
    b. Humidity: 0% RH to non-condensing

10. Power: Self-powered via integral photovoltaic cells
11. Weiss DVU or equal

B. Stem Length for Nominal Pipe Sizes

1. Below 4 inch: 3-1/2 inch stem, elbow mounted
2. 4-8 inch: 3-1/2 inch stem
3. 10-14 inch: 6 inch stem

2.8 PRESSURE GAUGES

A. Pipe or equipment mounted type

1. Diameter: 4 1/2 inch, except as noted
2. Case: black finished cast aluminum with flangeless back
3. Threaded black cast aluminum ring with gasketed glass face
4. Type 316 stainless steel spring tube
5. Stainless steel precision movement: Micrometer adjustment on needle
6. Accuracy: 0.5 of 1 percent full scale range
7. With calibration adjustment
8. Quarter turn stop cock: Materials compatible with service
9. Pressure snubbers

    a. Filter type
    b. For liquid, air and gas

10. Weksler Type AA44 or equal

B. Pressure gauge ranges in pounds per square inch gage

1. Chilled water pump: 0-200
2. Heating water pump: 0-160
3. Condensate pump set: 0-60
4. Diesel oil pump: 0-160
5. Emergency generator jacket water pump: 0-50
6. City water connection, connection to equipment: 0-100
7. Pressure gauges indicated on drawings or in specifications not indicated above to be submitted with appropriate range for review

2.9 PRESSURE/TEMPERATURE TEST PLUG

A. Solid brass with valve core

B. Valve core: Nordel

C. Fitted with a color coded and marked cap with gasket

D. Suitable for 500 pounds per square inch gage and 275ºF for water systems

E. Pete's Plug: No. 110/100XL with yellow cap or equal

2.10 FLANGES

A. Convoluted

B. Carbon steel, cold-formed

C. Weld-neck and blind flanges in conformance with the design criteria of Section VIII, Division I of the ASME Pressure Valve Code

D. Flanges drilled and tapped to match ANSI 150

E. All material to comply with requirements of ASTM A516

F. Gaskets: Teflon or as recommended by the flange manufacturer and suitable for the service

G. Slip-on flanges will not be permitted

H. 150-pound and 300-pound weld-neck and screwed steel flanges on steel lines to conform to ANSI Standard B16.5 for dimensions and ASTM A 181 Material Standard

2.11 FLEX CONNECTORS

A. General: Fabricated from materials suitable for system fluid and that will provide flexible pipe connections. Include 125-psig minimum working-pressure rating, unless higher working pressure is indicated, and ends according to the following:

1. 2” and Smaller: Threaded.
2. 2-1/2“ and Larger: Flanged.

B. Bronze-Hose, Flexible Connectors: Corrugated, bronze, inner tubing covered with bronze wire braid. Include copper-tube ends or bronze flanged ends, braze welded to hose.

C. Stainless-Steel-Hose/Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include steel nipples or flanges, welded to hose.

D. Rubber, Flexible Connectors: CR or EPDM elastomer rubber construction, with multiple plies of NP fabric, molded and cured in hydraulic presses. Include 125-psig minimum working-pressure rating at 220 °F. Units may be straight or elbow type, unless otherwise indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install items in accordance with manufacturer's instructions.

3.2 EXPANSION TANKS

A. Support from structure as indicated.

B. Make piping connections as indicated.

1. Expansion tank connection to the piping main shall be on the side of the pipe (3 o’clock or 9 o’clock).
2. On hot water systems, provide an anti-thermosyphon loop to prevent warm water from migrating to the tank.

C. Connect with ball valve with locked guard.

1. Relief valve shall be located on system-side of expansion tank isolation valve.

3.3 AIR/DIRT SEPARATORS

A. Install at lowest pressure, highest temperature point or where indicated on drawings.

B. Provide drain valve.

C. Install automatic vent with cock on top tapping. See Section 23 05 23 – Valves.

3.4 BYPASS CHEMICAL FEEDERS

A. Install feeder in convenient location where it may be easily refilled, maximum 4 feet above floor.

B. Install as indicated on drawings.

1. Support from floor
2. Valves on inlet, outlet and drain

3.5 STRAINERS

A. Wye-type: Where shown on drawings and ahead of all automatic flow control valves and pressure regulating valves

B. Basket-type strainers: Where shown on drawings

C. Install strainers in horizontal or vertical-down position

3.6 SUCTION DIFFUSERS

A. Provide on suction side of base mounted centrifugal pumps where indicated.

B. Support with floor mounted pipe and flange supports: From pump isolation base where provided, see Section 23 05 48 – Mechanical Sound and Vibration Control

3.7 INSTRUMENTATION

A. Install sensors and sensor wells to piping using thread o-lets welded or soldered to pipe, or other approved means. For piping smaller than 1.5 times well depth, wells shall be installed in the end of an elbow, or tee used in place of an elbow, to minimize obstruction

3.8 THERMOMETERS

A. Install thermometers for easy readability (height, distance, view angle) from floor, except thermometers at ceiling coils: Use remote mounted dial thermometers when mercury or spirit thermometers are not easily readable due to distance or position in piping.

B. Locate where shown on drawings.

3.9 PRESSURE GAUGES

A. Provide gauges where shown on drawings.

B. Install gauges on non-vibrating backing.

C. Provide instrument cocks for isolation and removal of gauge at each pressure connection point.

D. Install gauges for easy readability (height, distance, view angle) from floor, except gauges at ceiling coils

E. At pumps, install a single pressure gauge only piped to pump taps at the inlet and outlet of pump. Using two gauges or connecting to piping rather than pump taps is not acceptable.

3.10 PRESSURE-TEMPERATURE TEST PLUGS

A. Provide pressure/temperature test plugs where shown on drawings.

B. Install at all equipment, coil and heat exchanger connections. Install at each VAV terminal unit.

C. Also locate at all temperature/pressure wells for calibration, see Section 23 09 00 – Energy Management & Control Systems

3.11 INSPECTION

A. Verify that adequate clearance between piping specialties and adjacent walls or equipment is available to permit maintenance and repairs.

3.12 TESTING AND ADJUSTING

A. Test thermometers, pressure gauges and water meters for accurate indication with known calibrated master; calibrate or replace if not within 5 percent of reading.

B. Test air vent points to insure all air has been vented.

C. Test other piping specialties for proper operation.

D. See Section 23 80 00 – Mechanical Commissioning.

END OF SECTION 23 05 16

SECTION 23 05 23 - VALVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. These heating, ventilating and air conditioning (HVAC) provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.2 SUMMARY

A. Work Included in This Section: Materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Service valves in hydronic and plumbing systems (other than gas and fire sprinkler)
2. Balancing valves
3. Check valves
4. Pressure reducing valves
5. Safety and relief valves
6. Vent and gas cocks
7. Manual and automatic air vents
8. Miscellaneous valves

B. Related Sections

1. Section 01 91 00 – Commissioning
2. Section 23 00 10 – Mechanical General Provisions
3. Section 23 05 00 – Basic Mechanical Materials and Methods
4. Section 22 11 16 – Domestic Water Piping
5. Section 23 21 12 – Heating and Cooling Piping

1.3 QUALITY ASSURANCE

A. Provide valves with manufacturer's name and pressure rating clearly marked on outside of body.

1.4 SUBMITTALS

A. See Section 23 00 10 – Mechanical General Provisions

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Valves, all types	R	R		R
Manual and automatic air vents	R	R		

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Gate, ball, globe, and check valves

1. Nibco Inc.
2. Crane Company
3. Lunkenheimer Company
4. William Powell Company
5. Stockham Valves and Fittings
6. Walworth Company
7. Grinnell
8. Or equal

C. Gate valves – buried

1. Mueller Company
2. Kennedy Valve Mfg. Company
3. Clow Corporation
4. Fairbanks Valve Company
5. Or equal

D. Butterfly valves

1. Nibco
2. Allis-Chalmers, Corporation
3. Centerline, Mark Controls Corporation
4. Crane Company
5. Demco, Inc.
6. De Zurik Corporation
7. Fairbanks Valve Company
8. Or equal

E. Balancing valves

1. ITT Bell and Gossett
2. Mueller Steam Specialty
3. Taco, Inc.
4. Watts
5. Or equal

F. Silent check valves

1. Nibco, Inc.
2. Grinnell
3. Mueller Steam Specialty
4. Williams-Hager
5. Miller Valve Company
6. Mission Valve and Pump Company
7. Or equal

G. Pressure pump check valves

1. Clay-Val Company
2. Bermad
3. Or equal

H. Combination check and shut-off valves and Triple duty valves: Not allowed

I. Pressure reducing valves-air and water

1. Cash-Acme
2. Bermad
3. Wilkins
4. Watts Regulator Company
5. Or equal

J. Safety and relief valves

1. Consolidated
2. Kunkle Valve Company
3. J.E. Lonergan Company
4. Or equal

K. Relief valves, water type

1. ITT Bell and Gossett
2. Cash-Acme
3. Taco, Inc.
4. Watts Regulator Company
5. Or equal

L. Differential pressure relief valves

1. Bermad
2. Clay-Val Company
3. Watt's Regulator Company
4. Or equal

M. Vent cocks

1. Weigh Instruments
2. Conbraco
3. Crane Company
4. Lunkenheimer
5. Or equal

N. Automatic air vents

1. Amtrol Inc./Thrush Division
2. Bell and Gossett ITT
3. Dole Valve Company
4. Or equal

2.2 GENERAL

A. Where possible, provide valves of same manufacturer for all Mechanical Sections per products in this Section.

B. For copper tubing provide solder-joint valves, flare fittings, or IPS-to-copper adaptor, sized for use with tubing and respective valve.

C. For flanged valves, provide streamline companion flanges, ANSI B16.5, 1988 150 class pounds per square inch

1. 255 pounds per square inch water on gage (WOG) at 150 degree Fahrenheit
2. 225 pounds per square inch water on gage (WOG) at 250 degree Fahrenheit unless indicated otherwise

D. Provide valves rated not less than 125 pounds per square inch steam working pressure, unless indicated otherwise.

E. Provide valve materials suitable for service and temperature of respective systems, especially with respect to discs, plugs, balls, linings, gaskets, and lubricants of globe valves, plug cocks, ball valves, etc.

F. Provide chain-operated hand wheels, rustproof chain and chain guide for following valves

1. Valves 8 feet or more above operating floor or platform
2. As noted

2.3 GATE VALVES

A. General

1. 2 inches and smaller a. Bronze

a. Class 125 (125 psi steam, 200 psi water)
b. Solid wedge
c. Union bonnet
d. Inside screw
e. Rising stem
f. Equal to Nibco

(1) Threaded: T-124
(2) Soldered: S-134

2. 2-1/2 inches and Larger

a. Iron body
b. Bronze trim

c. Class 125 (125 psi steam, 200 psi water)
d. Solid wedge
e. Outside screw and yolk (OS&Y)
f. Flanged
g. Equal to Nibco:

(1) 125 pounds per square inch: F617-0
(2) 250 pounds per square inch: F-667-0

B. Gate Valves Hose

1. Cast Bronze
2. 200 pounds per square inch water working pressure
3. Rising stem
4. Polished chrome plated
5. Satin chrome
6. Rough bronze
7. Polished bronze
8. NFPA approved
9. Cap chained to valve body
10. With escutcheon
11. Hose threads per requirements of Fire Authority having jurisdiction
12. Equal to Potter-Roemer

a. 2-1/2 x 2-1/2 = 4315
b. 2-1/2 x 3 = 4335

C. Gate Valves - Direct Buried

1. AWWA C500
2. Federal Specification WW-V-586, Type II, Class1
3. Cast iron
4. Pressure ratings: 2-12 inches - 200 pounds per square inch working, 400 pounds per square inch test; 14 inch and larger - 150 pounds per square inch working, 300 pounds per square inch test
5. Double disc, parallel seat
6. Non-rising stem
7. Joint ends to match piping
8. Equal to Clow Series F-5062 through F-5085

D. Valve Indicator Posts

1. U.L. listed
2. Two piece
3. Non-rising stem
4. Equal to Nibco NIP-1AJ

E. Lockshield Gate Valves: Same as gate valves, except key operated

2.4 GLOBE AND ANGLE VALVES

A. 2 inches and smaller

1. Bronze

2. Class 125 (125 psi steam, 200 psi water)
3. Renewable composition disc
4. Union Bonnet
5. Equal to Nibco

    a. Globe, Threaded - T-235
    b. Globe, Soldered - S-235
    c. Angle, Threaded - T-335
    d. Angle, Soldered - S-335

B. 2-1/2 inches and larger

1. Iron body, bronze trim
2. Class 125 (125 psi steam, 200 psi water)
3. Renewable composition disc
4. Outside screw and yolk (OS&Y)
5. Flanged
6. Equal to Nibco

    a. Straight - F-718-B
    b. Angle - F-818-B

C. Lockshield Globe Valves: Same as globe valves, except key operated

D. Needle Valves

1. 3/4 inch and smaller
2. Bronze
3. Class 125 (125 psi steam, 200 psi water)
4. Bronze spindle
5. Threaded
6. Equal to Crane

    a. Angle No. 89
    b. Globe No. 88

E. Stop-Check Valve

1. Cast iron body, bronze and stainless steel trim
2. 250 pounds per square inch steam
3. Bronze disc and seats
4. Outside screw and yolk (OS&Y)
5. Flanged
6. Equal to Nibco F-869-B

2.5 BUTTERFLY VALVES

A. Flange Type

1. Iron body and companion flanges

    a. Lug type at equipment locations and for dead head shut off only
    b. Wafer type at all other locations

2. 316 or 416 stainless steel stem, continuous with pinned disc
3. Disk shall be either

    a. 316 stainless steel
    b. Aluminum bronze
    c. Nickel encapsulated ductile iron
    d. EPDM encapsulated ductile iron
    e. Nylon encapsulated ductile iron

4. Steel seat or cast iron support ring
5. BUNA-N body and stem seal
6. Bronze or copper bushings
7. Stem to extend 1-1/4 inches minimum for insulated piping
8. Piping adjacent to lug type shall be flange removable while valve is in use
9. Equal to Nibco

    a. Lug Type

        (1) Series LD-2000
        (2) Lugs drilled and tapped to match ANSI 150 flanges
        (3) Use cap screws both sides

    b. Wafer Type: Series WD-2000

B. Operator

1. Infinite throttling handle with memory stop: smaller than 8 inches
2. Gear operators: 8 inches and larger

C. Factory tested bubble-tight at 150 pounds per square inch

2.6 BALL VALVES

A. 2 inches and smaller

1. Bronze
2. 316 SS trim
3. Two piece body
4. Standard port
5. 600 pounds per square inch water on gage (WOG) at 100 degree F, 125 pounds per square inch saturated steam
6. Equal to Nibco

    a. Threaded - T-580-70
    b. Soldered - S-580-70

B. 2-1/2 inches and larger: Not used

2.7 BALANCING VALVES

A. Calibrated Balancing Valves

1. Combination balancing and shut-off valves

2. Calibrated name plate and adjustable memory stop
3. Capped read-out valves
4. Pre-formed insulation
5. One differential pressure read-out meter for all valves in system
6. 2 inches and smaller

    a. Brass body
    b. Threaded or soldered ends
    c. Teflon seats
    d. 250 pounds per square inch at 250 degrees Fahrenheit

7. 2-1/2 inches and larger

    a. Ductile or cast iron body
    b. Flanged
    c. 175 pounds per square inch at 250 degrees Fahrenheit

8. Devices using venture type flow meter not acceptable (due to propensity for clogging and ease of putting valve with limited flow range in wrong direction)
9. Devices using Pitot tube or Annubar type flow meter not acceptable (due to propensity for clogging)
10. Devices using other than ball or butterfly valves shall not be used for coil isolation – a separate ball valve or butterfly valve shall be added for isolation (to ensure positive shut-off and to allow 90˚ open-close with memory stop).
11. Bell & Gossett type CB, or equal.

B. Combination shut-off, balancing, and check valve: Not allowed

2.8 CHECK VALVES

A. Check Valves, General Service

1. 2 inches and smaller

    a. Swing check
    b. Class 125 (125 psi steam, 200 psi water)
    c. Regrinding bronze disc
    d. Screw-in cap
    e. Threaded body
    f. Equal to Nibco

        (1) Threaded - T-413-Y
        (2) Soldered - S-413-Y

2. 2-1/2 inches and larger

    a. Swing Check
    b. Class 125 (125 psi steam, 200 psi water)
    c. Regrinding bronze disc
    d. Bolted cap
    e. Flanged body
    f. Equal to Nibco F-918-8

B. Silent Check Valves

1. For pump discharges:

    a. Except sump pumps and sewage ejectors
    b. Variable speed pumps. Check valve pressure drop shall vary roughly as the square of flow rate to near zero flow. Valves that use hydrodynamic profiles (e.g. Victaulic 716 check valve) resulting in high or erratic pressure drop at low flow rates are not acceptable.

2. 2 inches or smaller

    a. Center-guided, silent check
    b. Class 125 (125 psi steam, 200 psi water)
    c. Bronze trim
    d. Equal to Nibco

        (1) Threaded - T-480-Y
        (2) Soldered - S-480-Y

3. 2-1/2 inches or larger

    a. Globe body silent check
    b. Class 125 (125 psi steam, 200 psi water)
    c. Bronze trim
    d. Center-guided
    e. Flanged body
    f. Equal to Nibco F-910-W

C. Check Valves at Domestic Water Pressure Pumps

1. 2 inches and smaller

    a. Bronze
    b. 125 pounds per square inch steam, 175 pounds per square inch water on gage (WOG)
    c. Diaphragm actuated globe type
    d. Separate opening and closing speed control
    e. Threaded body
    f. Equal to Clayton No. 81-01

2. 2-1/2 inches and larger

    a. Iron body with bronze trim
    b. 125 pounds per square inch steam, 175 pounds per square inch water on gage (WOG)
    c. Diaphragm actuated globe type
    d. Separate opening and closing speed control
    e. Flanged body
    f. Equal to Clayton No. 81-02

D. Detector Check Valves

1. Automatic compound lever check valve and bypass bronze disc meter
2. Flanged galvanized cast iron body
3. With threaded or flanged bronze IBBM control and check valves
4. Equal to Hersey Model D.C.

2.9 PRESSURE REDUCING VALVES

A. For Water

1. 2 inches and Smaller

a. Bronze body, threaded
b. Equal to Watts Series 223

2. 2-1/2 inches and Larger

a. Iron body, flanged
b. Equal to Watts No. 2300

2.10 SAFETY AND RELIEF VALVES

A. Use “pressure relief valves” for unheated liquids

B. Use “safety relief valves” for heated liquids

C. ASME rated direct spring-loaded type

1. Lever operated
2. Non adjustable factory set discharge pressure

D. Constructed, rated and stamped in accordance with ASME

1. Relief valves: for unheated liquids
2. Safety relief valves: for heated liquids
3. Safety valves for gases and vapors: Including air and steam

E. Set pressures and ratings

1. Suitable and rated for system pressure and temperature: For safety relief valves, minimum temperature rating: saturated steam temperature corresponding to pressure 10 percent higher than valve set pressure
2. Set pressure as indicated on Drawings: Not to exceed pressure rating of protected equipment

F. Valves to open, under test, at set pressure with following tolerance

1. Set pressure up to 70 pounds per square inch gage: plus or minus 2 pounds per square inch
2. Set pressure, above 70 pounds per square inch gage: plus or minus 3 percent

G. Capacities

1. Valves shall have capacity to relieve maximum possible generated energy while maintaining pressure in protected equipment at no more than 10 percent above vessel working pressure.
2. Greater than make-up pressure reducing valve capacity
3. Equipment relief valve capacity to exceed rating of connected equipment
4. Provide multiple valves if required for capacity even though only one valve may be shown on Drawings

H. Maintain pressure in protected equipment at not more than following

1. Low pressure Boilers: 5 pounds per square inch above boiler working pressure
2. High pressure Boilers: 6 percent above boiler working pressure
3. Unfired Pressure Vessels: 10 percent above vessel working pressure

I. Provide multiple valves if required for capacity even though only one valve may be shown on Drawings: Factory manifold

J. Safety and Relief Valves: Similar to Consolidated

K. Relief Valves, Water: Equal to Watts

2.11 VENT COCKS

A. Bronze body, 1/4 inch size

B. Lever handle

C. 125 pounds per square inch steam working pressure

D. Equal to Weiss LC-14

2.12 MANUAL AIR VENTS

A. Construction

1. Vertical
2. Provide 1/8 inch brass needle valve at top of chamber
3. To 3 inch pipe: Line size air chamber, 12 inch long
4. 4 inch to 8 inch: Line size air chamber, 6\inch long
5. 10 inch and larger: Line size pipe cap

2.13 AUTOMATIC AIR VENTS

A. Float type

1. With isolating valve
2. Brass or semi-steel body
3. Float copper or stainless steel
4. Stainless steel valve and valve seat
5. Suitable for system operating temperature and pressure
6. Non-opening on negative pressure
7. Equal to Thrush/Amtrol No. 720

B. Disc type

1. All brass with hydroscopic fiber discs
2. Vent ports
3. Adjustable cap for manual shut-off
4. Integral spring loaded ball check valve
5. Equal to Dole

C. Threaded vent connection for piping vent to drain

D. Upstream ball valve for isolation

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate with work of other trades

B. Install valves in accordance with manufacturer's written installation instructions

C. Provide valves as shown on drawings, and provide shutoff valves around all equipment whether shown with valves on drawings or not.

D. Provide all valves (except control valves), strainers, and check valves of same size as the pipes in which they are installed unless otherwise indicated

E. Pressure rating of valves same as piping in which installed

F. Install valves with stems upright or horizontal, not inverted

G. Install valves with cast directional arrows in direction of flow

H. Install all globe and angle valves to close against the pressure

I. Support line valves at the valve in addition to regularly spaced pipe supports shown and specified

J. Check valves

1. Provide silent check valves at discharge of pumps. Triple duty valves shall not be used as a substitution for check and shut-off valve.
2. Install swing checks and gravity closing lift checks in horizontal position.

K. Provide blow-down ball valves and hose adaptors at strainers, air separators, tanks, pipe traps, equipment drains, etc. of same size as strainer blow-off connection

L. Provide drain valves at main shut-off valves, low points of piping and apparatus

M. Provide extended valve stems to clear insulation on insulated valves.

N. Locate wheel handles to clear obstructions with hand

O. Install valves only in accessible locations

P. Wherever possible, install valves accessible from floor level. Provide guided chain operators on valves over 7 feet above floor in equipment areas. Extend chains to within 6 feet 6 inches of floor.

Q. Locate equipment shut-off valves to be accessible without climbing over equipment

R. Provide operating handles for all valves and cocks without integral operators, unless otherwise noted. Provide adequate clearance for easy operation

S. Provide discharge pipe to atmosphere from all relief and safety valves, sized with area equal to sum of outlet areas of all valves connected thereto, unless indicated larger. Extend to over code compliant drain receptacle with airgap.

T. Provide ball valves to isolate shock absorbers

U. Provide open-ended line valves with plugs or blind flanges

3.2 VALVE APPLICATIONS

A. Valves shall be limited to the applications listed below. Where this section disagrees with drawings, obtain clarification from Professional and provide as directed by the Professional at no additional cost to the Using Agency.

B. Gate Valves

1. Shut-off: water (use ball valves where possible, Professional shall approve use of gate valves aboveground)

C. Globe and Angle Valves: Throttling and shut-off: water, air and steam

D. Plug cocks: Not used

E. Butterfly valves

1. Throttling and shut-off: water
2. Use in HVAC systems interchangeably in place of gate, globe and angle valves

F. Ball valves

1. Throttling and shut-off: water
2. Use in HVAC and domestic water piping 2-1/2 inches and smaller interchangeably in place of gate, globe and angle valves

3.3 AIR VENTS

A. Manual air vents

1. Locate

a. As shown on drawings
b. At all high points in closed piping systems
c. At equipment with vents, such as coils

2. 1/4 inch copper tube discharged into nearest drain or with 180 degree bend to discharge into portable container
3. Extend tubing or piping as required to make valve accessible

B. Automatic air vents

1. Locate as shown on drawings
2. Provide manual cock at automatic air vents. Shut after system is free of air
3. 1/4 inch copper tube discharged into nearest drain

3.4 FIELD QUALITY CONTROL

A. Test valve bonnets for tightness. Test operate valves from closed-to-open-to-closed position while valve is under test pressure.

B. Test automatic valves including solenoid valves, expansion valves, water regulating valves, pressure reducing valves, pressure relief valves, safety valves and temperature and pressure relief valves for proper operation at settings indicated.

C. Insure that valves are field checked for packing and lubricant and that disc is for service intended. Replace leaking packing at no additional cost to the Using Agency. Service valves which do not operate smoothly and properly with suitable lubricant before placing in operation at no additional cost to the Using Agency.

3.5 INSPECTION & COMPLETION

A. Verify that adequate clearance between valves and adjacent walls or equipment is available to permit maintenance and repairs.

B. Verify valve set for normal operation.

C. Valves tags, see Section 23 05 53 – Mechanical Identification

D. See Section 23 08 00 – Mechanical Commissioning

E. See Section 23 05 93 – Testing, Adjusting and Balancing

END OF SECTION 23 05 23

SECTION 23 05 29 HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. These heating, ventilating and air conditioning (HVAC) provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.2 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Pipe and duct hangers, supports and associated anchors
2. Thermal hanger shields for insulated piping

B. Related Sections include the following:

1. Section 23 00 10 – Mechanical General Provisions
2. Section 23 05 48 – Mechanical Sound and Vibration Control
3. Division 21 – Fire Protection Work
4. Division 22 – Plumbing Work

1.3 REFERENCE STANDARDS

A. American Society of Mechanical Engineers: ASME Section VIII – Boiler and Pressure Vessel Code – Pressure Vessels

B. Pipe Supports: ANSI B31.1, Power Piping

C. Duct Hangers: SMACNA Duct Manuals

1.4 DEFINITIONS

A. MSS: Manufacturers Standardization Society for the Valve and Fittings Industry.

B. Terminology: As defined in MSS SP-90, “Guidelines on Terminology for Pipe Hangers and Supports”.

1.5 PERFORMANCE REQUIREMENTS

A. Design channel support systems for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

B. Design heavy-duty steel trapezes for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

1.6 SUBMITTALS

A. See Section 23 00 10 – Mechanical General Provisions

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. "R" means required.
2. "R2" means required only for products and equipment differing for the specified manufacturer and model and for "or equals" where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Pipe hangers and supports	R			R
Structural attachments	R			R
Pipe protection and thermal hanger shields	R			
Expansion shields	R			

1.7 QUALITY ASSURANCE

A. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications".

PART 2 - PRODUCTS

2.1 GENERAL

A. Terminology used below is as defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports." Pipe hangars and supports shall comply with MSS SP-58 requirements for materials, design and manufacturer, MSS SP-69 requirements for selection and design and MSS SP-89 requirements for fabrication and installation. All hangers shall be furnished and installed complete with rods and supports proportioned to the size of piping or equipment to be supported.

2.2 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Hangers, Inserts and Supports

1. Fee and Mason
2. B-Line Systems, Inc.
3. ITT Grinnell Corporation
4. Kin-Line, Inc.
5. Unistrut
6. Superstrut
7. Midland-Ross Corp.: Superstrut

8. Elcen Metal Products Company

C. Pipe Protection and Thermal Hanger Shields

1. Pipe Shields, Inc.
2. Elcen Metal Products Company
3. Midland-Ross Corp.: Superstrut
4. Uni-Grip
5. Kin Line

D. Expansion Shields

1. ITT Phillips Drill Co.: Red Head
2. Hilti Fastening Systems
3. Omark Industries, Inc.
4. Ramset Fastening Systems

E. Pipe Stand Supports

1. B-Line Systems, Inc.
2. Grinnell Corp.
3. PHD Manufacturing, Inc.
4. PHS Industries, Inc..

F. Powder-Actuated Fastener Systems:

1. Hilti, Inc.
2. ITW Ramset/Red Head.
3. Masterset Fastening Systems, Inc.

G. Insulation Protectors:

1. B-Line Systems, Inc.
2. ITT Grinnell Corporation
3. PHD Manufacturing, Inc.
4. PHS Industries, Inc..

H. Roof Pipe Supports

1. Mifab
2. Or equal

I. Miscellaneous Devices

1. Kopty
2. Wejit

2.3 PIPE HANGERS AND SUPPORTS

A. Model numbers are Superstrut, unless otherwise indicated

B. Provide electro-chromate, galvanized or factory painted finish; no plain, "black" hangers allowed

C. Dielectric Isolators: All uninsulated copper tubing systems; Superstrut isolators or equal,

Cush-A-Strip or Cush-A-Clamp on all pipe clamps; for individual hangers, use felt lined hangers

D. Individual Pipe Hangers

1. Cold pipe all sizes: Clevis hanger, No. C710
2. Hot pipe sizes up to 4 in: Clevis hanger, No. C710
3. Hot pipe sizes above 6 in: Adjustable steel yoke and cast iron roll No. C729

E. Multiple or Trapeze Hangers

1. Factory channel

    a. 12 gauge thick steel
    b. Single or double section
    c. Electro-chromate finish
    d. Strutnuts: Series A-100 or CM-100
    e. Straps: Series 702
    f. Other accessories
    g. No. A-1200 or A-1202

2. Hot pipe sizes 6 in and larger: cast iron roll and stand; C728 or CR728

F. Wall Supports

1. Pipe sizes up to 3 in: Steel bracket No. C738
2. Pipe sizes 4 in and larger: Welded steel bracket C-735
3. Hot pipe sizes 6 inches and larger

    a. Welded steel bracket No. C739
    b. Adjustable steel yoke and cast iron roller No.C729

G. Vertical Support

1. Riser clamp Series C-720

H. Floor Support:

1. Hot pipe sizes up to 4 in; cold pipe, all sizes

    a. Adjustable cast iron saddle No. R786
    b. Locknut nipple
    c. Floor flange

2. Hot pipe sizes 6 in and larger: Adjustable cast iron roll and stand No. R-730-C

I. Thermal Hanger Shields

1. 360 degree high density insert

    a. 100 psi waterproofed calcium silicate, asbestos-free, K=0.38, encased in a 360-degree galvanized sheet metal shield, ASTM A653
    b. See Section 23 07 00 Mechanical Insulation
    c. Same thickness as adjoining pipe insulation

2. 360 degree galvanized sheet metal shield

a. Shield length and gauges

Pipe Size	Shield Length	Minimum Gauge
1/2-1 1/2	4	26
2 - 6	6	20
8 - 10	9	16

3. Insert to extend one inch beyond metal shield ends on chilled water piping
4. Use double layer shield on bearing surface for

   a. Roller hangers
   b. Support spacing exceeding 10 feet

5. Pipe Shields Incorporated or equal

J. Pipe Isolators

1. Hanger with felt padding
2. Tolco Fig. 3F felt lined hangers or equal

K. Insulated Pipe Supports

1. Pipe supported on rod hangers - use Models A1000, A2000, A3000, 4000 and A9000
2. Pipe supported on flat surfaces - use Models A1000, A2000, A5000, A6000, A7000, A7200 and A7400 Series
3. Pipe supported on pipe rolls - use Models A3000, A4000, A5000, A6000, A8000, A8200 and A8400 Series
4. Model designations are Pipe Shields, Inc. or equal; use only models designed for service for which supports are to be used

L. Anchors and Guides: Provide anchors and guides where indicated on the Drawings and as required. Structural inserts shall be high density calcium silicate compressive strength 600 pounds per square inch. Guide slide pads shall be Teflon. Ensure that slide accommodates pipe movement over full range of service and out-of-service temperatures. Guides shall be Pipe Shields, Inc. Model #B3000 or equal. Anchors shall be Pipe Shields, Inc. Model #C4000 or equal. See Section 23 07 00 – Mechanical Insulation.

M. Insulated Pipe Strap

1. 1/2 in to 1 in plumbing piping in wood frame construction
2. Felt insulated
3. Nailable pipe straps; In lieu of other hangers and dielectric isolators
4. Kopty or equal

N. Escutcheons: See Section 23 05 00 – Basic Mechanical Materials and Methods

O. Flashing and Sleeves

1. Flashings

   a. See Division 7 – Thermal and Moisture Protection
   b. Flash and counter flash watertight all pipe and duct penetrations of roofs and exterior walls

c. Flash pipes through roofs with ITWBuildex Dektite
d. Flash vents through roofs with

(1) Minimum 24 gage soldered roof jack for flat surface roofs
(2) Minimum 4 pound lead soldered roof jack for roofs other than flat surface roofs
(3) Vandal caps
(4) Provide counter-flashing sleeves and storm collars
(5) Caulk counter-flashing and storm collar weather tight
(6) Other flashings shall be minimum 24-gage galvanized sheet metal

2. Sleeves

a. Through exterior concrete walls below grade and floor slabs on grade

(1) Schedule 40, galvanized steel pipe sleeves
(2) Seal annular space between pipe and sleeve water tight with one of the following

a) Thunderline Link-Seals
b) Calpico Pipe Linx
c) Oakum sealed in with mastic
d) Provide membrane clamps at penetrations of membranes
e) Or equal

b. Other concrete walls, floors and roofs

(1) Adjustable telescopic metal sleeves
(2) Tightly pack annular space between pipe and sleeve with fiberglass. Seal both sides with mastic

c. For insulated piping, sleeve diameter shall not be less than diameter of insulation

d. Terminate sleeves flush with walls, and ceiling

e. For exposed vertical pipe, extend sleeves 1 inch above finished floor except where escutcheons are required

f. Packing through fire rated partitions on of following

(1) 3M Penetration Sealing Systems (PSS 7909) and 3M Fire Barrier Caulk and Putty
(2) Dow-Corning LTV Silicone foam
(3) Or equal

3. Separate piping through walls, other than concrete walls, from contact with wall construction materials; use non-hardening caulking

4. Install insulation on piping in walls which require insulation at time of installation

2.4 DUCT HANGERS AND SUPPORTS

A. See Section 23 31 13 – Ducts.

2.5 DUCT AND PIPE SUPPORT AT ROOF LEVEL.

A. The Contractor shall coordinate pipe work and ductwork to provide access to all equipment. The services at roof level indicated on our details provide the minimum clearance required for pipe work and ductwork for maintenance of the roof. The plans indicate higher elevations where necessary for access. Where pipe work and ductwork cross over at the same point, the pipe work shall run underneath the ductwork. The Contractor may propose a combined structure, for approval, to support the pipes and ducts at roof level. The contractor shall provide calculations by a certified licensed engineer in the state of Mississippi once the conceptual support has been approved. The main path of egress shall be maintained clear at 7’-6”.

2.6 STRUCTURAL ATTACHMENTS

A. Model Numbers are Superstrut, unless otherwise indicated

B. Anchor Bolts: Size as specified for hanger rods

C. Concrete Inserts

1. Malleable iron
2. Place reinforcing steel through insert as recommended by manufacturer for recommended loads
3. No. 452 or equal

D. Beam Clamps

1. All with U-568 safety strap
2. All with locknuts on

a. Set Screw
b. Hanger rod

3. Bottom flange attachment

a. Loading 150 pound and less: U-563
b. Loading 150 pound to 300 pound: U-562
c. Loading more than 300 pound: U-560

4. Top flange attachment

a. Permitted only when bottom flange attachment cannot be used
b. Loading 400 pound and less: M-777
c. Loading more than 400 pound: M-778

E. Welded Beam Attachments

1. No. C-780 or equal

F. Side Beam Brackets

1. No. 542 or equal

G. Hanger Rods

1. ASTM A575 Hot rolled steel
2. ANSI B1.1 Unified Inch Screw Treads
3. Threaded both ends, threaded one end, or continuous threaded

H. Hanger Rod Fixtures

1. Turnbuckles: No. F-112 or equal
2. Linked Eye Rod

    a. Rod swivel
    b. No. E-131 or equal

3. Clevis: No. F-111 or equal

I. Powder or Gas Actuated Anchors

1. Not allowed on initial building construction; allowed only for revisions made after initial construction and with approval of Using Agency
2. Hardened steel stud with threaded shank; size of shank to match hanger rod size
3. Use only with non-shock loads
4. Maximum load safety factors:

    a. Maximum anchor load: 100 pounds
    b. Static loads - 5
    c. Vibratory loads - 8-10

5. For concrete and steel; not to be used for light weight concrete, brick or concrete block
6. 10% testing rate required, testing by contractor
7. Omark Drivit or equal

J. Expansion Shields

1. Carbon-steel anchors, zinc coated
2. Stainless steel for corrosive atmospheres
3. For normal concrete use

    a. Self-drilling anchor
    b. Sleeve anchor
    c. Stud anchor

4. For thin concrete use: wedge anchor
5. For brick or concrete block use: sleeve anchor
6. Maximum load safety factors

    a. Static loads - 4
    b. Vibratory loads - 8 - 10
    c. Shock loads - 8 - 10

7. Size to suit hanger rods
8. ITT Phillips Red Head or equal

K. Steel Deck Inserts

1. Factory stud with

a. Clip
b. Spring
c. Coupling

2. ITT Phillips Red-Head or equal

L. Miscellaneous Metal

1. Steel plate, shapes and bars: ASTM A36
2. Steel pipe columns: ASTM A53, Schedule 40, black
3. Bolts and nuts: regular hexagon-head type, ASTM A307, Grade A
4. Lag bolts: square head type, Fed. Spec. FF-B-561
5. Plain washers: round, carbon steel, Fed. Spec. FF-W.92

2.7 ROOF PIPE SUPPORTS

1. All piping HVAC, plumbing, gas, etc. located above the roof (and supported by the roof) shall be supported utilizing the following roof supports.
2. Rubber support base with 1-5/8-inch galvanized steel channel.
3. Materials:

a. Base: 100% recycled rubber, UV resistant
b. Channel: 14 gauge galvanized steel (1-5/8-inch wide x 1-5/8-inch high)

4. Maximum load: 750 lbs for each 9.6-inch long support
5. Include strut clamp
6. Manufactures

a. Mifab C6 series
b. Or equal

2.8 MISCELLANEOUS MATERIALS

A. Powder-Actuated Drive-Pin Fasteners: Powder-actuated-type, drive-pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

C. Structural Steel: ASTM A36/A36M, steel plates, shapes, and bars, black and galvanized.

D. Concrete: Normal weight concrete (145 pcf) using Type I Portland Cement, 1" maximum size coarse aggregate to provide a minimum 28 day compressive strength of 3000 psi.

E. Grout: ASTM C1107, Grade B, factory-mixed and -packaged, nonshrink and nonmetallic, dry, hydraulic-cement grout.

1. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
2. Properties: Nonstaining, noncorrosive, and nongaseous.
3. Design Mix: 7000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 PIPE HANGERS, SUPPORTS AND GUIDES

A. Specific hanger requirements are specified in Sections specifying equipment and systems.

1. Assure adequate support for pipe and contents
2. Provide adjustable hangers for all pipes complete with inserts, adjusters, bolts, nuts, swivels, all-thread rods, etc., except where specified otherwise
3. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping and do not support piping from other piping.
4. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping
5. Install all cast iron piping in accordance with Cast Iron Soil Pipe Industry (CISPI) Standards
6. Support all piping within 2 feet of each change of direction on both sides of fitting
7. Thermal hanger shields shall be provided at hangers and supports where piping is insulated
8. Prevent vibration or swaying
9. Provide for expansion and contraction
10. Supports of wire, rope, wood, chain, strap perforated bar or any other makeshift device not permitted
11. Comply with applicable requirements at ANSI B31.1 and B31.2 for piping
12. Support piping independently so that equipment is not stressed by piping weight of expansion
13. See Section 23 05 48 – Mechanical Sound and Vibration Control for mechanical sound and vibration control
14. See Section 23 05 48 – Mechanical Sound and Vibration Control for hangers, guides, anchors and supports requiring vibration isolation units
15. Hangers and supports shall have minimum safety factor of five (5), based on ultimate tensile or compressive strength, as applicable, of material used; base calculations on equipment's heaviest operating weight and pipes full of water
16. Install additional supports or braces if, during normal operation, piping should sway, crawl or vibrate. Piping shall be immobile
17. Install thrust blocks as required to prevent sway

B. Horizontal piping, except as noted

1. Adjustable clevis type and rod; all services at or below 250 degrees F
2. Rollers or slide bases: not required
3. Trapeze hangers; guide individual pipes on trapezes with 1/4 inch U-bolt or Superstrut 702 pipe clamp
   a. Install thermal hanger shield at each support point
4. Galvanized sheet metal shields between hangers and PVC piping
5. Threaded steel rods

   a. 2 in vertical adjustment with 2 nuts each end for positioning and locking
   b. Size to 12 in inside pipe size (IPS)

Pipe, IPS	Rod
to 2 inch	3/8 inch

2-1/2 inch and 3 inch	1/2 inch
4 inch	5/8 inch
6 inch and 8 inch	3/4 inch
10 inch and 12 inch	7/8 inch
14 inch and 18 inch	1 inch
20 inch and 30 inch	1-1/4 inch

c. Size above 12 inch IPS and multiple pipe standards: safety factor of 5 on ultimate strength on area
d. For double rod hangers: 1 size smaller than above

C. Vertical piping

1. Base support

a. Base elbow or welded equivalent
b. Bearing plate on structural support

2. Guides

a. At every third floor but not to exceed

(1) 25 feet for piping to 2 inch
(2) 36 feet for piping 2-1/2 inch to 12 inch
(3) 50 feet for piping 14 inch and larger

b. Or as otherwise designed by the Vibration Isolation vendor; coordinate with Section 23 05 48 – Mechanical Sound and Vibration Control

3. Top support

a. Special hanger or saddle in horizontal connection
b. Provisions for expansion

4. Intermediate supports: steel pipe clamp at floor

a. Bolted and welded to pipe
b. Extension ends bearing on structural steel or bearing plates

5. For multiple pipes: coordinate guides, bearing plates and accessory steel

D. Horizontal insulated piping

1. Install saddles for rollers or slide bases
2. Install thermal hanger shields for all other types of supports
3. See Section 23 07 00 – Mechanical Insulation for insulation connection to shields

E. Vertical insulated piping

1. Install thermal hanger shields at guides
2. See Section 23 07 00 – Mechanical Insulation for insulation connection to shields

F. Install Pipe Isolators between hangers and piping for all uninsulated copper tubing.

G. Spring Supports for Piping

1. See Section 23 05 48 – Mechanical Sound and Vibration Control

H. Miscellaneous Steel

1. Provide miscellaneous steel members, beams, brackets, etc., for support of work in this division unless specifically included in other divisions

I. Roof pipe supports shall be installed per manufacturer's recommendations in coordination with the roofing system and company holding the roof warranty.

3.2 PIPE SUPPORT SPACING

A. Maximum spacing for horizontal piping

Type of Pipe	Size	MAXIMUM SPACING
Steel	1-1/2 inch and smaller	7 feet
	2 inch and larger	10 feet
Copper	3/4 inch and smaller	5 feet
	1- 1-1/4 inch	6 feet
	1-1/2 - 3 inch	8 feet
	4 inch and larger	10 feet
Plastic	3/4 inch and smaller	3 feet

B. Spacing Notes: Additional supports at

1. Changes in direction
2. Branch piping and runouts over 5 feet
3. Concentrated loads due to valves, strainers and other similar items
4. At valves 4 inch and larger in horizontal piping, support piping on each side of valve

C. Parallel piping on trapezes

1. Maximum spacing to be that of pipe requiring closest spacing

3.3 ATTACHMENT TO STRUCTURE

A. Concrete

1. Use inserts for suspending hangers from reinforced concrete slabs, walls and sides of reinforced concrete beams wherever practicable
2. Set inserts in position in advance of concrete work
3. Provide reinforcement rod in concrete for inserts carrying

    a. Pipe over 4 inch
    b. Ducts over 60 inches wide

4. Where concrete slabs form finished ceiling, finish inserts flush with slab surface
5. Where inserts are omitted, install hangers with expansion shields
6. Through-deck support

    a. Drill through concrete slab from below
    b. Provide rod with recessed square steel plate and nut above slab

7. Where permitted by Using Agency and only for revisions made after initial construction, powder actuated anchors or expansion shields may be used in lieu of inserts

    a. In bottom of thick slabs
    b. In thin slab construction, only in sides of beams

8. Pre-Cast Concrete

    a. Use pre-set inserts
    b. Where inserts are not available, field drill through beam or joists at locations as directed by Professional
    c. Through bolt side beam bracket to beam or joist

9. Poured-In-Place Concrete

    a. With metal form or underdeck
    b. Before concrete is poured

        (1) Field drill hole through metal deck
        (2) Provide bearing plate, nut and locknut on rod; or install factory-made steel deck inserts specified hereinbefore

    c. After concrete is poured

        (1) Install hangers with expansion shields

B. Steel Beam Anchors

1. Beam or channel clamps
2. Do not cut or weld to structural steel without permission of structural engineer

C. Steel Deck Anchors

1. Concrete filled: as specified above
2. Decking without concrete

    a. Through rod Support

        (1) Weld to square plate, 1/4 in thick
        (2) Plate to distribute load over minimum of two full cells
        (3) Coordinate with floor layouts to clear cells with wiring

D. Side Wall Supports

1. Concrete walls

    a. As specified for hangers

2. Stud Walls

a. Toggle bolts
b. Studs welded to structural studs

E. Support Spreaders

1. Install spreaders spanning between structural members when hangers fall between them, and hanger load is too great for slab or deck attachment
2. Spreaders may be one of methods listed below, or combination of both as required

a. Fabricated from structural channel

(1) End fittings bolted or welded
(2) Secure to structural members

a) As required by construction
b) As reviewed by Structural Engineer

b. Formed channels with fittings, Superstrut or equal

(1) Submit manufacturer's calculations for installation

3.4 DUCT HANGERS AND SUPPORTS

A. See Section 23 31 13 – Ducts

3.5 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure above or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

3.6 METAL FABRICATION

A. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.

B. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.7 ADJUSTING

A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.8 PAINTING

A. Painting and Touching Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.

END OF SECTION 23 05 29

SECTION 23 05 48 – MECHANICAL SOUND AND VIBRATION CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. These heating, ventilating and air conditioning (HVAC) provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.2 SUMMARY

A. Work Included in This Section: Materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Vibration isolators for equipment
2. Vibration isolators for piping systems
3. Equipment bases
4. Inertia bases

B. Related Sections

1. Section 23 00 10 – Mechanical General Provisions
2. Section 23 05 00 – Basic Mechanical Materials and Methods
3. Duct sound attenuators, see Section 23 33 00 – Duct Accessories
4. Section 23 05 16 – Piping Specialties

1.3 REFERENCE STANDARDS

A. AFBMA – Anti-Friction Bearing Manufacturer's Association

B. ASHRAE – American Society of Heating, Refrigerating and Air Conditioning Engineers

C. NEMA – National Electrical Manufacturer's Association

D. Underwriters' Laboratories, Inc.: UL 778 – Motor Operated Water Pumps

E. American Society of Mechanical Engineers: ASME Section VIII – Boiler and Pressure Vessel Code – Pressure Vessels

F. Published specifications standards, tests or recommended methods of trade, industry or governmental organizations apply to work in this section where cited below

1. Mason Industries “Seismic Restraint Guidelines for Suspended Piping, Ductwork, and Electrical Systems”
2. SMACNA and PPIC “Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Piping Systems”.

G. Publication references below are basic industry standards; however, regulatory requirements may

reference, modify or supersede:

1. American Institute of Steel Construction (AISC) publications

    a. Specification for the Design, Fabrication and Erection of Structural Steel Buildings (Eighth Edition)

2. American National Standards Institute (ANSI) Standard

    a. B027.2-965 – Plain Washers

3. American Society for Testing and Materials (ASTM) Specifications

    a. A 6 – General Requirements for Delivery and Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use
    b. A 36 – Structural Steel
    c. A 53 – Welded and Seamless Steel Pipe
    d. B633 – Electrodeposited Coatings of Zinc on Steel
    e. A 307 – Carbon Steel Externally and Internally Threaded Standard Fasteners
    f. A 500 – Cold-Formed Welded and Seamless Carbon Steel Structural Tubing
    g. A1011 – Hot Rolled Carbon Steel Sheet and Strip

4. American Society for Testing and Materials (ASTM) Specifications

    a. A 6 – General Requirements for Delivery and Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use
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    e. A 307 – Carbon Steel Externally and Internally Threaded Standard Fasteners
    f. A 500 – Cold-Formed Welded and Seamless Carbon Steel Structural Tubing
    g. A1011 – Hot Rolled Carbon Steel Sheet and Strip

5. American Welding Society (AWS) Publication

    a. D 1.1 – Structural Welding Code

1.4 QUALITY ASSURANCE

A. Qualifications

1. Manufacturer

    a. All equipment and accessories to be the product of a manufacturer regularly engaged in its manufacture for not less than five years

B. Manufacturer or manufacturer's representative of vibration isolation equipment shall have the following responsibilities

1. Determine vibration isolator sizes and locations
2. Provide piping and equipment isolation systems as scheduled or specified
3. Guarantee specified isolation system static deflection under installed actual load.
4. Provide installation instructions, drawings and field supervision to assure proper installation, adjustment and performance

C. The installation of all vibration isolation units and associated hangers and bases shall be as directed by the vibration isolation manufacturer's representative.

D. It is the objective of this Specification to provide the necessary design for the control of excessive noise and vibration in the building due to the operation of machinery or equipment, and due to interconnected piping, ductwork or conduit

1. All vibration isolators shall have either known undeflected heights or calibration markings so that, after adjustment, when carrying their load, the deflection under load can be verified, thus determining that the load is within the proper range of the device and that the correct degree of vibration isolation is being provided according to the design.
2. All isolators shall operate in the linear portion of their load versus deflection curve. Load versus deflection curves shall be furnished by the manufacturer and must be linear over a deflection range of not less than 50 percent greater than the design deflection.
3. The theoretical vertical natural frequency for each support point, based upon load per isolator and isolator stiffness, shall not differ from the design objectives for the equipment as a whole by more than ±10 percent.
4. All neoprene mountings shall have a Shore hardness of 30 to 60 ±5, after minimum aging of 20 days or corresponding oven-aging.

E. Acoustical Testing

1. The contractor shall cooperate with regard to sound tests (ARI 575, ANSI S1.13) which may be conducted by Professional to verify that noise criteria are met.
2. The contractor shall notify the Professional of any changes which will affect the acoustical performance.

1.5 SUBMITTALS

A. See Section 23 00 10 – Mechanical General Provisions

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Vibration isolation devices: catalog cuts, static deflections, quantity, load per isolator, mounting details, etc.	R	R		
Concrete and steel details for equipment pads				R
Weld or anchor bolt locations				R
Reinforcing and template steel locations and details				R
Inertia and equipment bases	R	R		R
Anchors, inserts and fasteners and fastening details	R	R		R
Flexible pipe connectors	R	R		R
Flexible duct connectors	R	R		R

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Vibration Isolation

1. Mason Industries, Inc.
2. Kinetics Noise Control, Inc.
3. M.L. Saussé & Co. (Vibrex)
4. Amber-Booth
5. Or equal.

2.2 VIBRATION ISOLATOR TYPES

A. Spring type

1. Spring isolators shall incorporate following

a. All springs to be single coil steel with minimum spring coil outer diameter 0.8 of loaded operating height
b. Horizontal spring stiffness within 0.8 to 1.25 times rated vertical spring stiffness
c. Corrosion resistance

(1) Where exposed to corrosive environment including but not limited to:

a) Outdoors
b) Exposed to outdoor air within 5 feet of outdoor air intake

(2) Corrosion protection: painted with outdoor paint
(3) Springs neoprene coated
(4) Hardware cadmium plated
(5) All other metal parts hot dip galvanized

d. Reserve deflection (from loaded to solid height) of 50 percent of rated deflection
e. Designed and installed so that ends of springs remain parallel; neoprene cups not acceptable
f. Noise pads of ½ inch or 1 inch thickness below the spring base to reduce the chance that the springs shall be resonant with equipment forcing frequencies or support structure natural frequencies. See Table in Paragraph 3.4B.
g. Leveling device
h. Where operating weight differs from installed weight provide built-in adjustable limit stops to prevent equipment rising when weight is removed. Stops shall not be in contact during normal operation.

2. Type "A": Similar to Mason Type SLF
3. Type "B": same as Type "A" except

a. Provide built-in resilient vertical limit stops

b. Tapped holes in top plate for bolting to equipment
c. Capable of supporting equipment at fixed elevation during equipment erection
d. Mason Type SLRS or equal for 1 inch and 2 inch deflection, Type SLR Series 100 for 3 inch to 5 inch deflection

4. Type "C": spring hanger rod isolators shall incorporate the following

a. Spring element seated on steel washer within neoprene cup
b. Steel retainer box encasing spring and neoprene cup
c. Minimum 1/2 inch clearance between retainer box and spring hanger rod
d. Minimum 15 degrees angular clearance between rod and retainer box
e. Double deflection neoprene element at top of hanger box
f. Mason 30N or equal

B. Elastomer mounting types

1. Type "D": Double deflecting type incorporating following

a. Bolt holes for bolting to equipment base
b. Bottom steel plates for bolting to sub-base as required
c. Unit type design molded in black oil-resistant neoprene
d. Neoprene compounded to meet following:

(1) Not greater than 50 durometer
(2) Minimum tensile strength 2000 pounds per square inch
(3) Minimum elongation 300 percent
(4) Maximum compression set of 25 percent of the original deflection

e. Mason Type ND or equal
f. Mason Type BR or equal

2. Type "E": Elastomer hanger rod isolators shall incorporate following

a. Molded unit type neoprene element
b. Compounding described in Type "D" above
c. Steel retainer box encasing neoprene mounting.
d. Minimum 1/2 inch box
e. Mason Type HD or equal

3. Type "F": pad type elastomer mountings to incorporate following

a. 5/16 to 3/8 inch minimum thickness per layer
b. 50 psi maximum loading
c. Ribbed or waffled design
d. 1/16 inch galvanized steel plate between multiple layers of pad thickness
e. 1/16 inch deflection per pad thickness
f. Suitable bearing plate to distribute load
g. Bolts through equipment and pad shall be oversized and provided with resilient washers, bushings and lock nuts
h. Mason Type W Series or equal

4. Type "G": Pad type elastomer mountings to incorporate following

a. High quality bridge bearing neoprene
b. Maximum loading 800 psi

c. Suitable bearing plate to distribute load
d. Minimum thickness 2 inch
e. Mason Type BBP or equal

5. Type "H": Combination spring/elastomer hanger rod isolators to incorporate following

a. Spring and neoprene isolator elements in steel box retainer
b. Characteristics of spring and neoprene as described in Type "C" and Type "E" hanger isolators
c. Factory preloading to 75 percent of rated load
d. Mason PC30N or equal

2.3 EQUIPMENT BASES

A. Integral structural steel bases, Type "B-1"

1. Reinforced as required to prevent base flexure at start-up and misalignment of drive and driven units
2. Fan bases complete with motor slide rails
3. Drilled for drive and driven unit mounting template
4. Mason Type WFSL or equal

B. Concrete inertia base, Type "B-2"

1. Formed in structural steel frame
2. Structural base reinforced as required to prevent flexure, misalignment of drive and driven unit or stress transferal into equipment
3. Minimum thickness of the inertia base shall be 6 inches or greater if required to meet weight ratio specified below
4. Fan bases complete with motor slide rails
5. Pump bases shall be large enough to support suction and discharge elbows and suction diffusers
6. Bases complete with

a. Height saving brackets
b. Reinforcing
c. Equipment bolting provisions
d. Isolators provided by vibration control supplier, type as scheduled

7. Base ready for concrete pour
8. Inertia Base Weights

a. Centrifugal Fans, except as noted: Minimum 1.0 times weight of fan, motor and drive
b. Air handling Units, except as noted: Minimum 1.0 times weight of fan and coil cabinet, coils, fan, motor and drive
c. Pumps: Minimum 1.5 times weight of pump, motor and base

(1) Base to be sized to support suction diffuser when used

d. Air compressors

(1) Minimum 2 times weight of compressor, motor and base
(2) Weight can be reduced by weight of tank when tank mounted unit is provided

9. Mason Type KSL/BMK or equal

2.4 ANCHORS, INSERTS AND FASTENERS

A. All anchors and inserts shall be installed according to the ICBO standards

B. Do not use any anchor or insert in concrete which does not have a signed structurally engineered design value based on its installed application and one of the following

1. ICBO evaluation report
2. Lab test report verifying compliance

C. Do not use powder driven and power driven (Shoot-In) fasteners, expansion nails or friction spring clips

D. All over-head concrete anchors or inserts shall be selected to comply with the ICBO report table for the anchor or insert

E. Torque testing of anchors shall be allowed to verify compliance of anchor installation. However, torque testing shall not justify usability of anchor. Only load or pull testing shall be allowed to justify usability of anchors. Failure of torque shall constitute failure of anchor.

F. Bolts and nuts

1. Bolts and heavy hexagon nuts: ANSI B18.2.1 and ASTM A307 or A576
2. Bolts, underground: ASTM A325
3. Expansion anchors: Federal Specification A-A-1922

2.5 FLEXIBLE PIPE CONNECTORS

A. Piping Connections for Vibration Isolation

1. Molded twin-sphere type connectors made of peroxide cured EPDM and Kevlar tire cord reinforcement
2. Connectors up to 2 inch diameter may have threaded ends
3. Connectors 2-1/2 inch diameter and larger to have floating steel flanges recessed to lock the connector's neoprene flanges
4. Connectors rated a minimum of 150 pounds per square inch at 220 degrees Fahrenheit without control rods or cables
5. Mason SAFEFLEX Type SFDEJ or equal

2.6 FLEXIBLE DUCT CONNECTORS

A. See Section 23 31 13 – Ducts

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install isolators in accordance with manufacturer's written instructions

B. Vibration isolators must not cause any change of position of equipment or piping resulting in piping stresses or misalignment

C. Make no rigid connections between equipment and building structure that degrade noise and vibration isolation system herein specified

1. Electrical conduit connections to isolated equipment shall be flexible liquid tight conduit of sufficient length to incorporate a right angle bend, an offset of not less than 8 inches or a loop to allow free motion of isolated equipment
2. The HVAC Sub-contractor shall not install any equipment, piping or conduit which makes rigid contact with the building unless permitted in this Specification; building includes, but is not limited to, slabs, beams, columns, studs and walls
3. Coordinate work with other trades to avoid rigid contact with the building. Inform other trades following work, such as plastering or electrical, to avoid any contact which would reduce the vibration isolation

D. Do not use isolator leveling bolts as jacking screws

E. Verify that all installed isolators and mounting systems permit equipment motion in all directions

3.2 FLOOR MOUNTED EQUIPMENT

A. Concrete housekeeping pads

1. Isolation supplier to determine dimensions and thickness required

a. Minimum thickness: 5.5 inches

2. Support all vibration isolation devices and bases
3. Key with stirrups as required, integral with structural slab

3.3 EQUIPMENT ISOLATION

A. General

1. Provide 1 inch operating clearance between equipment or structural bases and housekeeping pad

a. 1 inch minimum clearance for inertia bases over 96 inches in any dimension

2. Position equipment, structural base and concrete bases on blocks or wedges at proper operating height
3. Provide operating load conditions prior to transferring base isolator loads to springs and removing wedges
4. Adjust or provide additional resilient restraints to flexibly limit start-up equipment lateral motion to 1/4 inch
5. Prior to start-up, clean out all foreign matter between bases and equipment
6. Verify that there are no isolation short circuits in the base, isolators, or conduit, pipe and duct connections
7. Locate spring hanger boxes directly adjacent to the structural support element above, as opposed to down at the location of the supported equipment
8. Where isolator base pad is called for in Vibration Isolator Schedule, install pad between the

isolator base and structure

9. For isolator pads penetrated by anchors to the structure, to prevent short-circuiting, provide neoprene grommet between the anchor and isolator. Hand-tighten nut so that grommet is not compressed then secure with lock nut.

B. Vibration Isolator Schedule

Equipment	Base Type	Isolator Type	Isolater Static Deflection	Thickness
Floor-mounted Pumps				
10 HP and larger	B-2	A	2 inch	1 inch
5 HP to 7.5 HP	B-2	A	1.5 inch	1/2 inch
<5 HP	B-2	A	1 inch	1/2 inch–
Floor-mounted AHUs (internally isolated)	None	F	1/4 inch	–
Suspended fan-coils, AC, HP	None	C	1 inch	–
Floor-mounted fans <10 HP	B-1	A	1 inch	1/2 inch
Floor-mounted fans > 10 HP				
<300 RPM	B-1 (B-2 if 50 HP or larger	A	3.5 inch	1/2 inch
300-450 RPM	ditto	A	3 inch	1/2 inch
451-600 RPM	ditto	A	2.5 inch	1/2 inch
601-750 RPM	ditto	A	2 inch	1/2 inch
751-850 RPM	ditto	A	1.5 inch	1/2 inch
>850 RPM	ditto	A	1 inch	1/2 inch
Suspended fans direct drive	None	E	0.2 inch	–
Suspended fans belt drive	None	C	As for floor mounted fans plus 1/4 inch	As for floor mounted fans
Wall mounted propeller fans				
1 HP and larger	None	F	1/4 - inch	–
<1 HP	None	–	–	–

3.4 PIPING AND DUCTWORK ISOLATION

A. See Section 23 21 12 – Heating and Cooling Piping and Section 23 31 13 – Ducts

B. Ductwork

1. No vibration isolation required

C. Piping other than risers

1. No vibration isolation required

D. Pipe Risers

1. For pipe risers less than 75 feet, vertical risers shall be laterally supported with a riser clamp at each floor set on a Type F isolation pad, ¼" deflection.
2. For pipe risers greater than 75 feet, riser supports shall be engineered by the vibration isolation vendor as follows

    a. All vertical risers shall be supported by spring isolators designed to support the riser filled with water. Assigned loads must be within the building design limits at the support points.
    b. Neutral central resilient anchors close to the center of the run shall direct movement up and down. The anchors shall be capable of holding an upward force equal to the water weight when the system is drained. If one level cannot accommodate this force, anchors can be located on 2 or 3 adjacent floors. Anchors shall be Mason ADA or equal.
    c. Resilient guides shall be spaced and sized properly depending on the pipe diameter. Guides shall be Mason VSG Vertical Sliding Guides or equal.
    d. Support spring mountings shall be Type A. The initial spring deflection shall be a minimum of 0.75 inches or four times the thermal movement at the isolator location, whichever is greater.
    e. Submittals must include the initial load, initial deflection, change in deflection, final load and change in load at all spring and anchor support locations, as well as guide spacing. Calculations shall include pipe stress at end conditions and branch off locations and the manufacturer must include installation instructions. Submittal must be stamped and signed by a licensed professional engineer in the employ of the vibration isolator vendor.

E. Wall and Floor Penetrations

1. All piping and ductwork to be vibration isolated, and all piping and ductwork passing through acoustically rated partitions, shall freely pass through walls and floors without rigid contacts or connections. Penetration points shall be sleeved or otherwise formed to allow passage of piping or ductwork, and maintain 0.75 inches to 1.25 inches clearance around the pipe or duct outside surfaces.

    a. For installations through air plenum partitions and through acoustically rated partitions, clearance space shall be tightly packed with fiberglass, and caulked airtight after installation of piping or ductwork
    b. For installation in rated walls, see Section 23 21 12 – Heating and Cooling Piping and Section 23 31 13 – Ducts

2. Provide sleeves and escutcheons as specified in Section 23 21 12 – Heating and Cooling Piping and Section 23 31 13 – Ducts.

3.5 FIELD QUALITY CONTROL

A. Inspection by manufacturer's representative of all vibration isolating devices

1. After installation of all devices
2. Provide written report by manufacturer regarding

    a. Installation errors
    b. Improper selection of devices
    c. Other fault that could affect performance of system

B. Submit written report to Professional

1. Include manufacturer's report indicating required corrections
2. Include report on steps to properly complete isolation work

C. See Section 23 08 00 – Mechanical Commissioning

END OF SECTION 23 05 48

SECTION 23 05 53 – MECHANICAL SYSTEM IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. These heating, ventilating and air conditioning (HVAC) provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.2 SUMMARY

A. This Section includes the following mechanical identification materials and their installation:

1. Equipment nameplates.
2. Equipment markers.
3. Equipment signs.
4. Access panel and door markers.
5. Pipe markers.
6. Duct markers.
7. Valve tags.
8. Valve schedules.
9. Warning tags.

B. Related Sections

1. Section 23 00 10 – Mechanical General Provisions
2. Section 23 05 00 – Basic Mechanical Materials and Methods

1.3 REFERENCE STANDARDS

A. Pipe marker shall comply with ANSI A13-1

1.4 SUBMITTALS

A. See Section 23 00 10 – Mechanical General Provisions

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing

Item	Product Data	O&M Manual	Samples	Shop Drawing
Pipe markers	R		R	
Duct markers	R		R	
Equipment tags	R		R	
Valve tags	R		R	
Concealed equipment markers	R		R	

C. Samples: For color, letter style, and graphic representation required for each identification material and device.

D. Valve numbering scheme.

E. Valves Schedules: For each piping system. Furnish extra copies (in addition to mounted copies) to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

1.6 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with location of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. W.H. Brady

C. Seton

D. Marking Systems, Inc. (MSI)

E. Or equal

2.2 EQUIPMENT IDENTIFICATION DEVICES

A. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.

1. Data:

a. Manufacturer, product name, model number, and serial number.
b. Capacity, operating and power characteristics, and essential data.
c. Labels of tested compliances.

2. Location: Accessible and visible.
3. Fasteners: As required to mount on equipment.

B. Equipment Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.

1. Data: Instructions for operation of equipment and for safety procedures.
2. Engraving: Manufacturer's standard letter style, of sizes and with terms to match equipment identification.
3. Thickness: 1/8 inch, unless otherwise indicated.
4. Thickness: 1/16 inch for units up to 20 sq. in. or 8 inches in length, and 1/8 inch for larger units.
5. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

C. Access Panel and Door Markers: 1/16-inch thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification. Provide 1/8-inch center hole for attachment.

1. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

2.3 PIPING IDENTIFICATION DEVICES

A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.

1. Colors: Comply with ASME A13.1, unless otherwise indicated.
2. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
3. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers extending 360 degrees around pipe at each location.
4. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or shaped pipe markers at least three times letter height and of length required for label.
5. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.

B. Pretensioned Pipe Markers: Precoiled semirigid plastic formed to cover full circumference of pipe and to attach to pipe without adhesive.

C. Shaped Pipe Markers: Preformed semirigid plastic formed to partially cover circumference of pipe and to attach to pipe with mechanical fasteners that do not penetrate insulation vapor barrier.

D. Background Color

Service	Pipe marker	Background color	Lettering
Chilled water	Chilled water supply	Green	Black
	Chilled water return	Green	Black
Heating water	Heating water supply	Yellow	Black
	Heating water return	Yellow	Black
Cold water	Domestic cold water	Green	Black
Hot water	Domestic hot water supply	Yellow	Black
	Domestic hot water return	Yellow	Black
Sprinkler water	Fire protection water	Red	Black
Air, instrument	Instrument air	Green	Black
Sanitary waste	Sanitary waste	Green	Black
Storm drain	Storm drain	Green	Black
Overflow drain	Overflow drain	Green	Black
Vent	Vent	Green	Black
Heat recovery water	Heat recovery supply	Yellow	Black
	Heat recovery return	Yellow	Black
Process grey water	Process grey water	Green	Black
Emergency eyewash and shower	Emergency shower	Yellow	Black
Refrigerant Suction/Gas	Refrigerant Suction/Gas	Yellow	Black
Refrigerant Liquid	Refrigerant Liquid	Yellow	Black
Natural gas	Natural gas	Yellow	Black

2.4 DUCT IDENTIFICATION DEVICES

A. Duct Markers: Engraved, color-coded laminated plastic. Include direction and quantity of airflow and duct service (such as supply, return, and exhaust). Include contact-type, permanent adhesive.

2.5 VALVE IDENTIFICATION

A. Valve Tags: Numbering scheme approved by Professional

1. General: Identify valves with metal tags, legends to be stamped or embossed. It shall indicate the function of the valve and its normal operating position; such as:

   a. “56 HW” (NUMBER AND CONTENT OF PIPE)
   b. “ISOLATION” (VALVE FUNCTION)
   c. “NO” (NORMAL OPERATION POSITION)

2. Not required at isolation valves located adjacent to equipment they isolate.
3. Size: Valve tags 2-inch diameter with 1/4-inch high letters for piping system abbreviation and 1/2-inch numbers with numbering scheme approved by Professional.
4. Material: Use 0.050 or 0.064-inch brass tags
5. Automatic Valves and Regulating Valves: Use 1/16-inch thick laminated 3-ply plastic, center ply white, outer ply red, “lamicoid” or equal. Form letters by exposing center ply
6. Valve Tag Directory: Include tag number, location, exposed or concealed, service, valve size, valve manufacturer, valve model number, tag material, and normal operating position of valve
7. Medical Gas Zone Valves (Regulatory Identifier): See attached sample, confirm with

Using Agency and Professional.

a. Acrylic: 3.00” h x 7.00” w x 0.125” non-glare, reversed lettered, backpainted
b. Actual Outside Dimensions: 3.00 “ x 7.00”
c. Text:

1) Tactile: 0.375” Futura Medium, First Letter Capital, Centered, 0.25” between lines of text

d. Colors:

1) UMS Blue: Tactile Plate
2) White: Text

e. Installation: Signage company to install. Mount with double-sided adhesive tape and silastic adhesive or mechanically secure with 3/16” x 1” nylon anchors.

2.6 VALVE SCHEDULES

A. Valve Schedules: For each piping system, on plastic laminated, standard-size bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-Schedule Frames: Glazed display frame for removable mounting on masonry walls for each page of valve schedule. Include mounting screws.
2. Frame: Extruded aluminum.
3. Glazing: ASTM C 1036, Type I, Class 1, Glazing Quality B, 2.5-mm, single-thickness glass.

2.7 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags; of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 4 by 7 inches.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.
4. Color: Yellow background with black lettering.

2.8 EQUIPMENT LOCATOR TACKS

A. 7/8" diameter tack for pushing into ceiling tile near closest equipment access point. Colors to be as specified.

PART 3 - EXECUTION

3.1 HVAC EQUIPMENT IDENTIFICATION

A. Install and permanently fasten equipment nameplates on each major item of mechanical

equipment that does not have nameplate or has nameplate that is damaged or located where not easily visible. Locate nameplates where accessible and visible. Include nameplates for the following general categories of equipment:

1. Fuel-burning units, including boilers, makeup air units, and domestic water heaters.
2. Pumps, chillers, condensing units, cooling towers and similar motor-driven units.
3. Coils, evaporators, tanks, and similar equipment.
4. Fans, blowers, primary balancing dampers, and VAV terminal units.
5. Packaged HVAC central-station and zone-type units, including modular air handling units, ductless split-system units, unit heaters, etc.
6. Tanks, large piping specialties (expansion tanks and air separators).

B. Install equipment signs with screws or permanent adhesive on or near each major item of mechanical equipment. Locate signs where accessible and visible.

1. Identify mechanical equipment with equipment markers in the following color codes:

   a. Blue: For cooling equipment and components.
   b. Orange: For heating equipment and components.
   c. Green: For combination cooling and heating equipment and components.
   d. Brown: For energy-reclamation equipment and components.

2. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

3. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.

4. Include signs for the following general categories of equipment:

   a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
   b. Meters, gages, thermometers, and similar units.
   c. Fuel burning units including boilers, gas-fired makeup air units, domestic water heaters.
   d. Pumps, chillers, condensing units, and similar motor-driven units.
   e. Heat exchangers, coils, evaporators, and similar equipment.
   f. Fans, blowers, primary balancing dampers, and control dampers.
   g. Packaged HVAC central-station units, including modular air handling units, ductless split system heat pumps, terminal units, unit heaters, etc.
   h. Tanks and pressure vessels.
   i. Strainers, filters, water-treatment systems, and similar equipment.
   j. Starters, variable frequency drives, contactor, push-button station, control switch, disconnect and thermal overload switch

C. Install access panel markers with screws on equipment access panels.

3.2 PIPING IDENTIFICATION

A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.

1. Pipes with OD, Including Insulation, Less Than 6 Inches: Pretensioned pipe markers. Use size to ensure a tight fit.

B. Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior nonconcealed locations as follows:

1. Within 18” of each valve, valve assembly and control device.
2. Within 3’ of each 90 degree elbow, connection to equipment or vessel and where pipe enters shafts and penetrates outside walls, floors, ceilings and nonaccessible enclosures.
3. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 20 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings (maximum of 20 feet). Omit intermediately spaced markers.

3.3 HVAC DUCT IDENTIFICATION

A. Install duct markers with permanent adhesive on air ducts in the following color codes:

1. Green: For cold-air supply ducts.
2. Yellow: For hot-air supply ducts.
3. Blue: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
4. ASME A13.1 Colors and Designs: For hazardous material exhaust.
5. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

B. Locate markers near points where ducts enter into concealed spaces and at maximum intervals of 25 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.4 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; plumbing fixture supply stops; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following:

1. Valve-Tag Size and Shape:

a. Domestic and Hydronic Cold Water: 1-1/2 inches round.
b. Domestic and Hydronic Hot Water: 1-1/2 inches round.
c. Refrigerant: 1-1/2 inches round.
d. Fire Suppression Water: 1-1/2 inches round.

2. Valve-Tag Color:

    a. Domestic and Hydronic Cold Water: Blue
    b. Domestic and Hydronic Hot Water: Yellow
    c. Refrigerant: Green
    d. Fire Suppression Water: Red

3. Letter Color:

    a. Domestic and Hydronic Cold Water: Black
    b. Domestic and Hydronic Hot Water: Black
    c. Refrigerant: White
    d. Fire Suppression Water: White

3.5 VALVE-SCHEDULE INSTALLATION

A. Mount valve schedule on wall in accessible location in each major equipment room.

3.6 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

3.7 EQUIPMENT LOCATOR TACKS

A. Install tacks into the ceiling tile or insulation at the closest access point to the device.

B. Install tacks to locate above ceiling equipment and devices as follows:

1. Fire dampers (red)
2. Manual volume dampers (orange)
3. Motorized control dampers (yellow)
4. HVAC equipment (black)
5. Hydronic system valves (green)
6. Control system devices (light blue)
7. Cold water (blue)
8. Hot water (red)

3.8 ADJUSTING

A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

3.9 CLEANING

A. Clean faces of mechanical identification devices and glass frames of valve schedules.

END OF SECTION 23 05 53

SECTION 23 05 93 – TESTING, ADJUSTING AND BALANCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. These heating, ventilating and air conditioning (HVAC) provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.2 SUMMARY

A. The Testing, Adjusting, and Balancing (TAB) Agency shall be hired by the Commissioning Authority directly, under a separate contract with the Using Agency. This Section is provided to establish the TAB scope of work and provide information to enable the Contractor to schedule TAB activities with all other trades.

B. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Operational testing and adjusting of air handling equipment
2. Balancing of air distribution systems
3. Adjustment of air terminal devices
4. Flow testing, adjusting and balancing of hydronic systems.

C. Related Sections

1. Section 01 91 00 – Commissioning
2. Section 23 00 10 – Mechanical General Provisions
3. Section 23 05 00 – Basic Mechanical Materials and Methods
4. Section 23 31 13 – Ducts
5. Section 23 08 00 – Mechanical Commissioning
6. Section 23 09 00 – Energy Management & Control Systems

1.3 REFERENCE STANDARDS

A. National Environmental Balancing Bureau Procedural Standards

B. Associated Air Balance Council National Standards

C. ASHRAE Standard 111 Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilating, and Air-Conditioning Systems

1.4 QUALITY ASSURANCE

A. Agency shall be member of Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB)

B. Agency shall have satisfactorily balanced at least three systems of comparable type and size

C. Prior to start of testing, adjusting and balancing, verify that required Project conditions are met

1. Systems installation is complete and in full operation
2. All pre-functional tests have been performed
3. Equipment has been started and tested in accordance with manufacturers written installation instructions
4. Doors and windows are in place or under normal traffic conditions

1.5 SUBMITTALS

A. See Section 23 00 10 – Mechanical General Provisions.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. "R" means required.
2. "R2" means required only for products and equipment differing for the specified manufacturer and model and for "or equals" where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
AABC, NEBB or TABB certification	R			
Report forms	R			
List of instrumentation	R			
Final air balancing report		R		
Final water balancing report		R		

C. Submit to Professional documentation that

1. Agency is a member of Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB).
2. Agency has satisfactorily balanced at least three systems of comparable type and size

a. Include list of such projects
b. Include sample forms for use in compiling and recording test and balance data

D. Pre-Test Submittal

1. At least 15 days prior to starting field work, submit paper copies of the following

a. Set of final report forms

(1) Complete with design conditions of all equipment and design flow rates for all equipment and devices to be balanced.
(2) Forms shall include blank entry space for all data requested in this Section. Carefully review requested data; standard balancing forms may not be acceptable.

(3) Verify that forms are in acceptable word-searchable electronic format per Section 23 05 00 – Basic Mechanical Materials and Methods.

b. Complete list of instruments proposed to be used

(1) Organize in appropriate categories
(2) Include data sheets for each
(3) Show

a) Manufacturer and model number
b) Description and use when needed to further identify instrument
c) Size or capacity range
d) Latest calibration date

c. Provide certification that

(1) All instruments have been calibrated prior to tests
(2) Instruments comply with requirements of AABC or NEBB for tests required
(3) Agency is currently certified by AABC or NEBB

2. Do not proceed with field work until the above submittal has been approved by Professional.

E. Final Test & Balance Report

1. At least 15 days prior to Contractor's request for final inspection, submit three paper copies of final reports on approved reporting forms for review and approval by Professional. Once approved, provide required quantity of paper and electronic copies per 23 00 10 – Mechanical General Provisions.

2. Form of Final Reports

a. Fully completed report forms for all systems specified to be tested and balanced including at a minimum all data specified herein to be recorded
b. Each individual final reporting form must bear

(1) Signature of person who recorded data
(2) Signature of air balance supervisor of reporting organization

c. When more than one certified organization performs total air balance services, firm having managerial responsibility shall make submittals.
d. Identify instruments of all types that were used and last date of calibration of each.

1.6 PROJECT REVIEW

A. Pre-Construction Review

1. Review following documents

a. Contract documents

(1) Drawings
(2) Specifications
(3) Addenda
(4) Change orders

b. Design intent documents
c. Submittal data
d. Shop drawings
e. Temperature control drawings
f. Pre-functional test reports

2. Assure that design intent and all sequences of operation are clearly understood.
3. Identify potential problems from standpoint of total system balance.
4. Review of specifications for

a. Scope of work
b. Special requirements
c. Items that will make balancing difficult or impossible

5. Review of Drawings for

a. Potential problems for total system balance

(1) Location of balancing devices
(2) Lack of balancing devices
(3) General System layout
(4) Architectural features
(5) Accessibility

b. Most effective system balance procedures
c. Scheduling and coordination requirements

6. Review of submittal data for

a. Completeness of data
b. Conformity with contract documents
c. Special instructions for use of balancing devices
d. Factors for flow meters
e. Limitations affecting accuracy of measurements
f. Balancing forms shall show design data and submittal data where different
g. Equipment performance data and curves

7. Review of shop drawings for potential problems for total system balance, as specified above for review of the contract Drawings.

8. Review of temperature control drawings for:

a. Thorough understanding of system functions
b. Determining most effective total system balance procedure for minimum control manipulation
c. Coordinate required control manipulation with EMCS installer

9. Submit report recommending addition and/or relocation of balancing devices, including, but not limited to

a. Volume dampers
b. Balancing valves
c. Flow metering devices, for air and water
d. Pressure and temperature measuring points

B. Construction Review

1. Make on-site visits during progress of construction: Number of visits to be as required to perform the functions specified below.
2. Purpose of review

a. Identify potential problem for performing total system balance
b. Identify modifications that will affect air total system balance
c. Schedule and coordinate total system balance with other work
d. Identify conditions that could create hazardous environment for building occupants

3. Typical activities

a. Check that necessary balancing and measuring hardware is

(1) In place
(2) Located properly and accessibly
(3) Installed correctly

b. Identify and evaluate variations from system design
c. Record data from equipment nameplates
d. Identify and report possible restrictions in systems; such as

(1) Closed fire dampers
(2) Long runs of flexible duct
(3) Poorly designed duct fittings
(4) Questionable piping connections
(5) Others as may arise or based on Agency's experience

e. Verify that construction progress will not delay total system balance
f. Identify best location for duct Pitot tube traverses
g. Identify scaffolding needs

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified herein. If not otherwise noted, the following minimum requirements apply

1. Volt-meter: plus or minus 1 percent scale
2. Ammeter: plus or minus 1 percent scale
3. Ohmmeter: plus or minus 0.1 percent scale for calibrating plus or minus 0.4 degrees Fahrenheit resistance temperature sensors, plus or minus 0.25 percent scale for calibrating plus or minus 1 degrees Fahrenheit temperature sensors, plus or minus 1 percent scale for measuring motor current
4. Ultrasonic time-of-travel strap-on flow sensor: plus or minus 5 percent of reading
5. Other flow sensors: plus or minus 2 percent of reading
6. Water pressure gauge: plus or minus1/2 percent scale, ASME Grade 2A
7. Watt meter, plus or minus1/2 percent scale: 3 phase split core current transducers
8. Temperature: plus or minus 0.4 degrees Fahrenheit

B. All equipment shall be calibrated within 6 months of use, or according to the manufacturer's recommended interval, whichever is shorter, and when dropped or damaged. Calibration tags shall be affixed or certificates readily available and proof of calibration shall be included reports.

PART 3 - EXECUTION

3.1 GENERAL

A. Coordinate with work of other trades.

B. Coordinate all work with Commissioning Coordinator

1. See Section 01 91 00 – Commissioning
2. See Section 23 08 00 – Mechanical Commissioning

C. Report to Professional any discrepancies or items not installed in accordance with the Contract Drawings pertaining to proper balance and operation of air and water distribution systems.

D. Perform testing, adjusting and balancing in accordance with AABC or NEBB standards.

E. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to Section 23 07 00 – Mechanical Insulation.

F. Mark equipment settings with paint or other suitable, permanent identification material, including damper control positions, valve indicators, and similar controls and devices, to show final settings.

3.2 CONTROL SYSTEM COORDINATION

A. See Section 23 09 00 – Energy Management & Control Systems (EMCS)

B. System balance techniques in this Section rely on the operation of the EMCS. Test and balance agency shall coordinate schedule of work with EMCS installer to ensure test and balance work can be executed and completed in a timely manner.

C. Cooperate with EMCS installer in determining operating conditions and setpoints, as indicated in this Section.

D. Cooperate with EMCS installer in calibrating all airflow measuring devices.

E. Obtain and receive training for required software from controls system vendor for setting calibration constants in terminal devices.

3.3 WATER SYSTEMS BALANCING

A. Prepare water systems for balancing in following manner

1. Verify the following conditions

a. Piping systems have been flushed and treated in accordance with Section 23 21 13 – Heating and Cooling Piping
b. Strainers have been cleaned
c. Insides of traps, reducing and regulating valves have been cleaned
d. Expansion tanks are not air bound
e. Piping systems are completely full of water, all air properly vented
f. All coil and heat exchanger isolation shut-off and balance valves are fully open

2. Check pump:

a. Rotation
b. Pump factory impeller trimming by comparing shut-off heads with pump curves from approved submittals

(1) Note that impellers on variable speed pumps should not be trimmed to design flow and head conditions. See 23 21 23 – Pumps.
(2) Report discrepancy in shut-off head to Professional and if impeller does not appear to be properly trimmed, wait for direction before proceeding with pump test and balance.

3. EMCS and Central Plant Operability

a. Do not proceed with any of the following balancing procedures until the EMCS is capable of operating equipment such as fans, pumps, VAV boxes, control valves, and the like, in manual and automatic modes and capable of reading sensors such as differential pressure, flow rates, temperatures, and the like, of air and hydronic systems to be tested and adjusted.
b. Do not proceed with air handler and fan-coil testing until chilled and hot water at design temperatures are available from the central plant.

B. Pumps

1. Test and report for each pump

a. Tag
b. Manufacturer and model of pump and motor
c. Motor horse power, volts, phase, full load amps
d. Pump shut-off head from curves and measured shut-off head
e. With all control valves open to coils, variable speed drive (where installed) at 60 hertz, and parallel pumps all operating (where applicable)

(1) Volts and amps, measured with handheld meter, and calculated brake horsepower
(2) Amps and kilowatts, from EMCS/variable speed drive
(3) Entering and leaving gage pressure and difference in feet
(4) Flow rate deduced from pump curve
(5) Flow meter reading from EMCS

C. Hot Water System

1. The system is self-balancing via the controls. Two-way control valves at coils prevent each coil from being over-supplied with water, other than minor excursions during transients such as cool-down or warm-up. Conventional balancing (throttling of balancing valves) is not required nor desired. Do not adjust any valves on any coil or pump, except where specifically noted herein.

2. Balancing

    a. No balance is required at 2-way valves. Leave isolation shut-off valves full open.
    b. At 3-way valves, adjust balance valve in bypass leg as required to make pressure drop across the coil-valve assembly when valve is in full-bypass position equal to that when valve is in through-coil position. (Not required on coils with less than 1 foot pressure drop.) Leave isolation shut-off valves full open.
    c. Run pumps with all heating coil valves open. Balance flow through boilers to be equal .
    d. Report

        (1) Reheat Coils

            a) Tags of HW coils with 3-way valves that are balanced
            b) Pressure drop across the assembly with valve open to coil
            c) Pressure drop across the assembly with valve open to bypass before and after bypass valve balance

        (2) See Air Balance below for reheat coil temperature data

3. Test control valve shut-off

    a. See Section 23 09 00 – Energy Management & Controls Systems and coordinate with EMCS installer.
    b. Close all control valves in the system via the EMCS. Close bypass balance valves of 3-way valves. Run all HW pumps at full speed, dead-headed

        (1) Verify that all control valves remain shut with no measurable flow, as indicated by pump differential pressure, boiler flow , and any temperature rise across coils. See Section 23 09 00– Energy Management & Controls Systems.
        (2) Do not run pumps deadheaded for more than 5-minutes at any one time.
        (3) After test, return 3-way valve balance valves to prior position.

    c. Report: Provide a report separate form for this work for each pumping system and include as a minimum the following as measured under the control valve shut-off condition described above

        (1) Tag of coils where flow is detected: Initials of EMCS installer to indicate that this information was transmitted to them.
        (2) Measured pump inlet and outlet pressures, and difference converted to feet.

D. Variable flow pumping systems with variable speed drives

1. Applies to

    a. Chilled water system
    b. Hot water system

2. System is variable flow with variable speed drives: The system is self-balancing via the controls. Two-way control valves at coils prevent each coil from being over-supplied with water, other than minor excursions during transients such as cool-down or warm-up, and the flow meter at the building connection to the central plant will be used to limit over-pumping of primary water from the central plant. Conventional balancing (throttling of balancing valves) will increase pump energy use by not allowing aggressive differential pressure setpoint reset. Hence, do not adjust any valves on any coil or pump, except temporary adjustments where noted. All manual valves at coils and pumps shall be wide open when test and balance work

is complete.

3. Determine differential pressure setpoint in conjunction with the EMCS installer as follows. (All adjustments made via the EMCS, not field measurements except as noted.)

    a. Fully open all chilled water control valves serving coils that are located downstream of the differential pressure sensor.
    b. Fully close all chilled water control valves serving coils that are located upstream of the differential pressure sensor.
    c. Start one of the building loop chilled water pumps. Manually adjust speed slowly until design flow (or design pressure drop, for coils without calibrated balance valves) is just achieved through all open coils without modulating any balance valves: One coil should be just at design flow, while others should be at or above design flow by no more than 20 percent. If flow is over 20 percent of design rate, temporarily throttle flow to coil with shut-off valve as required to reduce rate to design. Fully open shut-off valve after procedure is complete.
    d. Once flow condition in previous step is achieved, note the EMCS system differential pressure reading at the differential pressure sensor. This reading becomes the differential pressure setpoint: Using pressure taps at differential pressure sensor and handheld digital pressure sensor, verify accuracy of EMCS reading.
    e. If there are multiple differential pressure sensors, repeat steps above for each sensor and use largest as differential pressure setpoint.
    f. Convey to the EMCS installer

        (1) Differential pressure setpoint
        (2) Any discrepancy between EMCS differential pressure reading and handheld measurement

    g. Test Report: Provide a separate form for each pumping system and include as a minimum the following

        (1) Differential pressure setpoint and concurrent reading of handheld measurement: Initials of EMCS installer to indicate that the information was transmitted to them.
        (2) Tag of coils downstream of differential pressure sensor, along with the following for each

            a) Design flow rate and pressure drop
            b) Tested flow rate and pressure drop with differential pressure at setpoint determined above
            c) Note if any shut-off valves at coils were required to be throttled in order to prevent excess flow, and initials of balancer that valves were returned to full open position after tests are complete

        (3) Concurrent pump data

            a) Amps and kilowatts, from EMCS
            b) Variable speed drive speed in hertz
            c) Entering and leaving gage pressure and difference in feet
            d) Flow rate deduced from pump curve
            e) Flow rate reading from EMCS

4. Test control valve shut-off

    a. Close all control valves in the system. Close bypass balance valves of 3-way valves. Run all pumps (except stand-by pumps, if any) at full speed, dead-headed

(1) Verify that all control valves remain shut with no measurable flow, as indicated by pump differential pressure and any temperature rise across coils.
(2) Do not run pumps deadheaded for more than 5-minutes at any one time.
(3) After test, return 3-way valve balance valves to prior position.

b. Report: Provide a report separate form for this work for each pumping system and include as a minimum the following as measured under the control valve shut-off condition described above

(1) Tag of coils where flow is detected: Initials of EMCS installer to indicate that this information was transmitted to them.
(2) Measured pump inlet and outlet pressures, and difference converted to feet
(3) Differential pressure reading at all differential pressure sensors, through EMCS
(4) Water flow rate from flow meter, through EMCS

E. Bypass balance at 3-way valves

1. At all 3-way valves serving coils with a design coil pressure drop exceeding 2 feet, adjust balance valve in bypass leg as required to make pressure drop across the coil-valve assembly when valve is in full-bypass position equal to that when control valve is in through-coil position.

2. Record and Report

a. Mark setting on bypass balancing valve
b. The following shall be included as part of air-handler/fan-coil test form

(1) Differential pressure across coil-valve assembly when control valve is in full-bypass position
(2) Differential pressure across coil-valve assembly when control valve is in through-coil position

F. Chilled Water System

1. System is variable flow with variable speed drives: The system is self-balancing via the controls. Conventional balancing (throttling of balancing valves) will increase pump energy use by not allowing aggressive differential pressure setpoint reset. Hence, do not adjust any valves on any coil or pump, except temporary adjustments where noted. All manual valves at coils and pumps shall be wide open when test and balance work is complete unless otherwise indicated.
2. Balance

a. Coils with two-way pressure dependent (standard) control valves:

(1) No balance is required. Leave all shut-off and balancing valves full open.

b. Coils with two-way pressure independent control valves:

(1) No balance is required. Leave all shut-off and balancing valves full open.
(2) Verify that model number matches coil design flow rate from equipment schedule.

a) Where adjustment is required to achieve ½ gpm increments, adjust maximum setting per manufacturer's charts.

c. Test and record

(1) Coils with two-way pressure dependent (standard) control valves:

a) Terminal tag
b) Control valve model number and serial number
c) Pressure drop across the coil with valve open to coil

(2) Coils with two-way pressure independent control valves:

a) Terminal tag
b) Control valve model number and serial number
c) Pressure drop across the coil with valve open to coil
d) Maximum valve position adjustment

(3) See Air Balance below for coil temperature data

3. Determine differential pressure setpoint in conjunction with the EMCS Contractor as follows. (All adjustments made via the EMCS, not field measurements except as noted.):

a. Fully open all control valves serving coils that are located downstream of the differential pressure sensor.
b. Fully close all control valves serving coils that are located upstream of the differential pressure sensor.
c. Start one of the chilled water pumps. Manually adjust speed slowly until design flow (or design pressure drop, for coils without calibrated balance valves) is just achieved through all open coils without modulating any balance valves:

(1) One coil should be just at design flow, while others should be at or above design flow by no more than 20 percent. If flow is over 20 percent of design rate, temporarily throttle flow to coil with shut-off valve as required to reduce rate to design. Fully open shut-off valve after procedure is complete.

d. Once flow condition in previous step is achieved, note the EMCS system differential pressure reading at the differential pressure sensor. This reading becomes the differential pressure setpoint:

(1) Using pressure taps at differential pressure sensor and handheld digital pressure sensor, verify accuracy of EMCS reading.

e. If there are multiple differential pressure sensors, repeat steps above for each sensor; each will have a different setpoint.
f. Convey to the EMCS contractor:

(1) Differential pressure setpoint
(2) Any discrepancy between EMCS differential pressure reading and handheld measurement

g. Test Report: Provide a separate form for each pumping system and include as a minimum the following:

(1) Differential pressure setpoint and concurrent reading of handheld measurement:

a) Initials of EMCS contractor to indicate that the information was transmitted to them.

(2) Tag of coils downstream of differential pressure sensor, along with the following for each:

a) Design flow rate and pressure drop.
b) Tested flow rate and pressure drop with differential pressure at setpoint determined above.
c) Note if any shut-off valves at coils were required to be throttled in order to prevent excess flow, and initials of balancer that valves were returned to full open position after tests are complete.

(3) Concurrent pump data:

a) Amps and kilowatts, from EMCS.
b) Variable speed drive speed in hertz.
c) Entering and leaving gage pressure and difference in feet.
d) Flow rate deduced from pump curve.
e) Flow rate reading from EMCS flow meter.

4. Test control valve shut-off:

a. Close all control valves in the system through the EMCS. Run all pumps at full speed, dead-headed:

(1) Verify that all control valves remain shut with no measurable flow, as indicated by pump differential pressure, flow meters, and any temperature rise across coils. See Section 23 09 00.
(2) Do not run pumps deadheaded for more than 5-minutes at any one time.

b. Report: Provide a report separate form for this work for each pumping system and include as a minimum the following as measured under the control valve shut-off condition described above:

(1) Tag of coils where flow is detected:

a) Initials of EMCS contractor to indicate that this information was transmitted to them.

(2) Measured pump inlet and outlet pressures, and difference converted to feet.
(3) Differential pressure reading at all differential pressure sensors, through EMCS.
(4) Water flow rate from flow meter, through EMCS.

3.4 AIR SYSTEM BALANCING

A. General

1. Do not operate fan systems for test or balance until spaces served have been cleaned of dust and debris, to avoid contamination of supply air or return air paths and equipment.
2. Check that filters are installed, free of bypass, and clean; type as specified herein

a. Make allowance for air filter resistance at time of tests

(1) Pressure drop across filter banks midway between drop for clean and dirty filters at design airflow

b. For systems with construction prefilters and high efficiency final filters

(1) Perform all zone level balancing with only pre-filter installed, no final filter, and system operating on 100 percent outdoor air.
(2) Immediately prior to occupancy replace prefilters with new clean filters and install final filters. With final filters in place, perform tests of air handling unit per Paragraph 3.4D.

3. In cooperation with EMCS installer, set adjustments of automatically operated dampers and valves to operate as indicated.
4. Balance hydronic systems prior to air balance and have operational during air balance for air temperature measurements.

B. Air Outlets

1. Adjust diffusers' throw pattern, grilles and registers to pattern indicated on the Drawings.
2. Test and adjust each diffuser, grille and register to within plus or minus 10 percent of design requirements

a. Start with all dampers wide open.
b. Adjust dampers, starting with nearest to terminal unit or fan. Make adjustments using duct mounted volume dampers rather than dampers at diffuser face unless absolutely required.
c. At least one damper shall remain wide open at end of balance.

3. Plenum return air grilles or slots in lights: No balance required
4. Read and Report

a. Tag each grille, diffuser and register and mark tag on copy of floor plan.
b. For each grille, diffuser and register, indicate tag, size, type, and effective area (where applicable).
c. Required velocity/cubic feet per minute
d. Initially tested velocity/cubic feet per minute
e. Finally tested cubic feet per minute after adjustments

C. Terminal Boxes

1. Balancing Agency shall provide laptop computer or other device for communicating with EMCS system, using software provided by EMCS installer. Cooperate with EMCS installer to learn how to use software to calibrate EMCS zone controller.
2. Terminal box calibration procedure listed below may be modified based on specific features or limitations of digital controller and recommendations of the controller manufacturer. Submit revised procedure for approval by Professional along with pre-test submittal per Paragraph 1.4C.
3. Calibration at maximum volume setpoints

a. Zero transmitter prior to each test.
b. Adjust EMCS calibration constants so that actual box and measured air flow rate at air outlets matches EMCS reading within 5 percent at

(1) Maximum cooling airflow rate
(2) Maximum heating airflow rate

4. Calibration at minimum volume setpoint

a. Test flow at minimum volume setpoint. If EMCS indicated flow deviates from measured air flow rate at air outlets by more than 10 percent

(1) Calibrate EMCS again if a second calibration point is available
(2) If EMCS can only calibrate to one point, adjust EMCS minimum volume setpoint so that measured air flow rate at air outlets equals desired minimum, even though this will cause EMCS to read improperly

5. Terminal fans (fan-powered boxes)

a. Adjust speed to achieve design cfm within 10 percent
b. For series-flow boxes, adjust EMCS setpoint to allow VAV damper to operate at maximum airflow rate: Increase fan speed until there is no backflow through plenum opening.

6. Read and Report

a. Tag, manufacturer, and model
b. VAV maximum cooling flow rate, design and measured
c. VAV minimum flow rate, design and measured
d. VAV maximum heating flow rate, design and measured
e. EMCS calibration coefficients
f. Entering and leaving terminal static pressure at maximum cooling airflow
g. Entering and leaving terminal total pressure at maximum cooling airflow
h. Terminals with reheat coils, with HW valve wide, include also

(1) Entering air drybulb temperature to reheat coil
(2) Leaving air drybulb temperature from reheat coil
(3) Entering HW temperature to reheat coil
(4) Leaving HW temperature from reheat coil

D. Air Handling Unit and Fan-coil Airflow Rate Readings

1. Total supply air quantities shall be determined at all of the following where applicable:

a. Pitot traverse in the supply duct downstream, positive pressure side of the fan
b. Pitot traverse at coil or filter bank
c. Totaling the readings of individual air outlets
d. Totaling the readings of individual terminals as read through the EMCS
e. Supply fan airflow sensor reading as read through the EMCS

2. Total return air quantities shall be determined at all of the following where applicable:

a. Pitot traverse in the return air duct or damper entering air handler
b. Totaling the readings of individual air outlets, if ducted return system
c. Totaling reading of each return air shaft inlet, if multi-story plenum return system
d. Return fan airflow sensor reading as read through the EMCS

3. Outside air quantities shall be determined by all of the following where applicable:

a. Subtracting pitot traverses of supply and return ducts
b. Pitot traverse of outdoor air intake duct
c. Outdoor airflow sensor reading as read through the EMCS
d. Note: Balance by measurement of return air, outside air, and mixed air temperatures

shall not be used due to inherent inaccuracy.

4. For systems with airflow measuring stations, measure airflow and coordinate with EMCS installer to calibrate airflow stations at a minimum of three conditions:

    a. Design airflow
    b. 50 percent of design airflow
    c. Minimum airflow

E. Variable Air Volume Air Handlers

1. Adjust fan speed using manual adjustment of variable speed drive for testing only. Do not change or adjust sheaves.
2. Establish minimum static pressure setpoint in conjunction with the EMCS installer as follows. All adjustments made via the EMCS, not field measurements except as noted.

    a. Set all boxes upstream of the static pressure sensor to full shut-off, zero flow.
    b. Set all boxes downstream of the static pressure sensor to operate at maximum airflow setpoints.
    c. For cooling systems only to account for diversity: Calculate diversity ratio as the sum of design airflow rates of terminal boxes divided by fan design airflow rate. Sum up the design airflow of terminal boxes downstream of static pressure sensor**.** Shut off boxes, starting with boxes that are closest to the static pressure sensor, until the airflow equals the diversity ratio times the sum of design airflows downstream of static pressure sensor.
    d. Manually lower fan speed slowly while observing VAV box airflow rates downstream of the static pressure sensor. Stop lowering speed when one or more VAV box airflow rates drops 10 percent below maximum airflow rate setpoint.
    e. Once flow condition in previous step is achieved, note the EMCS system static pressure reading at the duct static pressure sensor.

        (1) This reading becomes the maximum static pressure setpoint.
        (2) Using pressure taps at differential pressure sensor and handheld digital pressure sensor, verify accuracy of EMCS reading.

    f. If there are multiple static pressure sensors, repeat steps above for each sensor. Each sensor will have its own setpoint.
    g. Convey to the EMCS installer

        (1) Static pressure setpoints
        (2) Any discrepancy between EMCS differential pressure reading and handheld measurement

    h. Test Report: Provide a report separate form for this work for each VAV fan system and include as a minimum the following

        (1) Static pressure setpoint and concurrent reading of handheld measurement: Initials of EMCS installer to indicate that the information was transmitted to them.
        (2) Tag of VAV boxes that dropped below design maximum airflow rate in tests above. These are the critical boxes, those requiring the largest static pressure.
        (3) Concurrent fan data

            a) Amps and kilowatts, from EMCS
            b) Variable speed drive speed in hertz
            c) Entering and leaving fan static pressure

d) Flow rate, summed from EMCS terminals
e) Fan airflow sensor reading from EMCS, where applicable

3. Test and adjust minimum outside air flow

a. Supply air fan and return air fan (if any) shall first be operating at design airflow. For VAV systems with diversity, close enough boxes close to fan to reduce supply airflow to scheduled design condition.
b. For systems with economizers and differential pressure sensor across the damper:

(1) For systems with separate two-position outdoor air damper:

a) Open the minimum outdoor air damper and return air damper fully; close the economizer outdoor air damper.
b) Determine outdoor airflow as indicated above.
c) If outdoor airflow rate is above design minimum, adjust damper linkage on minimum outdoor air damper so that intake is at minimum with damper fully stroked.
d) If outdoor airflow rate is below design minimum, temporarily adjust return air damper position via the EMCS until design outdoor airflow is achieved. This position shall be used for testing only and shall not limit the return air damper position during normal operation.

(2) For systems without a separate two-position outdoor air damper:

a) Open return air damper fully.
b) Adjust the outdoor air damper signal through the EMCS until the minimum outdoor airflow rate is achieved.
c) Convey this minimum outdoor air damper signal to EMCS installer and note on air balance report.

(3) Note differential pressure across the outdoor air damper. This value becomes the minimum outdoor air differential pressure setpoint in the EMCS. Convey this setpoint to EMCS installer and note on air balance report.
(4) For systems with CO_2 demand-controlled ventilation

a) With the system at the minimum outdoor air position, reduce supply air fan speed until the outdoor air rate is equal to [0.15 cfm/ft2 of floor area served by the system] [the absolute minimum outdoor air rate on AHU schedule].
b) Note differential pressure across the outdoor air damper. This value becomes the absolute minimum outdoor air differential pressure setpoint in the EMCS. Convey this setpoint to EMCS installer and note on air balance report.

c. For systems with economizers and no active outdoor air control

(1) Determine minimum outdoor air damper signals required to deliver design minimum outdoor airflow rate by adjusting the minimum damper signal through the EMCS at the following conditions:

a) Design supply fan airflow and speed
b) 30 percent of design supply fan speed

(2) Convey the two minimum signals and associated fan speeds to the EMCS installer and note on air balance report.

d. For systems with outdoor airflow measuring stations, see Paragraph 3.4D.4.

4. Test with system operating at design fan and minimum outside air flow conditions described above and record the following on a schematic of the system:

a. Tag
b. Manufacturer and model of fan and motor
c. Sheave data at motor and fan; belt data
d. Motor HP, rpm, volts, phase, FLA
e. Fan airflow rate at all locations measured, as listed above
f. Final measured fan speed and amps
g. Amps and kilowatts, from EMCS
h. Variable speed drive speed in hertz (where applicable)
i. Static pressures measured at

(1) Return air plenum
(2) Mixed air plenum
(3) Downstream of filter
(4) Downstream of coil
(5) Discharge of fans
(6) At static pressure sensor

j. Concurrent airflow rate readings from EMCS airflow sensors, including sum of VAV box airflow rates
k. Minimum EMCS outdoor air control setpoints and signals, where applicable

5. Test and adjust minimum outside air flow

(1) Test with

a) Associated pumps running in automatic maintaining differential pressure setpoint determined above
b) Central plan cooling (heating) equipment operational
c) Controls adjusted to provide coil design water temperature entering coil
d) Fan is running at design airflow
e) Fully open control valve, allow steady-state to be reached, and measure

(2) Measure and record on a schematic of the system

a) Entering water temperature
b) Leaving water temperature
c) Coil differential pressure drop
d) Coil flow rate, from calibrated balance valve or deduced from manufacturer's coil flow vs. pressure drop data, see submittals
e) Coil entering drybulb and wetbulb to cooling coils, drybulb only for heating coils
f) Leaving supply air drybulb and wetbulb from cooling coils, drybulb only for heating coils

6. Documentation of three-way valve bypass balance valve per Paragraph 3.3G

F. Relief Fans

1. Test Conditions: Associated air handler operating in 100% outdoor air position.

2. Total air quantities for fan shall be determined by pitot tube traverse of main ducts near the fan inlet or outlet.
3. Adjust fan speed using manual adjustment of variable speed drive for testing only. Do not change or adjust sheaves,
4. Test and record

    a. Tag
    b. Manufacturer and model of fan and motor
    c. Sheave data at motor and fan; belt data
    d. Motor horsepower, rpm, volts, phase, full load amps
    e. Fan airflow rate
    f. Final measured fan speed and amps
    g. Amps and kilowatts, from EMCS
    h. Variable speed drive speed in hertz
    i. Inlet and outlet static pressure

G. Constant Volume Exhaust Fans

1. See Paragraph 3.4B for air outlet balancing
2. Total air quantities for fan shall be determined by both

    a. Pitot tube traverse of main ducts near the fan inlet, and
    b. Totaling the readings of individual air outlets

3. Total air quantities shall be obtained within 10 percent of design by adjustment of fan speed

    a. Adjust sheaves on fans with adjustable sheaves.
    b. Change sheaves on fans with fixed sheaves. See Paragraph 3.4H.

4. Test and record

    a. Tag
    b. Manufacturer and model of fan and motor
    c. Sheave data at motor and fan; belt data
    d. Motor horsepower, rpm, volts, phase, full load amps
    e. Fan airflow rate at all locations measured, as listed above
    f. Final measured amps
    g. Inlet and outlet static pressure

3.5 ADDITIONAL ITEMS

A. Fans: If drives are not capable of being adjusted to meet required performance, inform Professional and replace sheaves as required.

B. Pumps: Do not trim pump impellers. Adjust flow with pump speed via VFD.

3.6 SPOT CHECKING

A. Spot checks shall take place after test and balance work is complete and reports have been prepared and approved.

B. Spot checks shall be witnessed by an Professional. Schedule spot checks with Professional at least 1 week prior to proposed test date.

C. Professional shall select subsets of any tested and balanced air or hydronic system to be spot-checked on the day of tests without prior notice to the Contractor.

1. Spot-checking will not require more than one working day.
2. If additional spot checks are requested by the Professional causing the time limit above to be exceeded, inform Professional and indicate added price to perform the additional tests. Do not include additional tests in initial bid.

D. Discrepancies

1. If any of the spot-check measurements differ more than 25 percent from those documented in test and balance reports, the Agency shall completely rebalance the associated system. For balance discrepancies at or downstream of a VAV box, rebalance only is required at or downstream of that box.
2. If discrepancies as described above are found on more than 25 percent of the spot-checks for air systems, all air systems shall be rebalanced.
3. If discrepancies as described above are found on more than 25 percent of the spot-checks for hydronic systems, all hydronic systems shall be rebalanced.
4. Rebalance work shall be witnessed by the Professional at the option of the Professional.
5. All rebalance work shall be documented and documentation shall be resubmitted as specified above.
6. All rebalance work shall be provided at no additional cost to the Using Agency.

3.7 TRAINING USING AGENCY PERSONNEL

A. See Section 23 08 00 – Mechanical Commissioning.

B. Go over the final Testing, Adjusting and Balancing Report, explaining the layout and the meanings of each data type.

C. Discuss any outstanding deficient items in control, ducting, piping or design that may affect the delivery of air or water.

D. Identify and discuss any systems or system components that are not meeting their design capacities.

E. Discuss any temporary settings and steps to finalize them for any areas that are not finished or fully occupied.

F. Any other appropriate points that may be helpful for facilities operations, relative to testing, adjusting and balancing or the mechanical systems.

END OF SECTION 23 05 93

SECTION 23 07 00 - MECHANICAL INSULATION

PART – 1 GENERAL

1.1 RELATED DOCUMENTS

A. These heating, ventilating and air conditioning (HVAC) provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.2 SUMMARY

A. Work Included in This Section: Materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Piping insulation
2. Pipe insulation jacket
3. Equipment insulation
4. Ducts and plenums, thermal insulation
5. Duct and plenums, acoustic insulation
6. Duct and plenums, fire rated insulation

B. Related Sections

1. Section 01 91 00 – Commissioning
2. Section 23 00 10 – Mechanical General Provisions
3. Section 23 05 00 – Basic Mechanical Materials and Methods

1.3 REFERENCE STANDARDS

A. ASTM B209 – Aluminum and Aluminum-Alloy Sheet and Plate

B. ASTM C177 – Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus

C. ASTM C335 – Steady-State Heat Transfer Properties of Horizontal Pipe Insulation

D. ASTM C585 – Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe

E. ASTM C921 – Properties of Jacketing Materials for Thermal Insulation

F. ASTM E84 – Surface Burning Characteristics of Building Materials

G. ASTM E96 – Water Vapor Transmission of Materials

H. NFPA 255 – Surface Burning Characteristics of Building Materials

I. SMACNA – HVAC Duct Construction Standards - Metal and Flexible

J. UL 723 – Surface Burning Characteristics of Building Materials

K. ASTM E 814 – Standard Test Method for Fire Tests of Through-Penetration Fire Stops

1.4 DEFINITIONS

A. Duct Dimensions

1. Where acoustical liner is indicated on the Drawings the duct sizes indicated shall be clear inside dimensions unless duct size is specifically indicated as outside dimensions (OD)

1.5 QUALITY ASSURANCE

A. Source Quality Control

1. Service: Use insulation specifically manufactured for service specified
2. Labeling: Insulation labeled or stamped with brand name and number

B. Applicator: Company specializing in performing the work of this section with minimum three years experience

1.6 SUBMITTALS

A. See Section 23 00 10 – Mechanical General Provisions

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. "R" means required.
2. "R2" means required only for products and equipment differing for the specified manufacturer and model and for "or equals" where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Equipment insulation	R			
Piping insulation	R			
Jackets	R			
Duct insulation, wrap and liner	R			
Adhesives and coatings	R			
Mechanical fasteners	R			

PART – 2 PRODUCTS

2.1 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Insulation: Cellular glass

1. Pittsburg-Corning
2. Or equal

C. Insulation: fiberglass

1. Owens-Corning Fiberglass Corporation
2. Manville
3. Certainteed Corporation
4. Knauf
5. Or equal

D. Insulation: Elastomeric Closed Cell

1. Armstrong World Industries, Inc.
2. Rubatex Corporation
3. Or equal

E. Weatherproof Aluminum Jacket

1. Childers Products Company
2. Insul-Coustic/Birma Corporation
3. Or equal

F. Pre-molded pipe fitting covers and Jacketing

1. Manville: Zeston
2. Childers Products Company
3. Proto Corporation
4. Insul-Coustic/Birma Corporation
5. Or equal

G. Adhesives

1. Foster Div. Amchem Products Inc.
2. Childers Products Company
3. Epolux Mfg. Corporation
4. Insul-Coustic/Birma Corporation
5. Armstrong 520 Adhesive
6. Or equal

H. Mechanical Fasteners

1. AGM Industries, Inc.
2. Miracle Adhesives Corporation
3. Grip-Nail
4. Or equal

2.2 GENERAL

A. Energy Codes: The current versions of ASHRAE 90.1 shall govern where requirements for thickness exceeds thickness specified

B. All insulation materials, including jackets, facings, adhesives, coatings, and accessories are to be fire hazard rated and listed by Underwriters' Laboratories, Inc., using Standard UL 723 (ASTM E-84), (NFPA-255), (ASA A2.5-1963)

1. Flamespread: maximum 25
2. Fuel contributed and smoke developed: maximum 50
3. Flameproofing treatments subject to deterioration from moisture or humidity are not acceptable

C. Insulation and accessories shall not provide any nutritional or bodily use to fungi, bacteria, insects, rats, mice, or other vermin, shall not react corrosively with equipment, piping or ductwork, and shall be asbestos free: Duct lining shall meet ASTM C1136 and ASTM C665 for biological growth in insulation

2.3 MATERIALS

A. Pipe Insulation

1. Cellular Glass

a. Insulation (without jacket) ASTM C 552, Type II, Class 1
b. Insulation (with jacket) ASTM C552, Class 2
c. Sectional
d. 0.32 maximum K-factor at 75 degrees Fahrenheit mean temperature
e. Pittsburg-Corning or equal

2. Fiberglass

a. ASTM C547, Type I, Molded: one piece, with factory-applied, all purpose, vapor retarder jacket, maximum 0.26 K factor at 75 degrees Fahrenheit mean temperature: Owens-Corning ASJ/SSL-II Pipe Insulation or equal
b. ASTM C553, Type II, Blanket: without facing and with all service FSK jacket manufactured from kraft paper, reinforced scrim and aluminum foil, minimum 1 lb. density, maximum 0.28 K factor at 75 degrees Fahrenheit mean temperature: Owens-Corning Faced Duct Wrap or equal
c. ASTM C612, Type 1B, Board: Density as noted with FSK all service jacket manufactured from kraft paper, reinforced scrim and aluminum foil, maximum 0.26 K factor at 75 degrees Fahrenheit mean temperature: Owens-Corning 700 Series with face or equal

3. Flexible, closed cell elastomeric thermal insulation

a. Insulation ASTM C534
b. Service rating of 220 degrees Fahrenheit
c. Density 6.0 pounds per cubic foot
d. Closed cell foam: Vapor permeability ASTM E96 0.2 perm
e. Max moisture absorption: 1.0 percent by volume, 10 percent by weight
f. Molded pipe insulation

(1) Maximum 0.27 K factor at 75 degrees Fahrenheit mean temperature
(2) Maximum water vapor transmission rating of 0.17 perm-inches

g. Sheet insulation

(1) Maximum 0.28 K factor at 75 degrees Fahrenheit mean temperature
(2) Maximum water vapor transmission rating of 0.17 perm-inches

h. Seal with Rubatex adhesive or equal: Armstrong Armaflex II or equal

4. Underground pipe insulation: See Section 23 21 12 – Heating and Cooling Piping

B. Jackets

1. Factory Applied Vapor Barrier All Service Jacket (ASJ)

a. ASTM C921, White kraft paper bonded to aluminum foil and reinforced with glass fiber yarn
b. Moisture Vapor Transmission: ASTM E96; 0.02 perm inches
c. Secure with self sealing longitudinal laps and butt strips
d. Secure vapor barrier mastic
e. Tie Wire: See Paragraph E.1, with twisted ends on maximum 12 inch centers

2. Vapor Barrier Lap Adhesive: Compatible with insulation

a. Canvas Jacket: UL listed
b. Fabric: ASTM C921, 6 ounce/square yard, plain weave cotton treated with dilute fire retardant lagging adhesive
c. Lagging Adhesive: Compatible with insulation

3. Aluminum Jacket: ASTM B209

a. Use for weatherproof jacket
b. Thickness: 0.016 inch sheet
c. Finish: Embossed
d. Joining: Longitudinal slip joints and 2 inch laps
e. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner
f. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum or 0.010 inch thick stainless steel

4. Preformed PVC

a. Polyvinylchloride covers similar to Manville Zeston.
b. Color: white

5. Equipment insulation facings: Foil-scrim-kraft laminate of aluminum foil facing, glass scrim reinforcing, kraft paper backing

C. Preformed Pipe Fitting Covers

1. Aluminum

a. Factory fabricated formed covers
b. General Aluminum Supply Corporation GASCO or equal

2. PVC

a. Factory fabricated formed covers
b. Manville Zeston or equal

D. Adhesives and coatings

1. Foster product names and figure numbers or equal

    a. Lagging adhesive: 30-36
    b. Fiberglass: Zeston Z-Glu
    c. Vapor barrier coating: Tite-fit 30-80, UP Label, comply with MIL-C-19565C, Type II; fire and water resistant
    d. Vaporseal adhesive: 85-60
    e. Cellular glass bedding and sealing compound adhesive: Foamseal 30-45
    f. Outdoor mastic: 30-90
    g. Asphalt mastic: C.I. Mastic 60-25
    h. For elastomeric insulation: 520 contact adhesive

E. Wire, banding and fastening devices

1. Wire: minimum 16 gauge copper clad annealed steel wire
2. Bands: 3/4 inches nominal width with wing seals, of minimum thickness as follows:

    a. Aluminum: 0.007 inches. Except where exposed to weather, 0.020 inches
    b. Stainless steel: 0.010 inches

3. Staples: outward clinching type of corrosion resistant steel

F. Mechanical Fasteners

1. Mild steel, copper plated
2. AGM Industries Power Base insulation pins or equal
3. Insulation washers

    a. Galvanized steel
    b. 1- 1/2 inch diameter
    c. AGM Industries SLW-1 or equal

G. Provide a continuous vapor seal for any service piping that carries liquid below 60 degrees Fahrenheit.

H. Pre-insulated pipe support and shields

1. Provide insulated pipe supports for all insulated pipe and tubing. Insulated pipe supports shall be Pipe Shields, Inc. or equal
2. All insulated pipe supports shall be load rated. Load ratings shall be established by pipe support manufacturer based upon testing and analysis in conformance with the latest edition of the following codes: ASME B31.1, MSS SP-58, MSS SP-69 and MSS SP-89.
3. All insulated pipe supports shall have Calcium Silicate insulation and galvanized steel jackets. Pipe supports for use on flat surfaces shall have integral load distribution plates coated with zinc primer minimum 3 mils thick.
4. See Section 23 05 29 Hangers and Supports
5. Hangers and supports shall fit outside of all pipe insulation and insulation inserts. Provide pre-insulated pipe supports as specified and install per manufacturer's installation instructions. Shield lengths and gauges shall also be per manufacturer's recommendations.
6. Tape all butt joints where pipe insulation butts up against hanger shield

    a. On hot pipe, apply three inch wide vapor barrier tape or band over the butt joint
    b. On chilled water piping, apply a wet coat vapor barrier lap cement on all butt joints and

seal the joints with a minimum of three inch wide vapor tape or band

I. Fire-stopping

1. At pipe penetrations through rated assemblies
2. Commercial pipe sleeve assemblies that are UL listed and that have been approved by the fire marshal for this purpose
3. Insulation shall be continuous through penetration.

J. Accessories

1. Insulation Protection Saddles: 12-inch long, 16 gauge steel
2. Paint: Ultraviolet resistant latex paint with special adherence capabilities to the fitting covers, elastomeric, aluminum facing, Kraft paper, tapes and adhesives

K. Equipment Insulation

1. Glass fiber, semi-rigid

a. Insulation: ASTM C612; rigid, noncombustible

(1) 'K' ('ksi') value: ASTM C335, 0.24 at 75 degrees Fahrenheit
(2) Maximum service temperature: 450 degrees Fahrenheit
(3) Maximum moisture absorption: 0.1 percent by volume
(4) Density: 3.0 pounds per cubic foot density

b. Vapor Barrier Jacket

(1) Kraft paper reinforced with glass fiber yarn and bonded to aluminized film
(2) Moisture vapor transmission: ASTM E96; 0.04 perm
(3) Secure with self sealing longitudinal laps and butt strips. Minimum lap 2 inches
(4) Secure with bands, adhesive or ties

c. Facing: 1 inch galvanized or stainless steel hexagonal wire mesh stitched on one face of insulation
d. Vapor Barrier Lap Adhesive: Compatible with insulation
e. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool

2. Flexible Elastomeric

a. Insulation: ASTM C534, Type II sheet materials
b. Service rating of 220 degrees Fahrenheit
c. Density 6.0 pounds per cubic foot
d. Closed cell foam: Vapor permeability ASTM E96 0.2 perm
e. Max moisture absorption: 1.0 percent by volume, 10 percent by weight
f. Sheet insulation

(1) Maximum 0.28 K factor at 75 degrees Fahrenheit mean temperature
(2) Maximum water vapor transmission rating of 0.17 perm-inches

g. Seal with Rubatex adhesive or equal: Armstrong Armaflex II or equal

3. Jackets

a. Aluminum

b. Use for weatherproof jacket
c. Thickness: 0.016 inch sheet
d. Finish: Embossed
e. Joining: Longitudinal slip joints and 2 inch laps
f. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner
g. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum or 0.010 inch thick stainless steel

4. Equipment insulation facings: Foil-scrim-kraft laminate of aluminum foil facing, glass scrim reinforcing, kraft paper backing
5. Wires, bands and fastening devices

a. Wires: Minimum 16 gage galvanized steel wire
b. Bands: 3/4 inch nominal width wing seals, of minimum thickness as follows

(1) Aluminum: 0.007 inches indoors. Where exposed to weather 0.020 inches
(2) Stainless Steel: 0.010 inches

L. Duct Insulation

1. Duct Wrap With Vapor Barrier; Type DW-V

a. Insulation: ASTM C553 and C612; flexible, noncombustible blanket

(1) 'K' ('Ksi') value: ASTM C518, 0.24 at 75 degrees Fahrenheit
(2) Maximum service temperature: 350 degrees Fahrenheit
(3) Maximum moisture absorption: 0.20 percent by volume

b. Vapor Barrier Jacket - factory installed. (FSK)

(1) Kraft paper reinforced with glass fiber yarn and bonded to aluminized film
(2) Moisture vapor transmission: ASTM E96 Procedure E; 0.02 perm
(3) Secure with pressure sensitive tape

c. Vapor Barrier Tape: Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive

(1) Flexible fiberglass wrap. 1-1/2 pounds per cubic foot
(2) Installed conductance: 0.30 BTU-inch/hr/square foot/degree Fahrenheit
(3) Factory applied jacket

a) Foil-scrim-kraft laminate: Aluminum foil facing
b) Glass scrim reinforcing
c) Kraft paper backing

(4) Maximum vapor permeance: 0.02 perms

d. Owens-Corning All Service Faced Duct-Wrap or equal

2. Duct Wrap Without Vapor Barrier; Type DW

a. Insulation: ASTM C553 and C612; flexible, noncombustible blanket

(1) 'K' ('Ksi') value: ASTM C518, 0.24 at 75 degrees Fahrenheit
(2) Maximum service temperature: 350 degrees Fahrenheit

(3) Maximum moisture absorption: 0.20 percent by volume

b. Owens-Corning or equal

3. Duct Board Without Vapor Barrier; Type DB

a. Insulation: ASTM C612; rigid, noncombustible blanket

(1) K (Ksi) value: ASTM C518, 0.23 at 75 degrees Fahrenheit
(2) Maximum service temperature: 350 degrees Fahrenheit
(3) Maximum moisture absorption: 0.20 percent by volume

b. Installed conductance: 0.23 BTU-inch/hr/square foot/degree Fahrenheit
c. Thickness per Paragraph 3.5A Duct Insulation Type and Thickness Schedule
d. Owens-Corning Type 703 or equal

4. Duct Board With Vapor Barrier; Type DB-V

a. Insulation: ASTM C612; rigid, noncombustible blanket

(1) 'K' ('Ksi') value: ASTM C518, 0.23 at 75 degrees Fahrenheit
(2) Maximum service temperature: 350 degrees Fahrenheit
(3) Maximum moisture absorption: 0.20 percent by volume

b. Vapor Barrier Jacket - factory installed (FSK)

(1) Kraft paper reinforced with glass fiber yarn and bonded to aluminized film
(2) Moisture vapor transmission: ASTM E96; 0.02 perm
(3) Secure with pressure sensitive tape

c. Vapor Barrier Tape: Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive
d. Installed conductance: 0.23 BTU-inch/hr/square foot/degree Fahrenheit
e. Thickness per Paragraph 3.5A Duct Insulation Type and Thickness Schedule
f. Factory applied jacket

(1) Foil-scrim-kraft laminate

a) Aluminum foil facing
b) Glass scrim reinforcing

5. Tie Wire: Annealed steel, 16 gage

M. Duct and Plenum Lining

1. Rectangular Duct Lining; Type AL

a. Material

(1) Insulation: ASTM C423
(2) 'K": ASTM C518, 0.23 at 75 degrees Fahrenheit
(3) Maximum service temperature: 350 degrees Fahrenheit
(4) Maximum moisture absorption: 0.20 percent by volume
(5) Thickness per Paragraph 3.5A Duct Insulation Type and Thickness Schedule
(6) 1-1/2 pounds per cubic foot unless shown otherwise to be 3 pounds per cubic

foot
(7) Installed conductance: 0.25 BTU-inch/hr/square foot/degree Fahrenheit

b. Interior air-side surface

(1) Smooth black neoprene or matte facing overlay on air side. Coating shall conform to NFPA 90A, ASTM C665, ASTM G21
(2) Suitable for velocity up to 4000 feet per minute
(3) Meet erosion test method described in UL publication No. 181
(4) Durable and mechanically cleanable
(5) EPA registered anti-microbial agent
(6) Certainteed Toughgard Duct Liner or equal
(7) Adhesives

a) Duct Insulation, Internal: Foster 85-60 or equal
b) Weld Pins: Duro-Dyne CP or equal

2. Round Duct Lining; Type RAL

a. Material same as Paragraph 2.3M.1.a
b. Interior air-side surfaces same as Paragraph 2.3M.1.b
c. Self-supporting, slide-in installation
d. Schuller Permacote Spiracoustic or equal
e. Small diameter ducts which cannot be insulated internally using duct lining materials shall be pre-fabricated. Insulation material shall be fixed between outer duct metal and a perforated metal liner. United McGill k27 series or equal. Fittings shall be insulated to same standard and shall be by same manufacturer.

3. Plenum Lining; Type PL

a. Material same as Paragraph 2.3M.1.a
b. Interior air-side surfaces same as Paragraph 2.3M.1.b

2.4 DUCT FIREPROOFING

A. Material applied directly to metal ducts and achieving 1- or 2-hour fire rated separation (as required by application) when tested in accordance with UL 1978 by independent testing agency.

1. Surface Burning Characteristics: Flame spread index of 0 and smoke developed index of 0, when tested in accordance with ASTM E 84, both blanket and foil
2. Combustibility: Non-combustible, when tested in accordance with ASTM E 136
3. Flexibility: Capable of being formed around corners and shapes by hand
4. Fiber Content: Demonstrated to be soluble in the lungs according to EU 67/548/EWG, Note Q for biopersistence
5. Surface: Foil or other damage resistant surface; fiber not exposed after installation
6. Accommodation for Duct Access Doors and Panels: Capable of being installed to achieve fire rating without impeding access.
7. Acceptable Product: 3M Fire Barrier Duct Wrap; fire resistant inorganic blanket encapsulated with scrim-reinforced foil facing.

B. Fasteners: Non-combustible; use one or both of the following to attach fireproofing to ducts

1. Banding: Steel or stainless steel, 1/2 inch wide, minimum, and 0.015 inch thick, minimum; with steel banding clips

2. Insulation Pins: Copper-coated steel impalement pins, minimum 12 gage, for welded attachment, with galvanized steel self-locking washers, 1-1/2 inch square or diameter; or equivalent sized cup-head pins

C. Access Panel Hardware: Galvanized threaded rods, sleeves, washers, and wing nuts as specified in manufacturer's instructions

D. Tape: Aluminum foil tape for sealing exposed fiber edges and repairing tears in facing

E. Fire-stopping: Material tested in conjunction with wrap in accordance with ASTM E 814 to achieve fire rated penetration seal at penetrations through fire rated assemblies

1. Fire Rating: Same or greater than rating of penetrated assembly
2. Acceptable Products: 3M Fire Barrier 1000 N/S, 1003 S/L, and 2000+ Silicone Sealants, as required by tested assembly

PART – 3 EXECUTION

3.1 PIPE & EQUIPMENT INSULATION SCHEDULE

A. Insulation Application Types

1. Type P-1

a. Molded fiberglass
b. All-service jacket
c. Vapor-sealed

2. Type P-1A

a. Molded fiberglass
b. PVC jacket
c. Vapor-sealed

3. Type P-2

a. Molded fiberglass
b. All-service jacket

4. Type P-2A

a. Molded fiberglass
b. Aluminum preformed jacket or PVC jacket

5. Type P-3: Flexible elastomeric insulation
6. Type P-4

a. Cellular glass insulation
b. All service jacket with vapor retarder

7. Type P-4A

a. Cellular glass insulation
b. All service jacket with vapor retarder

c. PVC jacket

8. Type E-1

a. Fiberglass board
b. 3 pounds per cubic foot density
c. Foil-scrim-kraft facing
d. Vapor-sealed

9. Type E-2

a. Fiberglass board
b. 6 pounds per cubic foot density
c. Segmented or scored for curved surfaces

10. Type E-3: Flexible cellular foam insulation

B. Application Schedule

Service	Type	Size	Minimum Thickness	Freeze Protection
Chilled Water (indoor concealed)	P-4	All	1-1/2 inch	-
Chilled Water (Indoor exposed, including mechanical rooms)	P-4A	All	1-1/2 inch	-
Chilled Water Pumps	E-3	All	1-1/2 inch	-
Chilled Water Air Separators, Storage Tanks, and Expansion Tanks	E-3	All	1-1/2 inch	-
Hot Water (indoor concealed)	P-1	≤2 inch	1-1/2 inch	-
Hot Water (indoor exposed, including mechanical rooms)	P-1A	≥2-1/2 inch	1-1/2 inch	-
Hot Water Pumps	E-2 or E-3	All	1-1/2 inch	-
Heating Water Air Separators, Storage Tanks, and Expansion Tanks	E-3	All	1-1/2 inch	-
Hot water coil frame and tube bends	E-2 or E-3 or DW-V duct wrap	All	1/2 inch(E-2/3) 1-1/2 inch DW-V	
Condensate, and sanitary sewer waste/vent piping receiving condensate (horizontal piping and first three feet of vertical piping, Underside of floor drain bodies	P-3	All	1/2 inch	-

Service	Type	Size	Minimum Thickness	Freeze Protection
receiving condensate)				
Refrigerant (suction)	P-3	All	3/4 inch	-
Domestic cold water (indoor concealed)	P-1	All	1/2 inch	-
Domestic cold water (indoor exposed)	P-1A	All	1/2 inch	-
Domestic cold water (exterior exposed)	P-1B	All	1 inch	Yes
Domestic hot water (indoor concealed)	P-1	All	1 inch	-
Domestic hot water (indoor exposed, including mechanical rooms)	P-1A	All	1 inch	-
Roof drains (horizontal and first three feet of vertical piping)	P-1	All	1/2 inch	-
Roof drains (underside of roof drain bodies/bowl)	P-3	All	1/2 inch	-

C. Non-insulated piping and equipment

1. Pneumatic tubing
2. Cooling coil condensate drains except horizontal and first three feet of vertical
3. Condenser water piping and condenser water pumps (indoors)
4. Vent, overflow, drain and relief, except as noted otherwise
5. Hot water control valves. (Note: this exclusion applies only to the valves themselves; all other hot water piping and accessories, including that between isolation valves and coils, shall be insulated.)

3.2 INSTALLATION

A. Install materials in accordance with manufacturer's instructions

B. Coordinate with work of other trades

C. Deliver material to job site in original non-broken factory packaging, labeled with manufacturer's density and thickness

D. Install insulation where it cannot become wet. If insulation becomes wet, remove and dispose of properly and replace with new, dry insulation. Wetted insulation is not acceptable. Ensure insulation is dry before and during installation.

E. Insulate all piping, valves, fittings, flanges and accessories

F. On piping exposed to public view, locate insulation and cover seams in least visible locations

G. Insulate fittings, joints and valves with insulation of same material and thickness as adjoining pipe. Use pre-molded fiberglass fitting covers or radial mitered segments of pipe insulation. For strainers, expansion joints, fittings and accessories requiring servicing or inspection insulation shall be removable and replaceable without damage. Enclose within two-piece no. 15 gauge aluminum covers fastened with cadmium-plated bolts and nuts.

H. Insulate flanges with insulation sleeve of same material as pipe insulation to cover flange and overlap insulation on adjacent piping

I. Continue insulation through walls, sleeves, pipe hangers and other pipe penetrations

J. Finish insulation at supports, protrusions and interruptions. No hangers or supports shall be embedded in insulation. Do not insulate expansion bellows.

K. Fiberglass insulation

1. Provide insulation with factory applied vapor barrier jackets
2. Butt edges neatly. ASJ with 3 inch minimum butt strips
3. Longitudinal overlaps: Minimum 2 inch self sealing, double adhesive
4. Apply additional jacket as specified
5. For insulation with factory-applied jackets, secure laps with aluminum or stainless steel bands at 18 inches o.c.
6. For piping conveying fluids below ambient temperature finish with vapor barrier adhesive

L. Cellular glass Insulation

1. Provide insulation with factory applied vapor barrier jackets
2. Butt edges neatly. Seal longitudinal and transverse joints with adhesive to maintain minimum vapor permeance. Adhesive shall be selected and applied in accordance with insulation manufacturer’s recommendations.
3. Secure insulation sections with bands without deforming insulation materials
4. Build up coating of insulating and finishing cement
5. For insulation with factory-applied jackets, secure laps with aluminum or stainless steel bands at 18 inches o.c.
6. For piping conveying fluids below ambient temperature finish with vapor barrier adhesive
7. Apply additional jacket as specified. If no additional jacket specified apply skim coat of finishing cement to smooth out surface of fitting insulation

M. Elastomeric Tubing

1. Provide insulation
2. Butt edges neatly. Seal longitudinal and transverse joints with adhesive to maintain minimum vapor permeance. Adhesive shall be selected and applied in accordance with insulation manufacturer’s recommendations.
3. Apply additional jacket as specified

N. For all pipe systems exposed in the mechanical equipment rooms, finish with an all service PVC

jacket

O. For exterior applications, provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

P. For buried piping, provide factory fabricated assembly with inner all-purpose service jacket with self sealing lap, and asphalt impregnated open mesh glass fabric, with one mil thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with a polyester film.

Q. Perform work at ambient and equipment temperatures as recommended by adhesive manufacture

R. Protection: Protect against dirt, water, chemical, or mechanical damage before, during, and after installation. Repair or replace damaged insulation at no additional cost

S. Paint all insulation exposed to ultraviolet light (sunlight); see Paragraph 2.3J.2

T. All vapor barriers shall be continuous. Tears, holes, staples, etc. shall be coated with vapor barrier mastic and patch with facing or tape.

U. Joints between insulation and access shall be sealed with vapor barrier mastic

V. See Section 23 21 12 – Heating and Cooling Piping

W. See Section 23 23 00 – Refrigerant Piping

X. See Section 23 31 13 – Ducts

3.3 PIPE INSULATION APPLICATION

A. General

1. Before applying insulation

   a. Test piping for tightness and obtain approval
   b. Clean surfaces to be insulated of dust, grease and foreign matter

2. Butt edges neatly
3. Fill voids with insulating cement
4. Longitudinal overlaps

   a. 2 inches minimum
   b. For exposed work: toward ceiling or wall
   c. For weatherproof aluminum jackets: on side to shed water

5. Circumferential overlaps on weatherproof aluminum jackets: 2 inches minimum
6. Continuous insulation passing through sleeves or other openings
7. Oversize insulation to accommodate heat tracing on piping

B. Valves, fittings, flanges and accessory insulation

1. Unless otherwise noted, insulate

a. Valves including bonnets
b. Flanges
c. Fittings
d. Strainers
e. Expansion joints
f. Specialties

2. Insulation for strainers, expansion joints, fittings and accessories requiring servicing or inspection

a. Insulation removable and replaceable without damage
b. Enclosed within two piece, No. 18 gauge aluminum covers fastened with cadmium plated bolts and nuts

3. Insulation of same thickness as adjacent piping insulation
4. For piping systems insulated with fiberglass

a. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
b. When premolded insulation elbows and fittings are not available, apply mitered sections of pipe insulation (blanket insulation is not acceptable) to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire, tape, or bands.
c. Cover fittings with heavy PVC fitting covers. Overlap PVC covers on pipe insulation jackets at least 1 inch at each end. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

5. For piping systems insulated with cellular glass

a. Apply premolded insulation sections of the same material as straight segments of pipe when available. Secure according to manufacturer’s written instructions.
b. When premolded insulation elbows and fittings are not available, apply mitered sections of pipe insulation (blanket insulation is not acceptable) to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire, tape, or bands.
c. Cover fittings with heavy PVC fitting covers. Overlap PVC covers on pipe insulation jackets at least 1 inch at each end. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

6. For piping systems insulated with elastomeric thermal insulation

a. Apply mitered sections of pipe insulation.
b. Secure insulation materials and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

7. Flanges

a. Apply preformed pipe insulation to outer diameter of pipe flange
b. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation
c. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with the same insulation material as adjacent piping insulation
d. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch, and seal joints with vapor-retarder mastic

8. Finish for outdoor locations only: weatherproof aluminum jacket compatible with weatherproof jacket on adjoining pipe insulation.

C. At pipe hangers

1. Insulation protection shields specified in Section 23 05 29 Hangers and Supports
2. Butt insulation to shields
3. Cold piping: Wet coat of vapor barrier lap cement on all butt joints

D. Jackets and facings

1. Vapor-sealed types: continuous; staples not permitted
2. Adhere longitudinal laps: Adhere 3 inches wide joint strip, of same material as facing, at center of each butt joint
3. Adhesives

a. Vapor-sealed insulation: vapor-seal adhesive
b. Heating service insulation: vapor-seal adhesive
c. Weatherproof aluminum jacket: sealing compound
d. Underground asphalt felt jacket: asphalt mastic

E. Wiring, banding and fastening devices: Secure insulation to piping and equipment in accordance with following minimum requirements

1. Piping insulation section 3 foot long

a. Concealed vapor-sealed insulation banded at ends and center
b. Other concealed insulation banded at ends and center

2. Pipe fitting insulation

a. Loops of wire to secure mitered segments of insulation
b. Wire spiraled on from end to end on blanket insulation

3. Outdoor piping weatherproof aluminum jackets banded at circumferential joints and center of each section: Lap joint at bottom

3.4 EQUIPMENT INSULATION

A. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Secure insulation to equipment with bands, welded-on anchors, ties or adhesive. Where access to equipment is required for testing or maintenance the insulation shall be installed so that it is removable and so that the vapor barrier can be remade after access.

B. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor barrier cement.

C. For cold equipment or equipment containing fluids below ambient temperature

1. Insulate entire system
2. Provide vapor barrier jackets, factory applied or field applied
3. Finish with glass cloth and vapor barrier adhesive
4. Cover with aluminum jacket where specified

D. For equipment containing fluids above ambient temperature

1. Insulate entire system
2. Provide standard jackets, with or without vapor barrier, factory applied or field applied
3. Finish with glass cloth and adhesive
4. Cover with aluminum jacket where specified
5. For hot equipment containing fluids 140 degrees Fahrenheit or less, do not insulate flanges and unions, but bevel and seal ends of insulation
6. For hot equipment containing fluids over 140 degrees Fahrenheit, insulate flanges and unions with removable sections and jackets

E. Finish insulation at supports, protrusions, and interruptions

F. For equipment in mechanical equipment rooms or in finished spaces, finish with aluminum jacket

G. Do not insulate over nameplate or ASME stamps; bevel and seal insulation around such

H. General

1. Apply insulation with edges tightly butted

a. Joints staggered and secured in place by steel bands
b. Where necessary weld on suitable anchors

2. Seal with 520 adhesive

I. Special considerations

1. Chiller heads: removable and replaceable covers to allow tube removal
2. Strainers and suction diffusers: removable and replaceable covers to allow strainer removal
3. Pumps: removable and replaceable covers to allow impeller replacement
4. Provide sufficient clearance around openings for normal operation of equipment

3.5 DUCT & PLENUM INSULATION

A. Duct Insulation Type and Thickness Schedule

Location	Cooling or Heat/Cool Supply	Heating-only Supply	Return/Outdoor Air	Exhaust
Concealed in ceiling or return air plenum	2 inches DW-V	2 inches DW-V	1-1/2 inches DW-V	-
Concealed in unconditioned spaces	2 inches DW-V	2 inches DW-V	1-1/2 inches DW-V	-
Exposed within mechanical rooms	2 inches 3.0 pounds Per cubic foot DB-V	2 inches 3.0 pounds Per cubic foot DB-V	1-1/2 inches 3.0 pounds Per cubic foot DB-V	-
Exposed within conditioned space	–	–	–	-
Lined duct on drawings at risers	2 inches 1.5 pounds per Cubic foot AL	2 inches 1.5 pounds per Cubic foot AL	2 inches 1.5 pounds per Cubic foot AL	2 inches 1.5 pounds per Cubic foot AL

Location	Cooling or Heat/Cool Supply	Heating-only Supply	Return/Outdoor Air	Exhaust
Lined duct on drawings (unless otherwise noted)	1 inch 1.5 pounds per Cubic foot AL or RAL	1 inch 1.5 pounds per Cubic foot AL or RAL	1 inch 1.5 pounds per Cubic foot AL or RAL	1 inch 1.5 pounds per Cubic foot AL or RAL
Transfer air ducts	1 inch 1.5 pounds per Cubic foot AL or RAL	1 inch 1.5 pounds per Cubic foot AL or RAL	1 inch 1.5 pounds per Cubic foot AL or RAL	1 inch 1.5 pounds per Cubic foot AL or RAL
Terminal cans	0.5 inches 1.5 pounds per cubic foot AL	0.5 inches 1.5 pounds per cubic foot AL	0.5 inches 1.5 pounds per cubic foot AL	-
Flex duct	By manufacturer	By manufacturer	By manufacturer	-
Double wall duct	1 inch 1-1/2 pounds Per cubic foot DW	1 inch 1-1/2 pounds Per cubic foot DW	-	-
Air distribution devices (backpans of grilles, registers, and diffusers)	2 inches DW-V	2 inches DW-V	1-1/2 inches DW-V	

3.6 NON-INSULATED DUCTWORK

A. No insulation required for ducts so indicated in Duct Insulation Type and Thickness Schedule, plus

1. Exhaust ducts, unless shown to be lined

B. Do not line ducts

1. Where prohibited by codes
2. Food service exhaust
3. Dishwasher exhaust
4. Shower exhaust
5. Ten feet downstream from humidifiers

3.7 DUCT INSULATION INSTALLATION

A. General

1. Ensure that insulation is continuous through all walls: See 23 05 48 Mechanical Sound and Vibration Control for packing openings through walls
2. Finish insulation neatly at hangers, supports and other protrusions
3. Locate insulation joints or cover seams in least visible locations
4. Where ducts run in groups too close to be individually insulated and finished

   a. Completely fill all spaces between ducts with rigid or flexible insulating material
   b. Insulate and finish exterior surfaces of group as specified for particular service

5. Where ducts cannot be insulated after erection, insulate prior to installation

6. Where specified thickness of insulation and/or lining exceeds available thickness in single layer, provide insulation and/or lining in 2 or more layers with joints staggered
7. Preparation

    a. Do not install covering before ductwork and equipment has been tested and reviewed
    b. Ensure surface is clean and dry prior to installation
    c. Ensure insulation is dry before and during application

8. Mechanical fasteners

    a. Use spot weld anchors in all shop fabricated internally lined ducts
    b. Adhered anchors
    c. Clip off pin penetrations flush with insulation surface or facing
    d. Seal pins and washers where pins penetrate vapor barriers

        (1) With 4 inch square pieces of vapor barrier material to match facing
        (2) Adhere with vaporseal adhesive

    e. Spacing on rectangular ducts

        (1) Typical of horizontal and vertical, unless otherwise specified
        (2) Duct board

            a) 3 inches in from edges
            b) Intermediate fasteners: 12 inches on counter maximum spacing all directions
            c) Not less than four pins per surface

        (3) Duct Wrap

Side Dimension	Maximum Spacing
24 inches and under	None required.
25 to 32 inches	Horizontal - none. Vertical: 1 row centered, 12 inches on center
33 to 48 inches	2 rows, 12 inches on center.
49 to 60 inches	3 rows, 12 inches on center.
61 inches and over	16 inches on center, all directions.

        (4) Duct wrap spacing applicable to flat surfaces of flat oval ducts

9. Provide 24 gauge sheet metal Z section frames over edges of duct and plenum lining

    a. At access openings and doors
    b. Along edges exposed to air flow

B. Rectangular Duct Wrap

1. Without vapor barrier

    a. Comply with published recommendations of manufacturer and with following
    b. Secure with 4 inch strips of adhesive, 8 inches on center
    c. For rectangular ducts 24 inches and wider, secure to bottom of duct with mechanical fasteners 18 inches on center

d. Wrap with 18 gauge galvanized wire, 16 inches on center

2. With Vapor Barrier

a. Vapor barrier and sealing continuous without breaks. Vapor proof seal around supports and bracing
b. 2 inches lap strip at one end
c. Peel insulation for 2 inch lap strip along longitudinal joints
d. Seal lap strips with vaporseal adhesive; Foster's 85-60 or equal

C. Round Duct Wrap

1. General

a. Adhere flexible insulation to ductwork with adhesive applied in 6 inch wide strips on 16 inch centers
b. Provide 16 gauge annealed tie wire tied, spiral wound or half hitched at 16 inch centers
c. Overlap insulation 2 inches and seal joints and breaks with 2 inch lap of foil adhered over joint

2. Apply duct wrap with vapor barrier as specified above for rectangular ducts

D. Duct Board

1. Comply with published recommendations of manufacturer
2. Secure on top, sides and bottom of duct with mechanical fasteners, spacing as scheduled
3. Secure with 4 inch strips of adhesive, 8 inch on center

E. Rectangular Duct and Plenum Lining

1. Comply with SMACNA Duct Liner Application Standard, published recommendations of manufacturer, and following:
2. Apply adhesive over 100 percent of surfaces to be lined
3. The coated surface shall face air stream
4. Surface adjacent to air flow, including at joints, to be uniformly flat
5. Insulation on floors of plenums and large ducts where access is required shall be protected by wire mesh so that lining is not damaged when walked or crawled on.
6. Blank-Off Panels: Insulation, enclosed with sheet metal on all sides; all joints with vapor barrier mastic and taped
7. Volume Dampers: Where volume dampers do not allow for continuous insulation, terminate insulation clear of handle sweep and finish edges to maintain vapor barrier and to prevent damage to the insulation
8. Seal butt joints and exposed edges of liner to prevent erosion
9. Edges at terminal points shall be provided with metal beading and heavily coated with adhesive
10. Damaged areas replaced or heavily coated with adhesive
11. Mechanical fasteners

a. Use weld pins
b. Install mechanical fasteners

(1) Weld pins flush with liner surface. Weld pins spaced maximum of 12-inch on center in both directions and within 2 inches of all corners and joints, except where SMACNA Standard requires closer spacing
(2) Within 2 inches of all edges

(3) Minimum 4 pins per side
(4) For field alterations of lined ducts, install adhesive and glued pins with washers. Clip-off pins after washers installed. Field installed pins shall be used for unusual conditions only and shall not exceed 1 percent of total pins.

3.8 PENETRATIONS THROUGH RATED WALLS

A. Refer to drawings for penetrations of rated assemblies.

B. Install per manufacturer's installation and listing requirements.

3.9 FIELD QUALITY CONTROL

A. Repair separation of joints or cracking of insulation due to thermal movement or poor workmanship

B. All vapor barriers shall be continuous; tears, holes, staples, etc. shall be coated with vapor barrier mastic and patch with facing or tape

C. See Section 23 31 13 – Ducts for protection of lined duct during construction

END OF SECTION 23 07 00

SECTION 23 09 00 - ENERGY MANAGEMENT AND CONTROL SYSTEM - GENERAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. These heating, ventilating and air conditioning (HVAC) provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.2 WORK INCLUDED

A. A Request for Proposals (RFP) will be issued by the Professional to receive bids for the Energy Management and Control System (EMCS) contractor selection. The RFP shall be distributed to the approved EMCS contractors referenced herein and sealed proposals received by the Professional. The Professional will make an EMCS contractor recommendation to the Owner based upon proposals received.

B. An allowance for inclusion in the Contract Sum has been specified in Division One Supplement, Section 01900, “Part 2 – Allowance Supplement” for purchase of the EMCS.

C. Contractor shall furnish and install a direct digital control and Energy Management and Control System (EMCS).

D. The systems to be controlled under work of this Section include but are not limited to the following:

1. HVAC Systems
2. Plumbing Systems
3. Irrigation Systems
4. Lighting
5. Building Electrical Systems
6. Site Utilities

1.3 RELATED WORK AND REQUIREMENTS

A. Other EMCS Sections:

1. Section 23 09 13 EMCS Basic Materials and Devices
2. Section 23 09 16 EMCS Operator Interfaces
3. Section 23 09 19 EMCS Field Panels
4. Section 23 09 23 EMCS Communication Devices
5. Section 23 09 26 EMCS Software and Programming
6. Section 23 09 29 EMCS Points and Sequence of Operation
7. Section 23 09 33 EMCS Commissioning

B. Coordination with other Divisions. The table in specification 23 00 10 paragraph 1.2-B shall be used to determine scope of work between Division 23 and other Divisions including Divisions 23 and 26. All work not specified to be a part of the EMCS scope of work shall be provided by General Contractor and associated subcontractors for each building and the infrastructure.

C. Testing and Commissioning

1. Section 01 91 00 Commissioning
2. Section 23 05 93 Testing, Adjusting and Balancing
3. Section 23 08 00 Mechanical Commissioning
4. Section 26 08 00 Electrical Commissioning

D. Communications

1. Connection to Using Agency IT WAN/LAN and terminations to wall jack shall be by Division 23C Contractor. Coordinate connection location of IT WAN/LAN and terminations with Using Agency. This connection shall also provide access to Internet through Using Agency firewall to Internet Services Provider procured by Using Agency.
2. Telephone lines: none required.

E. Integration with Existing System

1. Include all services required to integrate this building into existing EMCS for a fully operational system.

2. Procedure

a. Provide all controls work as indicated on drawings and in Section 23 09 29.
b. Develop all building level control system databases and control programming using existing standards and standard programming.
c. Install building databases and control programming on a temporary portable operator's terminal provided by the Contractor. The POT shall be used for start-up, testing, and commissioning. The POT shall remain the property of the Contractor after final completion of the project.
d. Once the building EMCS has been fully commissioned and accepted by the Using Agency, merge database and programming with those existing on the existing Operator Workstation and/or servers. Confirm that the merge was successful by sample testing points and sequences, and approve final installation in writing.
e. Integrate graphic screens into the existing EMCS graphics including adding appropriate hyperlinks so that the system operates as one integrated system.
f. Provide high level password for Using Agency operator access to the system only at this point; Using Agency will not have access to the system prior to system acceptance and integrations.

1.4 REFERENCE STANDARDS

A. Nothing in Contract Documents shall be construed to permit Work not conforming to applicable laws, ordinances, rules, and regulations. When Contract Documents differ from requirements of applicable laws, ordinances, rules and regulations, EMCS contractor shall comply with documents establishing the more stringent requirement.

B. The latest published or effective editions, including approved addenda or amendments, of the following codes and standard shall apply to the EMCS design and installation as applicable.

C. State and Local Codes:

1. Local City and County Codes

D. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

1. ASHRAE 135: BACnet - A Data Communication Protocol for Building Automation and Control Networks.

E. Electronics Industries Alliance

1. EIA-232: Interface Between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange.
2. EIA-458: Standard Optical Fiber Material Classes and Preferred Sizes
3. EIA-485: Standard for Electrical Characteristics of Generator and Receivers for use in Balanced Digital Multipoint Systems.
4. EIA-472: General and Sectional Specifications for Fiber Optic Cable
5. EIA-475: Generic and Sectional Specifications for Fiber Optic Connectors and all Sectional Specifications
6. EIA-573: Generic and Sectional Specifications for Field Portable Polishing Device for Preparation Optical Fiber and all Sectional Specifications
7. EIA-590: Standard for Physical Location and Protection of Below-Ground Fiber Optic Cable Plant and all Sectional Specifications

F. Underwriters Laboratories

1. UL 916: Energy Management Systems.

G. NEMA Compliance

1. NEMA 250: Enclosure for Electrical Equipment
2. NEMA ICS 1: General Standards for Industrial Controls.

H. NFPA Compliance

1. NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems" where applicable to controls and control sequences.

I. Institute of Electrical and Electronics Engineers (IEEE)

1. IEEE 142: Recommended Practice for Grounding of Industrial and Commercial Power Systems
2. IEEE 802.3: CSMA/CD (Ethernet – Based) LAN
3. IEEE 802.4: Token Bus Working Group (ARCNET – Based) LAN

1.5 DEFINITIONS

A. Acronyms

AAC	Advanced Application Controller
AH	Air Handler
AHU	Air Handling Unit
AI	Analog Input
ANSI	American National Standards Institute
AO	Analog Output
APDU	Application Protocol Data Unit
ASC	Application Specific Controllers

ASCII	American Standard Code for Information Interchange
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers.
ASME	American Society of Mechanical Engineers.
ASTM	American Society for Testing and Materials.
A-to-D	Analog-to-Digital
BACnet	Data Communications Protocol for Building Automation and Control Systems
BC	Building Controller
BIBB	BACnet Interoperability Building Blocks
BMA	BACnet Manufacturers Association \
CAD	Computer Aided Drafting
CHW	Chilled Water
CHWR	Chilled Water Return
CHWS	Chilled Water Supply
COV	Change of Value
CSS	Control Systems Server
CU	Controller or Control Unit
CV	Constant Volume
CW	Condenser Water
CWR	Condenser Water Return
CWS	Condenser Water Supply
DCS	Digital Control Stations
DBMS	Database Management System
DDC	Direct Digital Control
DHW	Domestic Hot Water
DI	Digital Input
DO	Digital Output
D-to-A	Digital-to-Analog
EMCS	Energy Management and Control System
EMT	Electrical Metallic Tubing
EP	Electro-Pneumatic
ETL	Edison Testing Laboratories.
GUI	Graphical User Interface
HOA	Hand-Off-Automatic
HVAC	Heating, Ventilating and Air-Conditioning'
HTTP	Hyper-Text Transfer Protocol
I/O	Input/output
IEEE	Institute of Electrical and Electronics Engineers
ISO	International Organization for Standardization
LAN	Local Area Network
LANID	LAN Interface Device
LCP	Lighting Control Panel
MAC	Medium Access Control
MHz	Megahertz
MS/TP	Master-Slave/Token-Passing
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association.
NIST	National Institute of Standards and Technology
ODBC	Open Database Connectivity
OI	Operator Interface

OWS	Operator Workstation
P	Proportional
PC	Personal Computer
PI	Proportional-Integral
PICS	Protocol Implementation Conformance Statement
PID	Proportional-Integral-Derivative
POT	Portable Operators Terminal
PTP	Point-to-Point
RAM	Random Access Memory
SOO	Sequence of Operation
SQL	Standardized Query Language
SSL	Secure Socket Layers
TAB	Test, Adjust, and Balance
TDR	Time Delay Relay
THS	Trend Historian Server
UL	Underwriters' Laboratories, Inc.
XML	Extensible Markup Language

B. Terms

Term	Definition
Accessible	Locations that can be reached with no more than a ladder to assist access and without having to remove permanent partitions or materials. Examples include inside mechanical rooms, mechanical equipment enclosures, instrument panels, and above suspended ceilings with removable tiles.
Advanced Application Controller	A device with limited resources relative to the Building Controller. It may support a level of programming and may also be intended for application specific applications.
Application Protocol Data Unit	A unit of data specified in an application protocol and consisting of application protocol control information and possible application user data (ISO 9545).
Application Specific Controller	A device with limited resources relative to the Advanced Application Controller. It may support a level of programming and may also be intended for application-specific applications. .
BACnet Interoperability Building Blocks	A BIBB defines a small portion of BACnet functionality that is needed to perform a particular task. BIBBs are combined to build the BACnet functional requirements for a device in a specification.
BACnet/BACnet Standard	BACnet communication requirements as defined by the latest version of ASHRAE/ANSI 135 and approved addenda.
Building Controller	A fully programmable device capable of carrying out a number of tasks including control and monitoring via direct digital control of specific systems, acting as a communications router between the LAN backbone and sub-LANs, and data storage for trend information, time schedules, and alarm data.
Change of Value	An event that occurs when a digital point changes value or an analog value changes by a predefined amount
Client	A device that is the requestor of services from a server. A client device makes requests of and receives responses from a server device.
Concealed	Embedded in masonry or other construction, installed in furred

	spaces, within double partitions or hung ceilings, in trenches, in crawl spaces, or in enclosures.
Continuous Monitoring	A sampling and recording of a variable based on time or change of state (e.g. trending an analog value, monitoring a binary change of state).
Contract Documents	Specifications, drawings, and other materials provided with request for bids.
Contractor, EMCS Contractor, or Division 23C Contractor	The Contractor retained by Using Agency to execute the work defined in Division 23C and associated design documents
Control Systems Server	A computer (or computers) that maintains the systems configuration and programming database.
Controller or Control Unit	Intelligent stand-alone control panel. Controller is a generic reference and shall include BCs, AACs, and ASCs as appropriate.
Digital Control Stations	One or more EMCS control panels
Direct Digital Control	Microprocessor-based control including Analog/Digital conversion and program logic
Energy Management and Control System	The entire integrated management and control system
Equal	Approximately equal in material types, weight, size, design, quality, and efficiency of specified product.
Exposed	Not installed underground or concealed.
Extensible Markup Language	A specification developed by the World Wide Web Consortium. XML is a pared-down version of SGML, designed especially for Web documents. It allows designers to create their own customized tags, enabling the definition, transmission, validation, and interpretation of data between applications and between organizations.
Functional Profile	A collection of variables required to define a the key parameters for a standard application. As this applies to the HVAC industry, this would include applications like VAV terminal, fan coil units, and the like.
Gateway	Bi-directional protocol translator connecting control systems that use different communication protocols
Hand Held Device	Manufacturer's microprocessor based device for direct connection to a Controller.
Inaccessible	Locations that do not meet the definition of accessible. Examples include inside furred walls, pipe chases and shafts, or above ceilings without removable tiles.
Indicated, shown or noted	As indicated, shown or noted on drawings or specifications.
Install	To erect, mount and connect complete with related accessories.
Instrumentation	Gauges, thermometers and other devices mounted in ductwork or piping that are not a part of the automatic temperature control system
IT LAN	Reference to the facility's Information Technology network, used for normal business-related e-mail and Internet communication.
LAN Interface Device	Device or function used to facilitate communication and sharing of data throughout the EMCS
Local Area Network	General term for a network segment within the architecture.
Supervisory LAN	Ethernet-based LAN connecting Primary Controller LANs with each other and OWSs, CSS, and THS. See System Architecture below.
Master-Slave/Token	Data link protocol as defined by the BACnet standard.

Passing	
Motor Controllers	Manual or magnetic starters (with or without switches), individual pushbuttons or hand-off-automatic (HOA) switches controlling the operation of motors.
Open Database Connectivity	An open standard application-programming interface for accessing a database developed. ODBC compliant systems make it possible to access any data from any application, regardless of which database management system is handling the data.
Operator Interface	A device used by the operator to manage the EMCS including OWSs, POTs, and HHDs.
Operator Workstation	The user's interface with the EMCS system. As the EMCS network devices are stand-alone, the OWS is not required for communications to occur.
Piping	Pipe, tube, fittings, flanges, valves, controls, strainers, hangers, supports, unions, traps, drains, insulation, and related items.
Points	All physical I/O points, virtual points, and all application program parameters.
Point-to-Point	Serial communication as defined in the BACnet standard.
Portable Operators Terminal	Laptop PC used both for direct connection to a controller and for remote dial up connection.
Primary Controlling LAN	High speed, peer-to-peer controller LAN connecting BCs and optionally AACs and ASCs. Refer to System Architecture below.
Protocol Implementation Conformance Statement	A written document, created by the manufacturer of a device, which identifies the particular options specified by BACnet that are implemented in the device (ASHRAE/ANSI 135).
Provide	To supply, install and connect up complete and ready safe and regular operation of particular work referred to unless specifically noted.
Reviewed, approved, or directed	As reviewed, approved, or directed by the Using Agency.
Router	A device that connects two or more networks at the network layer.
Secondary Controlling LAN	LAN connecting AACs and ASCs. Generally lower speed and less reliable than the Primary Controlling LAN. Refer to System Architecture below.
Server	A device that is a provider of services to a client. A client device makes requests of and receives responses from a server device.
Smart Device	A control I/O device such as a sensor or actuator that can directly communicate with the controller network to which it is connected. This differs from an ASC in that it typically deals only with one variable.
Standardized Query Language	A standardized means for requesting information from a database.
Supply	To purchase, procure, acquire and deliver complete with related accessories.
Trend Historian Server	A computer (or computers) that maintains the database of recorded trend logs.
Using Agency	Owner, University, Institution and/or its designated representatives.
Wiring	Raceway, fittings, wire, boxes and related items.
Work	Labor, materials, equipment, apparatus, controls, accessories, and other items required for proper and complete installation.

1.6 QUALITY ASSURANCE

A. Materials and Equipment

1. Manufacturer's Qualifications: See 2.01 for approved manufacturer.
2. Product Line Demonstrated History: The direct digital control equipment product line being proposed for the project must have an installed history of demonstrated satisfactory operation for a length of one year since date of final completion in at least 10 installations of comparative size and complexity.
3. All products used in this project installation shall be new, currently under manufacture, and shall have been available from the manufacturer for a minimum of 6 months prior to date of proposal and previously installed and proven effective in installations of similar nature, not including test sites. This installation shall not be used as a test site for any new products unless explicitly approved by the Using Agency in writing. Spare parts shall be available for at least five years after completion of this contract.
4. All BACnet devices must either be certified as complaint with BACnet through the BACnet Manufacturers Association or the vendor must supply proof of having submitted the device for testing by BMA.
5. The EMCS and components shall be listed by Underwriters Laboratories UL 916 as an Energy Management System.

B. Installer

1. EMS Contractor's Project Manager Qualifications: Individual shall specialize in and be experienced with direct digital control system installation for not less than 3 years. Project Manager shall have experience with the installation of the proposed direct digital control equipment product line for not less than 2 projects of similar size and complexity. Project Manager must have proof of having successfully completed the most advanced training offered by the manufacturer of the proposed product line.
2. EMS Contractor's Programmer Qualifications: Individual(s) shall specialize in and be experienced with direct digital control system programming for not less than 3 years and with the proposed direct digital control equipment product line for not less than 1.5 years. Programmers must show proof of having successfully completed the most advanced programming training offered by the vendor of the programming application on the proposed product line.
3. EMS Contractor's Service Qualifications: The installer must be experienced in control system operation, maintenance and service. EMS Contractor must document a minimum 5-year history of servicing installations of similar size and complexity. Installer must also document at least a 1-year history of servicing the proposed product line.
4. Installer’s Response Time and Proximity

    a. Installer must maintain a fully capable service facility within Mississippi. Service facility shall manage the emergency service dispatches and maintain the inventory of spare parts.
    b. Installer must demonstrate the ability to meet the emergency response times listed in paragraph 1.12B.2.

5. Electrical installation shall be by manufacturer-trained electricians.

    a. Exception: Roughing in wiring/conduit and mounting panels may be subcontracted to any licensed electrician.

1.7 SUBMITTALS

A. No work may begin on any segment of this project until the related submittals have been reviewed for conformity with the design intent and the Contractor has responded to all comments to the satisfaction of the resentative.

B. Submit drawings, product data, samples and certificates of compliance required as hereinafter specified. See also Division 1 Shop Drawings, Product Data and Samples. Conditions in this Section take precedence over conditions in above referenced Section.

C. Submittal Schedule: Submittal schedule shall be as follows unless otherwise directed by the Using Agency:

1. Allow 10 working days for approval, unless Professional agrees to accelerated schedule.
2. Submittal Package 1 (Hardware and Shop Drawings) shall be submitted in accordance with schedule established by the Using Agency in bid documents.
3. Submittal Package 2 (Programming and Graphics) and shall be submitted no less than 30 days before software is to be installed in field devices.
4. Submittal Package 3 (Functional Testing) shall be submitted no less than 30 days prior to conducting tests.
5. Submittal Package 4 (Training Materials) shall be submitted no less than 14 days prior to conducting first training class.
6. Submittal Package 5 (Post-Construction Trend Logs) shall be submitted after demonstration tests are accepted and systems are in full automatic operation. The list of points to be trended shall be submitted for approval 14 days prior to the start of the trend collection period.
7. Submittal Package 6 (End-of-Warranty Trend Logs) shall be submitted 30 days prior to the end of the warranty period.

D. Submission and Resubmission Procedure:

1. Each submittal shall have a unique serial number that includes the associated specification section followed by a number for each sub-part of the submitted for that specification section, such as SUBMITTAL 230900-01.
2. Each resubmittal shall have the original unique serial number plus unique revision number such as SUBMITTAL 230900-01 REVISION 1.
3. Submit one copy of submittal in electronic format specified under each submittal package below. Submissions made in the wrong format will be returned without action.
4. Submit two (2) and only two hardcopies copies of submittals to Professional for review. Any additional copies will be returned without review.
5. Professional will return one copy with comments and corrections noted where required.
6. Make corrections:

    a. Revise initial drawings or data.
    b. Indicate any changes that have been made other than those requested.
    c. Clearly identify resubmittal by original submittal number and revision number.

7. Resubmit two (2) and only two copies of revised submittals to Professional for review until no exceptions are taken.
8. Once submittals are accepted and stamped with no exceptions taken, Contactor shall make photocopies for coordination with other trades, as required by the General Contractor. Photocopies will serve as submittal for record and coordination.

E. Submittals Packages

1. Submittal Package 1 (Hardware and Shop Drawings)

a. Provide Installer and Key personnel qualifications as specified.
b. Hardware

(1) Organize by specification section and device tags as tagged in these specifications.
(2) Do not submit products that are not used even if included in specifications.
(3) Include a summary table of contents listing for every submitted device:

a) Tab of submittal file/binder where submittal is located
b) Device tag as tagged in these specifications (such as TS-1A, FM-1)
c) Specification section number (down to the lowest applicable heading number)
d) Whether device is per specifications and a listed product or a substitution
e) Manufacturer
f) Model Number
g) Device accuracy (where applicable)
h) Accuracy as installed including wiring and A/D conversion effects (where applicable)

(4) Submittal shall include manufacturer's description and technical data, such as performance data, product specification sheets, and installation instructions for all control devices and software.
(5) When manufacturer's cut-sheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Each submitted piece of literature and drawings shall clearly reference the specification and/or drawing that the submittal is to cover. General catalogs shall not be accepted as cut sheets to fulfill submittal requirements.
(6) A BACnet_ Protocol Implementation Conformance Statement (PICS) for each type of controller and operator interface shall be included submittals.
(7) Format: Electronic word-searchable format.

c. Shop Drawings

(1) Format:

a) Sheets shall be consecutively numbered.
b) Each sheet shall have a title indicating the type of information included and the mechanical/electrical system controlled.
c) Table of Contents listing sheet titles and sheet numbers.
d) Legend and list of abbreviations.
e) Schematics

1) AutoCAD or Visio compatible format.
2) 21 inch x 15 inch or 17 inch x 11 inch.

f) Floor plans: None required

(2) System architecture one-line diagram indicating schematic location of all control units, workstations, LAN interface devices, gateways, etc. Indicate address and type for each control unit. Indicate media, protocol, baud rate, and type of each LAN.
(3) Schematic flow diagram of each air and water system showing fans, coils, dampers, valves, pumps, heat exchange equipment and control devices. The

schematics provided with bid package shall be the basis on the EMCS Contractor's schematics with respect to control points, but EMCS Contractor may use alternative graphics format.

(4) All physical points on the schematic flow diagram shall be indicated with names, descriptors, and point addresses identified as listed in the point summary table.

(5) With each schematic, provide a point summary table listing building number and abbreviation, system type, equipment type, full point name, point description, Ethernet backbone network number, network number, device ID, object ID (object type, instance number). See Section 23 09 26 - Part 3 for additional requirements.

(6) Label each control device with setting or adjustable range of control.

(7) Label each input and output with the appropriate range.

(8) Device table (Bill of Materials). With each schematic, provide a table of all materials and equipment including:

a) Device tag as indicated in the schematic and actual field labeling (use tag as indicated in these specifications where applicable and practical)
b) Device tag as indicated in these specifications where applicable and if it differs from schematic device tag
c) Description
d) Quantity
e) Proposed manufacturer and model number
f) Range

(9) With each schematic or on separate valve sheet, provide valve and actuator information including size, C_v, design flow, target pressure drop, actual design pressure drop, manufacturer, model number, close off rating, etc. Indicate normal positions of spring return valves and dampers.

(10) Indicate all required electrical wiring. Electrical wiring diagrams shall include both ladder logic type diagram for motor starter, control, and safety circuits and detailed digital interface panel point termination diagrams with all wire numbers and terminal block numbers identified. Provide panel termination drawings on separate drawings. Ladder diagrams shall appear on system schematic. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

(11) Details of control panels, including controls, instruments, and labeling shown in plan or elevation indicating the installed locations.

d. Do not include sequence of controls on shop drawings or equipment submittals; they are included in Submittal Package 2.

e. Submit along with shop drawings but under separate cover memory allocation projections and calculated and guaranteed response times of the most heavily loaded LAN in the system.

2. Submittal Package 2 (Programming and Graphics)

a. A detailed description of point naming convention conforming to Section 23 09 26 to be used for all software and hardware points, integrated with existing database convention.

b. A list of all hardware and software points identifying their text names, device addresses and descriptions.

c. Control Logic Documentation

(1) Submit control logic program listings (graphical programming) consistent with specified English-language Sequences of Operation for all control units.

(2) Control logic shall be annotated to describe how it accomplishes the sequence of operation. Annotations shall be sufficient to allow an operator to relate each program component (block or line) to corresponding portions of the specified Sequence of Operation.
(3) Include specified English-language Sequences of Operation of each control sequence updated to reflect any suggested changes made by the Contractor to clarify or improve the sequences. Changes shall be clearly marked. SOO shall be fully consistent with the graphical programming. (An electronic version of the sequences of controls in Section 23 09 29 will be provided to the Contractor upon request.)
(4) Include control settings, setpoints, throttling ranges, reset schedules, adjustable parameters and limits.
(5) Submit one complete set of programming and operating manuals for all digital controllers concurrently with control logic documentation. This set will count toward the required number of Operation and Maintenance materials specified below.

d. Graphic screens of all required graphics, provided in final colors, one 11” x 8.5” page per screen.
e. Format

(1) Points list: Word-searchable format per Paragraph 1.8C.3.
(2) Programming: Native electronic file if interpreter is available, otherwise provide pdf files of screen shots.
(3) Programming and operating manual: Word-searchable format per Paragraph 1.8C.3.
(4) Graphics: Graphical electronic format (pdf, png, etc.).

3. Submittal Package 3 (Functional Testing)

a. Provide pre-functional test forms as required by Section 23 09 33.
b. Provide functional test forms as required by Section 23 09 33.
c. Format: Word-searchable format per Paragraph 1.8C.3.

4. Submittal Package 4 (Training Materials)

a. Provide training materials as required by Section 23 09 33.
b. Format: Word-searchable format per Paragraph 1.8C.3.

5. Submittal Package 5 and 6 (Trend Logs)

a. Provide a list of points being trended along with trend interval or change-of-value per Section 23 09 29.
b. Provide trend logs as required by Section 23 09 29.
c. Format: See Section 23 09 26.

1.8 COMPLETION REQUIREMENTS

A. Procedure.

1. Until the documents required in this section are submitted and approved, the system will not be considered “accepted” and final payment to EMCS Contractor will not be made.
2. Before requesting acceptance of work, submit one set of completion documents for review and approval of Using Agency.

3. After review, furnish quantity of sets indicated below to Using Agency.

B. Completion Documents:

1. Operation and Maintenance (O & M) Manuals. Provide in both paper and electronic format per paragraph 1.8C.

    a. Include all submittals (product data, shop drawings, control logic documentation, hardware manuals, software manuals, installation guides or manuals, maintenance instructions and spare parts lists) in maintenance manual; in accordance with requirements of Division 1.
    b. As-built versions of the submittal product data. Submittal data shall be located in tabs along with associated maintenance information.
    c. Engineering, Installation, and Maintenance Manual(s) that explain how to design and install new points, panels, and other hardware; preventive maintenance and calibration procedures; how to debug hardware problems; and how to repair or replace hardware.
    d. Complete original issue documentation, installation, and maintenance information for all third-party hardware and software provided, including computer equipment and sensors.
    e. A list of recommended spare parts with part numbers and suppliers.
    f. Operators Manual with procedures for operating the control systems, including logging on/off, alarm handling, producing point reports, trending data, overriding computer control, and changing set points and other variables.
    g. Programming Manuals with a description of the programming language, control block descriptions (including algorithms and calculations used), point database creation and modification, program creation and modification, and use of the programming editor.
    h. Recommended preventive maintenance procedures for all system components, including a schedule of tasks (inspection, cleaning, calibration, etc.), time between tasks, and task descriptions.
    i. A listing and documentation of all custom software for the project created using the programming language, including the set points, tuning parameters, and point and object database.
    j. English language control sequences updated to reflect final programming installed in the EMCS at the time of system acceptance.

2. Complete original issue diskettes/CDs for all software provided, including operating systems, programming language, operator workstation software, and graphics software.
3. Project Record Drawings.

    a. “As-built” versions of the submittal drawings in reproducible paper and electronic format per paragraph 1.8C.
    b. Provide as-built network architecture drawings showing all BACnet nodes including a description field with specific controller/device identification, description and location information.
    c. Record floor plans with controller locations with all interconnecting wiring routing including space sensors, LAN wiring, power wiring, low voltage power wiring. Indicate device instance, address and drawing reference number.

4. Commissioning Reports. Completed versions of all Pre-functional, Functional, and Demonstration Commissioning Test reports, calibration logs, etc., per Section 23 09 33.
5. Copy of inspection certificates provided by the local code authorities.
6. Written guarantee and warranty documents for all equipment and systems, including the start and end date for each.
7. Training materials as required by Section 23 09 33.
8. Contact information. Names, addresses, and 24-hour telephone numbers of contractors

installing equipment, and the control systems and service representatives of each.

C. Format of Completion Documents

1. Provide the type and quantity of media listed in table below.
2. Documents such as manuals and control sequences shall be in word-searchable electronic format such as MS Word, Adobe Acrobat (pdf), and HTML and broken into separate files for each type of equipment. Record drawings shall be in original format per paragraph 1.06F.
3. Optical media shall be readable on Operator Workstations.

	Document	Paper (binder or bound)	Electronic	
			Read only optical disk	Loaded onto OWSs and POTs
1.	O&M Manual	5	1	1
2.	Original issue software	–	1 per workstation	1
3.	Project Record Drawings	5	1	1
4.	Control sequences	1	1	1
5.	Commissioning Reports	5	–	–
6.	Inspection Certificates	1	–	–
7.	Warranty documents	1	–	–
8.	Training materials	1 per trainee	–	–
9.	Contact information	1	–	1

D. Permanent On-site Documentation:

1. In panels, provide point list of all points in panel in sufficiently permanent manner that list cannot be easily removed (and lost).
2. Mount half size drawings of primary system schematics and network architecture in glass covered frame. The number of drawings will depend on the complexity of the system; compressed or abridged versions of shop drawings are acceptable provided all control points are shown. Mount the drawings in space available in mechanical rooms. Drawings may be mounted in different locations, e.g. air handler schematic may be in fan room, chiller schematic in chiller room, etc.

1.9 SYSTEM ARCHITECTURE

A. General

1. The system provided shall incorporate hardware resources sufficient to meet the functional requirements of these Specifications. The Contractor shall include all items not specifically itemized in these Specifications that are necessary to implement, maintain, and operate the system in compliance with the functional intent of these Specifications.
2. The control system shall consist of a high-speed, peer-to-peer network of DDC controllers, a control system server, and an operator workstation capable of expansion as specified herein.
3. System software shall be based on a server/thin-client architecture, designed around the open standards of web technology. The control system server shall be accessed using a Web browser over the control system network, the Using Agency's local area network, and remotely over the Internet (through the Using Agency's LAN).
4. The intent of the thin-client architecture is to provide operators complete access to the control system via a Web browser. No special software other than a Web browser shall be required

to access graphics, point displays, and trends, configure trends, configure points and controllers, or to edit programming.

5. Performance Monitoring. The EMCS will provide the specified performance monitoring functionality, including required monitoring points and performance metrics, improved through system accuracy, data acquisition and data management capabilities, and required graphical and data displays.
6. Event Response. The EMCS will provide the specified operational changes based on event response from the energy service provider.
7. All control products provided for this project shall comprise an interoperable fully-native BACnet system, including all communication media, connectors, repeaters, hubs, and routers necessary for the network. All control products provided for this project shall conform to ANSI/ASHRAE Standard 135.

B. EMCS network architecture.

1. Supervisory LAN: The LAN shall be an Ethernet-based, 100/1000 Mbps network connecting the control system servers and OWSs to routers in each building. Contractor shall utilize the Using Agency's Enterprise IT LAN/WAN for this purpose. This network shall be BACnet/IP as defined in Addendum A (Annex J) of the BACnet standard, and shall share a common network number for the Ethernet backbone, as defined in BACnet.
2. Primary Controller LAN (Primary LAN): High-speed, peer-to-peer communicating LAN used to connect AACs, ASCs and BCs and communicate exclusively control information. Acceptable technologies include:

    a. Ethernet (IEEE 802.3)

3. Secondary Controller LAN (Secondary LAN or sub LAN): Network used to connect AACs and ASCs. These can be Master Slave/ Token Passing or polling, in addition to those allowed for Primary Controller LANs. Network speed vs. the number of controllers on the LAN shall be dictated by the response time and trending requirements.

C. Operator Interfaces and Servers:

1. Control Systems Server (CSS). This shall be a server upon which the systems configuration and programming databases are maintained and serves as web server for operator interface. It shall hold the backup files of the information downloaded into the individual controllers and as such support uploading and downloading that information directly to/from the controllers. It shall also act as a control information server to non-control system based programs. It shall allow secure multiple-access to the control information.
2. The Operator Workstations and Portable Operator Terminals shall provide for overall system supervision, graphical user interface, management report generation, and alarm annunciation.
3. Remote monitoring and control shall be through use of a web browser through the Using Agency's IT LAN and via the internet through the Using Agency's IT LAN.
4. The operator interface and server already exist. Modify existing hardware and software as needed for the project.

D. Controllers. The BCs, AACs, and ASCs shall monitor, control, and provide the field interface for all points specified. Each BC, AAC, or ASC shall be capable of performing all specified energy management functions, and all DDC functions, independent of other BCs, AACs, or ASCs and operator interface devices.

E. Gateways:

1. Gateways shall be provided only as required for connection to the following:

a. Electrical Power System Controls
b. Variable Speed Drive Controls
c. Lighting Control
d. Boilers

2. Where gateways are used, critical points shall be hard-wired from the DDC system to the controlled device, rather than using the gateway, to avoid problems with gateway failures, currently a common problem. Critical points are those that are essential for proper operation and are listed in points list as separate points. Where listed, these points shall be hard-wired even when available through gateway.

1.10 SYSTEM PERFORMANCE

A. The communication speed between the controllers, LAN interface devices, and operator interface devices shall be sufficient to ensure fast system response time under any loading condition. This includes when system is collecting trend data for commissioning and for long term monitoring. (See Section 23 09 33.) In no case shall delay times between an event, request, or command initiation and its completion be greater than those listed herein, assuming no other simultaneous operator activity. Contractor shall reconfigure LAN as necessary to accomplish these performance requirements. This does not apply to gateways and their interaction with non-EMCS-vendor equipment.

1. Object Command. The maximum time between an operator command via the operator interface to change an analog or binary point and the subsequent change in the controller shall be less than 5 seconds.
2. Object Scan. All changes of state and change of analog values will be transmitted over the network such that any data used or displayed at a controller or workstation will have been current within the previous 10 seconds.
3. Graphics Scan. The maximum time between an operator's selection of a graphic and it completely painting the screen and updating at least 10 points shall be less than 10 seconds.
4. Alarm Response Time. The maximum time from when an object goes into alarm to when it is annunciated at the workstation or broadcast to pager (where so programmed) shall not exceed 10 seconds for a Level 1 or 2 alarm, 20 seconds for alarm levels 2 and 3, and 30 seconds for alarm levels 4 and 5. All workstations on the onsite network must receive alarms within 5 seconds of each other.
5. Program Execution Frequency. Custom and standard applications shall be capable of running as often as once every 5 seconds. The EMCS Contractor shall be responsible for selecting execution times consistent with the mechanical process under control.
6. Control Loop Performance. Programmable controllers shall be able to execute DDC PID control loops at a selectable frequency of at least once per second. The controller shall scan and update the process value and output generated by this calculation at this same frequency.

1.11 OWNERSHIP OF PROPRIETARY MATERIAL

A. All project-developed software and documentation shall become the property of the Using Agency. These include, but are not limited to:

1. Project graphic images
2. Record drawings
3. Project database
4. Project-specific application programming code

5. All documentation

1.12 WARRANTY

A. In accordance with Division 1 Guarantees, Warranties, Bonds, Service & Maintenance Contracts, and as follows.

B. At the successful completion of the final testing, commissioning, and demonstration phase in accordance with the terms of this specification, if equipment and systems are operating satisfactorily to the Using Agency and if all completion requirements per paragraph 1.07 have been fulfilled, the Using Agency shall certify in writing that the control system has been accepted. The date of acceptance shall be the start of the warranty period.

C. Guarantee all materials, equipment, apparatus and workmanship (including programming) to be free of defective materials and faulty workmanship for period of one year from date of acceptance.

1. Valve and damper actuators shall carry a manufacturer’s 5-year warranty.

D. Provide new materials, equipment, apparatus and labor to replace that determined by Using Agency to be defective or faulty.

E. Control system failures during the warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to the Using Agency. The EMCS Contractor shall respond to the Using Agency's request for warranty service within 24 hours during normal business hours.

F. Operator workstation software, project-specific software, graphic software, database software, and firmware updates that resolve known software deficiencies as identified by the EMCS Contractor shall be provided at no charge during the warranty period. Software bugs (both due to programming misinterpretations and sequence errors) shall be corrected and any reasonable control sequence changes required to provide proper system operation shall also be provided at no additional cost during this period.

1.13 WARRANTY MAINTENANCE

A. The Using Agency reserves the right to make changes to the EMCS during the warranty period. Such changes do not constitute a waiver of warranty. The Contractor shall warrant parts and installation work regardless of any such changes made by the Using Agency, unless the Contractor provides clear and convincing evidence that a specific problem is the result of such changes to the EMCS.

B. At no cost to the Using Agency, during the warranty period, the Contractor shall provide maintenance services for software and hardware components as specified below:

1. Maintenance services shall be provided for all devices and hardware specified in Division 23C. Service all equipment per the manufacturer’s recommendations.
2. Emergency Service: Any malfunction, failure, or defect in any hardware component or failure of any control programming that would result in property damage or loss of comfort control shall be corrected and repaired following telephonic notification by the Using Agency to the Contractor.

a. Response by telephone or via internet connection to the EMCS to any request for service shall be provided within two hours of the Using Agency's initial telephone request for service.

b. In the event that the malfunction, failure, or defect is not corrected through the telephonic communication, at least one hardware and software technician, trained in the system to be serviced, shall be dispatched to the Using Agency's site within eight hours of the Using Agency's initial telephone request for such services, as specified.

3. Normal Service: Any malfunction, failure, or defect in any hardware component or failure of any control programming that would not result in property damage or loss of comfort control shall be corrected and repaired following telephonic notification by the Using Agency to the Contractor.

   a. Response by telephone to any request for service shall be provided within eight working hours (contractor specified 40 hr per week normal working period) of the Using Agency's initial telephone request for service.
   b. In the event that the malfunction, failure, or defect is not corrected through the telephonic communication, at least one hardware and software technician, trained in the system to be serviced, shall be dispatched to the Using Agency's site within three working days of the Using Agency's initial telephone request for such services, as specified.

4. Using Agency’s Telephonic Request for Service: Contractor shall specify a maximum of three telephone numbers for Using Agency to call in the event of a need for service. At least one of the lines shall be attended continuously (24/7). Alternatively, pagers can be used for technicians trained in system to be serviced. One of the three paged technicians shall respond to every call within 15 minutes.
5. Technical Support: Contractor shall provide technical support by telephone throughout the warranty period.
6. Preventive maintenance shall be provided throughout the warranty period in accordance with the hardware component manufacturer's requirements.
7. Record drawings and software documentation shall be updated as required to reflect any and all changes made to the system or programming during the warranty period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS (PRODUCT LINE)

A. Johnson Controls (Metasys)

B. Johnson Controls (Facilities Explorer)

C. Trane (Tracer SC)

D. Siemens (Apogee)

E. Honeywell (ComfortPoint)

2.2 MATERIALS AND EQUIPMENT

A. Materials shall be new, the best of their respective kinds without imperfections or blemishes and shall not be damaged in any way.

B. To the extent practical, all equipment of the same type serving the same function shall be identical and from the same manufacturer

PART 3 - EXECUTION

3.1 COORDINATION

A. The Contractor shall coordinate work schedule with Professional to complete project on schedule without disruption or delays.

B. The Contractor shall coordinate work with other trades prior to construction.

C. Examine areas and conditions under which control systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION

A. Install systems and materials in accordance with manufacturer's instructions, roughing-in drawings and details shown on drawings.

B. Refer to additional requirements in other Sections of this specification.

3.3 DIGITAL CONTROL STATIONS

A. Individual Digital Control Stations referenced on drawings to indicate allocation of points to each DCS and DCS location. Digital control stations shall consist of one or multiple controllers to meet requirements of this specification. It is the Contractor's responsibility to provide enough controllers to ensure a completely functioning system, according to the point list and sequence of operations.

B. Where a DCS is referenced, Contractor shall provide at least one (1) controller, and additional controllers as required, in sufficient quantity to meet the requirements of this Specification. Restrictions in applying controllers are specified in Section 23 09 19 - EMCS Field Panels.

C. Contractor is responsible for ensuring DCSs do not interfere with other requirements of the project and maintain adequate clearance for maintenance access.

D. DCSs have not been located. The Contractor shall locate DCSs in electrical rooms, mechanical rooms, and adjacent to rooftop equipment where space is available.

E. Contractor is responsible for ensuring DCSs do not interfere with other requirements of the project and maintain adequate clearance for maintenance access.

3.4 CONTROL POWER

A. Division 23C Contractor shall extend power to all EMCS devices, including 120V power to panels, from an acceptable power panel.

1. See Division 26 Electrical drawings for power locations pre-allocated for EMCS system.
2. Where no power source is shown, for bid purposes only, assume a dedicated circuit is available within an average of 50 feet of panel location. If this is not the case, request additional cost prior to submission of shop drawings or no additional costs will be reimbursed.
3. Coordinate with Division 26 during shop drawing development for final connection location.

B. General requirements for obtaining power include the following:

1. Obtain power from a source that feeds the equipment being controlled such that both the control component and the equipment are powered from the same panel. Where equipment is powered from a 460V source, obtain power from the electrically most proximate 120v source fed from a common origin.
2. Where control equipment is located inside a new equipment enclosure, coordinate with the equipment manufacturer and feed the control with the same source as the equipment. If the equipment's control transformer is large enough and of the correct voltage to supply the controls, it may be used. If the equipment's control transformer is not large enough or of the correct voltage to supply the controls, the Contractor shall provide separate transformer(s).
3. Where a controller controls multiple systems on varying levels of power reliability (normal, emergency, and/or interruptible), the controller shall be powered by the highest level of reliability served.
4. Standalone Functionality: Refer to Section 23 09 19.

C. Power line filtering. Provide transient voltage and surge suppression for all workstations and controllers either internally or as an external component.

3.5 DELIVERY, STORAGE, AND HANDLING

A. Provide factory-shipping cartons for each piece of equipment and control device. Maintain cartons during shipping, storage and handling as required to prevent equipment damage, and to eliminate dirt and moisture from equipment.

B. Store equipment and materials inside and protect from weather.

3.6 IDENTIFICATION

A. General:

1. Manufacturers' nameplates and UL or CSA labels to be visible and legible after equipment is installed.
2. Identifiers shall match record documents.
3. All plug-in components shall be labeled such that removal of the component does not remove the label.

B. Wiring and Tubing:

1. All wiring and cabling, including that within factory-fabricated panels, shall be labeled at each end within 2" of termination with the DDC address or termination number.
2. Permanently label or code each point of field terminal strips to show the instrument or item served.
3. All pneumatic tubing shall be labeled at each end within 2" of termination with a descriptive identifier.

C. Equipment and Devices:

1. Valve and damper actuators: Provide 2" diameter brass tags and brass chains. Lettering shall be ½" high, stamped and painted black. Indicate unique valve or damper identifier from record drawings.
2. Sensors: Provide 1"x 3"x 1/8" black micarta or lamacoid labels with engraved white lettering, ¼" high. Indicate sensor identifier and function (e.g. "CHWS temp").

3. Panels: Provide 2"x 5" 1/8” black micarta or lamacoid labels with engraved white lettering, ½" high. Indicate panel identifier and service.
4. Identify room sensors relating to terminal box or valves with indelible marker on sensor hidden by cover.

3.7 CUTTING, CORING, PATCHING & PAINTING

A. The EMCS Contractor shall provide canning for openings in concrete walls and floors and other structural elements prior to their construction. Should any openings be missed, the EMCS Contractor shall be responsible for all cutting, coring, and patching that may be required for Division 23C work. Structural elements shall not be cut without the written consent of Using Agency.

B. Penetrations through rated walls or floors shall be filled with an approved material to provide a code compliant fire-stop.

C. All damage to and openings in ductwork, piping insulation, and other materials and equipment resulting from Division 23C work shall be properly sealed, repaired, and/or re-insulated by experienced mechanics of the trade involved. Repair insulation to maintain integrity of insulation and vapor barrier jacket. Use hydraulic insulating cement to fill voids and finish with material matching or compatible with adjacent jacket material.

D. At the completion of work, all equipment furnished under this section shall be checked for paint damage, and any factory-finished paint that has been damaged shall be repaired and repainted to original finish.

3.8 CLEANING

A. The EMCS Contractor shall clean up all debris resulting from its activities daily. The EMCS Contractor shall remove all cartons, containers, crates, etc., under its control as soon as their contents have been removed. Waste shall be collected and legally disposed of by EMCS Contractor.

B. Materials stored on-site shall be stored in an orderly manner, neatly stacked, or piled in the designated area assigned by the Professional.

C. At the completion of work in any area, the EMCS Contractor shall clean all of its work, equipment, etc., keeping it free from dust, dirt, and debris, etc.

D. The EMCS Contractor shall use only cleaning materials recommended by the manufacturer of the surfaces to be cleaned and on surfaces recommended by the cleaning material manufacturer.

3.9 FIELD QUALITY CONTROL

A. See Division1 Quality Control.

B. Perform tests as required by authorities having jurisdiction.

C. See 23 08 00 Mechanical Commissioning.

D. Repair or replace defective work, as directed by Professional in writing, at no additional cost to the Using Agency.

E. Restore or replace damaged work due to tests as directed by Professional in writing, at no additional cost to the Using Agency.

F. Restore or replace damaged work of others, due to tests, as directed by Professional in writing, at no additional cost to the Using Agency.

G. Remedial work shall be performed to the satisfaction of the Professional, at no additional cost to the Using Agency, including:

1. Work related to all Division 23C pre-functional, functional, and demonstration tests.
2. Division 23C work related to Section 23 05 93 Testing, Adjusting and Balancing.

H. Remedial work shall include performing any commissioning or other tests related to remedial work an additional time at no additional cost to the Using Agency.

END OF SECTION 23 09 00

SECTION 23 09 13 - EMCS BASIC MATERIALS AND DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. These heating, ventilating and air conditioning (HVAC) provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.2 WORK INCLUDED

A. Provide and install the following:

1. Field devices including control valves, control dampers, sensors, etc.

B. Refer to Section 23 09 00 for general requirements.

C. Refer to Section 23 09 29 for points list and specific device requirements.

1.3 RELATED WORK AND REQUIREMENTS

A. Section 23 09 00 Energy Management and Control System (EMCS) − General

B. Section 23 09 16 EMCS Operator Interfaces

C. Section 23 09 19 EMCS Field Panels

D. Section 23 09 23 EMCS Communications Devices

E. Section 23 09 26 EMCS Software and Programming

F. Section 23 09 29 EMCS Points and Sequence of Operation

1.4 GENERAL

A. Sensor selection, wiring method, use of transmitters, A-to-D conversion bits, etc. shall be selected and adjusted to provide end-to-end (fluid to display) accuracy at or better than those listed in the following table.

Measured Variable	**Reported Accuracy**
Space drybulb temperature	±1ºF
Ducted Air drybulb temperature	±0.5ºF
Mixed Air drybulb temperature	±1ºF
Outside Air drybulb temperature	±0.5ºF
Hot Water Temperature	±1ºF
Hot/chilled Water Delta-T (supply to return) − general	±0.3ºF

Measured Variable	Reported Accuracy
Water Flow	±3% of full scale
Airflow (terminal)	±10% of full scale
Airflow (measuring stations)	±5% of full scale
Air Pressure (ducts)	±0.05”
Air Pressure (space)	±0.01”
Water Pressure	±2% of full scale
Electrical power	2% of reading
Carbon Dioxide (CO_2)	±75 ppm

B. The listing of several sensors or devices in each section of Part 2 does not imply that any may be used. Refer to points list in Section 23 09 29 for device specification. Only where two or more devices are specifically listed in points list (e.g. “FM-1 or FM-4”) may the contractor supply any of the listed products.

PART 2 - PRODUCTS

2.1 AIR TUBING

A. Seamless copper tubing, Type L-ACR, ASTM B 88; with cast-bronze solder joint fittings, ANSI B1.18; or wrought-copper solder joint fittings, ANSI B16.22; except brass compression-type fittings at connections to equipment. Solder shall be 95/5 tin antimony, or other suitable lead free composition solder.

B. Virgin polyethylene non-metallic tubing type FR, ASTM D 2737, and with flame-retardant harness for multiple tubing. Use compression or push-on brass fittings.

2.2 ELECTRIC WIRING AND DEVICES

A. General. All electrical work shall comply with Division 26.

B. Power Wiring:

1. Power wiring and wiring connections required for EMCS shall be provided under this section unless specifically shown on drawings or specified to be under Division 26. See Coordination section in Section 23 09 00.
2. See Control Power section of 23 09 00.

C. Communication Wiring:

1. Contractor shall supply all communication wiring between Building Controllers, Routers, Gateways, AAC’s, ASC’s and local and remote peripherals (e.g., operator workstations, printers, and modems).
2. Supervisory LAN: For any portions of this network required under this section of the specification, contractor shall use Fiber or Category 5 of standard TIA/EIA 68 (10baseT). Network shall be run with no splices and separate from any wiring over thirty (30) volts.
3. Primary and Secondary Controller LANs: Communication wiring shall be individually 100% shielded pairs per manufacturers recommendations for distances installed, with overall PVC cover, Class 2, plenum-rated run with no splices and separate from any wiring over thirty (30) volts. Shield shall be terminated and wiring shall be grounded as recommended by BC manufacturer.

D. Signal Wiring:

1. Signal wiring to all field devices, including, but not limited to, all sensors, transducers, transmitters, switches, etc. shall be twisted, 100% shielded pair, minimum 18-gauge wire, with PVC cover. Signal wiring shall be run with no splices and separate from any wiring above thirty (30) volts.
2. Signal wiring shield shall be grounded at controller end only unless otherwise recommended by the controller manufacturer.

E. Low Voltage Analog Output Wiring:

1. Low voltage control wiring shall be minimum 16-gauge, twisted pair, 100% shielded, with PVC cover, Class 2 plenum-rated. Low voltage control wiring shall be run with no splices separate from any wiring above thirty (30) volts.

2.3 CONTROL CABINETS:

A. All control cabinets shall be fully enclosed with hinged door, key-lock latch. A single key shall be common to all field panels and sub-panels within each building. Provide 3 keys.

B. Construction

1. Indoor: NEMA 1
2. Outdoor: NEMA 4

C. Interconnections between internal and face-mounted devices shall be pre-wired with color-coded stranded conductors neatly installed in plastic troughs and/or tie-wrapped. Terminals for field connections shall be UL Listed for service, individually identified per control/interlock drawings, with adequate clearance for field wiring. All control tubing and wiring shall be run neatly and orderly in open slot wiring duct with cover. Control terminations for field connection shall be individually identified per control drawings.

D. Provide ON/OFF power switch with over-current protection for control power sources to each local panel.

E. Provide with:

1. Framed, plastic-encased point list for all points in cabinet.
2. Nameplates for all devices on face.

2.4 CONTROL VALVES

A. Manufacturers

1. Belimo
2. Siemens
3. Johnson Controls
4. Invensys
5. Delta
6. Warren
7. Or equal

B. Plug-Type Globe Pattern for Water Service:

1. Valves shall have cage-type trim, providing seating and guiding surfaces for plug on 'top-and-bottom' guided plugs.
2. Temperature Rating: 25□F minimum, 250□F maximum
3. Body:

    a. Bronze, screwed for 1/2" to 2".
    b. Cast Iron, flanged for 2-1/2" and larger.

4. Valve Trim: Bronze; Stem: Polished stainless steel.
5. Packing: Spring Loaded Teflon or Synthetic Elastomer U-cups, self-adjusting.
6. Plug: Brass, bronze or stainless steel, Seat: Brass
7. Disc: Replaceable Composition or Stainless Steel Filled PTFE.
8. Ambient Operating Temperature Limits: -10 to 150□F (-12.2 to 66 □C).

C. Butterfly Type:

1. Body: Extended neck epoxy coated cast or ductile iron with full lug pattern, ANSI Class bolt pattern to match specified flanges.
2. Seat: EPDM replaceable, non-collapsible, phenolic backed
3. Disc: Polished aluminum bronze or stainless steel, pinned or mechanically locked to shaft. Sanded castings are not acceptable.
4. Bearings: Bronze or stainless steel
5. Shaft: 416 stainless steel supported at three locations with PTFE bushings for positive shaft alignment.
6. Close Off: Bubble-tight shutoff at rated differential pressure.
7. Operation: Valve and actuator operation shall be smooth both seating and unseating. Should more that 2 psi deadband be required to seat/unseat the valve, valve shall be replaced at no additional cost to the Using Agency.
8. Manufacturers in Addition to Section 2.04 A:

    a. Jamesbury
    b. Keystone
    c. Dezurik
    d. Or equal

D. Characterized Ball Type

1. Valves shall be specifically designed for modulating duty in control application with guaranteed average leak-free life span over 200,000 full stroke cycles.
2. Maximum size: 3 inch
3. Industrial quality with nickel plated forged brass bronze bodies and female NPT threads.
4. Blowout proof stem design, glass-reinforced Teflon thrust seal washer and stuffing box ring with minimum 600 PSI rating (two way valves) or 400 PSI rating (three way valves). The stem packing shall consist of 2 lubricated O-rings designed for on-off, floating, or modulating service and requiring no maintenance.
5. Valves suitable for water or low-pressure steam shall incorporate an anti-condensation cap thermal break in stem design.
6. Ball: stainless steel
7. Stem: stainless steel
8. Port: Segmented design with characterizing disk held securely by a keyed ring.

E. Valve assembly pressure ratings:

1. Chilled water: 125 psi at 60□F.

2. Hot water: 125 psi at 200□F.
3. Condenser water. 125 psi at 60□F.

F. Valve Selection

1. Valve type:

a. Modulating 2-way or 3-way valves: globe or characterized ball type. Butterfly valves may also be used for applications requiring low valve authority (pressure drop 1 psi and less) such as cooling tower bypass and boiler bypass. Valves (in conjunction with actuator) shall have minimum rangeability of 100 to 1.

1) 3 inch and less: characterized ball type
2) 4 inch and greater: globe type

b. Two-position: butterfly or ball valves

2. Valve Characteristic:

a. 2-way valves: equal percentage or modified equal percentage.
b. 3-way valves controlling cooling coils and condenser water heat exchangers: linear.
c. 3-way valves controlling heating coils: equal percentage or modified equal percentage.
d. Two-position valves: not applicable.

3. Valve Sizing

a. Modulating Water: Size valve to achieve the following full-open pressure drop:

(1) Minimum pressure drop: equal to pressure drop of coil or exchanger.
(2) Maximum pressure drop:

a) Hot and chilled water at bridge connection: 2 psi.
b) Hot water at coils: 2 psi.
c) Chilled water at coils: 5 psi.
d) Tower bypass: 1 psi.
e) Boiler bypass: 1 psi

(3) Three-way valves shall be selected for near minimum pressure drop. Two-way valves shall be selected near maximum pressure drop.
(4) Flow coefficient (C_v) shall not be less than 1.0 (to avoid clogging).

b. Modulating Steam:

(1) The outlet pressure of valves for converters shall be no less than the inlet pressure required for the converters as given in plans for project.
(2) As limited above, size modulating valves for applications of 15 psig or less for 80% of inlet gage pressure unless otherwise indicated.
(3) As limited above, modulating valves for applications of greater than 15 psig shall be sized for 42% of inlet absolute pressure unless otherwise indicated.

c. Two-position valves: Line size unless otherwise indicated.

2.5 CONTROL DAMPERS

A. See Section 23 33 00 – Duct Accessories

2.6 ACTUATORS

A. Manufacturers:

1. Belimo
2. Siemens
3. Johnson Controls
4. Delta
5. Invensys
6. Or equal

B. Warranty: Valve and damper actuators shall carry a manufacturer's 5-year warranty.

C. Electric Actuators

1. Entire actuator shall be UL or CSA approved by a National Recognized Testing Laboratory.
2. Dampers. The actuator shall be direct coupled over the shaft, enabling it to be mounted directly to the damper shaft without the need for connecting linkage. The clamp shall be steel of a "V" bolt design with associated "V" shaped, toothed cradle attaching to the shaft for maximum strength and eliminating slippage via cold weld attachment. Single bolt or set screw type fasteners are not acceptable. Aluminum clamps are unacceptable.
3. Valves. Actuators shall be specifically designed for integral mounting to valves without external couplings.
4. Actuator shall have microprocessor based motor controller providing electronic cut off at full open so that no noise can be generated while holding open. Holding noise level shall be inaudible.
5. Actuators shall provide protection against actuator burnout using an internal current limiting circuit or digital motor rotation sensing circuit. Circuit shall insure that actuators cannot burn out due to stalled damper or mechanical and electrical paralleling. End switches to deactivate the actuator at the end of rotation or use of magnetic clutches are not acceptable.
6. Modulating actuators:

    a. General: Actuators shall accept a 0 to 10 VDC or 0 to 20 mA control signal and provide a 2 to 10 VDC or 4 to 20 mA operating range. Actuators shall have positive positioning circuit so that controlled device is at same position for a given signal regardless of operating differential pressure.
    b. Optional for VAV box dampers only: Actuators may be floating type if either:

        1) Feedback from the actuator is provided as an analog input; or
        2) For VAV boxes not serving areas occupied 24 hours per day, damper position is estimated by timing pulse-open and pulse-closed commands with auto-zeroing whenever zone is in Unoccupied mode and damper is driven full closed.

7. Where shown on Drawings or Points List, actuators shall include

    a. 2 to 10 VDC position feedback signal.
    b. Limit (end) position switches

8. All 24 VAC/DC actuators shall operate on Class 2 wiring and shall not require more than 10 VA for AC. Actuators operating on 120 VAC power shall not require more than 10 VA. Actuators operating on 230 VAC power shall not require more than 11 VA.
9. All modulating actuators shall have an external, built-in switch to allow the reversing of

direction of rotation.

10. Actuators shall be provided with a conduit fitting an a minimum three-foot electrical cable and shall be pre-wired to eliminate the necessity of opening the actuator housing to make electrical connections.
11. Where fail-open or fail-closed position is required, an internal mechanical, spring return mechanism shall be built into the actuator housing. Non-mechanical forms of fail-safe are not acceptable. All spring return actuators shall be capable of both clockwise or counterclockwise spring return operation by simply changing the mounting orientation.
12. Actuators shall be capable of being mechanically and electrically paralleled to increase torque where required.
13. All non-spring return actuators shall have an external manual gear release to allow manual positioning of the damper when the actuator is not powered. Spring return actuators with more than 60 in-lb torque capacity shall have a manual crank for this purpose.
14. Actuators shall be designed for a minimum of 60,000 full cycles at full torque and be UL 873 listed.
15. Provide limit (end) position switches where indicated on schematics.

D. Electric Actuators for Large Butterfly Valves

1. Entire actuator shall be UL or CSA approved by a National Recognized Testing Laboratory.
2. The valve actuator shall consist of a capacitor-type reversible electric motor, gear train, limit switches and terminal block, all contained in a die cast aluminum enclosure.
3. Enclosure shall meet NEMA 4 weatherproof requirements for outdoor applications. Unless NEMA-3R indicated elsewhere.
4. Output shaft shall be electroless nickel plated to prevent corrosion.
5. Actuator shall have a motor rated for minimum 75% duty cycle. Duty cycle shall be defined as running time / Installed time at maximum torque
6. Actuator shall be suitable for operation in ambient temperature ranging from -22□F to +150□F (-30□C to +65□C).
7. A pre-wired cable shall bring wiring outside enclosure to avoid necessity of opening cover.
8. Gears shall be hardened alloy steel, permanently lubricated. A self-locking gear assembly or a brake shall be supplied.
9. Actuator shall be equipped with a hand wheel for manual override to permit operation of the valve in the event of electrical power failure or system malfunction. Hand wheel must be permanently attached to the actuator. When in manual operation electrical power to the actuator will be permanently interrupted.
10. The hand wheel will not rotate while the actuator is electrically driven.
11. Actuator shall have heater and thermostat to minimize condensation within the actuator housing.
12. Provide limit (end) position switches where indicated on schematics.

E. Normal Position. Actuators shall be spring return to the normal position, unless non-spring style is specifically listed as acceptable in table below. Except as specified otherwise, “normal” positions of control devices shall be as follows:

Device	**Normal Position**	**Spring Return Required**
AHU heating coil valves:	OPEN	
AHU cooling coil valves:	OPEN	
Equipment isolation valves:	OPEN	
Outside air damper:	CLOSED	Yes
Return air damper:	OPEN	Yes
Exhaust/relief air damper:	CLOSED	Yes
Domestic hot water generator valves	CLOSED	

Hot water reheat coil valves:	OPEN	
Fan-coil HW and CHW valves:	OPEN	
VAV box dampers:	OPEN	

F. Valve Actuator Selection:

1. Modulating actuators for valves shall have minimum rangeability of 50 to 1.
2. Water:

a. Two way and two-position valves:

(1) Tight closing against 125 percent of system pump shut-off head.
(2) Modulating duty against 90 percent of system pump shut-off head.

b. Three-way shall have close-off against twice the full open differential pressure for which they are sized.

G. Damper Actuator Selection:

1. Actuators shall be direct coupled. For multiple sections, provide one actuator for each section; linking or jack-shafting damper sections shall not be allowed.
2. Provide sufficient torque as velocity, static, or side seals require per damper manufacturer's recommendations and the following.

a. Torque shall be a minimum 5 in-lb. per sq. ft. for opposed blade dampers and 7 in-lb. per sq. ft. for parallel blade dampers.
b. The total damper area operated by an actuator shall not exceed 80% of the manufacturer's maximum area rating.

2.7 GENERAL FIELD DEVICES

A. Provide field devices for input and output of digital (binary) and analog signals into controllers (BCs, AACs, ASCs). Provide signal conditioning for all field devices as recommended by field device manufacturers, and as required for proper operation in the system.

B. It shall be the Contractor's responsibility to assure that all field devices are compatible with controller hardware and software.

C. Field devices specified herein are generally ‘two-wire’ type transmitters, with power for the device to be supplied from the respective controller. If the controller provided is not equipped to provide this power, or is not designed to work with ‘two-wire’ type transmitters, or if field device is to serve as input to more than one controller, or where the length of wire to the controller will unacceptably affect the accuracy, the Contractor shall provide ‘four-wire’ type equal transmitter and necessary regulated DC power supply or 120 VAC power supply, as required.

D. For field devices specified hereinafter that require signal conditioners, signal boosters, signal repeaters, or other devices for proper interface to controllers, Contractor shall furnish and install proper device, including 120V power as required. Such devices shall have accuracy equal to, or better than, the accuracy listed for respective field devices.

E. Accuracy: As used in this Section, accuracy shall include combined effects of nonlinearity, nonrepeatability and hysteresis. Sensor accuracy shall be at or better than both that specifically listed for a device and as required by paragraph 1.3A.

2.8 TEMPERATURE SENSORS (TS)

A. General:

1. Unless otherwise noted, sensors may be platinum RTD, thermistor, or other device that is commonly used for temperature sensing and that meets accuracy, stability, and resolution requirements.
2. When matched with A/D converter of BC, AAC, or ASC, sensor range shall provide a resolution of no worse than 0.3°F (0.16˚C) (unless noted otherwise).
3. Sensors shall drift no more than 0.3˚F and shall not require calibration over a five-year period.
4. Manufacturers:

    a. Mamac
    b. Kele Associates
    c. Building Automation Products Inc.
    d. Or equal

B. Duct temperature sensors. Shall consist of sensing element, junction box for wiring connections and gasket to prevent air leakage or vibration noise. Sensor probe shall be 316 stainless steel.

1. TS-1A. Single point (use where not specifically called out to be averaging in points list).
2. TS-1B. Averaging. Sensor length shall be at least 1 linear foot for each 3 square feet of face area up to 25 feet maximum.

C. Water temperature sensors.

1. TS-2A: Immersion sensors. All piping immersion sensors shall be in brass or stainless steel wells that allow removal from operating system, with lagging extension equal to insulation thickness where installed in insulated piping. Wells shall be rated for maximum system operating pressure, temperature and fluid velocity. The well shall penetrate the pipe by the lesser of half the pipe diameter or four inches. The use of direct immersion or strap-on type sensors is not acceptable.
2. TS-2B. Same as TS-2A except provide matched temperature sensors for differential temperature measurement, e.g. chilled water supply and return temperature. See paragraph 1.3A.
3. TS-2C. Same as TS-2A or TS-2B (matched pair) with the following added requirements (for extremely high accuracy and stability at central plant main supply/return chilled water temperature sensors): Each assembly shall consist of a 100 Ohm platinum RTD and a solid-state 4-wire, 4-20mA transmitter contained in a housing suitable for pipe mounting, spring-loaded probe to ensure good thermal contact between the sensor and the well. Manufacturer must be certified as meeting the requirements of ISO 9001. RTD shall conform to the DIN 437601980 standards (Ultra precision DIN RTD). 2 Year NIST traceable guarantee. Manufacturer: Accutech AI-2000, or equal.

D. Room sensors: Shall be an element contained within a ventilated cover, suitable for wall mounting, with insulated base.

1. TS-3A.

    a. Thermistor in enclosure with blank cover.
    b. Include a USB port for connection of portable Operator Interface.

2. TS-3B. Same as TS-3A except

a. Setpoints shall be adjustable at wall mounted sensor with setpoint knobs with software limits.
b. Override button capable of being programmed to start system during unscheduled hours.

3. TS-3C. Same as TS-3B except:

a. Integral LCD display of space temperature and active setpoint.

4. Unless otherwise indicated in points list, locate sensors as follows:

a. Lobbies, corridors, break rooms, library reading rooms, and other public spaces: TS-3A.
b. Equipment rooms: TS-3A
c. Offices and other spaces not listed above: TS-3C.

E. TS-4. Outdoor air sensors shall have a sun shield, utility box, and watertight gasket to prevent water seepage.

F. TS-5. Dewpoint.

1. Industrial humidity sensor designed for applications with a risk of condensation.
2. Stainless steel probe head leak-proof up to 1 MPa.
3. Configurable to output dewpoint, relative humidity, and temperature.
4. TS-5A: Include local LCD readout.
5. Manufacturer

a. Vaisala HMP-247
b. No known equal

G. Temperature Transmitters. Where required by Controller, or to meet specified end-to-end accuracy requirements, sensors as specified above shall be matched with transmitters outputting 4-20 mA linearly across the specified temperature range. Transmitters shall have zero and span adjustments, an accuracy of 0.1˚F when applied to the sensor range.

2.9 DIFFERENTIAL PRESSURE TRANSMITTERS (DP)

A. DPT-1. Water, General Purpose

1. Fast-response capacitance sensor
2. Two-wire transmitter, 4-20 mA output with zero and span adjustments.
3. Accuracy

a. Overall Accuracy (at constant temp) ±0.25% full scale (FS).
b. Non-Linearity, BFSL ±0.20% FS.
c. Hysteresis 0.10% FS.
d. Non-Repeatability 0.05% FS.

4. Long Term Stability 0.5% FS per year
5. Only 316 stainless steel in contact with fluid
6. Pressure limits

a. 0 to 100 psid range: 250 psig maximum static pressure rating, 250 psig maximum

overpressure rating.
b. 100 to 300 psid range: 450 psig maximum static pressure rating, 450 psig maximum overpressure rating.

7. Include brass 3-valve assembly. See sensor installation specifications below.
8. Manufacturers

a. Setra 230
b. Modus W30
c. Or equal

B. DPT-2. Liquid

1. General: Two-wire smart DP cell type transmitter, 4-20 mA or 1-5 Vdc user-selectable linear or square root output, adjustable span and zero, stainless steel wetted parts.
2. Ambient limits: –40 to 175□F, 0 to 100% RH.
3. Process fluid limits:

a. Other applications: 0°F to 250□F

4. Accuracy: less than 0.15% of span, combined errors of reference accuracy, ambient temperature effect, and line pressure effect.
5. Rangeability: greater than 50::1.
6. Long term stability: ±0.15% of upper range limit for 5 years; for ±50°F temperature changes, 0-100% relative humidity.
7. Vibration Effect: Less than □0.1% of upper range limit from 15 to 2000 Hz in any axis relative to pipe mounted process conditions.
8. The transmitter shall be capable of sustaining differential pressures in either direction, up to the body rating without damage to the instrument or a loss of accuracy.
9. Output Damping: Time constant user selectable from 0 to 36 seconds.
10. Transmitter shall have dual-compartment housing with a moisture barrier totally isolating the electronic circuitry from the field wiring and calibration terminals. Provide local LCD display and wire-on-tag with instrument service information.
11. Manufacturer must be certified as meeting the requirements of ISO 9001.
12. Manufacturers:

a. Rosemount Inc. 3051 Series
b. Accutech
c. Foxboro,
d. Johnson-Yokagawa
e. Mamac
f. Or equal

C. DPT-3. Air, Duct Pressure:

1. General: Loop powered two-wire differential capacitance cell-type transmitter.
2. Output: two wire 4-20 mA output with zero adjustment.
3. Overall Accuracy: ±1% scale.
4. Minimum Range: 0.5 in. w.c.
5. Maximum Range: 10 inches w.c.
6. Housing: Polymer housing suitable for surface mounting.
7. Static Sensing Element: Pitot-type static pressure sensing tips similar to Dwyer model A-301, Davis Instruments, or equal and connecting tubing.
8. Range: Select as specified in points list or, if not listed for specified setpoint to be between 25% and 75% full-scale.

9. DPT-3A: Include LCD display of reading.
10. Manufacturers:

    a. Veris
    b. Setra
    c. Modus
    d. Invensys
    e. Dwyer
    f. Or equal

D. DPT-4. Air, Low Differential Pressure (space pressure)

1. General: Loop powered, two-wire differential capacitance cell type transmitter.
2. Output: Two-wire 4-20 mA output with zero adjustment.
3. Overall Accuracy: Plus or minus 1%.
4. Minimum Range: 0, -0.1, -0.25, or -0.5 inches w.c
5. Maximum Range: +0.1, 0.25, or 0.5 inches w.c.
6. Housing: Polymer housing suitable for surface mounting.
7. Static Sensing Element:

    a. Ambient sensor: Dwyer A-306
    b. Space sensor: Open tube or Bosco plate sensor

8. Range: Select as specified in points list or, if not listed for specified setpoint to be between 25% and 75% full-scale.
9. DPT-4A: Include LCD display of reading.
10. Manufacturers:

    a. Veris
    b. Setra
    c. Modus
    d. Invensys
    e. Dwyer
    f. Or equal

E. DPT-5. VAV Velocity Pressure:

1. General: Loop powered two-wire differential capacitance cell type transmitter.
2. Output: Two-wire, 4-20 mA output with zero adjustment.
3. Flow transducer (including impact of A-to-D conversion) shall be capable of stably controlling to a setpoint of 0.004” differential pressure or lower, shall be capable of sensing 0.002” differential pressure or lower, and shall have a ±0.001” or lower resolution across the entire scale. .
4. Minimum Range: 0 in. w.c.
5. Maximum Range: 1.5 inch w.c.
6. Housing: Polymer housing suitable for surface mounting.
7. Manufacturer:

    a. Trane
    b. Johnson Controls
    c. Siemens
    d. Automated Logic
    e. Honeywell
    f. Veris
    g. Or equal

F. Water Leak Detector (WLD):

1. Gold plated adjustable sensing probes to detect water from 0 to 1/8 inch above surface.
2. All electronic circuitry encapsulated in epoxy to protect from dirt, fungus and short term immersion in water.
3. DPDT (2 form C) relay contact outputs rated at 1 amp @ 28 VDC
4. Powered with 12-24 VAC or VDC from EMCS panel. Battery not acceptable
5. 5 year warranty minimum
6. Manufacturer:

a. Dorlen Water Alert SS-4
b. Or equal

2.10 HUMIDITY TRANSMITERS (HT)

A. Suitable for duct, wall (room) or outdoor mounting as indicated in points list and Construction Drawings
B. Two-wire transmitter utilizing bulk polymer resistance change or thin film capacitance change humidity sensor producing a continuous 4-20 mA output proportional to percent relative humidity (%RH).
C. Input Range: 0 to 100% RH
D. Accuracy (%RH), NIST Traceable and certified at 77 ˚F over 20-95% RH including hysteresis, linearity and repeatability:

1. HT-1: ±2%
2. HT-2: ±3%

E. Sensor Operating Range

1. Humidity: 0-99%, non-condensing, sensor
2. Temperature: 32 ˚F to 122 ˚F

F. Temperature Effect: Less than 0.06% per ˚F at baseline of 77 ˚F.
G. Sensitivity: 0.1% RH.
H. Repeatability: 0.5 RH.
I. Hysteresis: Less than 1%.
J. Long Term Stability: Less than 2% drift per 5 years.
K. Manufacturer

c. Vaisala HM Series
d. Automation Components Inc. RH Series
e. Or equal

2.11 DIFFERENTIAL PRESSURE SWITCHES (DPS)

A. DPS-1. Water: Diaphragm with adjustable setpoint, 2 psig or adjustable differential, and snap-acting Form C contacts rated for the application. 60 psid minimum pressure differential range. 0□F to 160□F operating temperature range.

B. DPS-2. Air: Diaphragm with adjustable setpoint and differential and snap acting form C contacts rated for the application. Provide manufacturer's recommended static pressure sensing tips and connecting tubing

2.12 CURRENT SWITCHES (CS)

A. CS-1 (Constant Speed Motor Status Indication)

1. Clamp-on or solid-core
2. Range: 1.5 to 150 amps.
3. Trip Point: Adjustable.
4. Switch: Solid state, normally open, 1 to 135 Vac or Vdc, 0.3 Amps. Zero off state leakage.
5. Lower Frequency Limit: 6 Hz.
6. Trip Indication: LED
7. Approvals: UL, CSA
8. May be combined with relay for start/stop.
9. Where used for single-phase devices, provide the CS/CR in a self-contained unit in a housing with override switch. Kele RIBX, Veris H500, or equal.
10. Manufacturers:

    a. Veris Industries H-708/908; Inc.
    b. RE Technologies SCS1150A-LED
    c. Or equal.

B. CS-2 (Variable Speed Motor Status Indication)

1. Clamp-on or solid-core
2. Range: 1.5 to 135 Amps.
3. Trip Point: Self-calibrating based on VA memory associated with frequency to detect loss of belt with subsequent increase of control output to 60 Hz. The belt break scenario shall be indicated as a loss of status and the operation at low speed shall indicate normal status.
4. Switch: Solid state, normally open, 1 to 135 Vac or Vdc, 0.3 Amps. Zero off state leakage.
5. Frequency Range: 5-75 Hz
6. Trip Indication: LED
7. Approvals: UL, CSA
8. Manufacturers:

    a. Veris Industries, Inc. H-904.
    b. RE Technologies
    c. Or equal.

2.13 CURRENT TRANSFORMERS (CT)

A. Clamp-On Design Current Transformer (for Motor Current Sensing)

1. Range: 1-10 amps minimum, 20-200 amps maximum
2. Trip Point: Adjustable
3. Output: 0-5 VDC.
4. Accuracy: □0.2% from 20 to 100 Hz.
5. Manufacturers: KELE SC100, Veris 722, or equal.

2.14 FLOW METER (FM)

A. FM-1. Magnetic Flow Tube Flow Meters for Water Service

1. General Requirements:

   a. Sensor shall be a magnetic flow meter, which utilizes Faraday's Law to measure volumetric fluid flow through a pipe. The flow meter shall consist of 2 elements, the sensor and the electronics. The sensor shall generate a measuring signal proportional to the flow velocity in the pipe. The electronics shall convert this EMF into a standard current output.
   b. Electronic replacement shall not affect meter accuracy (electronic units are not matched with specific sensors).
   c. Provide a four-wire, externally powered, magnetic type flow transmitter with adjustable span and zero, integrally mounted to flow tube.

      (1) Output: 4-20 mA proportional to the flow rate or velocity

   d. Flow Tube:, ANSI class 150 psig Stainless steel protected with ETFE or PFAT liner
   e. ANSI flanges
   f. Electrical Enclosure: NEMA 4, 7.
   g. Approvals: UL or CSA.
   h. The electrode material shall be 316L Stainless steel.
   i. Approvals

      (1) UL or CSA
      (2) NFF Drinking Water approval for domestic water applications

   j. Performance:

      (1) Accuracy shall be ±0.5% of actual reading from 3 to 30 feet per second flow velocities, and 0.015 fps from 0.04 fps to 3 fps.
      (2) Stability: 0.1% of rate over six months.
      (3) Meter repeatability shall be +/- 0.1% of rate at velocities > 3 ft/sec.
      (4) Calibration: The sensor must be calibrated on an internationally accredited (i.e. NAMAS) flow rig with accuracy better than 0.1%. Calibration shall be NIST traceable.

2. Manufacturers:

   a. Siemens/Danfoss Magflo 3100
   b. Krohne Optiflux 4000
   c. Sparling Tigermag EP FM656
   d. Onicon 3000 series

B. FM-2. Magnetic Insertion Type Flow Meters for Water Service

1. Magnetic Faraday point velocity measuring device.
2. Insertion type complete with 'hot-tap' isolation valves to enable sensor removal without water supply system shutdown.
3. 4-20 mA transmitter proportional to flow or velocity.
4. Accuracy: ± 1% of reading from 0.25 to 20 fps.
5. Flow range: 0.25 to 20 fps, bidirectional.
6. Each sensor shall be individually calibrated and tagged accordingly against the manufacturer's primary standards which must be accurate to within 0.1% and traceable to the U.S. National Institute Standards and Technology (NIST).
7. Manufacturers:

   a. Onicon F-3500

b. FloCat YD20-A
c. Marsh McBirney MultiMag 284
d. SeaMetrics 100/200 Series

C. FM-3: Displacement Gas Meter

1. Positive displacement, rotary type gas meter designed for volumetric measurement of widely varying flow rates of low pressure natural gas
2. Permanent, non-adjustable calibration, not affected by low or varying line pressure and independent of the gas specific gravity, temperature, and pressure
3. Manufactured in accordance with ANSI B109.3 for Rotary Type Gas Displacement Meters
4. Operating temperature range: -40 ˚F to +140 ˚F
5. Temperature compensating with a corrected reading for temperatures ranging from -20 ˚F to +120 ˚F
6. Low frequency pulse output
7. Rangeability at ±1% accuracy: Minimum 40 to 1
8. Glass enclosed 8 digit totalizer, re-zeroed with on-board device
9. Manufacturer

a. Dresser Roots B3
b. Or equal

D. FM-4. Vortex shedding flow meter for liquid, steam and gas service:

1. Output: 4-20 mA, 0-10 Vdc, 0-5 Vdc
2. Maximum Fluid Temperature: 800 □F (427 □C)
3. Wetted Parts: Stainless Steel
4. Housing: NEMA 4X
5. Turndown: 10:1 minimum.
6. Accuracy: 0.5% of calibrated span for liquids, 1% of calibrated span for steam and gases.
7. Each sensor shall be individually calibrated and tagged accordingly against the manufacturer's primary standards which must be accurate to within 0.1% and traceable to the U.S. National Institute Standards and Technology (NIST).
8. Body: Wafer style or ANSI flanged to match piping specification.
9. Manufacturers:

a. Foxboro 83 series
b. Johnson-Yokagawa
c. Rosemount
d. Or Equal

E. FM-5. Ultrasonic Flow Meter for Water Service.

1. Clamp-On transit-time ultrasonic flow meter
2. Wide-Beam transducer technology
3. 4-20 mA transmitter proportional to flow or velocity.
4. Accuracy: 0.5% of reading in range 1 to 30 fps, 0.001 fps sensitivity.
5. Each sensor shall be individually calibrated and tagged accordingly against the manufacturer's primary standards which must be accurate to within 0.1% and traceable to the U.S. National Institute Standards and Technology (NIST).
6. Controlotron 1020C or equal.

F. FM-6. Insertion type dual turbine meter for water service.

1. Dual counter-rotating axial turbine elements, each with its own rotational sensing system, and

an averaging circuit to reduce measurement errors due to swirl and flow profile distortion. Flow sensing turbine rotors shall be non-metallic and not impaired by magnetic drag.

2. Insertion type complete with 'hot-tap' isolation valves to enable sensor removal without water supply system shutdown.
3. Sensing method shall be impedance sensing (iron magnetic and non-photoelectric), with volumetric accuracy of +/- 2% of reading over middle 80% of operating range, and +/- 4% of
4. Each sensor shall be individually calibrated and tagged accordingly against the manufacturer's primary standards which must be accurate to within 0.1% and traceable to the U.S. National Institute Standards and Technology (NIST).
5. Maximum operating pressure of 400 psi and maximum operating temperature of 200□F continuous (220□F peak).
6. All wetted metal parts shall be constructed of 316 stainless steel.
7. Analog outputs shall consist of non-interactive zero and span adjustments, a DC linearly of 0.1% of span, voltage output of 0-10 V, and current output of 4-20 mA.
8. Manufacturers:

    a. Onicon Corp.
    b. Hersey
    c. Or equal

G. FM-7. Compound-type cold water meter.

1. Shall consist of a combination of a turbine-type, mainline meter for measuring high rates of flow and a bypass meter of an appropriate size for measuring low rates of flow. The compound meter shall have an automatic valve mechanism for diverting low rates of flow through the bypass meter.
2. Comply or exceed the latest revision of AWWA C702
3. Maximum operating pressure of 150 psi and maximum operating temperature of 120 ˚F continuous.
4. Shall provide a pulse output scaled to a selectable unit of measurement; i.e., 1 pulse per gallon. The pulse output needs to retain the lowest flow rate and the accuracy that the meter is capable of.
5. Shall have permanently sealed, straight reading local register indicating in gallons, including a center-sweep test hand, a low flow indicator, totalizer, and a glass lens. The registers shall be serviceable without interruption of the meter's operation.
6. Separate magnetic-drive registers shall record the flow of the turbine and disc meters and their total will be the registration of the compound meter. A single pulse output denoting the total high and low flow will be required.

Size	Normal Operating Range @100% +/- 1.5% accuracy (gpm)	Maximum Continuous Flow (gpm)	Maximum Loss of Head at Max Cont Flow (psi)	Maximum Intermittent Flow (gpm)	Lowest Flow @ 95% accuracy (gpm)	Minimum Accuracy at Crossover (%)
2"	1/2 - 200	160	8	200	1/4	97
3"	1/2 - 450	350	8	450	1/4	97
4"	1 - 1000	700	11	1000	3/8	97
6"	1 1/2 - 2000	1400	10	2000	3/8	95

7. Operating characteristics: Shall comply with the operating characteristics shown below:
8. Size: the size shall be determined by: a) Laying Length: nominal size (in inches) of the opening in the inlet and outlet flanges and b) Total Height: nominal size (in inches) from the lowest point of the meter installed for horizontal flow to the highest point. The size of meters shall not exceed:

Meter Size	Laying Length (in)	Total Height (in)
2”	15 1/4	11
3”	17	12
4”	20	16
6”	24	17

9. Materials: The main case wetted parts shall be cast from an ANSI/NSF 61 certified no lead high copper alloy. A test plug shall be located in the main case or the cover for the purpose of field testing of the meter. Casing bolts shall be made of stainless steel.
10. Manufacturers:

    a. Badger Recordall Compound Meter, Bronze Housing with Pulse Output (two RTR registers and summator/converter)
    b. Or equal

2.15 LEVEL SWITCH

A. Conductive Level Switch

B. Integral tank mounted conductivity level switch with required SPDT 10 amp relays for thermal energy storage tank level alarms.

C. Level alarms to include low, high and overflow level.

1. Switch shall be mounted in a NEMA 4x polypropylene enclosure with 3/4 inch npt mounting
2. Manufacturer:

    a. Levelite
    b. Or equal

2.16 AIRFLOW MEASURING STATIONS (AFMS)

A. AFMS-1. Airflow measurement probes at fan inlet:

1. Transverse probes factory mounted in each inlet bell.
2. The fan inlet airflow traverse probes shall contain multiple total and static pressure sensors placed at concentric area centers along the exterior surface of the cylindrical probes and internally connected to their respective averaging manifolds. Sensors shall not protrude beyond the surface of the probe, nor be adversely affected by particle contamination normally present in building system airflows. The fan inlet airflow traverse probes shall have symmetrical averaging signal takeoffs, and shall be of aluminum construction with hard anodized finish with galvanized steel mounting hardware.
3. The fan inlet airflow traverse probes shall not significantly impact fan performance or contribute to fan generated noise levels. The probes shall be capable of producing steady, non-pulsating signals of standard total and static pressure, without need for flow corrections or factors, with an accuracy of 3% of actual flow over a fan operating range of 6 to 1 capacity turndown.
4. Provide with DPT selected as close as possible to design maximum velocity pressure to provide high accuracy at low airflow rates. See equipment schedules for design airflow rate.

5. Manufacturers

    a. Air Monitor VOLU-probe/FI
    b. Paragon FE-1050
    c. Or Equal

B. AFMS-2. Airflow measurement in duct or plenum.

1. The AFMS shall be an array of sensors mounted across the entire area of the duct in which the AFMS is mounted.
2. Include electronic devices or transducers to provide a 4-20 mA or 0-10 Vdc signal proportional to airflow or velocity with specified accuracy over entire range.
3. Performance:

    a. Sensors shall be calibrated to NIST-traceable standards for airflow/velocity.
    b. Factory tested prior to shipment and shall not require calibration or adjustment over the life of the equipment, when installed in accordance to manufacturer's guidelines.
    c. The installed total accuracy for airflow shall be better than ±3% of reading over the sensor probe operating ranges when installed in accordance with manufacturers' guidelines. Installed accuracy shall include the probe itself plus the electronics for converting probe signal to an electronic signal proportional to airflow and shall be demonstrated at both maximum and minimum airflow rates of operating range.
    d. Operating Range: 50 to 4,000 FPM

4. Duct & Plenum Mounted Sensor Probes

    a. Sensor probes shall be constructed of anodized aluminum alloy tube with stainless steel mounting brackets. Probes shall be constructed to provide insertion, internal, or standoff mounting, depending on the applications and field installation requirements.
    b. Probe Sensor Density. The number of independent sensing points shall be distributed per duct face area, at a minimum quantity as indicated below.

Area (ft^2)	Sensors
<= 1	2
>1 to <4	4
4 to <8	6
8 to <12	8
12 to <16	12
>=16	16

    c. Pressure drop: The maximum allowable unrecovered pressure drop caused by the probes shall not exceed .025" at 2000 FPM, or .085" at 4000 FPM.

5. Manufacturers:

    a. Ebtron Gold Series
    b. Ruskin
    c. Or Equal

2.17 CO_2 SENSORS/TRANSMITTERS (CO2)

A. CO2-1. Wall mounted.

1. Non-dispersive infrared sensor with dual beam technology where a reference channel is used to maintain sensor calibration.
2. Detachable base with all field wiring terminations on base.
3. Accuracy: ±50 ppm or 5% of reading from 0 to 1500 ppm at temperatures from 60°F to 90°F.
4. Factory calibrated and set to 0-2000 ppm range (equals 4-20 mA or 0-10 V)
5. Include elevation adjustment.
6. The sensor shall not require recalibration for a minimum of 5 years, guaranteed. If sensor is found to be out of calibration, supplier shall recalibrate at no additional cost to the Using Agency within 5 years of purchase date.
7. No display.
8. Manufacturers:

    a. Telaire 8101 or 8102 with cover over display.
    b. Veris
    c. Or Equal

B. CO2-2. Duct mounted.

1. CO_2 sensors shall use silicon based, diffusion aspirated, infrared single beam, dual-wavelength sensor.
2. Accuracy: ±36 ppm at 800 ppm and 68□F.
3. Stability: 5% over 5 years.
4. Output: 4-20 mA, 0-10 Vdc or relay.
5. Duct mounted.
6. Manufacturers

    a. Vaisala, Inc. GMD20
    b. AirTest
    c. Or equal

2.18 POWER TRANSDUCER (KWT)

A. Power measurement device shall include current and potential (voltage) transformers on each leg and shall be certified under UL-3111.

B. The transducer range shall be selected such that the maximum value shall be 150% of the nominal value being monitored.

C. Output shall be true rms power measurement with a frequency response of on no less than 2kHz (32 samples-per-cycle) on all voltage and current signals.

2.19 WEATHER SENSORS

A. Temperature

1. See TS-4 for sensor specifications.
2. Enclose in fan-aspirated radiation shield that combines both active and passive aspiration to minimize the effects of radiation.

    a. Motor-driven fan draws air through the sensor chamber and exhausts it through the top of the shield.
    b. Triple-walled sensor chamber shielded by flow-through plates.
    c. Aspiration rate: minimum is 220 feet per minute.

d. Davis Instruments 7752 or equal.

2.20 ELECTRIC CONTROL COMPONENTS

A. Limit Switches (LS): Limit switches shall be UL listed, SPDT or DPDT type, with adjustable trim arm. Limit switches shall be as manufactured by Square D, Allen Bradley, or equal.

B. Line-Voltage Wall Thermostat: Wall-mounted thermostat shall consist of SPDT contacts rated for 120V and current as required for application, temperature setpoint range of 50 to 95□ F, and an adjustable 2-10□F setpoint differential.

C. Low Temperature Detector (Freeze-stat) (LLT): Low temperature detector shall consist of a cold spot element that responds only to the lowest temperature along any one foot of entire element, minimum bulb size of 1/8 inch x 20 feet, junction box for wiring connections and gasket to prevent air leakage or vibration noise, DPST (4 wire 2 circuit) with manual reset, Temperature range 15 to 55˚F, factory set at 38˚F.

D. Control Relays: All control relays shall be UL listed, with contacts rated for the application, and mounted in minimum NEMA-1 enclosure for indoor locations, NEMA-4 for outdoor locations.

1. Control relays for use on electrical systems of 120 volts or less shall have, as a minimum, the following:

    a. AC coil pull-in voltage range of +10%, -15% or nominal voltage.
    b. Coil sealed volt-amperes (VA) not greater than four (4) VA.
    c. Silver cadmium Form C (SPDT) contacts in a dustproof enclosure, with 8 or 11 pin type plug.
    d. Pilot light indication of power-to-coil and coil retainer clips.

2. Relays used for across-the-line control (start/stop) of 120V motors, 1/4 HP, and 1/3 HP, shall be rated to break minimum 10 Amps inductive load.
3. Relays used for stop/start control shall have low voltage coils (30 VAC or less), and shall be provided with transient and surge suppression devices at the controller interface.

E. General Purpose Power Contactors: NEMA ICS 2, AC general-purpose magnetic contactor. ANSI/NEMA ICS 6, NEMA type 1enclosure. Manufacturer shall be Square 'D', Cutler-Hammer, or equal.

F. Control Transformers and Power Supplies:

1. Control transformers shall be UL Listed. Furnish Class 2 current-limiting type, or furnish over-current protection in both primary and secondary circuits for Class 2 service per NEC requirements. Mount in minimum NEMA-1 enclosure.
2. Transformer shall be proper size for application. Limit connected loads to 80% of rated capacity.
3. DC power supply output shall match output current and voltage requirements. Unit shall be full-wave rectifier type with output ripple of 5.0 mV maximum peak-to-peak. Regulation shall be 1.0% line and load combined, with 100 microsecond response time for 50% load changes. Unit shall have built-in over-voltage and over-current protection, and shall be able to withstand a 150% current overload for at least 3 seconds without trip-out or failure.
4. Unit shall operate between 0°C and 50°C [32°F and 120°F]. EM/RF shall meet FCC Class B and VDE 0871 for Class B, and MIL-STD 810C for shock and vibration.
5. Line voltage units shall be UL Recognized and CSA Approved.

G. Electric Push Button Switch: Switch shall be momentary contact, oil tight, push button, with number of N.O. and/or N.C. contacts as required. Contacts shall be snap-action type, and rated for minimum 120 Vac operation. Switch shall be 800T type, as manufactured by Allen Bradley, Kele, or equal.

H. Pilot Light: Panel-mounted pilot light shall be NEMA ICS 2 oil tight, transformer type, with screw terminals, push-to-test unit, LED type, rated for 120 VAC. Unit shall be 800T type, as manufactured by Allen-Bradley, Kele, or equal.

I. Alarm Horn: Panel-mounted audible alarm horn shall be continuous tone, 120 Vac Sonalert solid-state electronic signal, as manufactured by Mallory, Kele, or equal.

J. Electric Selector Switch (SS): Switch shall be maintained contact, NEMA ICS 2, oil-tight selector switch with contact arrangement, as required. Contacts shall be rated for minimum 120 Vac operation. Switch shall be 800T type, as manufactured by Allen-Bradley, Kele, or equal.

K. Window switch

1. Surface mount magnetic burglar alarm switch
2. Screw mount, magnet on window, switch on frame
3. Sealed to prevent dirt or dust contact
4. Color to match electrical and lighting switch plates in the room. See Division 16 and Electrical Drawings.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which control systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION

A. General: Install systems and materials in accordance with manufacturer's instructions, roughing-in drawings and details shown on drawings. Install electrical components and use electrical products complying with requirements of National Electric Code and all local codes.

3.3 ELECTRICAL INSTALLATION

A. Wiring

1. Comply with Division 26.
2. All NEC Class 1 (line voltage) wiring shall be UL Listed in approved raceway per NEC requirements and shall be installed by a licensed electrician.
3. All low-voltage wiring shall meet NEC Class 2 requirements. (Low-voltage power circuits shall be sub-fused when required to meet Class 2 current-limit.) Class 2 wiring shall be installed in UL Listed approved raceway, except where wires are in concealed in accessible locations, approved cables not in raceway may be used, provided that cables are UL Listed for the intended application. For example, cables used in ceiling return plenums shall be UL Listed specifically for that purpose.
4. Do not install Class 2 wiring in raceway containing Class 1 wiring. Boxes and panels containing high-voltage wiring and equipment may not be used for low-voltage wiring except

for the purpose of interfacing the two (e.g., relays and transformers).

5. Do not install wiring in raceway containing tubing.
6. Where Class 2 wiring is used without raceway, it shall be supported from or anchored to structural members neatly tied at 10 foot intervals. Cables shall not be supported by or anchored to ductwork, electrical raceways, piping, or ceiling suspension systems and at least 1 foot above ceiling tiles and light fixtures.
7. All wire-to-device connections shall be made at a terminal block or terminal strip. All wire-to-wire connections shall be at a terminal block.
8. All field wiring shall be properly labeled at each end, with self-laminating typed labels indicating device address, for easy reference to the identification schematic. All power wiring shall be neatly labeled to indicate service, voltage, and breaker source.
9. Use coded conductors throughout with different colored conductors.
10. All wiring within enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals.
11. Maximum allowable voltage for control wiring shall be 120 V. If only higher voltages are available, the Contractor shall provide step-down transformers.
12. All wiring shall be installed as continuous lengths, with no splices permitted between termination points.
13. Install plenum wiring in sleeves where it passes through walls and floors. Maintain fire rating at all penetrations.
14. Size of raceway and size and type of wire shall be the responsibility of the Contractor, in keeping with the manufacturer's recommendation and NEC requirements.
15. Include one pull string in each raceway 1 inch or larger.
16. Control and status relays are to be located in designated enclosures only. These enclosures include packaged equipment control panel enclosures unless they also contain Class 1 starters.
17. Conceal all raceways, except within mechanical, electrical, or service rooms. Install raceway to maintain a minimum clearance of 6” from high-temperature equipment (e.g., steam pipes or flues).
18. Secure raceways with raceway clamps fastened to the structure and spaced according to code requirements. Raceways and pull boxes may not be hung on flexible duct strap or tie rods. Raceways may not be run on or attached to ductwork.
19. Install insulated bushings on all raceway ends and openings to enclosures. Seal top end of all vertical raceways.
20. The EMCS Contractor shall terminate all control and/or interlock wiring, and shall maintain updated (as-built) wiring diagrams with terminations identified at the job site.
21. Flexible metal raceways and liquid-tight, flexible metal raceways shall not exceed 3 feet in length and shall be supported at each end. Flexible metal raceway less than ½” electrical trade size shall not be used. In areas exposed to moisture liquid-tight, flexible metal raceways shall be used.
22. Raceway must be rigidly installed, adequately supported, properly reamed at both ends, and left clean and free of obstructions. Raceway sections shall be joined with couplings (per code). Terminations must be made with fittings at boxes, and ends not terminating in boxes shall have bushings installed.
23. Electrical service to controls panels and control devices shall be provided by isolated circuits, with no other loads attached to the circuit, clearly marked at its source. The location of the breaker shall be clearly identified in each panel served by it. If a spare breaker is not available within an electrical panel, the EMCS Contractor shall be responsible for providing any and all equipment and labor necessary to supply an isolated circuit. Controllers controlling only packaged air conditioning equipment may be powered directly from the packaged units control circuit.
24. Wire digital outputs to either the normally-closed or normally-open contacts of binary output depending on desired action in case of system failure. Unless otherwise indicated, wire to the NO contact except the following shall be wired to the NC contact:

a. Hot water pumps
b. Coil recirc' pumps provided for freeze protection.

25. Hardwire Interlocks

a. The devices referenced in this section are hardwire interlocked to ensure equipment shutdown occurs even if control systems are down. Do not use software (alone) for these interlocks.
b. Hardwire device NC contact to air handler fan starter upstream of HOA switch, or to VFD enable contact.
c. Where multiple fans (or DDC DI) are controlled off of one device and the device does not have sufficient contacts, provide a relay at the device to provide the required number of contacts.
d. Provide for the following devices where shown on plans:

(1) Duct smoke detector
(2) High discharge static pressure
(3) Low mixing plenum pressure
(4) Freeze-stats

B. Communication Wiring

1. The EMCS Contractor shall adhere to the requirements of paragraph 3.3A in addition to this section.
2. Communication and signal wiring may be run without conduit in concealed, accessible locations as permitted by paragraph 3.3A only if noise immunity is ensured. Contractor will be fully responsible for noise immunity and rewire in conduit if electrical or RF noise affects performance.
3. All cabling shall be installed in a neat and workmanlike manner. Follow all manufacturers' installation recommendations for all communication cabling. Use shielded wiring if recommended by manufacturer.
4. Do not install communication wiring in raceway and enclosures containing Class 1 or other Class 2 wiring.
5. Maximum pulling, tension, and bend radius for cable installation as specified by the cable manufacturer shall not be exceeded during installation.
6. EMCS Contractor shall verify the integrity of the entire network following the cable installation. Use appropriate test measures for each particular cable.
7. All runs of communication wiring shall be unspliced length when that length is commercially available.
8. All communication wiring shall be labeled to indicate origination and destination data.
9. Grounding of coaxial cable shall be in accordance with NEC regulations Article on Communications Circuits, Cable and Protector Grounding.
10. Shielded cable shield shall be grounded only at one end.
11. Power-line carrier signal communication/transmission is not acceptable.

3.4 INSTALLATION OF SENSORS

A. Install sensors in accordance with the manufacturer's recommendations.

B. Mount sensors rigidly and adequately for the environment within which the sensor operates.

C. Temperature Sensors

1. Room temperature sensors/thermostats shall be installed on concealed junction boxes

properly supported by the wall framing.

2. All wires attached to sensors shall be air sealed in their raceways or in the wall to stop air transmitted from other areas affecting sensor readings.
3. Averaging sensors shall be installed in a serpentine manner vertically across duct. Each bend shall be supported with a capillary clip. Where located in front of filters (e.g. mixed air sensors), access for filter removal shall be maintained.
4. For sensors specified to be calibrated using a dry well bath (see points list), install sensors with a sufficient wiring/flexible conduit lead that sensor may removed from well or duct and placed in an ice bath or dry well for calibration. The spare wiring/flexible conduit shall be no less than 3' in length.
5. All pipe-mounted temperature sensors shall be installed in wells. Install the sensor in the well with a thermal-conducting grease or mastic. Use a closed-cell insulation patch that is integrated into the pipe insulation system to isolate the top of the well from ambient conditions but allow easy access to the sensor. Install a test plug adjacent to all wells for testing and calibration.
6. Unless otherwise noted, temperature sensors/thermostats, humidity sensors/humidistats, CO_2 sensors, and other room wall mounted sensors shall be installed at same centerline as adjacent electrical switches, 4'-0" above the finished floor where there are no adjacent electrical switches, and within ADA limitations.
7. Unless otherwise noted, install outdoor air temperature sensors on north wall, complete with sun shield, where they will not be influenced by building exhaust, exfiltration, or solar insolation. Do not install near intake or exhaust air louvers.

D. Differential Pressure Sensors.

1. Supply Duct Static Pressure: Locate transmitter in temperature control panel near or in DDC panel to which it is wired. Connect the low-pressure port to tee in building pressure (high) signal of the building static pressure transmitter. Pipe the high-pressure tap to the duct using a static pressure tip. Locate static pressure tip as shown on drawings; if no location is shown, locate at end of duct riser or main as far out in the system as possible but upstream of all smoke and fire dampers. Install pressure tips securely fastened with tip facing upstream in accordance with manufacturer's installation instructions.
2. Filter Differential Pressure:

    a. Install static-pressure tips upstream and downstream of filters with tips oriented in direction of flow.
    b. Mount transmitter on outside of filter housing or filter plenum in an accessible position with LCD display clearly visible. This sensor is used in lieu of an analog gauge and thus must be readily viewable.

3. Building Static Pressure:

    a. Low pressure port of the pressure sensor:

        (1) Pipe to the ambient static pressure probe located on the outside and at high point of the building through a high-volume accumulator or otherwise protected from wind fluctuations.

    b. High-pressure port of the pressure sensor:

        (1) Pipe to either:

            a) Behind a DDC temperature sensor cover in an interior zone.
            b) Bosco or Dwyer plate sensor mounted in ceiling.

(2) Do not locate near elevators, exterior doors, atria, or (for ceiling sensor applications) near diffusers.

4. All pressure transducers, other than those controlling VAV boxes, shall be located where accessible for service without use of ladders or special equipment. If required, locate in field device panels and pipe to the equipment monitored or ductwork.
5. The piping to the pressure ports on all pressure transducers (both air and water) shall contain a capped test port located adjacent to the transducer.
6. Piping differential pressure transducers shall have three valve manifold, two valves to allow removal of sensor without disrupting the hydronic system plus an equalizing valve to allow the sensor to be zeroed and to prevent sensor from experiencing full static (as opposed to differential) pressure, plus test plugs on each connection (also used as vents).
7. Copper tubing shall be installed in a neat manner (parallel and perpendicular to the building structure, equipment, piping, etc. from which it is supported) and shall be properly supported. Changes to copper tubing installation resulting from failure to comply with this requirement shall be made at the discretion of the Professional at no additional cost to the Using Agency.

E. Relative Humidity Sensors: Provide element guard as recommended by manufacturer for high velocity installations. For high limit sensors, position remote enough to allow full moisture absorption into the air stream before reaching the sensor.

F. Weather Sensors: Mount wind speed/direction sensor, radiation sensor, and temperature/humidity sensor in fan aspirated enclosure on pipe mount on roof per manufacturer's instructions.

G. Flow Switches: Install in a straight run of pipe at least 10 diameters in length to minimize false indications.

H. Current Switches for Motor Status Monitoring: Adjust so that setpoint is below minimum operating current and above motor no load current.

I. Airflow Measuring Stations: Install per manufacturer's recommendations in an unobstructed straight length of duct both upstream and downstream of sensor, except those installations specifically designed for installation in fan inlet. For installations in fan inlets, provide on both inlets of double inlet fans and provide inlet cone adapter as recommended by AFMS manufacturer.

J. Fluid Flow Sensors: Install per manufacturer's recommendations in an unobstructed straight length of pipe both upstream and downstream of sensor.

K. Window Switches:

1. Wiring:

a. All wiring concealed in mullions and wall cavity to the extent possible. Review wiring routing details in mullions with window manufacturer.
b. Any wiring exposed to view shall be reviewed and approved by Using Agency prior to installation.

2. Where there is more than one switch in a zone, wire in series so that windows are indicated as open when any window is open and indicated as closed when all are closed.

3.5 ACTUATORS

A. Type.

1. Actuators for two-position valves may be pneumatic or electric at the option of the Division 23C contractor.
2. Actuators for high pressure (125 psig) steam, both modulating and two-position, shall be pneumatic.
3. Except where listed above, actuators shall be electric.

B. Mount and link control damper actuators per manufacturer's instructions.

C. Dampers

1. To compress seals when spring-return actuators are used on normally closed dampers, power actuator to approximately 5° open position, manually close the damper, and then tighten the linkage, or follow manufacturers instructions to achieve same effect.
2. Check operation of damper/actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.
3. Provide all mounting hardware and linkages for actuator installation.

D. Control Valves: Install so that actuators, wiring, and tubing connections are accessible for maintenance. Where possible, install with valve stem axis vertical, with operator side up. Where vertical stem position is not possible, or would result in poor access, valves may be installed with stem horizontal. Do not install valves with stem below horizontal, or down.

END OF SECTION 23 09 13

SECTION 23 09 16 - EMCS OPERATOR INTERFACES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. These heating, ventilating and air conditioning (HVAC) provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.2 WORK INCLUDED

A. Provide and install the following:

1. Operator Workstations
2. Servers
3. Portable Operator Terminal
4. Uninterruptible Power Supply
5. Backup Device
6. Printers

B. Refer to Section 23 09 00 for general requirements.

1.3 RELATED WORK AND REQUIREMENTS

A. Section 23 09 00 Energy Management and Control System (EMCS) − General

B. Section 23 09 13 EMCS Basic Materials and Devices

C. Section 23 09 19 EMCS Field Panels

D. Section 23 09 23 EMCS Communications Devices

E. Section 23 09 26 EMCS Software and Programming

F. Section 23 09 29 EMCS Points and Sequence of Operation

PART 2 - PRODUCTS

2.1 OPERATOR WORKSTATION (OWS)

A. Hardware:

1. 3.2 GHz (minimum)
2. 4 GB SDRAM (minimum)
3. 8X DVD +/- RW Drive
4. 250 GB hard disk (minimum)
5. Ethernet 100 GB internal network card (for connection to Supervisory LAN)
6. 24” LED HD color, 1920 x 1080 pixel display monitor

7. 3-button optical USB mouse
8. USB Keyboard
9. Internal speakers
10. EnergyStar configured.
11. One spare serial port and one spare USB port in addition to those needed for specified peripherals.
12. 24x7 dedicated technical support service that delivers reduced hold time, direct access to advanced level technicians, and reduced time to resolution, minimum 1 year.

B. Software:

1. By PC Supplier (factory installed):

a. Operating system: Microsoft Windows 7 Professional.
b. Browser: Microsoft Internet Explorer .
c. Office Suite: Microsoft Office Professional.
d. CD burner software: Standard software provided by computer supplier.
e. All software shall be at least the latest version available as of the date of purchase.

2. By EMCS Contractor:

a. See Section 23 09 26.

2.2 CONTROL SYSTEM SERVER (CSS) AND OCCUPANT INTERFACE SERVER (OIS)

A. Hardware:

1. Dual Processor 3.2 GHz (minimum)
2. 4 GB DDRAM (minimum)
3. 4 Bay (1x4) Hot Plug SCSI Hard Drive Backplane with dual 500 GB (minimum) SCSI hard disks connected to on-board 128MB Battery Backed Cache, 2 Internal Ch- Embedded RAID controllers
4. 24X (minimum) CD ROM drive
5. One Ethernet 100 GB internal network card (for connection to Supervisory LAN)
6. One Ethernet 1000 Gigabit NIC-Fiber network card (for connection to Using Agency WAN)
7. Redundant AC power supplies.
8. 19” color , 1280 x 1024 pixel display
9. 3-button optical USB mouse
10. USB Keyboard
11. EnergyStar configured.
12. One spare serial port and one spare USB port in addition to those needed for specified peripherals.
13. 24x7 dedicated technical support service that delivers reduced hold time, direct access to advanced level technicians, and reduced time to resolution, minimum 1 year.
14. Rack mounting.

B. Software:

1. By PC Supplier (factory installed):

a. Operating system: Microsoft Windows Server 2012
b. Browser: Microsoft Internet Explorer
c. All software shall be at least the latest version available as of the date of purchase.

2. By EMCS Contractor:

a. See Section 23 09 26.

C. CSS shall be configured to secure it to the extent practical inside the Supervisory LAN with firewall software provided by the Contractor.

2.3 TREND HISTORIAN SERVER (THS)

A. Same as CSS expect dual 1 TB hard disks.

2.4 PORTABLE OPERATORS TERMINAL (POT)

A. Portable Operators Terminal shall support system management by connection to the controllers, by connection via the Supervisory LAN, Using Agency Intranet, or Internet; or by dial-up communications.

B. Hardware

1. 1.6 GHz (minimum)
2. 4 GB SDRAM (minimum)
3. 250 GB hard disk (minimum)
4. 24X (minimum) CD ROM drive (built-in)
5. Ethernet 100 GB internal network card (for connection to Supervisory LAN)
6. 15.6” color, 1366x768 Anti-Glare WLED-Backlit display
7. Touch pad
8. Rechargeable battery, spare battery and 110V power supply/charger
9. Internal speakers
10. Parallel, Serial and USB port.
11. Vinyl carry-bag.
12. IEEE 802.11b (DSSS) 2.4GHz-Compliant wireless PCMCIA card (compatible with wireless router; see Section 23 09 23).
13. 24x7 dedicated technical support service that delivers reduced hold time, direct access to advanced level technicians, and reduced time to resolution, minimum 1 year.

C. Software:

1. By PC Supplier (factory installed):

a. Operating system: Microsoft Windows 7 Professional.
b. Browser: Microsoft Internet Explorer
c. Office Suite: Microsoft Office Professional.
d. CD burner software: Standard software provided by computer supplier.
e. All software shall be at least the latest version available as of the date of purchase.

2. By EMCS Contractor:

a. See Section 23 09 26.

2.5 UNINTERRUPTIBLE POWER SUPPLY (UPS)

A. Back-UPS ES battery backup and surge protection.

B. EMI/RFI filtering to FCC Class B

C. Lightning and surge protection for all outlets

D. Stepped sine wave output

E. Wide input voltage range

F. Automatic battery testing

G. Continuous battery monitoring

H. Continuous overload monitoring

I. Sufficient to power all EMCS devices in Central Plant at full load for 5 minutes after power failure.

2.6 BACKUP DEVICE

A. eSATA or USB 3.0 External Hard Drive 1TB (minimum)

B. Include 1 external hard drive

2.7 PRINTERS

A. Network Laser Printer:

1. Print Quality: 1200 x 1200 dpi resolution.
2. Speed: 25 pages per minute; print time of less than 9 seconds to first page.
3. Cartridge / Printhead Duty Cycle: 5000 pages
4. Paper Size: 8.5x11
5. Ethernet Network hardware and software with remote management (configure, monitor and manage printer via network)
6. Compliant Standards:

    a. EPA Energy Star
    b. IEEE 802.3-LAN, IEEE 802.3U-LAN

B. Color Ink Jet printer:

1. Print Quality (Color): 1440 x 720 dpi resolution.
2. Speed: 5 pages per minute (color)
3. Cartridge / Printhead Duty Cycle: 300 pages
4. Paper Size: 11x17, 8.5x11

PART 3 - EXECUTION

3.1 DEVICE REQUIREMENTS

A. Provide the following Equipment in the Control Room or at location designated by the Using Agency:

Device	Quantity
Operator Workstation	3
Control System Server	1
Occupant Interface Server	1
Trend Historian Server	1
Portable Operator's Terminal	2
Interruptible Power Supply	As required
Backup device	1
Network Laser Printer	1
Color Inkjet Printer	1
Alarm Dot Matrix Printer	1

3.2 INSTALLATION

A. Install all servers and other devices available with a rack mounting configuration in a rack (provided by Contractor) located in the Control Room.

B. Install all hardware and software and configure all devices in accordance with manufacturer's instructions.

C. Provide all licenses, keys, etc. and all documentation and information required to install, configure, operate, diagnose and maintain the system shall be provided.

D. Network connections:

1. See System Architecture in Section 23 09 00.
2. Connect OWSs, CSS, OIS, and THS to Supervisory LAN.
3. Connect CSS, OIS, and THS to Using Agency IT WAN/LAN via fiber optic cable. Contractor shall coordinate with the Using Agency representative to establish IP addresses and communications parameters to assure proper operation.

E. Printers:

1. Connect network laser printer to Supervisory LAN.
2. Connect alarm printer to CSS.
3. Connect other printers to an OWS and configure to share with other OWSs.

F. Backup

1. After completion and acceptance of installation, create a tape backup of all OWSs and server database and configuration files for permanent record of initial installation.
2. Configure tape backup software to provide automatic backup of CSS and THS on a weekly basis.
3. All other backup configuration shall be by the Using Agency.

G. Anti-virus software and installation shall be by the Using Agency.

END OF SECTION 23 09 16

SECTION 23 09 19 - EMCS FIELD PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. These heating, ventilating and air conditioning (HVAC) provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.2 WORK INCLUDED

A. Provide and install the following:

1. Building Controller (BC)
2. Advance Application Specific Controller (AAC)
3. Application Specific Controller (ASC)
4. Lighting Control Panel (LCP)

B. Refer to Section 23 09 00 for general requirements.

1.3 RELATED WORK AND REQUIREMENTS

A. Section 23 09 00 Energy Management and Control System (EMCS) − General

B. Section 23 09 13 EMCS Basic Materials and Devices

C. Section 23 09 16 EMCS Operator Interfaces

D. Section 23 09 23 EMCS Communications Devices

E. Section 23 09 26 EMCS Software and Programming

F. Section 23 09 29 EMCS Points and Sequence of Operation

G. Section 23 09 33 EMCS Commissioning

PART 2 - PRODUCTS

2.1 GENERAL

A. Point information from any controller (including BCs, AACs, and ASCs) and from any gateway shall be capable of being used in a control sequence in any other panel. The use of OWS or CSS to serve as a communications server between control panels and gateways is not acceptable.

B. For all controllers, operating configuration and software shall be retained in the event of a power outage without requiring a download from upper level controllers by one or a combination of the following:

1. Volatile RAM shall have a replaceable battery backup using a lithium battery with a rated service life of 10,000 hours continuous, and a rated shelf life of at least 7 years.
2. Volatile RAM shall have a automatically rechargeable battery backup using a lithium battery with a rated service life of 50 hours continuous, and a rated shelf life of at least 10 years.
3. EEPROM, EPROM, or NOVROM non-volatile memory

C. Controllers shall allow independent operation regardless of the status of the other controllers or OWS or CSS. All energy management logic shall reside in field hardware and shall not be dependent on the OWS or CSS for operation.

D. Each controller shall continually check the status of its processor and memory circuits. If an abnormal operation is detected, the controller shall:

1. Assume a predetermined failure mode.
2. Generate an alarm notification to the master controller and/or Operator Workstation.

E. All input points and output points shall be protected such that shorting of the point to itself — to another point, or to ground — will cause no damage to the controller. All input and output points shall be protected from voltage up to 24V of any duration, such that contact with this voltage will cause no damage to the controller.

F. Controller hardware shall be suitable for the anticipated ambient conditions.

1. Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures, and shall be rated for operation at 0°F to 150°F.
2. Controllers used in conditioned space shall be mounted in dust--resistant enclosures, and shall be rated for operation at 32°F to 120°F.

G. Programmability. All controllers, including BCs, AACs, and ASCs, shall be fully user programmable. See Section 23 09 26. Configurable pre-programmed logic shall not be acceptable in any controller. (This is required due to non-standard control sequences at AHUs and VAV terminal units.)

2.2 STAND-ALONE FUNCTIONALITY

A. General: These requirements clarify the requirement for stand-alone functionality relative to packaging I/O devices with a controller. Stand-alone functionality is specified with the controller and for each Application Category specified in Part 3. This item refers to acceptable paradigms for associating the points with the processor.

B. Functional Boundary: Provide controllers so that all points associated with and common to one unit or other complete system/equipment shall reside within a single control unit. The boundaries of a standalone system shall be as dictated in the contract documents. Generally systems specified for the Application Category will dictate the boundary of the standalone control functionality. See related restrictions below. When referring to the controller as pertains to the standalone functionality, reference is specifically made to the processor. One processor shall execute all the related I/O control logic via one operating system that uses a common programming and configuration tool.

C. The following configurations are considered acceptable with reference to a controller’s standalone functionality:

1. Points packaged as integral to the controller such that the point configuration is listed as an essential piece of information for ordering the controller (having a unique ordering number).
2. Controllers with processors and modular back planes that allow plug in point modules as an

integral part of the controller.

3. I/O point expander boards, plugged directly into the main controller board to expand the point capacity of the controller

D. The following configurations are considered unacceptable with reference to a controller's standalone functionality:

1. Multiple controllers enclosed in the same control panel to accomplish the point requirement.

2.3 BUILDING CONTROLLER (BC)

A. General Requirements:

1. BCs shall be peer-to-peer devices connected to the Primary Controller LAN.
2. Each BC shall be capable of standalone direct digital operation utilizing its own microprocessor, internal RAM, non-volatile memory, input/output, wiring terminal strips, A/D converters, real-time clock/calendar and voltage transient and lightning protection devices, battery backup, regulated power supply, power conditioning equipment, ports for connection of operating interface devices, and control enclosure.. Refer to standalone functionality specified above.
3. The BC(s) shall provide fully distributed control independent of the operational status of the OWSs and CSS. All necessary calculations required to achieve control shall be executed within the BC independent of any other device.
4. BCs shall perform overall system coordination, accept control programs, perform automated HVAC functions, control peripheral devices and perform all necessary mathematical and logical functions. BCs shall share information with the entire network of BCs and AACs/ASCs for full global control. Each controller shall permit multi-user operation from multiple workstations and portable operator terminals connected either locally or over the Primary Controller LAN.
5. BC shall contain sufficient memory for all specified global control strategies, user defined reports and trending, communication programs, and central alarming.
6. The BC may provide for point mix flexibility and expandability. This requirement may be met via either a family of expander boards, modular input/output configuration, or a combination thereof. Refer to stand alone functionality specified above.
7. All BC point data, algorithms and application software shall be configurable, and all control strategies performed by the BC shall be both operator definable and modifiable, from Operator Interfaces. The point database and all application programs shall be stored in non-volatile or battery backed volatile memory within the BC and will be able to upload/download to/from the OWS and/or CSS.
8. BC shall provide buffer for holding alarms, messages, trends etc.
9. Each BC shall include self-test diagnostics, which allow the BC to automatically alarm any malfunctions, or alarm conditions that exceed desired parameters as determined by programming input.
10. Each BC shall contain software to perform full DDC/PID control loops.
11. Memory

a. Memory for data trending shall reside in BCs; the Operator Workstation shall not need to be connected for data trending to occur. Memory shall be large enough to record 256 records of each hardware point on the panel and an equal number of software points, each record to include both data value and time of occurrence. (See Section 23 09 26 for trending software requirements.)
b. Provide sufficient internal memory for the specified sequences of operation and trend logging. There shall be a minimum of approximately 25% of available memory free for future programming changes.

c. Provide an additional BC if needed to comply with this section.

12. For systems requiring end-of-line resistors those resistors shall be located in the BC.
13. Input-Output Processing

    a. Digital Outputs (DO): Outputs shall be rated for a minimum 24 Vac or Vdc, 0.5 amp maximum current. Each shall be configurable as normally open or normally closed. Each output shall have an LED to indicate the operating mode of the output and a supervised manual hand off or auto (HOA) switch to allow for override. HOA override switches shall be monitored via additional input channels to provide dynamic indication of the switch status at any Operator Interface. Each DO shall be discrete outputs from the BC's board (multiplexing to a separate manufacturer's board is unacceptable). Provide suppression to limit transients to acceptable levels.
    b. Analog Inputs (AI): AI shall be 0-5 Vdc, 0-10 Vdc, and 0-20 mA. Provide signal conditioning, and zero and span calibration for each input. Each input shall be a discrete input to the BC's board (multiplexing to a separate manufacturers board is unacceptable unless specifically indicated otherwise). A/D converters shall have a minimum resolution of 12 bits.
    c. Digital Inputs (DI): Monitor dry contact closures. Accept pulsed inputs of at least one per second. Source voltage for sensing shall be supplied by the BC and shall be isolated from the main board. Software multiplexing of an AI and resistors is unacceptable.
    d. Universal Inputs (UI-AI or DI): To serve as either AI or DI as specified above.
    e. Electronic Analog Outputs (AO): Voltage mode: 0-5 Vdc and 0-10 Vdc; Current mode: 4-20 mA. Provide zero and span calibration and circuit protection. Pulse Width Modulated (PWM) analog is not acceptable. D/A converters shall have a minimum resolution of 8 bits. Each output shall have an LED to indicate the operating mode of the output and a supervised manual hand off or auto (HOA) switch and trim potentiometer to allow for override and manual positioning of the output from 0 to 100%. HOA override switches shall be monitored via additional input channels to provide dynamic indication of the switch status at any Operator Interface.
    f. Analog Output Pneumatic (AOP), 0-20 psi: Pneumatic outputs via an I/ or V/P transducer. Multiplexed digital to pneumatic transducers are acceptable provided they are supplied as a standard product and part of the BC and provide individual feedback. Multiplexed pneumatic outputs of a separate manufacturer are unacceptable.
    g. Pulsed Inputs: Capable of counting up to 8 pulses per second with buffer to accumulate pulse count. Pulses shall be counted at all times.

14. A communication port for operator interface through a terminal shall be provided in each BC. It shall be possible to perform all program and database back-up, system monitoring, control functions, and BC diagnostics through this port. Standalone BC panels shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems, printers, or workstations.
15. Each BC shall be equipped with loop tuning algorithm for precise proportional, integral, derivative (PID) control. Loop tuning tools provided with the Operator Workstation software is acceptable. In any case, tools to support loop tuning must be provided such that P, I, and D gains are automatically calculated.
16. All analog output points shall have a selectable failure setpoint. The BC shall be capable of maintaining this failure setpoint in the event of a system malfunction, which causes loss of BC control, or loss of output signal, as long as power is available at the BC. The failure setpoint shall be selectable on a per point basis.
17. Slope intercepts and gain adjustments shall be available on a per-point basis.
18. BC Power Loss:

    a. Upon a loss of power to any BC, the other units on the primary controlling network shall

not in any way be affected.

b. Upon a loss of power, all software, database parameters, and data (except trend data) shall be protected from memory loss per paragraph 2.1B.
c. Upon restoration of power within the specified battery backup period, the BC shall resume full operation without operator intervention. The BC shall automatically reset its clock such that proper operation of any time dependent function is possible without manual reset of the clock. All monitored functions shall be updated.
d. Should the duration of a loss of power exceed the specified battery back-up period or BC panel memory be lost for any reason, the panel shall automatically report, or CSS shall automatically determine, the condition (upon resumption of power) and be capable of receiving a download via the network, and connected computer. In addition, the Using Agency shall be able to upload the most current versions of all energy management control programs, Direct Digital Control programs, database parameters, and all other data and programs in the memory of each BC to the operator workstation via the local area network, or via the telephone line dial-up modem where applicable, or to the laptop PC via the local RS-232C port.

19. BC Failure:

a. Controller LAN Data Transmission Failure: BC shall continue to operate in stand-alone mode. BC shall store loss of communication alarm along with the time of the event. All control functions shall continue with the global values programmable to either last value or a specified value.
b. BC Hardware Failure: BC shall cease operation and terminate communication with other devices. All outputs shall go to their specified fail position.

20. Each BC shall be equipped with firmware resident or software self-diagnostics for sensors and be capable of assessing an open or shorted sensor circuit and taking an appropriate control action (close valve, damper, etc.).
21. BCs may include LAN communications interface functions for controlling s\Secondary controlling LANs Refer to Section 23 09 23 - EMCS System Communications Devices for requirements if this function is packaged with the BC.
22. BCs shall be mounted on equipment, in packaged equipment enclosures, or locking wall mounted in a NEMA 1 enclosure, as specified elsewhere.

B. BACnet Building Controller Requirements:

1. The BC(s) shall support all BIBBs defined in the BACnet Building Controller (B-BC) device profile as defined in the BACnet standard.
2. Each BC shall be connected to the BACnet Primary Controller LAN communicating to/from other BCs.

2.4 ADVANCED APPLICATION SPECIFIC CONTROLLER (AAC) AND APPLICATION SPECIFIC CONTROLLER (ASC)

A. General Requirements:

1. AACs and ASCs shall be connected to the Primary or Secondary Controller LAN.
2. AACs and ASCs shall provide intelligent, standalone control of HVAC equipment. Each unit shall have its own internal RAM, non-volatile memory and will continue to operate all local control functions in the event of a loss of communications on the Secondary LAN. Refer to standalone requirements by application specified in Part 3 of this section. In addition, it shall be able to share information with every other BC and AAC /ASC on the entire network.
3. Each AAC and ASC shall include self-test diagnostics that allow the AAC /ASC to

automatically relay to the BC, LAN Interface Device or workstation, any malfunctions or abnormal conditions within the AAC /ASC or alarm conditions of inputs that exceed desired parameters as determined by programming input.

4. AACs and ASCs shall include sufficient memory to perform the specific control functions required for its application and to communicate with other devices.
5. Each AAC and ASC must be capable of stand-alone direct digital operation utilizing its own processor, non-volatile memory, input/output, voltage transient and lightning protection devices.
6. All point data; algorithms and application software within an AAC /ASC shall be modifiable from Operator Interfaces.
7. Memory

    a. Memory for data trending is not required for AACs and ASCs. If not provided in controller, memory for trend data shall reside in BCs connected to the same Network.
    b. Provide sufficient internal memory for the specified sequences of operation. For AACs, there shall be a minimum of approximately 25% of available memory free for future programming changes. Provide additional AACs or a BC if needed to comply with this requirement.

8. AAC Input-Output Processing. Same as BCs (paragraph 2.3A.13) except A/D converters may be 10 bit.
9. ASC Input-Output Processing

    a. Digital Outputs (DO): Outputs shall be rated for a minimum 24 Vac or Vdc, 0.5 amp maximum current. Each shall be configurable as normally open or normally closed. Each output shall have an LED to indicate the operating mode of the output. Each DO shall be discrete outputs from the ASC's board (multiplexing to a separate manufacturer's board is unacceptable). Provide suppression to limit transients to acceptable levels.
    b. Analog Inputs (AI): AI shall be 0-5 Vdc or direct thermistor connection. Provide signal conditioning, and zero and span calibration for each input. Each input shall be a discrete input to the ASC's board (multiplexing to a separate manufacturers board is unacceptable unless specifically indicated otherwise). A/D converters shall have a minimum resolution of 10 bits.
    c. Digital Inputs (DI): Monitor dry contact closures. Accept pulsed inputs of at least one per second. Source voltage for sensing shall be supplied by the ASC and shall be isolated from the main board. Software multiplexing of an AI and resistors may only be done in non-critical applications and only with prior approval of the Using Agency.
    d. Universal Inputs (UI-AI or DI): To serve as either AI or DI as specified above.
    e. Electronic Analog Outputs (AO): Voltage mode: 0-5 Vdc and 0-10 Vdc; Current mode: 4-20 mA. Provide zero and span calibration and circuit protection. Pulse Width Modulated (PWM) analog is not acceptable. D/A converters shall have a minimum resolution of 8 bits.
    f. Analog Output Pneumatic (AOP), 0-20 psi: Pneumatic outputs via an I/ or V/P transducer. Multiplexed digital to pneumatic transducers are acceptable provided they are supplied as a standard product and part of the ASC and provide individual feedback. Multiplexed pneumatic outputs of a separate manufacturer are unacceptable.

B. BACnet AAC(s) and ASC(s) Requirements:

1. The AAC(s) and ASC(s) shall support all BIBBs defined in the BACnet Building Controller (B-AAC and B-ASC) device profile as defined in the BACnet standard.
2. AAC(s) and ASC(s) shall communicate over the BACnet Primary Controller LAN or the Secondary LAN.

2.5 LIGHTING CONTROLS

A. General:

1. Lighting control hardware shall consist of lighting control panels and gateway (if required) to DDC system.

B. Overrides

1. Occupant override

a. Off-hour override control shall be via web browser through the Using Agency Intranet (see Section 23 09 26).
b. Low voltage wall switches as indicated on Division 26 Electrical drawings.

2. Janitor’s override

a. Provide momentary contact Janitor’s switch in one janitor’s closets per floor.
b. Switches shall be programmable to allow lights to be sequenced on by blocks to minimize the number of lights on at any one time. Program to turn on sufficient circuits to provide adequate lighting for cleaning during tenant improvements.

c. Timed to shut off lights after adjustable time period.

C. Each LCP (Lighting Control Panel) consists of a fully programmable controller operating in conjunction with low voltage relays which provide stand-alone or integrated lighting functions such as time scheduling, "flick" signals, ambient light control, cleaning schedules. Programming is provided either through the Operator Workstation or Portable Operator's Terminal. Each controller shall be capable of providing all logic, control runtime data, status information and communications functions for each lighting control relay. Each relay is "softwired" into any desired group and into common groups by the Portable Operator's Terminal, or Operator Workstation.

D. Each LCP enclosure includes multiple GE RR7 (or equal) pre-mounted relays, logic boards, terminals, power supplies, transformers, local override switches and a wiring schedule directory. Relays shall be momentarily-pulsed, mechanically latching contactors rated at 20 amps, 120-277 VAC. Enclosure shall have lockable hinged door.

E. Power supply shall have a transformer assembly with two 40 VA transformers, with separate secondaries, one providing power to relays, LED's and associated low voltage switches and occupancy sensors, the second providing power to intelligence cards. Transformers include internal overcurrent protection with automatic reset and metal oxide varistor protection against power spikes.

F. All lighting sequences programmed in the LCPs shall be stored in non-volatile EEPROM memory, which is not dependent upon the presence of a battery to be retained. Each LCP shall communicate with the Operator Workstation at a baud rate of not less than 19,200 baud.

G. LCPs shall be capable of supporting the following scenarios: Schedule with Flick Warn, Time Delay Overrides with Flick Warn, Common Area Interlock with Egress Timer, Master Switch Control with Flick Option, Cleaning Lights, Automatic Daylight Switching with Occupant Interlock/Override, Status and Runtime Data and Touch Tone Phone interface.

H. All relay changes of state and programmable switch actions shall be communicated over the network LAN to support interactive graphics and on line status monitoring. All programming shall be

on line or off line through the Portable Operator's Terminal or Operator Workstation.

I. Each LCP shall be capable of stand alone operation. None of the operating scenarios discussed above shall depend on the operation of a Operator Workstation or Portable Operator's Terminal. The relays override switches shall continue to operate should the LCP controller fail.

J. Each LCP shall have framed, plastic-encased point list for all points in cabinet.

K. Manufacturer: Equal to Triatek with Triatek Link Gateway.

PART 3 - EXECUTION

3.1 GENERAL

A. Install systems and materials in accordance with manufacturer's instructions, specifications roughing-in drawings and details shown on drawings.

3.2 HARDWARE APPLICATION REQUIREMENTS

A. General: The functional intent of this specification is to allow cost effective application of manufacturers standard products while maintain the integrity and reliability of the control functions. A BC as specified above is generally fully featured and customizable whereas the AAC/ASC refers to a more cost-effective unit designed for lower-end applications. Specific requirements indicated below are required for the respective application. Manufacturer may apply the most cost-effective unit that meets the requirement of that application.

B. Software Capability: Regardless of application category listed below, each Control Unit shall be capable of performing the specified sequence of operation for the associated equipment. All physical point data and calculated values required to accomplish the sequence of operation shall originate within the associated CU with only the exceptions enumerated below. Refer to Paragraph 2.2 above for physical limitations of standalone functionality. Listed below are functional point data and calculated values that shall be allowed to be obtained from or stored by other CUs via LAN.

1. Remote pressure sensors. To meet the requirements of this section, differential pressure sensors controlling fans and pumps shall either be home-run wired back to the CU controlling the fan/pump VFD; or install another DP sensor (not shown in points list) near the fan/pump and connected to the CU controlling the pump, connect remote sensors to remote CUs, and use cascading control loops (remote sensor loops reset setpoint for local sensor loop via the network, and local sensor loop controls the pump/fan).

C. Where associated control functions involve functions from different categories identified below, the requirements for the most restrictive category shall be met.

D. Application Category 0 (Distributed Monitoring)

1. Applications in this category include the following:

a. Monitoring of variables that are not used in a control loop, sequence logic, or safety. Examples include status of sump pumps or associated float switches, temperatures in monitored electrical rooms.

2. Applicable Controllers: Available points on conveniently located BCs, AACs, and ASCs may

be used in these applications.

3. Contractor shall verify and document that the network bandwidth is acceptable to accept specified trends of monitored points.

E. Application Category 1 (Application Specific Controller):

1. Applications in this category include the following:

   a. Fan Coil Units
   b. Terminal Units (e.g. VAV and Constant Volume Boxes)
   c. Miscellaneous heaters
   d. Constant speed exhaust fans and pumps
   e. Unitary single zone units with self contained controls (Package Terminal AC Units, Package Terminal Heat Pumps, Split-System AC Units, Split-System Heat Pumps, Water-Source Heat Pumps, Computer Room AC units)

2. Applicable Controllers: ASCs may be used in these applications .
3. Standalone Capability: Provide capability to execute control functions for the application for a given setpoint or mode, which shall generally be occupied mode control. Only the following data (as applicable) may be acquired from other controllers via LANs. In the event of a loss of communications with any other controller, or any fault in any system hardware that interrupts the acquisition of any of these values, the ASC shall use the last value obtained before the fault occurred. If such fault has not been corrected after the specified default delay time, specified default value(s) shall then be substituted until such fault has been corrected.

Physical/Virtual Point	Default Value
Time of day	Occupied
Scheduling Mode	Occupied
Morning Warm-Up	Off (cold discharge air)
Load Shed	Off (no shedding)
Trend Data	N/A

4. Mounting:

   a. ASCs that control equipment located above accessible ceilings shall be mounted on the equipment in an accessible enclosure and shall be rated for plenum use if ceiling attic is used as a return air plenum.
   b. ASCs that control equipment mounted in a mechanical room may either be mounted in/on the equipment, or on the wall of the mechanical room at an adjacent, accessible location.
   c. ASCs that control equipment mounted outside or in occupied spaces shall either be located in the unit or in a proximate mechanical/utility space.
   d. Division 23C contractor shall furnish ASCs to the VAV terminal unit manufacturer for factory mounting.

5. Mounting: LAN Restrictions: Limit the number of nodes on the network to the maximum recommended by the manufacturer.
6. Trending Restrictions: BCs connected to same Network shall be capable of storing trend data for points associated with ASCs and must still meet the requirement of paragraph 2.3A.11, or special purpose trend storage devices meeting the requirement of paragraph 2.3A.11 for ASC points must be added for this purpose.

F. Application Category 2 (Advanced Application Controller)

1. Applications in this category include the following:

    a. Unitary VAV AC Unit with self contained controls
    b. Single Zone Air Handling Units
    c. Constant or variable speed pump station
    d. DHW Converter control/monitoring

2. Applicable Controllers:

    a. BCs may be used in these applications.
    b. AACs may be used in these applications provided the AAC meets all requirements specified below and all control functions and physical I/O associated with a given unit resides in one AAC.

3. Standalone Capability: Only the following data (as applicable) may be acquired from other AACs or BCs via LANs. In the event of a loss of communications with any other AACs, or any fault in any system hardware that interrupts the acquisition of any of these values, the AAC shall use the last value obtained before the fault occurred. If such fault has not been corrected after the specified default delay time, specified default value(s) shall then be substituted until such fault has been corrected.

Physical/Virtual Point	Default Delay Time	Default Value
Outside Air Temperature	3 minutes	80˚F
Trend Data		N/A

4. Trending Restrictions for AACs: BCs connected to same Network shall be capable of storing trend data for points associated with AACs that do not have on-board trend storage capability, and must still meet the requirement of paragraph 2.3A.11, or special purpose trend storage devices meeting the requirement of paragraph 2.3A.11 for AAC points must be added for this purpose.
5. Mounting:

    a. AACs/BCs that control equipment located above accessible ceilings shall be mounted in a NEMA 1, locking enclosure and shall be rated for plenum use if ceiling attic is used as a return air plenum.
    b. AACs/BCs that control equipment located in occupied spaces or outside shall either be mounted within the equipment enclosure (responsibility for physical fit remains with the Contractor) or in a proximate mechanical/utility room in which case it shall be enclosed in a NEMA 1, locking enclosure.

G. Application Category 3 (Building Controller)

1. Applications in this category include the following:

    a. VAV Air Handlers
    b. Central Cooling Plant
    c. Central Heating Plant

2. Applicable Controllers: BCs shall be used in these applications.
3. Mounting: See 3.2F.5.

3.3 LIGHTING PANELS

A. See Division 26 Electrical drawings for quantity of lighting panels and relays. Include spare relays called for on Electrical drawings.

B. See 23 09 00 for coordination with Division 26 contractor with respect to installation and wiring of panels and field mounted switches.

C. Provide BACnet gateway or router (if required) between lighting panels and Primary or Supervisory LAN. Map over all points to the EMCS.

D. See Section 23 09 26 for software and graphics requirements.

3.4 CONTROL POWER

A. Refer to Section 23 09 00 for power to control panels,

END OF SECTION 23 09 19

SECTION 23 09 23 - EMCS COMMUNICATION DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. These heating, ventilating and air conditioning (HVAC) provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.2 WORK INCLUDED

A. Provide and install the following:

1. LAN Interface Devices/Routers
2. Wireless Routers
3. Modems
4. BACnet Gateways
5. Electrical Power System Gateway
6. Variable Speed Drive Gateway

B. Refer to Section 23 09 00 for General Requirements.

1.3 RELATED WORK AND REQUIREMENTS

A. Section 23 09 00 Energy Management and Control System (EMCS) − General

B. Section 23 09 13 EMCS Basic Materials and Devices

C. Section 23 09 16 EMCS Operator Interfaces

D. Section 23 09 19 EMCS Field Panels

E. Section 23 09 26 EMCS Software and Programming

F. Section 23 09 29 EMCS Points and Sequence of Operation

PART 2 - PRODUCTS

2.1 CONTROLLER LOCAL AREA NETWORK INTERFACE DEVICES (LANID)

A. The Controller LANID shall be a microprocessor-based communications device which acts as a gateway/router between the Primary LAN, Secondary LAN, an operator interface, modem to support remote operator interface, or printer. These may be provided within a BC or as a separate device.

B. The LANID shall perform information translation between the Primary LAN and the Secondary LAN, supervise communications on a polling secondary LAN, and shall be applicable to systems in which the same functionality is not provided in the BC. In systems where the LANID is a separate device,

it shall contain its own microprocessor, RAM, battery, real-time clock, communication ports, and power supply as specified for a BC in Section 23 09 19. Each LANID shall be mounted in a lockable enclosure.

C. Each LANID shall support interrogation, full control, and all utilities associated with all BCs on the Primary LAN, all AACs and ASCs connected to all secondary LANs under the Primary Controller LAN, and all points connected to those PCUs and SCUs.

D. Upon loss of power to a LANID, the battery shall provide for minimum 100-hour backup of all programs and data in RAM. The battery shall be sealed and self-charging.

E. The LANID shall be transparent to control functions and shall not be required to control information routing on the Primary LAN

2.2 SUPERVISORY LAN ROUTERS

A. The Supervisory Router shall be a microprocessor-based communications device that acts as a router between the Supervisory LAN CSSs or OWS and the Primary LAN.

B. The Supervisory Router shall not perform information translation. Both Primary LAN and the Supervisory LAN shall use BACnet.

C. The Supervisory Router shall contain its own microprocessor, RAM, communication ports, and power supply. Each Supervisory Router shall be mounted in a lockable enclosure

D. The Supervisory Router shall allow centralized overall system supervision, operator interface, management report generation, alarm annunciation, acquisition of trend data, and communication with control units. It shall allow system operators to perform the following functions from the CSS, OWSs, and POTs:

1. Configure systems.
2. Monitor and supervise control of all points.
3. Change control setpoints.
4. Override input values.
5. Override output values
6. Enter programmed start/stop time schedules.
7. View and acknowledge alarms and messages.
8. Receive, store and display trend logs and management reports.
9. Upload/Download programs, databases, etc. as specified.

E. Upon loss of power to the Supervisory Router, the battery shall provide for minimum 100-hour backup of all programs and data in RAM. The battery shall be sealed and self-charging.

F. The Supervisory Router shall be transparent to control functions and shall not be required to control information routing on the Primary LAN

2.3 MODEMS

A. None required.

2.4 BACnet BROADCAST MESSAGE ROUTING

A. To allow BACnet broadcast messages to be relayed from remote nodes communicating via the internet and connecting to the Supervisory Router through IP protocol, a BACnet/IP Broadcast Management Device (BBMD) shall be provided which conforms to the Annex J definition of the BACnet standard for two-hop distribution. Multicast messaging or one-hop distribution requiring configuration of IP routers which are not part of the EMCS vendor's cope in not acceptable.

2.5 BACNET GATEWAYS

A. Gateways shall be provided to link non-BACnet control products to the BACnet inter-network. All of the functionality described in this section is to be provided by using the BACnet capabilities. Each Gateway shall have the ability to expand the number of BACnet objects of each type supported by 20% to accommodate future system changes.

B. Each Gateway shall provide values for all points on the non-BACnet side of the Gateway to BACnet devices as if the values were originating from BACnet objects. The Gateway shall also provide a way for BACnet devices to modify (write) all points specified by the AOC using standard BACnet services. All points are required to be writable for each site.

C. The Gateway shall implement BACnet schedule objects and permit both read and write access to the schedules from the workstation.

D. Each Gateway shall provide a way to collect and archive or trend (time, value) data pairs.

E. Each Gateway and any devices that the Gateway represents which have time-of-day information shall respond to workstation requests to synchronize the date and time. Each Gateway and any devices that the Gateway represents shall support dynamic device binding and dynamic object binding.

F. All points in the system shall be made network visible through the use of standard BACnet objects or through proprietary BACnet extensions that the workstation also supports. All points shall be writable using standard BACnet services.

G. All devices have a Device Object instance number that is unique throughout the entire inter-network. All BACnet devices shall be configured with a Device Object instance number that is based on the format specified (shown in decimal notation). This includes all physical devices as well as any logical BACnet devices that are physically represented by Gateways.

H. All BACnet Interoperability Building Blocks (BIBBs) are required to be supported for each native BACnet device or Gateway. The Gateway shall support all BIBBs defined in the BACnet Gateway's device profile as defined in the BACnet standard.

I. Upon loss of power to a Gateway, the battery shall provide for minimum 1000-hour backup of all programs and data in RAM. The battery shall be sealed and self-charging.

J. UL 916 CE FCC part 15 Subpart B – Class A with surge and transient protection circuitry for power and communications..

2.6 ELECTRICAL POWER SYSTEM GATEWAY

A. BACnet Gateway device per paragraph 2.3 to provide bi-directional communications and translation between electrical system switchgear and meter system and EMCS.

B. Device shall convert Modbus EIA-485 to BACnet on Supervisory LAN protocol.

2.7 VARIABLE SPEED DRIVE GATEWAY

A. VFDs shall include a BACnet/MSTP bi-directional gateway specified under Division 23.

PART 3 - EXECUTION

3.1 GENERAL

A. Install systems and materials in accordance with manufacturer's instructions, roughing-in drawings and details shown on drawings.

B. Contractor shall provide all interface devices and software to provide an integrated system.

C. See Control Power in Section 23 09 00 for device power options and requirements.

3.2 LANID AND LAN ROUTERS

A. Provide as required. See System Architecture in Section 23 09 00.

B. At each building, connect Supervisory LAN to dedicated control system fiber optic cable via 100Base-T to 100/1000Base-SX/LX fiber media converter installed in NEMA 1 enclosure or rack mounted in BDF rooms.

C. Connect networks to both sides of device.

D. Thoroughly test to ensure proper operation.

E. Interruptions or fault at any point on any Primary Controller LAN shall not interrupt communications between other nodes on the network. If a LAN is severed, two separate networks shall be formed and communications within each network shall continue uninterrupted. The system shall automatically monitor the operation of all network devices and annunciate any device that goes off-line because it is failing to communicate.

3.3 GATEWAYS

A. General

1. Wire to networks on both sides of device.
2. Map across all monitoring and control points listed in Section 23 09 29.
3. Thoroughly test each point to ensure that mapping is accurate.
4. Initiate trends of points as indication in Section 23 09 29.

B. Electrical Power System Gateway

1. Install gateway in NEMA 1 enclosure in electrical room.
2. Connect to Modbus interface to electrical system PLC in location shown on Division 26 Electrical Drawings.

C. Variable Speed Drive Gateway

1. Install gateway in local EMCS panel or in separate NEMA 1 enclosure in convenient mechanical or electrical room.
2. Connect to Modbus RS-485 terminations provided with each variable speed drive by Division 23. See Division 23 Mechanical Drawings for locations.

D. Lighting Control

1. Provide BACnet gateway if required by lighting control system.

END OF SECTION 23 09 23

SECTION 23 09 26 - EMCS SOFTWARE AND PROGRAMMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. These heating, ventilating and air conditioning (HVAC) provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.2 WORK INCLUDED

A. Provide and install the following:

1. System Software
2. Programming Software
3. Graphical User Interface Software

B. Refer to Section 23 09 00 for general requirements.

1.3 RELATED WORK AND REQUIREMENTS

A. Section 23 09 00 Energy Management and Control System (EMCS) − General

B. Section 23 09 13 EMCS Basic Materials and Devices

C. Section 23 09 16 EMCS Operator Interfaces

D. Section 23 09 19 EMCS Field Panels

E. Section 23 09 23 EMCS Communication Devices

F. Section 23 09 29 EMCS Points and Sequence of Operation

G. Section 23 05 93 Testing, Adjusting, and Balancing

1.4 GENERAL

A. System software shall be based on server/thin-client architecture, designed around the open standards of web technology. Servers shall be accessed using a web browser over the control system Supervisory LAN, the Using Agency intranet, and remotely over the Internet (through the Using Agency IT WAN/LAN).

B. The intent of the thin-client architecture is to provide operators complete access to the EMCS via a web browser GUI. No special software other than a web browser (including active-x components or fat java clients) shall be required to be installed on OIs used to access the EMCS graphics, point displays, trends, and trend configuration. Additional software other than a browser may be used to configure or modify the EMCS and programming.

C. The Contractor shall furnish and install all software and programming necessary to provide a complete and functioning system as specified. The Contractor shall include all software and programming not specifically itemized in these specifications that is necessary to implement, maintain, operate, and diagnose the system in compliance with these specifications.

D. Software Components: All software components of the BAS system software shall be installed and completed in accordance with the specification. BAS system components shall include:

1. Server Software, Database and Web Browser Graphical User Interface
2. System Configuration Utilities for future modifications to the system
3. Graphical Programming
4. Direct digital control software
5. Application Software

E. Database Open Connectivity: The BAS server database shall be Java DataBase Connectivity (JDBC) compatible, allowing real time access of data via XML/SOAP.

1.5 LICENSING

A. Include licensing and hardware keys for all software packages at all workstations (OWSs and POTs) and servers.

B. Within the limitations of the servers, any number of users shall have web access to the CSS and THS at any given time.

C. All operator interface, programming environment, networking, database management and any other software used by the Contractor to install the system or needed to operate the system to its full capabilities shall be licensed and provided to the Using Agency.

D. All operator software, including that for programming and configuration, shall be available on all workstations. Hardware and software keys to provide all rights shall be installed on all workstations.

PART 2 - PRODUCTS

2.1 CONTROLLER SOFTWARE

A. BC Software Residency: Each BC shall be capable of control and monitoring of all points physically connected to it. All software including the following shall reside and execute at the BC:

1. Real-Time Operating System software
2. Real-Time Clock/Calendar and network time synchronization
3. BC diagnostic software
4. LAN Communication software/firmware
5. Direct Digital Control software
6. Alarm Processing and Buffering software
7. Energy Management software
8. Data Trending, Reporting, and Buffering software
9. I/O (physical and virtual) database
10. Remote Communication software

B. AAC/ASC Software Residency: Each AAC/ASC shall be capable of control and monitoring of all points physically connected to it. As a minimum, software including the following shall reside and execute at the AAC/ASC. Other software to support other required functions of the AAC/ASC may

reside at the BC or LAN interface device (specified in Section 23 09 23) with the restrictions/exceptions per application provided in Section 23 09 19:

1. Real-Time Operating System software
2. AAC/ASC diagnostic software
3. LAN Communication software
4. Control software applicable to the unit it serves that will support a single mode of operation
5. I/O (physical and virtual) database to support one mode of operation

C. Stand Alone Capability: BC shall continue to perform all functions independent of a failure in other BC/AAC/ASC or other communication links to other BCs/AACs/ASCs. Trends and runtime totalization shall be retained in memory. Runtime totalization shall be available on all digital input points that monitor electric motor status. Refer also to Section 23 09 19 for other aspects of stand alone functionality.

D. Operating System: Controllers shall include a real-time operating system resident in ROM or EEPROM. This software shall execute independently from any other devices in the system. It shall support all specified functions. It shall provide a command prioritization scheme to allow functional override of control functions. Refer also to Section 23 09 19 for other aspects of the controller's operating system.

E. Network Communications: Each controller shall include software/firmware that supports the networking of CUs on a common communications trunk that forms the respective LAN. Network support shall include the following:

1. Building Controller/Primary LAN shall be a high-speed network designed and optimized for control system communication. If a Primary LAN communications trunk is severed, BCs shall reconfigure into two separate LANs and continue operations without interruption or Operator intervention.
2. Controller communication software shall include error detection, correction, and re-transmission to ensure data integrity.
3. Operator/System communication software shall facilitate communications between other BCs, all subordinate AACs/ASCs, Gateways and LAN Interface Devices or Operator Workstations. Software shall allow point interrogation, adjustment, addition/deletion, and programming while the controller is on line and functioning without disruption to unaffected points. The software architecture shall allow networked controllers to share selected physical and virtual point information throughout the entire system.

F. Diagnostic Software: Controller software shall include diagnostic software that checks memory and communications and reports any malfunctions

G. Alarm/Messaging Software: Controller software shall support alarm/message processing and buffering software as specified below.

H. Application Programs: CUs shall support and execute application programs specified:

I. Updating/Storing Application Data: Site-specific programming residing in volatile memory shall be uploadable/downloadable from an OWS or CSS using BACnet services connected locally, to the Primary LAN, to the Local Supervisory LAN and remotely via modem and telephone lines as applicable but all must be available. Initiation of an upload or download shall include all of the following methods; Manually, Scheduled, and Automatically upon detection of a loss or change.

J. Power Loss and Restart: System software shall provide for orderly shutdown upon loss of power. Volatile memory shall be retained. Outputs shall go to programmed fail position, which as a default

shall be set to their position in unoccupied mode. Equipment restart shall be automatic upon power restoration and shall include a user definable time delay on each piece of equipment to stagger the restart. Loss of power shall be alarmed at operator interface indicating date and time.

K. Time Synchronization: Operators shall be able to set the time and date in any device on the network that supports time-of-day functionality. The operator shall be able to select to set the time and date for an individual device, devices on a single network, or all devices simultaneously. Automatic time synchronization shall be provided using BACnet services.

L. Anti-dithering. In order to improve the life expectancy of modulating electronic actuators, software shall limit the number of re-positions. This can be accomplished by providing anti-dithering software, a small deadband for fully proportioning actuators, and by ensuring that floating actuators do not receive control pulses of excessively short duration.

2.2 GRAPHICAL USER INTERFACE SOFTWARE

A. A web browser installed on each OWS, POT, and server (see Section 23 09 16) shall serve as the graphical user interface to the EMCS. Communication between the web server GUI and EMCS server shall be encrypted using 128-bit encryption technology within Secure Socket Layers. Communication protocol shall be Hyper-Text Transfer Protocol.

B. The GUI shall provide a comprehensive user interface. Using a collection of web pages, it shall be constructed to “feel” like a single application, and provide a complete and intuitive mouse/menu driven operator interface. It shall be possible to navigate through the system using a web browser to accomplish all features specified in this section.

C. The GUI shall (as a minimum) provide a Navigation Pane for navigation, and a Action Pane for display of animated graphics, schedules, alarms/events, live graphic programs, active graphic setpoint controls, configuration menus for operator access, reports, and reporting actions for events.

D. Login. Upon launching the web browser and selecting the appropriate domain name or IP address, the operator shall be presented with a login page that will require a login name and password. Navigation in the system shall be dependent on the operator’s role privileges, and geographic area of responsibility. See Security Access below.

E. Navigation Pane

1. The Navigation Pane shall comprise a Navigation Tree which defines a geographic hierarchy of the EMCS system. Navigation through the GUI shall be accomplished by clicking on appropriate level of a navigation tree (consisting of expandable and collapsible tree control like Microsoft’s Explorer program), and/or by selecting dynamic links to other system graphics. Both the navigation tree and action pane defined below shall be displayed simultaneously, enabling the operator to select a specific system or equipment, and view the corresponding graphic. The navigation tree shall as a minimum provide the following views:

    a. Geographic View shall display a logical geographic hierarchy of the system including: cities, sites, buildings, building systems, floors, equipment and BACnet objects.
    b. Network View shall display the hierarchy of the actual BACnet IP Intranet network. This can include: Systems, Site, Networks, Routers, Half-Routers, Devices, Equipment and all the BACnet Objects in a device.
    c. Groups View shall display Scheduled Groups and custom reports.
    d. Configuration View shall display all the configuration categories (Operators, Schedule, Event, Reporting and Roles).

2. Alternative interface structures will also be accepted if they provide similar ease of navigation through the system hierarchy.

F. Action Pane. The Action Pane shall provide several functional views for each HVAC or mechanical/electrical subsystem specified. A functional view shall be accessed by clicking on the corresponding button:

1. Graphics: Using animated gifs or other graphical format suitable for display in a web browser, graphics shall include aerial building/campus views, color building floor-plans, equipment drawings, active graphic setpoint controls, web content, and other valid HTML elements. The data on each graphic page shall automatically refresh as frequently as 6 updates per minute.
2. Properties: Shall include graphic controls and text for the following: Locking or overriding BACnet objects, demand strategies, and any other valid data required for setup. Changes made to the properties pages shall require the operator to depress a 'accept/cancel' button.
3. Schedules: Shall be used to create, modify/edit and view schedules based on the systems geographical hierarchy and in compliance with paragraph 2.2H.
4. Events: Shall be used to view alarm event information geographically (using the navigation tree), acknowledge events, sort events by category, actions and verify reporting actions.
5. Trends: Shall be used to display associated trend and historical data, modify colors, date range, axis and scaling
6. Logic - Live Graphic Programs: Shall be used to display a 'live' graphic programs of the control algorithm for the mechanical/electrical system selected in the navigation tree.

G. Graphics

1. The GUI shall make extensive use of color in the graphic pane to communicate information related to setpoints and comfort. Animated graphics and active setpoint graphic controls shall be used to enhance usability.
2. Graphics tools used to create Web Browser graphics shall be non-proprietary and provided and installed on each OWS.
3. Graphical display shall be 1280 x 1024 pixels or denser, 256 color minimum.
4. Links:

    a. Graphics shall include hyperlinks which when selected (i.e. clicked on with mouse) launch applications, initiate other graphics etc.
    b. Screen Penetration: Links shall be provided to allow user to navigate graphics logically without having to navigate back to the home graphic. See additional discussion in Paragraph 3.5.
    c. Information Links:

        (1) On each MEP system and subsystem graphic, provide links to display in a new window the information listed below.

            a) English-language control sequence associated with the system. See Section 23 09 29.
            b) O&M and submittal information for the devices on the graphic. See Section 23 09 00.

        (2) The display shall identify the target of the link by file name/address.
        (3) Information shall be displayed in electronic format that is text searchable.
        (4) Window shall include software tools so that text, model numbers, or point names may be found. Source documents shall be read-only (not be editable) with this software, however.

5. Point Override Feature:

    a. Every real output or virtual point displayed on a graphic shall be capable of being overridden by the user (subject to security level access) by mouse point-and-click from the graphic without having to open another program or view.
    b. When the point is selected to be commanded:

        (1) Dialog box opens to allow user to override the point (place in “operator mode”) or release the point (“automatic mode”). Operator mode will override automatic control of the point from normal control programs.
        (2) Dialog box shall have buttons (for digital points) or a text box and/or slide bar (for analog points) to allow user to set the point’s value when in operator mode. These are grayed out when in automatic mode.
        (3) When dialog box is closed, mode and value are sent to controller.
        (4) Graphic is updated upon next upload scan of the actual point value.

    c. A list of points that are currently in an operator mode shall be available through menu selection.

6. Point override status (if a digital point is overridden by the supervised manual override per Section 23 09 19 or if a point is in operator mode per 2.2G.5) shall be clearly displayed for each point, e.g. by changing color or flag.
7. The color of symbols representing equipment shall change color or become animated based on status of binary point to graphically represent on/off status.
8. On floor plan displays of spaces, temperature shall be graphically displayed by coloring the zone area in accordance with or similar to the following:

    a. Red: space temperature above cooling setpoint by 2°F (adj.) or more. This condition can be programmed to generate an alarm.
    b. Yellow: space temperature between cooling setpoint and 2°F (adj.) above setpoint.
    c. Green: space temperature between cooling and heating setpoints and space is in occupied mode.
    d. Gray: space temperature between cooling and heating setpoints and space is in unoccupied mode.
    e. Light blue: space temperature between heating setpoint and 2°F (adj.) below setpoint.
    f. Dark blue: space temperature below heating setpoint by 2°F (adj.) or more. This condition can be programmed to generate an alarm.

9. On floor plan displays of spaces, lighting shall be graphically displayed by coloring the lighting zone area in accordance with or similar to the following:

    a. Yellow: lights on by timed override.
    b. Red: lights on by manual override in lighting panel.
    c. Green: lights on by schedule.
    d. Gray: lights off.

10. Floor plans shall include final room names and room numbers as confirmed by the Using Agency. Room names and room numbers included in Construction Documents are not necessarily the final room names and room numbers. Division 23C Contractor shall be responsible for obtaining and confirming the final room names and room numbers from Using Agency. Changes to floor plan graphics resulting from wrong room names and room numbers shall be made at no additional charge to the Using Agency.

H. Graphics Development Package:

1. Graphic development and generation software shall be provided to allow the user to add, modify, or delete system graphic displays.
2. Provide capability to store graphic symbols in a symbol directory and incorporate these symbols into graphics.
3. Provide libraries of pre-engineered screens and symbols depicting standard air handling unit components (e.g. fans, cooling coils, filters, dampers, etc.), mechanical system components (e.g., pumps, chillers, cooling towers, boilers, etc.), complete mechanical subsystems (e.g. VAV reheat zone, etc.) and electrical symbols.
4. The Graphic Development Package shall use a mouse or similar pointing device to allow the user to perform the following:

    a. Define symbols
    b. Position items on graphic screens
    c. Attach physical or virtual points to a graphic
    d. Define background screens
    e. Define connecting lines and curves
    f. Locate, orient and size descriptive text
    g. Define and display colors for all elements
    h. Establish correlation between symbols or text and associated system points or other displays.
    i. Create hot spots or link triggers to other graphic displays or other functions in the software.

5. A single graphic file shall be used for common control applications (e.g. VAV box) so that any updates to the graphic may be done once and automatically applied to all applications. Displayed points shall be automatically populated based on “wild card” entry of point name in graphic definition.

I. Time and Schedules

1. Provide a time master that is installed and configured to synchronize the clocks of all BACnet devices supporting time synchronization. Synchronization shall be done using Coordinated Universal Time. All trend sample times shall be able to be synchronized. The frequency of time synchronization message transmission shall be selectable by the operator.
2. System shall automatically change time/date for Daylight Savings Time and leap years.
3. An operator (with password access) shall be able to define a Normal, Holiday or Override schedule for an individual piece of equipment or room, or choose to apply a hierarchical schedule to the entire system, site or floor “isolation” area. For example, Independence Day ‘Holiday’ for every level in the system would be created by clicking at the top of the geographic hierarchy defined in the Navigation Tree. No further operator intervention would be required and every control module in the system with would be automatically downloaded with the ‘Independence Day’ Holiday.
4. All schedules that affect the system/area/equipment highlighted in the Navigation Tree shall be shown in a summary schedule table and graph.
5. Schedules shall comply with the BACnet standard, (Schedule Object, Calendar Object, Weekly Schedule property and Exception Schedule property) and shall allow events to be scheduled based on:

    a. Types of schedule shall be Normal, Holiday or Override
    b. A specific date,
    c. A range of dates,
    d. Any combination of Month of Year (1-12, any), Week of Month (1-5, last, any), Day of Week (M-Sun, Any)
    e. Wildcard (example, allow combinations like second Tuesday of every month).

6. Schedule Categories: The system shall allow operators to define and edit scheduling categories (different types of “things” to be scheduled; for example, lighting, HVAC occupancy, etc.). The categories shall include: name, description, icon (to display in the hierarchy tree when icon option is selected) and type of value to be scheduled.
7. Schedule Groups: In addition to hierarchical scheduling, operators shall be able to define functional Schedule Groups, comprised of an arbitrary group of areas/rooms/equipment scattered throughout the facility and site. For example, the operator shall be able to define an ‘individual tenant’ group – who may occupy different areas within a building or buildings. Schedules applied to the ‘tenant group’ shall automatically be downloaded to control modules affecting spaces occupied by the ‘tenant group’
8. Partial Day Exceptions: Schedule events shall be able to accommodate a time range specified by the operator (example: board meeting from 6 pm to 9 pm overrides Normal schedule for conference room).
9. Schedule Summary Graph: The schedule summary graph shall clearly show Normal versus Holiday versus Override Schedules, and the net operating schedule that results from all contributing schedules. Note: In case of priority conflict between schedules at the different geographic hierarchy, the schedule for the more detailed geographic level shall apply.
10. Schedule Distribution: For reliability and performance, instead of maintaining a single schedule in a field device that writes over the network to notify other devices when a scheduled event occurs, field devices will only keep their part of the schedule locally. The EMCS server software shall determine which nodes a hierarchical schedule applies to and will create/modify the necessary schedule objects in each field device as necessary.

J. Events and Alarms

1. Events and alarms associated with a specific system, area, or equipment selected in the Navigation Tree, shall be displayed in the Action Pane by selecting an ‘Events’ view.
2. Events View: Each event shall display an Event Category (using a different icon for each event category), date/time of occurrence, current status, and event report. An operator shall be able to sort events, edit event templates and categories, acknowledge or force a return to normal in the Events View as specified in this section.
3. Event Categories (Alarm Levels): The operator shall be able to create, edit or delete event categories (alarm level). An icon shall be associated with each Event category, enabling the operator to easily sort through multiple events displayed. Alarm levels shall be initially configured by the Contractor as follows:

    a. Level 1: Critical/life safety
    b. Level 2: Significant equipment failure
    c. Level 3: Non-critical equipment failure/operation
    d. Level 4: Energy conservation monitor
    e. Level 5: Maintenance indication, notification.

4. BACnet Event Templates: BACnet Event template shall define different types of alarms and their associated properties. As a minimum, properties shall include a reference name, verbose description, severity of event, acknowledgement requirements, high/low limit and out of range information.
5. Event Areas (Actions): Each Event Categories (Alarm Level) shall be configured to specific Event Reporting Actions. For example, it shall be possible for an operator to assign all HVAC Maintenance events on the 1st floor of a building to email the technician responsible for maintenance. The Navigation Tree shall be used to setup Event Areas in the Graphic Pane. For initial setup, contractor shall configure events as follows:

    a. Levels 1 and 2: Print to alarm printer and page two engineers.
    b. Level 3: Print to alarm printer and email engineer responsible for building/system
    c. Levels 4 and 5: Email engineer responsible for building/system

6. Event Reporting Actions: Event Reporting Actions specified shall be automatically launched (under certain conditions) after an event is received by the EMCS server software. Operators shall be able to define these Reporting Actions using the Navigation Tree and Graphic Pane through the GUI. Reporting Actions shall be as follows:

    a. GUI dialog box: Provide visual and optional audible alarm indication. The alarm dialog box shall always become the top dialog box upon receipt of an alarm irrespective of the foreground application.
    b. Print: Alarm/Event information shall be printed to the any network accessible printer.
    c. Email: Alarm/Event information shall be via email to a POP3 address on the Using Agency's intranet or through this intranet to the internet.
    d. Page: Alarm/Event information shall be sent to alphanumeric pager either via modem or using email to internet alphanumeric paging services.
    e. File Write: The ASCII File write reporting action shall enable the operator to append operator defined alarm information to any alarm through a text file. The alarm information that is written to the file shall be completely definable by the operator. The operator may enter text or attach other data point information (such as AHU discharge temperature and fan condition upon a high room temperature alarm).
    f. Write Property: The write property reporting action updates a property value in a hardware module.
    g. Run External Program: The Run External Program reporting action launches specified program in response to an event.

7. Event Time/Date Stamp: All events shall be generated at the DDC control module level and comprise the Time/Date Stamp using the standalone control module time and date.
8. Event Configuration: Operators shall be able to define the type of events generated per BACnet object. A 'network' view of the Navigation Tree shall expose all BACnet objects and their respective Event Configuration. Configuration shall include assignment of event, alarm, type of Acknowledgement and notification for return to normal or fault status.
9. Event Summary Counter: The view of events in the Graphic Pane shall provide a numeric counter, indicating how many events are active (in alarm), require acknowledgement, and total number of events in the EMCS Server database.
10. Event Auto-Deletion: Events that are acknowledged and closed, shall be auto-deleted from the database and archived to a text file after an operator defined period. The file shall be stored in file on the CSS with no limit to quantity or age of alarms, other than limitations of hard disk. The file can be archived to tape and deleted by operator to clear disk space.
11. Data Format. The system shall allow for external systems to access the event instance data. Event data shall be stored and queried in the database in a relational manner. At a minimum, the fields to be stored in the database are:

    a. Event Source
    b. Event Generation Time
    c. Acknowledge Required Flag
    d. Delivery Priority
    e. BACnet Event Type
    f. Event Message Text
    g. BACnet Event Parameter
    h. Classification of Event
    i. Event Acknowledgement Time
    j. Return to Normal Time
    k. Operator Comments
    l. Who Acknowledged the Event

12. Event Simulator: The GUI user shall provide an Event Simulator to test assigned Reporting

Actions. The operator shall have the option of using current time or scheduling a specific time to generate the Event. Utilizing the Navigation Tree and drop-down menus in the Graphic Pane, the operator shall be able to select the Event Type, Status, Notification, Priority, Message, and whether acknowledgement is required.

K. Trends

1. Trending and trend analysis capabilities are considered critical to system performance. The system shall be designed to upload and record large amounts of point data without causing network bottlenecks or affecting proper system operation. A separate server (Historical Trend Server) shall be provided (see Section 23 09 16) in order to reduce network traffic to and disk activity on the CSS. The system as a whole shall be designed to comply with the trending capability test defined in Section 23 09 33.
2. Every point, both real and virtual, shall be available for data trending.
3. Trending software shall be capable of recording point values and time on a user specified regular time step and on a change-of-value (COV) basis (data is recorded when point changes by a specified amount for analog points or by changes of state for binary points), at the user's option. Sampling intervals shall be as small as one second. Each trended point shall have the ability to be trended at a different sampling interval.
4. Trend data shall be sampled and stored in control panel memory (see Section 23 09 19). If historical trending is enabled for the BACnet object, trend data shall be uploaded from control panels to the THS on a user-defined interval, manual command, or automatically when the trend buffer becomes full.. There shall be no limit to the amount of trend data stored at the THS other than hard disk limitations.
5. Trends shall conform to the BACnet Trend Log Object specification. Trends shall both be displayed and user configurable through the GUI. Trend logs may comprise analog, digital or calculated points simultaneously. A trend log's properties shall be editable using the Navigation Tree and Graphic Pane.
6. Viewing Trends:

    a. Trend data shall be displayed graphically by the GUI. This shall be a capability internal to the workstation software and not a capability resulting from download of trend data on a third-party spreadsheet program unless such transfer is automatic and transparent to the operation and the third-party software is included with the workstation software package.
    b. The software shall be capable of dynamically graphing the trend logged object data by creating two-axis (x, y) graphs that simultaneously display values relative to time for at least eight objects in different colors, even if objects have been trended at different time intervals. Where trended values are COV, software shall automatically fill the trend samples between COV entries. A graph legend shall identify each variable plotted.
    c. Multiple scales shall be possible, one for each object, with range set automatically by the software but capable of being manually adjusted by the operator.
    d. Trend format, displayed points, etc. shall be capable of being saved as a template for future trend displays.
    e. Trends shall be able to dynamically update at operator-defined intervals, including on a 1 second interval for loop tuning.
    f. It shall be possible to zoom-in on a particular section of a trend for more detailed examination and 'pan through' historical data by simply scrolling the mouse.
    g. It shall be possible to pick (or float mouse over) any sample on a trend and have the numerical value displayed.
    h. The operator shall have the ability to pan through a historical trend and copy the data viewed to the clipboard using standard Windows keystrokes.

7. Trend Data Storage

a. The database shall allow applications to access the data while the database is running. The database shall not require shutting down in order to provide read-write access to the data. Data shall be able to be read from the database without interrupting the continuous storage of trend data being carried by the EMCS.
b. Provide a single licensed copy of Microsoft SQL Server and install on the THS.
c. Data shall be accessible to off-site SQL compliant database software through the Using Agency intranet and/or internet.

L. Security Access

1. Security access from the GUI to EMCS servers shall require a Login Name and Password.
2. Access to different areas of the EMCS shall be defined in terms of roles and geographic area of responsibility as specified:
3. Roles shall reflect the actual roles of different types of operators. Roles shall be defined in terms of View, Edit and Function Privileges.

    a. View Privileges: Navigation, Network, and Configuration Trees, Operators, Roles and Privileges, Alarm/Event Template and Reporting Action.
    b. Edit Privileges: Setpoint, Tuning and Logic, Manual Override, and Point Assignment Parameters.
    c. Function Privileges: Alarm/Event Acknowledgement, Control Module Configuration, Memory Download, and Upload, Schedules, Schedule Groups, Manual Commands, Print, and Alarm/Event Maintenance.

4. Roles shall be geographically assigned using a similar expandable/collapsible navigation tree. For example, it shall be possible to assign two HVAC Technicians with similar competencies (and the same operator defined HVAC Role) to different areas of the system.
5. Each operator shall automatically be logged off of the system if no keyboard or mouse activity is detected for an adjustable period of time. This auto logoff time shall be set individually per operator.
6. Provide an audit trail of actions taken by any user, including the user name and time. Store in secure file in database format on the CSS. Provide software to view and print audit trail.

M. Report Software

1. Provide software to create standard and custom reports of point status, alarms, etc. Report format, displayed points, time period (daily, weekly, monthly, or annual), etc. shall be capable of being saved as a template for future reports. Reports shall be time and date stamped and shall contain a report title editable by the user.
2. Reports shall be capable of being sent to a printer or export to Word or ASCII format to a file, and shall be capable of being generated automatically based on date and time of day.
3. Standard reports. Prepare the following standard reports for each building and the Using Agency as a whole, accessible automatically without requiring definition by user:

    a. Tenant after-hour usage. System must be capable of monitoring tenant override requests and generating a monthly report showing the daily total time in hours that each tenant has requested after-hours HVAC services.
    b. Monthly and annual energy usage and cost. See Utility cost calculation in Section 23 09 29.
    c. Alarm events and status.
    d. Points in “hand” (operator override) via Workstation command (including name of operator who made the command) or via supervised HOA switch at output, including date and time.
    e. Position reset: Where zones or system valve or damper positions are used to reset supply air/water temperature or differential pressure setpoints:

(1) EMCS shall record the following on an hourly basis: the descriptors of the zones/systems that have dampers/valves at the highest cooling/heating position, i.e. the control point that is being used in the reset loop. The information shall be accumulated in a report format for periodic printing upon operator command.
(2) Configure a tabular report using real-time or trend data with the following column headings: ZONE [SYSTEM] DESCRIPTION, VALVE [DAMPER] POSITION (0 to 100%), LOOP OUTPUT %, [CHWST, CHWDP, SAT, etc.] SETPOINT. At the top of the table, list building number, floor or area description if applicable, air handling unit or HW/CHW pump system designation.

2.3 CONTROL PROGRAMMING SOFTWARE

A. Points

1. Provide templates customized for point type, to support input of individual point information using standard BACnet Objects, including long-name field
2. All real and virtual points shall be accessible to any control panel for use in any control sequences regardless of physical location.

B. Programming Language

1. All controllers must be fully user-programmable using a single programming language for all control devices. Use of “canned” (preprogrammed, burned-in) software is not acceptable.
2. The control programming language must allow virtually any control sequences to be written. Software shall be capable of the sequences specified in Section 23 09 29 without exception.
3. All custom programs shall be modifiable from Operator Workstations without having to “burn chips”. Software shall allow the user to modify and input control sequence software and to download to panels via the control network or modem.
4. The programming language shall support floating point arithmetic using the following operators and functions: +, -, /, x, square root, and x-to-the-y-power, natural log, log, trigonometric functions (sine, cosine, etc.), absolute value, minimum/maximum value from a list of values, and psychrometric parameters (wetbulb, dewpoint, and enthalpy) from temperature and relative humidity.
5. The programming language shall have predefined variables that represent time of day, day of the week, month of the year, and the date. Other predefined variables shall provide elapsed time in seconds, minutes, hours, and days. These elapsed time variables shall be able to be reset by the language so that interval timing functions can stopped and started within a program.
6. The system must be capable of supporting software (“virtual”) points to be used in control sequences and monitored just as if they were real digital or analog points.
7. Control programming shall employ the BACnet protocols for Standard Command Priorities.
8. A PID (proportional-integral-derivative) algorithm with adjustable gains and anti-windup shall be included as an integral part (subroutine) of the programming language, not requiring special programming or hardware.
9. The programming language shall be graphical. BASIC-like or other line- or block-type programming languages are not acceptable. With the graphical programming language, a sequence of operations shall be created by drag-and-drop assembling on screen of graphic blocks that represent each of the commands or functions necessary to complete a control sequence. Blocks represent common logical control devices such as relays, switches, high signal selectors, PID loops, optimum start, etc. Blocks are then interconnected on screen using graphic "wires," each forming a logical connection. Once assembled, each logical grouping of graphic blocks and their interconnecting wires then forms a graphic function block which may be used to control any piece of equipment with a similar point configuration

and sequence of operation.

10. The graphic programming software shall support a 'live' mode, where all input/output data, calculated data, and setpoints shall be displayed in a 'live' real-time mode. For each piece of HVAC equipment, the entire graphic program shall be displayed through the GUI. The operator must have the ability to scroll through the entire 'live' graphic program as necessary.

C. Debugging software:

1. Provide a search capability that will search all control sequences for a given point name to determine all sequences that use or control the point.
2. The control programs shall be capable of being tested on-line or off-line (prior to installation in field panels). The program and results of programming tests shall be displayed graphically using graphical programming language with parameter values displayed in appropriate locations. Simulation capabilities shall include step-by-step, accelerated time, and operator defined simulation criteria like outside weather, demand, and communication status.

2.4 OCCUPANT INTERFACE SOFTWARE

A. The intent of this software is to allow occupants to use web browsers to access the EMCS through the Occupant Interface Server in Control Room. Capabilities shall include the following:

1. Override schedules for off-hour use of lighting and HVAC
2. View system status, such as any system-wide faults or other announcements
3. Change zone setpoints

B. Performance

1. Occupants will access the system using a web browser to an EMCS home page that will ask for user name and password. The system will be initially set up only to allow employees to have access. This may be expanded to students in the future.
2. User name will link the occupant to a location via an interface to the Using Agency's employee (and future student) database. For employees, the link will indicate department and classroom locations.
3. The user name link will allow access to the graphic of the floor plan of the employee's department and associated classrooms.
4. Through special hyperlinks, the user will be able to override schedules, change setpoints, etc. in the areas for which they are granted access.

C. Any number of occupants may have access to the system at any time.

D. Work shall include coordinating with the Using Agency's employee database system to define the fields necessary for this system to operate.

2.5 MISCELLANEOUS SOFTWARE:

A. Provide a context-sensitive, on-line help system to assist the operator in operating and editing the system. On-line help shall be available for all applications and shall provide relevant data for the application or object that help is being called from.

B. Provide software for viewing (but not editing) electronic versions of as-built shop drawings of:

1. Mechanical, electrical, and plumbing systems in AutoCAD Release 14 or 2000+ format.
2. EMCS drawings in format selected by contractor (see limitations in Section 23 09 00).

PART 3 - EXECUTION

3.1 SYSTEM CONFIGURATION

A. Contractor shall thoroughly and completely configure EMCS system software, supplemental software, network software etc. on CSS, POTs, and servers.

3.2 POINT STRUCTURING AND NAMING

A. The intent of this section is to require a consistent means of naming points across the Campus EMCS. Contractor shall configure the systems from the perspective of the Campus EMCS, not solely the local project. The following requirement establishes a standard for naming points and addressing Buildings, Networks, Devices, Instances, etc.

B. Point Summary Table

1. The term 'Point' includes all physical I/O points, virtual points, and all application program parameters.
2. With each schematic, Contractor shall provide a Point Summary Table listing:

    a. Building number and abbreviation
    b. System type
    c. Equipment type
    d. Point suffix
    e. Full point name (see Point Naming Convention paragraph)
    f. Point description
    g. Ethernet backbone network number,
    h. Network number
    i. Device ID
    j. Device MAC address
    k. Object ID (object type, instance number)
    l. Engineering units.
    m. Device make and model #. Include range of device if model number does not so identify.
    n. Device physical location description. Include floor and column line intersection to one decimal place (e.g. line 6.2 and line A.3).

3. Point Summary Table shall be provided in both hard copy and in a relational database electronic format (ODBC-compliant).
4. The EMCS Contractor shall coordinate with the Using Agency's representative and compile and submit a proposed Point Summary Table for review prior to any object programming or project startup.
5. The Point Summary Table shall be kept current throughout the duration of the project by the Contractor as the Master List of all points for the project. Project closeout documents shall include an up-to-date accurate Point Summary Table. The Contractor shall deliver to the Using Agency the final Point Summary Table prior to final acceptance of the system. The Point Summary Table shall be used as a reference and guide during the commissioning process.

C. Point Naming Convention

1. All point names shall adhere to the format as established below, unless otherwise agreed to

by the Using Agency. New categories and descriptors may be created with approval of the Using Agency.

2. Format:

   a. Building.Category.System.EquipmentTag.Component.Property.
   b. Example: 001LIB.HVAC.Heatplant.B-1.HWS.Temperature

Building	Category	System	Equipment Tag	Component	Property	Typical units
Building number	ELCT	Lighting Plug Generator MIsc	(from equipment schedules)	SWITCH PHOTO CB CWS CWR HWS HWR CHWS CHWR OA SA RA EA GAS FLUID	Command Status Light Power Voltage Current ValvePos DamperPos Temperature Humidity Pressure Flow Energy Speed Signal	On/off On/off Footcandles Watts Volts Amps %open %open °F %RH Psig, " H_2O Cfm, gpm Btu %, Hz Hz
	HVAC	Air handling Exhaust Heatplant Coolplant Misc				
	PLMB	Dom water Air Nat gas N2 O2 Irrigation Waste Misc				
	MISC	Weather				

D. Device Addressing Convention:

1. BACnet network numbers and Device Object IDs shall be unique throughout the network.
2. All assignment of network numbers and Device Object IDs shall be coordinated with the Using Agency.
3. Each Network number shall be unique throughout all facilities and shall be assigned in the following manner unless specified otherwise:

   BBBFF, where: BBB = 1-655 assigned to each building, FF = 00 for building backbone network, 1-35 indicating floors or separate systems in the building.

4. Each Device Object Identifier property shall be unique throughout the system and shall be assigned in the following manner unless specified otherwise:

   XXFFBBB, where: XX = number 0 to 40, FF = 00 for building backbone network, 1-35 indicating floors or separate systems in the building. BBB = 1-655 assigned to each building.

5. The EMCS Contractor shall coordinate with the Using Agency or a designated representative to ensure that no duplicate Device Object IDs occur.
6. Alternative Device ID schemes or cross project Device ID duplication if allowed shall be approved before project commencement by the Using Agency.

E. I/O Point Physical Description

1. Each point associated with a hardware device shall have its BACnet long-name point description field filled out with:

   a. The device manufacturer and model #. Include range of device if model number does not so identify.
   b. For space sensors (temperature, CO_2, etc.), include room number in which sensor is located.

3.3 POINT PARAMETERS

A. Provide the following minimum programming for each analog input:

1. Name
2. Address
3. Scanning frequency or COV threshold
4. Engineering units
5. Offset calibration and scaling factor for engineering units
6. High and low alarm values and alarm differentials for return to normal condition
7. High and low value reporting limits (reasonableness values), which shall prevent control logic from using shorted or open circuit values.
8. Default value to be used when the actual measured value is not reporting. This is required only for points that are transferred across the primary and/or secondary controlling networks and used in control programs residing in control units other than the one in which the point resides. Events causing the default value to be used shall include failure of the control unit in which the point resides, or failure of any network over which the point value is transferred.
9. Selectable averaging function that shall average the measured value over a user selected number of scans for reporting.

B. Provide the following minimum programming for each analog output:

1. Name
2. Address
3. Output updating frequency
4. Engineering units
5. Offset calibration and scaling factor for engineering units
6. Output Range
7. Default value to be used when the normal controlling value is not reporting.

C. Provide the following minimum programming for each digital input:

1. Name
2. Address
3. Engineering units (on/off, open/closed, freeze/normal, etc.)
4. Debounce time delay
5. Message and alarm reporting as specified
6. Reporting of each change of state, and memory storage of the time of the last change of state
7. Totalization of on-time (for all motorized equipment status points), and accumulated number of off-to-on transitions.

D. Provide the following minimum programming for each digital output:

1. Name
2. Address
3. Output updating frequency
4. Engineering units (on/off, open/closed, freeze/normal, etc.)
5. Direct or Reverse action selection
6. Minimum on-time
7. Minimum off-time
8. Status association with a DI and failure alarming (as applicable)
9. Reporting of each change of state, and memory storage of the time of the last change of state.
10. Totalization of on-time (for all motorized equipment status points), and accumulated number of off-to-on transitions.
11. Default value to be used when the normal controlling value is not reporting.

3.4 SITE-SPECIFIC APPLICATION PROGRAMMING

A. All site specific application programming shall be written in a manner that will ensure programming quality and uniformity among the various buildings. The EMCS Contractor will ensure:

1. Programs for all buildings are developed by one programmer, or a small group of programmers with rigid programming standards, to ensure a uniform style.
2. Programs for like functions are identical, to reduce debugging time and to ease maintainability.
3. Programs are thoroughly debugged before they are installed in the field.

B. Massage and tune application programming for a fully functioning system. It is the Contractor's responsibility to request clarification on sequences of operation that require such clarification.

C. All site-specific programming shall be fully documented and submitted for review and approval:

1. Prior to downloading into the panel (see Submittal Package 2 in Section 23 09 00.)
2. At the completion of functional performance testing, and
3. At the end of the warranty period (see Warranty Maintenance in Section 23 09 00).

D. All programming, graphics and data files must be maintained in a logical system of directories with self-explanatory file names. All files developed for the project will be the property of the Using Agency and shall remain on the workstations/servers at the completion of the project.

3.5 GRAPHIC SCREENS

A. All site specific graphics shall be developed in a manner that will ensure programming quality and uniformity among the various buildings.

B. Schematics of MEP systems.

1. Schematics shall be 2-D (or 3-D) and shall be based substantially on the schematics provided on design drawings.
2. All relevant I/O points and setpoints being controlled or monitored for each piece of equipment shall be displayed with the appropriate engineering units. Animation or color changes shall be used to indicate on/off status of mechanical components. Include appropriate engineering units for each displayed point value. Verbose names (English language descriptors) shall be included for each point on all graphics; this may be accomplished by the use of a pop-up window accessed by selecting the displayed point with

the mouse.

3. Animation or equipment graphic color changes shall be used to indicate on/off status of mechanical components.
4. Indicate all adjustable setpoints and setpoint high and low limits (for automatically reset setpoints), on the applicable system schematic graphic or, if space does not allow, on a supplemental linked-setpoint screen.

C. Displays shall show all points relevant to the operation of the system, including setpoints and setpoint limits for setpoints that are automatically reset.

D. The current value and point name of every I/O point and setpoint shall be shown on at least one graphic and in its appropriate physical location relative to building and mechanical systems.

E. Show weather conditions (local building outside air temperature ands humidity, wind speed, and wind direction) in the upper left hand corner of every graphic.

F. CAD Files: The contract document drawings will be made available to the Contractor in AutoCAD Release 14 or 2000+ format upon request for use in developing backgrounds for specified graphic screens, such as floor plans and schematics. However the Using Agency does not guarantee the suitability of these drawings for the Contractor’s purpose.

G. Provide graphics for the following as a minimum:

1. Campus homepage. Background shall be a campus map, approximately to scale. Include links to each building, central plant, domestic water pumping station, etc. Include real-time site utility data such as: building electrical demand, domestic cold water flow, and natural gas demand shown roughly on the map where the utilities connect to the site. Also include kW demand limit values and demand limit level.
2. Building homepage. Background shall be a bldg footprint, approximately to scale, oriented as in the campus homepage. Include links to each floor and mechanical room/roof, and to summary graphics described below. Include real-time building utility data such as: building electrical demand, chilled water demand (flow and Btu/h), hot water demand (flow and Btu/h), domestic cold water demand, steam demand (if applicable), and natural gas demand (if applicable) shown roughly on the building footprint where the utilities connect to the building.
3. Each occupied floor plan, to scale.

    a. HVAC. Floor plan graphics shall show heating and cooling zones throughout the buildings in a range of colors, which provide a visual display of temperature relative to their respective setpoints (see paragraph 2.2G.8). The colors shall be updated dynamically as a zone's actual comfort condition changes. In each zone, provide links to associated terminal equipment.
    b. Lighting. Floor plan graphics shall show lighting control zones throughout the buildings in a range of colors, which provide a visual display of temperature relative to their respective setpoints (see paragraph 2.2G.9). The colors shall be updated dynamically as a zone's actual lighting condition changes. In each zone, provide links to associated lighting panel screen to allow manual overrides.
    c. If multiple floor plans are necessary to show all areas, provide a graphic building key plan. Use elevation views and/or plan views as necessary to graphically indicate the location of all of the larger scale floor plans. Link graphic building key plan to larger scale partial floor plans. Provide links from each larger scale graphic floor plan screen to the building key plan and to each of the other graphic floor plan screens.

4. Each equipment floor/roof plan, to scale, with links to graphics of all DDC controlled/monitored equipment.

5. Each air handler and fan-coil. Provide link to associated HW and CHW pumping stations where applicable.
6. Each zone terminal. Provide link to associated air handling unit where applicable and to floor plan where terminal is located..
7. Each pumping building station. Provide link to central plant for heating and cooling systems.
8. Potable water pumping plant and irrigation meter.
9. Lighting panels. Indicate status of each relay and provide links to allow overrides.
10. Electrical power monitoring system.

    a. Site: Show site single line diagram up to each building ATS, in order to illustrate the 12 KV power distribution and connection of each building to one of the two site circuits. The power flow would change on the diagram (by changing line color and/or width) to show which power line is active into each building as the ATS position is changed. Show ATS status at each building and a link to each building's electrical system graphic.
    b. For each building: Show a schematic of the electrical system based on one-line diagrams. Show status and power of each switch, breaker, meter, etc. and override buttons for overriding switch positions.

11. Central plant equipment including chilled water system, cooling tower system, hot water system, steam system, generators, etc. The flow path shall change on the diagram (by changing piping line color and/or width) to show which piping has active flow into each boiler, chiller, tower, etc. as valve positions change.
12. Weather station. Show actual, daily, month-to-date, year-to-date, and historical high and low peaks and average temperature, humidity, wind speed, wind direction (average only), and solar radiation.
13. Summary graphics. Provide a single text-based page (or as few as possible) for each of the following summary screens showing key variables listed in columns for all listed equipment:

    a. For each building:

        (1) Air handling units: operating mode, on/off status, supply air temperature, supply air temperature setpoint, fan speed, duct static pressure, duct static pressure setpoint, outdoor air damper position, coil valve positions
        (2) Zone terminal units: operating mode, airflow rate, zone temperature, zone temperature setpoint, damper position, supply air temperature (reheat boxes), supply air temperature setpoint (reheat boxes), fan status (fan-powered boxes), fume hood status and exhaust airflow rate (laboratory).
        (3) Electrical meters and switches: Volts, current, kW, switch positions.

    b. For campus:

        (1) Building bridge connections (chilled and hot water): building pump on/off status, pump speed, supply water temperature before and after bridge, return water temperature, differential pressure across bridge, strainer differential pressure, primary system valve position, flow rate
        (2) Utility summary for each building: building electrical demand, chilled water demand (flow and Btu/h), hot water demand (flow and Btu/h), domestic cold water demand, steam demand (if applicable), and natural gas demand (if applicable).

14. All other DDC controlled/monitored equipment.

H. Alarms: Each programmed alarm shall appear on at least one graphic screen. In general, alarms shall be displayed on the graphic system schematic screen for the system that the alarm is

associated with (for example, chiller alarm shall be shown on graphic cooling system schematic screen). For all graphic screens, display analog values that are in a 'high alarm' condition in a red color, 'low alarm' condition in a blue color. Indicate digital values that are in alarm condition in a red color.

3.6 POT SOFTWARE

A. Direct Panel Access:

1. One of the POTs shall be configured to access BCs and AACs by directly connecting to these panels without having to connect to the CSS via the network. The purpose of this requirement is to provide access to building EMCS panels in case the Supervisory LAN is down.
2. At the end of commissioning and then again at the end of the warranty period, fully synchronize the database on this POT with that on the CSS.

B. Temporary Interface prior to Acceptance

1. Point database and control programming shall not be installed on and merged with that on the CSS until the system is fully commissioned and accepted by the Using Agency. During this phase, the Contractor shall provide a temporary POT configured with proper software for this purpose, connected to the EMCS locally at the building.
2. Once the EMCS has been accepted by the Using Agency, merge the database and control programming with existing systems on the CSS.

C. TAB Coordination:

1. Software shall be provided free of charge on at least a temporary basis to the TAB contractor to allow them to calibrate terminal box airflow controls and other work specified under Section 23 05 93 Testing, Adjusting, and Balancing.
2. Software may be provided for installation on POT provided by TAB contractor or Contractor shall loan a POT or hand held device with software installed to the TAB contractor for the duration of TAB work.
3. Provide sufficient training to the TAB contractor to allow them to use the software for balancing and airflow calibration purposes. Contractor shall include a single training session; additional training due to changes in TAB personnel shall be paid for by the TAB contractor.

END OF SECTION 23 09 26

SECTION 23 09 29 – EMCS POINTS AND SEQUENCE OF OPERATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. These heating, ventilating and air conditioning (HVAC) provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.2 WORK INCLUDED

A. This Section defines:

1. Real I/O points connected to the EMCS.
2. Sequence of operation of all controlled systems.

1.3 RELATED WORK AND REQUIREMENTS

A. Section 23 09 90 Energy Management and Control System (EMCS) − General

B. Section 23 09 13 EMCS Basic Materials and Devices

C. Section 23 09 16 EMCS Operator Interfaces

D. Section 23 09 19 EMCS Field Panels

E. Section 23 09 23 EMCS Communication Devices

F. Section 23 09 26 EMCS Software and Programming

G. Section 23 05 93 Testing, Adjusting, and Balancing

PART 2 - PRODUCTS

2.1 CONTROL POINTS

A. Table Column Definitions

1. Point description
2. Type (number in point schedule after each type refers to tag on schematics)

    a. AO: analog output
    b. AI: analog input
    c. DO: digital or binary output
    d. DI: digital or binary input

3. Device description

4. Trend Logging

    a. Commissioning. Where listed, point is to be trended at the basis listed for commissioning and performance verification purposes. Trend may be deactivated after acceptance.
    b. Continuous. Where listed, point is to be trended at the basis listed continuously, initiated after system acceptance, for the purpose of future diagnostics.
    c. Trend Basis:

        1) Where range of engineering units is listed, trend on a change of value (COV) basis (i.e. record time stamp and value when point value changes by engineering unit listed)
        2) Where time interval is listed, trend on a time basis (i.e. record time stamp and value at interval listed). All points relating to a specific piece of equipment shall be trended at the same initiation time of day so data can be compared in text format.

5. Calibration

    a. F = factory calibration only is required (no field calibration)
    b. HH = field calibrate with handheld device. See Calibration in Section 23 09 33.
    c. DB = field calibrate with a drywell bath. See Calibration in Section 23 09 33.

B. Note that points lists below are for <u>each</u> system of like kind. Refer to drawings for quantity of each.

C. Points mapped through gateways and network interfaces

1. Variable speed drives (typical of VFD driven fans and pumps): The following points shall be mapped over from the VFD network card as a minimum for each pump and fan that has a variable speed drive. (Note VFD start/stop and speed are hardware points as indicated in points list below and shall not be mapped through the gateway.)

Description	Type	Device	Trend Logging		Calibration
			Comm-issionng	Contin-uous	
Fault reset	DO	Through network	COV	COV	–
On/off status	DI	Through network	COV	COV	–
Fault (Critical Alarm)	DI	Through network	COV	COV	–
Minor Alarm	DI	Through network	COV	COV	-
Fault Text	DI	Through network (convert code to plain English text)	COV	COV	-
Alarm Text	DI	Through network (convert code to plain English text)	COV	COV	-
Keypad in hand/auto	DI	Through network	COV	COV	-
Minimum frequency setpoint	AO	Through network	±5%	±5%	-
Maximum frequency setpoint	AO	Through network	±5%	±5%	-
Acceleration rate	AO	Through network	±5%	±5%	-
Deceleration rate	AO	Through network	±5%	±5%	-
Actual frequency	AI	Through network	1 min	15 min	-
AC output voltage	AI	Through network	±10%	±10%	-

Description	Type	Device	Trend Logging		Calibra-tion
			Comm-issionng	Contin-uous	
Current	AI	Through network	15 min	60 min	F
VFD temperature	AI	Through network	60 min	60 min	F
Power, kW	AI	Through network	1 min	15 min	F
Energy, MWh	AI	Through network	15 min	60 min	-
DC Bus Voltage	AI	Through network	±10%	±10%	F

2. Emergency Generator Monitoring

   a. See electrical drawings and specifications for gateway connection points and the number of points that must be mapped over.

3. Electrical System Monitoring

   a. See electrical drawings and specifications for location of gateway connection points and the number of points that must be mapped over.
   b. The following table lists the trend logging requirements for each point mapped from the electrical system monitoring gateways.

Description	Type	Device	Trend Logging		Calibra-tion
			Comm-issionng	Contin-uous	
Real kW	AI	Through network	15 min	60 min	–
Consumption kWh	AI	Through network	15 min	60 min	–
Volts (each phase)	AI	Through network	±10%	±10%	–
Power Factor	AI	Through network	±10%	±10%	–
Amps (each phase)	AI	Through network	-	-	-

D. Hard-wired Points

1 VAV AHU (in addition to points mapped over from VFDs)

Description	Type	Device	Trend Logging		Calibra-tion
			Comm-issioning	Contin-uous	
Supply Fan Start/Stop	DO	Connect to VFD “Run”	COV	60 min	–
Relief Fan Start/Stop	DO	Connect to VFD “Run”	COV	60 min	
Relief Bypass Damper	DO	Two-Position Actuator	COV	-	-
OA Bypass Damper	DO	Two-Position Actuator	COV	-	-
Relief Fan Damper	DO	Two-Position Actuator	COV	-	-
Energy Wheel Start/Stop	DO	Dry Contact to 120V or 24V control circuit	COV	COV	
Energy Wheel Status	DI	CS-1	COV	COV	-
Water Sensor	DI	WS-1	COV	COV	-
OA Damper	AO	Modulating Actuator	1 min	60 min	-

Return Air Damper	AO	Modulating Actuator	1 min	60 min	-
HW Valve Signal	AO	Modulating 2-way valve	1 min	60 min	-
CHW Valve Signal	AO	Modulating 2-way valve	1 min	60 min	-
Supply Fan Speed	AO	Connect to VFD “Speed”	1 min	60 min	-
Relief Fan Speed	AO	Connect to VFD “Speed”	1 min	60 min	
Filter DP	AI	DPT-3A, 0 to 1”	1 min	60 min	-
OA Flow Rate	AI	AFMS-1	1 min	60 min	F
OA Temp	AI	AFMS-1	1 min	60 min	
Relief Air Lvg Temp	AI	TS-1B	1 min	60 min	-
RA Temp	AI	TS-1A	1 min	60 min	-
SA Temp	AI	TS-1A	1 min	60 min	-
OA Temp	AI	TS-1B	1 min	60 min	-
Mixed Air Temp	AI	TS-1B	1 min	60 min	-
HW Lvg Air Temp	AI	TS-1B	1 min	60 min	-
Duct Static	AI	DPT-3A, 0 to 2 inches	1 min	60 min	-
Building Static	AI	DPT-4A, -0.5 to 0.5 inches	1 min	60 min	-

2 Fan Coil Units

Description	Type	Device	Trend Logging		Calibra-tion
			Comm-issioning	Contin-uous	
Supply Fan Start/Stop	DO	Dry contact to ECM or Dry contact to 120V starter control circuit (coordinate with final equipment submittal)	COV	COV	–
Local Override	DI	TS-3C	COV	COV	–
CHW Valve Signal	AO	Modulating 2-way valve	1 min	60 min	–
HW Valve Signal	AO	Modulating 2-way valve	1 min	60 min	–
Fan Speed Status	AI/DI	From ECM or CS-1 (coordinate with final equipment submittal)	1 min	60 min	–
Supply air temperature	AI	TS-1A	1 min	60 min	–
Zone Temperature Setpoint Adjustment	AI	TS-3C	15 min	60 min	–
Zone Temperature	AI	TS-3C	1 min	60 min	–

3 VAV Box with reheat

Description	Type	Device	Trend Logging		Calibra-tion
			Comm-issioning	Contin-uous	
VAV Box Damper Positions	AO (or two DOs and an AI)	Modulating (or floating with position feedback) actuator	1 min	60 min	–
HW valve signal	AO	Modulating 2-way valve	1 min	60 min	
Local Override	DI	TS-3C	COV	COV	

Description	Type	Device	Trend Logging		Calibra-tion
			Comm-issioning	Contin-uous	
Occupancy Sensor	DI	OCC (By DIV 26, where indicated on Drawings)	COV	COV	-
Supply Airflow	AI	DPT-5 connected to box manufacturer supplied flow ring or cross	1 min	60 min	-
Supply air temperature	AI	TS-1A	1 min	60 min	-
Zone Temperature Setpoint Adjustment	AI	TS-3C	15 min	60 min	
Zone Temperature	AI	TS-3C	1 min	60 min	-
Zone CO2 Concentration	AI	CO2-1 (where indicated on Drawings)	1 min	60 min	-
Zone Humidity	AI	HS-1 (where indicated on Drawings)	1 min	60 min	-

4 Exhaust Fans – EMCS time-of-day controlled (includes fan controlled by motion detector)

Description	Type	Device	Trend Logging		Calibra-tion
			Comm-issioning	Contin-uous	
Exhaust Fan Start/Stop	DO	Dry Contact to 120V or 24V control circuit	COV	COV	–
Exhaust Fan Status	DI	CS-1	COV	COV	

5 Exhaust Fans – temperature controlled

Description	Type	Device	Trend Logging		Calibra-tion
			Comm-issioning	Contin-uous	
Exhaust Fan Start/Stop	DO	Dry Contact to 120V or 24V control circuit	COV	COV	–
Exhaust Fan Status	DI	CS-1	COV	COV	-
Zone Temperature	AI	TS-3A	1 min	60 min	-

6 Exhaust Fans – Crawlspace ventilation fan

Description	Type	Device	Trend Logging		Calibra-tion
			Comm-issioning	Contin-uous	
Exhaust Fan Start/Stop	DO	Dry Contact to 120V or 24V control circuit	COV	COV	–

Description	Type	Device	Trend Logging		Calibra-tion
			Comm-issioning	Contin-uous	
Exhaust Fan Status	DI	CS-1	COV	COV	-
Zone Humidity	AI	HS-1	1 min	60 min	-

7 Hot Water System (in addition to points mapped over from VFDs)

Description	Type	Device	Trend Logging		Calibra-tion
			Comm-issioning	Contin-uous	
HWP Start Stop	DO	Connect to VFD “Run”	COV	COV	–
HWP Speed	AO	Connect to VFD “Speed”	1 min	60 min	-
HW Valve	AO	Modulating 2-way valve	1 min	60 min	-
HWS Temp (Bldg. Side)	AI	TS-2C	1 min	60 min	-
HWR Temp (Bldg. Side)	AI	TS-2C	1 min	60 min	-
HWS Temp (Loop Side)	AI	TS-2C	1 min	60 min	-
HWR Temp (Loop Side)	AI	TS-2C	1 min	60 min	-
HW Flow (Bldg. Side)	AI	FM-1	1 min	60 min	F
HW Flow (Loop Side)	AI	FM-1	1 min	60 min	F
HW DP (Bldg. Side)	AI	DPT-1, 0 to 15 psi	1 min	60 min	-
HW DP (Loop Side)	AI	DPT-1, 0 to 15 psi	1 min	60 min	-
HW Loop Pressure	AI	P-1, 0 to 100 psi	1 min	60 min	-

8 Chilled Water System (in addition to points mapped over from VFDs)

Description	Type	Device	Trend Logging		Calibra-tion
			Comm-issioning	Contin-uous	
CWP Start Stop	DO	Connect to VFD “Run”	COV	COV	–
CWP Speed	AO	Connect to VFD “Speed”	1 min	60 min	-
CHW Valve	AO	Modulating 2-way valve	1 min	60 min	-
CWS Temp (Bldg. Side)	AI	TS-2C	1 min	60 min	-
CWR Temp (Bldg. Side)	AI	TS-2C	1 min	60 min	-
CWS Temp (Loop Side)	AI	TS-2C	1 min	60 min	-
CWR Temp (Loop Side)	AI	TS-2C	1 min	60 min	-
CHW Flow (Bldg. Side)	AI	FM-1	1 min	60 min	F
CHW Flow (Loop Side)	AI	FM-1	1 min	60 min	F
CHW DP (Bldg. Side)	AI	DPT-1, 0 to 15 psi	1 min	60 min	-
CHW DP (Loop Side)	AI	DPT-1, 0 to 15 psi	1 min	60 min	-
CHW Loop Pressure	AI	P-1, 0 to 100 psi	1 min	60 min	-

9 Hot Water Unit Heater

Description	Type	Device	Trend Logging		Calibra-tion
			Comm-issioning	Contin-uous	

Description	Type	Device	Trend Logging		Calibra-tion
			Comm-issioning	Contin-uous	
Fan Start/Stop	DO	Dry Contact to 120V or 24V control circuit	COV	COV	–
HW Valve	DO	Two position actuator	COV	COV	–
Fan Status	DI	CS-1	COV	COV	–
Zone Temperature	AI	TS-3A	1 min	60 min	–

10 Ductless Split Systems

Description	Type	Device	Trend Logging		Calibra-tion
			Comm-issioning	Contin-uous	
Unit Enable/Disable	DO	Dry Contact to 120V or 24V control circuit	COV	COV	–
Zone Temperature	AI	TS-3A	1 min	60 min	-

11 Domestic water flow

Description	Type	Device	Trend Logging		Calibra-tion
			Comm-issioning	Contin-uous	
Building Domestic Water Flow	AI	FM-1 (with local readout)	1 min	60 min	–
Irrigation System Domestic Water Flow	AI	FM-1 (with local readout)	1 min	60 min	-

12 Domestic hot water

Description	Type	Device	Trend Logging		Calibra-tion
			Comm-issioning	Contin-uous	
Electric Water Heater Enable/Disable	DO	Dry Contact to 120V or 24V control circuit	COV	COV	–
DHW Supply Temperature	AI	TS-2A	1 min	60 min	-

PART 3 - EXECUTION

3.1 SEQUENCE OF OPERATION

A. General

1. Control sequences listed below are to be the basis of the bid. Contractor shall review them prior to programming and suggest modifications where required to achieve the design intent. Contractor may suggest modifications to improve performance and stability or to simplify or reorganize logic in a manner that provides equal or better performance. Proposed changes in sequences shall be included as part of Submittal Package 2.
2. Include costs for minor program modifications if required to provide stable performance of the system.
3. Unless otherwise indicated, control loops shall be enabled and disabled based on the status of the system being controlled to prevent wind-up.
4. The term “PID loop” is used generically for all control loops and shall not be interpreted as requiring proportional plus integral plus derivative gains on all loops. Unless specifically indicated otherwise, the following guidelines shall be followed:

    a. Use proportional only (P-only) loops for limiting loops (such as CHW/HW flow limiting loops at bridge connections, zone CO_2 limiting loops, etc.) to ensure there is no integral windup.
    b. Do not use the derivative term on any loops unless field tuning is not possible without it.

5. All setpoints, timers, deadbands, etc. listed in sequences shall be capable of being adjusted by the operator without having to access programming whether indicated as “adjustable” in sequences or not. Software (virtual) points shall be used for these setpoints. Fixed scalar numbers shall not be imbedded in programs unless the value will never need to be adjusted.
6. Where zone data (e.g. damper or valve position, control loop signal) is used for reset of the AHU/pump system serving the zone, the zone tag (name) shall be recorded when it is the zone driving the reset (e.g. zone requiring the most cooling). This data shall be available for Reports (see 23 09 26) so that zones that are undersized or otherwise driving the system can be identified for remediation if required.
7. VFD minimum speed setpoints

    a. Minimum speed setpoints for each VFD shall be determined in accordance to description herein.
    b. Minimum speed for each piece of equipment shall be stored in a single software point that shall be used in programming (such as PID loop output range) and its value shall be assigned to the minimum speed setpoint stored in the VFD via the drive network interface. In this way there is only one minimum setpoint, rather than setpoints both in the drive and in software which could differ.

8. Trim & Respond Setpoint Reset Logic

    a. Trim & Respond setpoint reset logic and zone/system reset requests where referenced in sequences shall be implemented as described below.
    b. “Request” are pressure, cooling or heating setpoint reset request type listed for the zone/system provide the following software points:

        1) For each zone or system, and for each setpoint reset request type listed for the zone/system, provide the following software points:

            a) Importance Multiplier (default = 1). This point is used to scale the number of requests the zone/system is generating. A value of zero causes the zone/system’s request to be ignored. A value greater than zero can be used to effectively increase the number of requests from the zone/system based on the critical nature of the spaces served, or to increase the requests beyond the number of ignored requests (defined below) in the Trim & Respond reset block.
            b) Request hours

i. This point accumulates the integral of requests (prior to adjustment of Importance Multiplier) to help identify zones/systems that are driving the reset logic. Every x minutes (adjustable, default 5 minutes), add x/60 times the current number of requests to this request-hours accumulator point.
ii. The request-hours point is reset to zero upon a global command from the system/plant serving the zone/system – this global point simultaneously resets the request–hours point for all zones/systems served by this system/plant.
iii. Cumulative %-request-hours is the zone request-hours divided by the zone run-hours (the hours in any Mode other than Unoccupied Mode) since the last reset, expressed as a percentage.
iv. A Level 4 alarm is generated if the zone Importance Multiplier is greater than zero, the zone %-request-hours exceeds 70%, and the total number of zone run-hours exceeds 40.

2) See zone and air handling system control sequences for logic to generate requests.
3) Multiply the number of requests determined from zone/system logic times the Importance Multiplier and send to the system/plant that serves the zone/system. See system/plant logic to see how requests are used in Trim & Respond logic.

c. Variables. All variables below shall be adjustable from a reset graphic accessible from a hyperlink on the associated system/plant graphic. Initial values are defined in system/plant sequences below. Values for trim, respond, time step, etc. shall be tuned to provide stable control.

Variable	Definition
SP_0	Initial setpoint
SP_{min}	Minimum setpoint
SP_{max}	Maximum setpoint
T_d	Delay timer
T	Time step
I	Number of ignored requests
R	Number of requests from zones/systems
SP_{trim}	Trim amount
SP_{res}	Respond amount
$SP_{res\text{-}max}$	Maximum response per time interval

d. Trim & Respond logic shall reset setpoint within the range SP_{min} to SP_{max}. When the associated device (e.g. fan, pump) is off, the setpoint shall be SP_0. The reset logic shall be active while the associated device is proven on, starting T_d after initial device start command. When active, every time step T, trim the setpoint by SP_{trim}. If there are more than I Requests, respond by changing the setpoint by SP_{res} times (R – I), i.e. (the number of Requests minus the number of Ignored requests). But the net response shall be no more than $SP_{res\text{-}max}$. The sign of SP_{trim} must be the opposite of SP_{res} and $SP_{res\text{-}max}$. For example, if SP_{trim} = -0.1, SP_{res} = +0.15, $SP_{res\text{-}max}$ = +0.35, R = 3, I = 2, then each time step, the setpoint change = -0.1 + (3-2)*0.15 = +0.05. If R = 10, then setpoint change = -0.1 + (10-2)*0.15 = 1.1 but limited to a maximum of 0.35. If R≤2, the setpoint change is -0.1.

9. Lead/lag and lead/standby alternation

a. Even Wear

1) Lead/lag. Unless otherwise noted, parallel staged devices (such as pumps, towers) shall be lead/lag alternated when more than one is off or more than one is on so that the device with the most operating hours is made the later stage device and the one with the least number of hours is made the earlier stage device. For example, assuming there are three devices, if all three are off or all are on, the staging order will simply be based on run hours from lowest to highest. If two devices are on, the one with the most hours will be set to be stage 2 while the other is set to stage 1; this may be the reverse of the operating order when the devices were started. If two devices are off, the one with the most hours will be set to be stage 3 while the other is set to stage 2; this may be the reverse of the operating order when the devices were stopped.
2) Lead/standby. Unless otherwise noted, parallel devices (such as pumps, towers) that are 100% redundant shall be lead/standby alternated when more than one is off so that the device with the most operating hours is made the later stage device and the one with the least number of hours is made the earlier stage device. For example, assuming there are three devices, if all three are off, the staging order will be based on run hours from lowest to highest. If devices run continuously, lead/standby shall switch at an adjustable runtime; standby device shall first be started and proven on before former lead device is changed to standby and shut off.

b. Exceptions

1) Operators shall be able to manual fix staging order via software points on graphics overriding the Even Wear logic above, but not overriding the Failure or Hand Operation logic below.
2) Failure: If the lead device fails or has been manually switched off, the device shall be placed into high level alarm (Level 2) and set to the last stage position in the lead/lag order until alarm is reset by operator. Staging position of remaining devices shall follow the Even Wear logic. A failed device in alarm can only automatically move up in the staging order if another device fails. Note that a device in alarm will be commanded to run if the sequence calls for it to run. In this way the EMCS will keep trying to run device(s) until if finds enough that will operate. Failure is determined by:

a) Variable Speed Fans and Pumps

i. VFD critical fault is ON
ii. Status point not matching its on/off point for 15 seconds when device is commanded on
iii. Supervised HOA at control panel in OFF position
iv. Loss of power (e.g. VFD DC Bus voltage = zero)

b) Constant Speed Fans and Pumps

i. Status point not matching its on/off point for 15 seconds when device is commanded on
ii. Supervised HOA at control panel in OFF position

3) Hand Operation. If a device is on in Hand (for example via an HOA switch or local control of VFD), the device shall be set to the lead device and a low level alarm (Level 4) shall be generated. The device will remain as lead until the alarm is reset by the operator. Hand operation is determined by

a) Variable Speed Fans and Pumps

i. Status point not matching its on/off point for 15 seconds
ii. VFD in local “hand” mode

iii. Supervised HOA at control panel in ON position

b) Constant Speed Fans and Pumps

iii. Status point not matching its on/off point for 15 seconds when device is commanded off
iv. Supervised HOA at control panel in ON position

B. Electricity Rate Calculation

1. A program shall be created that calculates electricity cost as would be billed by the utility using the applicable utility rate schedule.
2. Utility cost shall be calculated real-time and summed for each month and year. For each month, store peak kW, kWh, and cost for each time-of-day rate period. Retain data for one year so that data may be displayed side-by-side as month-this-year and month-last-year. Also store month-to-date and year-to-date data.
3. Enter latest applicable rate schedule from utility upon start-up. Rates shall be stored in software points so that they may be easily displayed and edited.

C. Zones:

1. This section applies to all single zone systems.
2. Setpoints

a. VAV Zones: Each zone shall have separate unoccupied and occupied setpoints, and separate heating and cooling setpoint.

1) The occupied heating setpoint shall be 70°F and the occupied cooling setpoint shall be 74°F.
2) The unoccupied heating setpoint shall be 60°F and the unoccupied cooling setpoint shall be 90°F.

b. Electrical and mechanical rooms

1) The unoccupied and occupied heating setpoint shall be 65°F and the unoccupied and occupied cooling setpoint shall be 85°F.

c. Communications rooms

1) The unoccupied and occupied heating setpoint shall be 65°F and the unoccupied and occupied cooling setpoint shall be 75°F.

d. The software shall prevent:

1) The heating setpoint from exceeding the cooling setpoint minus 1°F (i.e. the minimum deadband shall be 1°F);
2) The unoccupied heating setpoint from exceeding the occupied heating setpoint; and
3) The unoccupied cooling setpoint from being less than the occupied cooling setpoint.

e. Where the zone has a local occupant adjustable setpoint adjustment knob/button:

1) The adjustment shall be capable of being limited in software.

a) As a default, occupied cooling setpoint shall be limited between 72°F and 80°F.
b) As a default, occupied heating setpoint shall be limited between 65°F and 72°F.

2) The adjustment shall move both the existing heating and cooling setpoints upwards or downwards by the same amount unless the limit has been reached.
3) The adjustment shall only be active in Occupied mode.
4) If a demand limit setpoint adjustment is in place, the local setpoint adjustment shall be disabled.

f. The operative setpoint shall be determined by the Zone Group's mode

1) The setpoinis shall be the occupied setpoint during Occupied mode, Warm-up mode, and Cool-down mode.
2) The setpoints shall be unoccupied setpoints during Unoccupied mode, Setback mode, and Setup mode.

g. Hierarchy of setpoint adjustments. The following adjustment restrictions shall prevail in order from highest to lowest priority:

1) Setpoint overlap restriction described herein.
2) Local setpoint adjustment.
3) Scheduled setpoints based on Zone Group mode.

3. Local override. When thermostat override buttons are depressed, the request for Occupied Mode operation shall be sent up to the Zone Group control for 60 minutes. (This will cause all zones in the Zone Group to operate in Occupied Mode to ensure that the system has adequate load to operate stably.)
4. Control Loops:

a. Two separate control loops shall operate to maintain space temperature at setpoint, the Cooling Loop and the Heating Loop. Both loops shall be continuously active.
b. The Cooling Loop shall maintain the space temperature at the active cooling setpoint. The output of the loop shall be a virtual point ranging from 0% (no cooling) to +100% (full cooling).
c. The Heating Loop shall maintain the space temperature at the active heating setpoint. The output of the loop shall be a virtual point ranging from 0% (no heating) to −100% (full heating).
d. Loops shall use proportional + integral logic or fuzzy logic. Proportional-only control is not acceptable, although the integral gain shall be small relative to the proportional gain. P and I gains shall be adjustable from the Operator Workstation.
e. See other sections for how the outputs from these loops are used.

5. Zone Modes:

a. Heating Mode: when the output of the space heating control loop is greater than zero.
b. Cooling Mode: when the output of the space cooling control loop is greater than zero and the output of the heating loop is equal to zero.
c. Dehumidification Mode: when the output of the space humidity control loop is greater than zero.
d. Deadband Mode: when not in either the Heating or Cooling Mode.

6. Alarms:

a. Inhibit alarms after zone setpoint is changed for a period of 10 minutes per degree of change (for example if setpoint changes from 68 °F to 70 °F, inhibit alarm for 20 minutes after the change) and while Zone Group is in Warm-up or Cool-down Modes.

1) If the zone is 3 °F above cooling or below heating setpoint, generate Level 3 alarm.

2) If the zone is 5 °F above cooling or below heating setpoint, generate Level 2 alarm.

b. For zones with CO_2 sensors

1) If the CO_2 concentration is less than 300 ppm, or the zone is in unoccupied mode for more than 2 hours and zone CO_2 concentration exceeds 600 ppm, generate a Level 4 alarm, indicating sensor may be out of calibration.
2) If the CO_2 concentration exceeds setpoint plus 10% for more than 10 minutes generate a Level 3 alarm.

D. VAV Terminal Units (Reheat boxes)

1. See Paragraph 3.1C for setpoints, loops, control modes, alarms, etc.

2. Design airflow rates shall be as scheduled on plans:

a. Zone maximum cooling airflow setpoint (Vcool-max)
b. Zone minimum airflow setpoint (Vmin)
c. Zone maximum heating airflow setpoint (Vheat-max)
d. Zone occupant component of minimum outdoor air setpoint (Vocc-min)
e. Zone building area component of minimum outdoor air setpoint (Varea-min)

3. OA-min is equal to Varea-min if the zone has a CO_2 sensor and equal to the larger of Varea-min and Vocc-min if the zone does not have a CO_2 sensor.

4. The occupied cooling minimum Vmin* shall be zero when the room is unoccupied.

a. If the zone has an occupancy sensor, Vmin* shall be zero when the room is unoccupied.
b. If Vmin is non-zero and less than the lowest possible airflow setpoint allowed by the controls (Vm), Vmin* shall be set equal to Vm. The minimum setpoint Vm shall be determined as follows:

1) Determine the velocity pressure sensor reading VPm in inches H_2O that results in a digital reading from the transducer and A/D converter of 12 bits or counts (assuming a 10 bit A/D converter). This is considered sufficient resolution for stable control (DPT-5 Section 23 09 13).
2) Using the velocity pressure sensor amplification factor *F* provided by the sensor manufacturer for each VAV box sensor size, calculated the minimum velocity v_m for each VAV box size as:

$$v_m = 4005\sqrt{\frac{VP_m}{F}}$$

Where F is not known it can be calculated from the measured CFM at 1 inch signal from the VP sensor

$$F = \left(\frac{4005A}{CFM_{@1"}}\right)^2$$

where A is the nominal duct area (ft^2), equal to

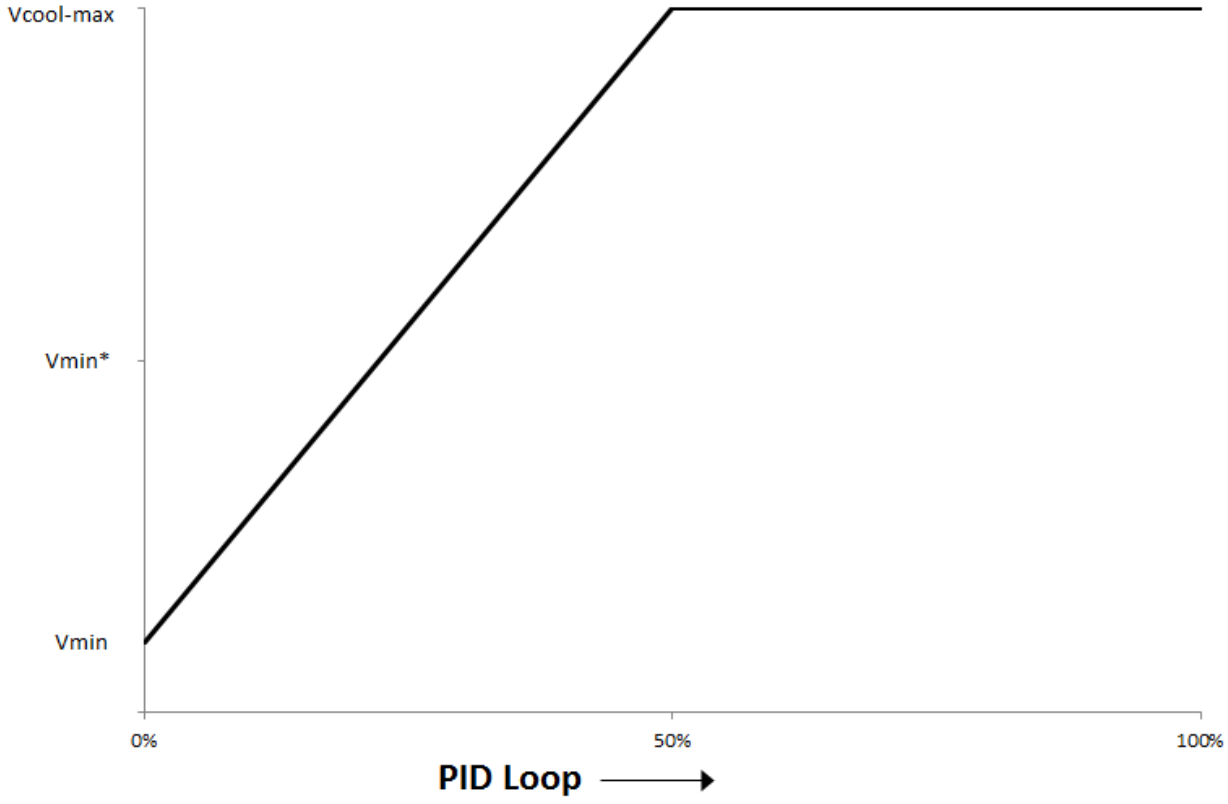
$$A = \pi\left(\frac{D}{24}\right)^2$$

Where D is the nominal duct diameter (inches).

3) Calculate the minimum airflow setpoint allowed by the controls (Vm) for each VAV box size as

$$Vm = v_m A$$

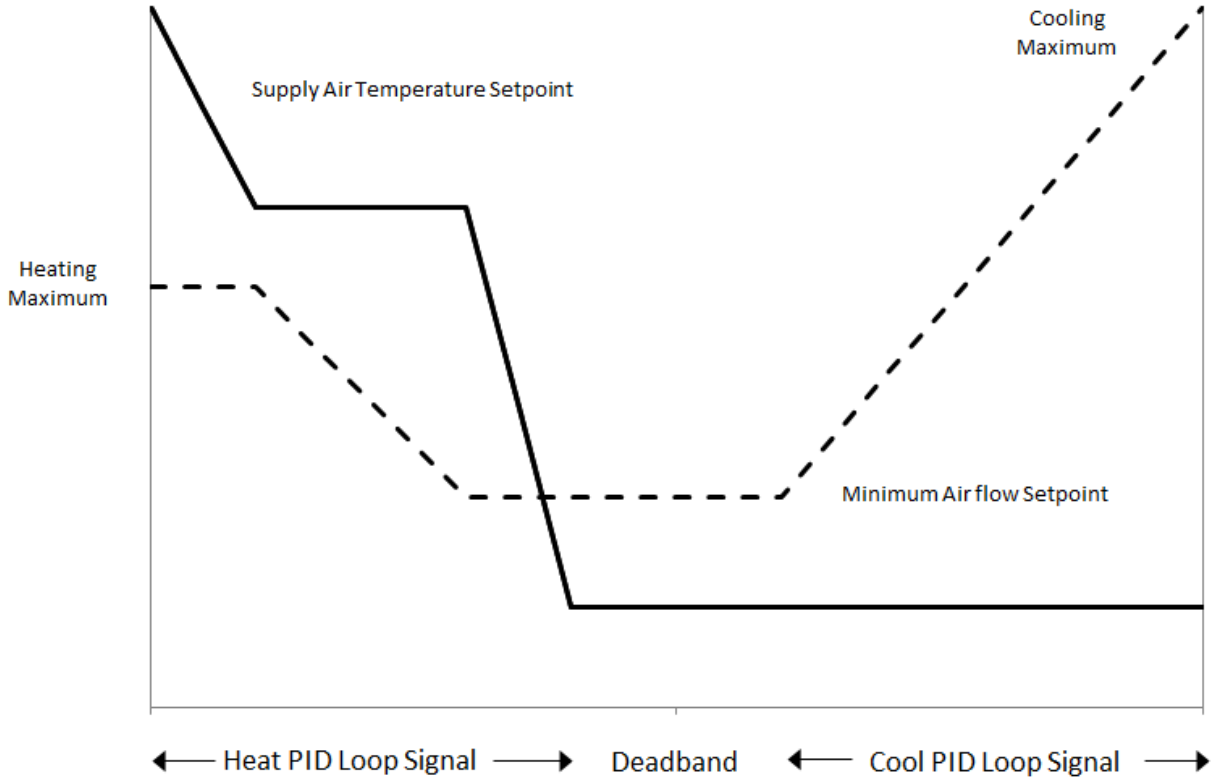
c. If the zone has a CO_2 sensor, during Occupied Mode, a P-only loop shall maintain CO_2 concentration at 1000 ppm; reset 0% at 800 ppm and 100% at 1,000 ppm of CO_2. The output of this loop (0 to 100%) shall be mapped as shown below. The loop output from 0 to 50% shall reset the minimum airflow setpoint to the zone from Vmin up to maximum cooling airflow setpoint Vcool-max. The loop output from 50% to 100% will be used at the system level to reset outdoor air minimum; see AHU controls. Loop is disabled and output set to zero when the zone is no in Occupied Mode.



5. Active maximum and minimum setpoints shall vary depending on the mode of the Zone Group the zone is a part of:

Setpoint	Occupied	Cool-down	Setup	Warm-up	Setback	Unoccupied
Cooling maximum	Vcool-max	Vcool-max	Vcool-max	0	0	0
Minimum	Vmin*	0	0	0	0	0
Heating maximum	Max (Vheat-max, Vmin*)	Vheat-max	0	Vcool-max	Vcool-max	0

6. Control logic is depicted schematically in the figure below and described in the following sections.



a. When the zone is in the Cooling Mode, the Cooling Loop output shall be mapped to the airflow setpoint from the cooling maximum to the minimum airflow setpoints. Hot water valve is closed.
b. When the zone is in the Deadband Mode, the airflow setpoint shall be the minimum airflow setpoint. Hot water valve is closed.
c. When the zone is in the Heating Mode, the Heating Loop shall maintain space temperature at the heating setpoint as follows:

    1) From 0-33%, the Heating Loop output shall reset the discharge temperature from 55 °F to 95 °F.
    2) From 33-66%, if the lead hot water pump is enabled the Heating Loop output shall reset the zone airflow setpoint from the minimum airflow setpoint to the maximum heating airflow setpoint.
    3) From 66-100%, the Heating Loop output shall reset the discharge temperature from 95 °F to 115 °F.
    4) The hot water valve shall be modulated using P+I loop to maintain the discharge temperature at setpoint. (Directly controlling HW valve off zone temperature PID loop is not acceptable.)

d. In any mode, the HW valve shall be modulated to maintain a supply air temperature no lower than 50 °F. (this is to prevent overly cold supply air temperatures when the AHU is providing high outdoor air rates since the AHU does not have a reheat coil.)
e. The VAV damper shall be modulated to maintain the measured airflow at setpoint.

7. Alarms

    a. Low airflow

1) If the measured airflow is less than 70% of setpoint for 5 minutes, generate a Level 3 alarm.
2) If the measured airflow is less than 50% of setpoint for 5 minutes, generate a Level 2 alarm.

b. Low supply air temperature

1) If the building HW pumps are proven on and the supply air temperature is 15 °F less than setpoint for 10 minutes, generate a Level 3 alarm.
2) If the building HW pumps are proven on and the supply air temperature is 30 °F less than setpoint for 10 minutes, generate a Level 2 alarm.

c. Airflow sensor calibration. If the fan serving the zone has been shut off for 10 minutes and airflow sensor reading is above 20 cfm, generate a Level 3 alarm.

8. Testing/Commissioning Overrides: Provide software points that interlock to a system level point to

a. Force zone airflow setpoint to zero
b. Force zone airflow setpoint to Vcool-max
c. Force zone airflow setpoint to Vmin
d. Force damper full closed/open
e. Force heating to off/closed
f. Reset request-hours accumulator point to zero (provide one point for each reset type listed below)

9. System Requests

a. Static Pressure Reset Requests

1) If the Damper Loop is less than 85%, send 0 requests.
2) If the Damper Loop is greater than 95%, send 1 request.
3) If the zone airflow is below the airflow setpoint sufficient to generate a Level 3 alarm (see alarms above), send 2 requests.
4) If the zone airflow is below the airflow setpoint sufficient to generate a Level 2 alarm (see alarms above), send 3 requests.

b. Heating HWST Reset Requests

1) If the HW valve is less than 85%, send 0 requests.
2) If the HW valve is greater than 95%, send 1 request.
3) If the supply air temperature is below setpoint sufficient to generate a Level 3 alarm (see alarms above), send 2 requests.
4) If the supply air temperature is below setpoint sufficient to generate a Level 2 alarm (see alarms above), send 3 requests.

E. Zone Groups (aka Isolation Areas)

1. Each system shall be broken into separate “Zone Groups” composed of a collection of one or more zones served by the air handling system.
2. Each Zone Group shall have separate occupancy schedules and operating modes from other Zone Groups served by the air handling system. All zones in the Zone Group shall be in the same operating mode.
3. Individual Zone Groups shall be as defined below: The default schedule is also listed, confirm

schedules with Using Agency prior to programming.

a. AHU-1 through AHU-4 shall have separate zone groups for zones served by each air-handling unit on each floor. For example AHU-1 has 2 zone groups

1) The default occupancy schedule for all Zone Groups shall be

a) Occupied: 7:00 am to 11 pm Monday to Friday, 8:00 AM to 8:00 PM Saturday and Sunday

b. Fan Coil Units

1) Occupied: 7:00 am to 11 pm Monday to Friday, 8:00 AM to 8:00 PM Saturday and Sunday

4. Provide software switches to override all zones served by the Zone Group. Provide a single software switch for each of the zone override switches listed under terminal box control above. When the Zone Group override switch value is changed, the terminal box zone override switch value for each zone in the Zone Group shall change to the same value. This only occurs when the switch changes value; the switch at each zone shall be capable of being changed to a different value from the Zone Group switch. These software switches are for commissioning and need not be shown on graphics.
5. Zone Group Operating Modes: Each Zone Group shall have the following modes:

a. Normal (Occupied) mode: A Zone Group is in the occupied mode when any of the following is true:

1) The time of day is between the Zone Group's scheduled occupied start and stop times.
2) Any zone local override timer (initiated by local override button) is nonzero.

b. Warm-up mode. Warm-up start time shall be determined based on the zone in the Zone Group whose space temperature is furthest below its occupied heating temperature setpoint, the outside air temperature, and a building mass/capacity factor. This factor shall be manually adjusted or self-tuned by the program based on internal trending so that all zones in the Zone Group are brought up to their occupied setpoint by the scheduled occupied start hour. The tuning period mode shall be turned on or off by a software switch (to allow tuning to be stopped after the system has been trained). Warm-up mode shall start no earlier than 3 hours before the scheduled occupied start hour and shall end at the scheduled occupied start hour.
c. Cool-down mode. Cool-down shall be determined based on the zone in the Zone Group whose space temperature is furthest above its occupied cooling temperature setpoint, the outside air temperature, and a building mass/capacity factor. This factor shall be manually adjusted or self-tuned by the program based on internal trending so that all zones in the Zone Group are brought down to their occupied setpoint by the scheduled occupied start hour. The tuning period mode shall be turned on or off by a software switch (to allow tuning to be stopped after the system has been trained). Cool-down mode shall start no earlier than 3 hours before the scheduled occupied start hour and shall end at the scheduled occupied start hour.
d. Setback mode. During other than normal mode, and warm-up mode, if any 2 (adjustable; set to all zones if there are fewer in Zone Group) zone(s) in the Zone Group falls 2°F below its active unoccupied setback setpoint, until all spaces in the Zone Group are above their active setback setpoints.
e. Setup mode. During other than normal mode, warm-up mode, and setback mode, if any 2 (adjustable; set to all zones if there are fewer in Zone Group) zone(s) in the Zone Group rises 2°F above its active unoccupied setup setpoint until all spaces in the Zone Group are below their active setup setpoints.

f. Unoccupied mode. When the Zone Group is not in any other mode.

F. Air Handling Unit System Modes:

1. AHU system modes are the same as the mode of the Zone Groups served by the system. When Zone Groups served by an air handling system are in different modes, the following hierarchy applies (highest one sets AHU mode):

a. Occupied mode
b. Cool-down mode
c. Setup mode
d. Warm-up mode
e. Setback mode
f. Unoccupied mode

G. VAV Air Handling Units (AHU-1 through AHU-4)

1. Supply Fan Control

a. Supply Fan Control

1) AHU fan shall run when system is in any mode other than Unoccupied Mode.
2) Fan VFD's shall be hard-wire interlocked through smoke detectors, high discharge pressure, and low mixed air temperature safety circuit. The safety circuit shall be tripped when high-limit DP switches sense pressure above 3.0 inches (adjustable) at the fan discharge, smoke detector auxiliary contacts are energized or the low-limit thermostat tripped, locking out the fans until they are reset by the operator.
3) Totalize current airflow rate from VAV boxes and display on AHU graphic at discharge duct.

b. Static Pressure Setpoint Reset

1) Static pressure setpoint: Setpoint shall be reset using Trim & Respond logic with the following parameters:

Variable	Definition
SP_0	0.5 inches
SP_{min}	0.1 inches
SP_{max}	Per 23 05 93
T_d	10 minutes
T	2 minutes
I	2
R	Zone Cooling Static Pressure Reset Requests
SP_{trim}	-0.05 inches
SP_{res}	+0.06 inches
$SP_{res-max}$	+0.13 inches

c. Static Pressure Control

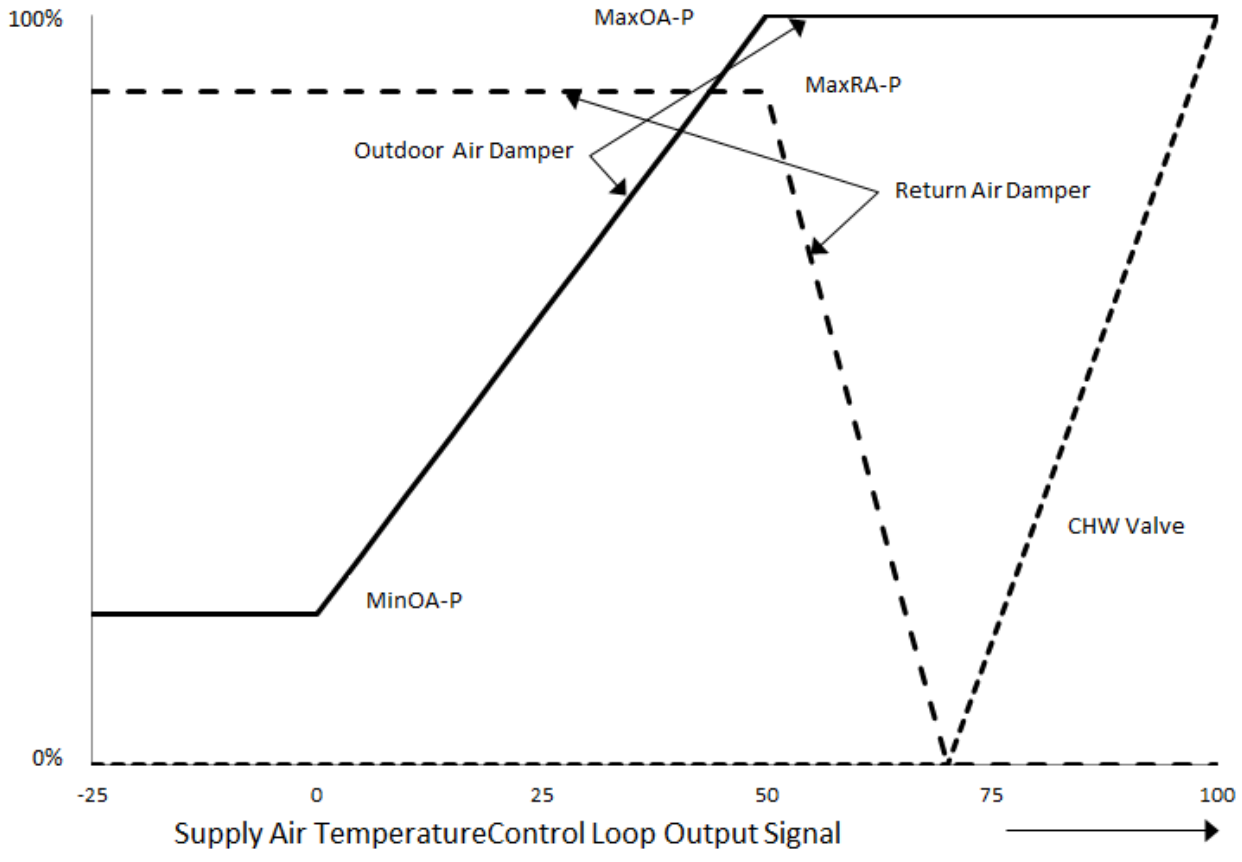
1) Fan speed shall be controlled to rise very slowly to prevent high pressure trips in case all VAV boxes are closed (they should close during unoccupied periods) or in case fire

dampers are closed. This can be done by configuring the VFD ramp rate or controlling ramp rate in EMCS software.

2) Supply fan speed is controlled to maintain duct static pressure at setpoint when the fan is proven on. See VFD minimum speed described herein. Where the Zone Groups served by the system are small, provide multiple sets of PID gains that are used in the PID loop as a function of a load indicator (such as supply fan airflow rate, the area of the Zone Groups that are occupied, etc.)

2. Supply Air Temperature Control

a. Control loop is enabled when the supply air fan is proven on, and disabled and output set to zero otherwise. When loop is disabled, slowly reduce loop output to zero to prevent sudden pressure changes in the hydronic distribution system.
b. Supply Air Temperature Setpoint: 55 °F.
c. Supply air temperature shall be controlled to setpoint using a PID loop whose output is mapped to sequence the outdoor air damper, return air damper, enthalpy (energy recovery) wheel, enthalpy wheel bypass dampers, and chilled water valve as shown in the diagram below. Outdoor air and return air dampers are sequenced rather than complementary (as per most standard sequences) to reduce fan power at part loads. Exact x-axis points in the figure shall be determined by Contractor to provide stable control. Outdoor air and return air damper minimum and maximum positions are limited for economizer lockout and to maintain minimum outdoor airflow rate as indicated below.



3. Pre-heat Coil Temperature Control

a. Pre-heat coil control loop is enabled when the supply fan is proven on and the mixed air

temperature is below 50 ˚F. Pre-heat coil control loop shall be disabled and output set to zero otherwise.

b. Leaving Pre-Heat Coil Air Temperature Setpoint: 53 ˚F.

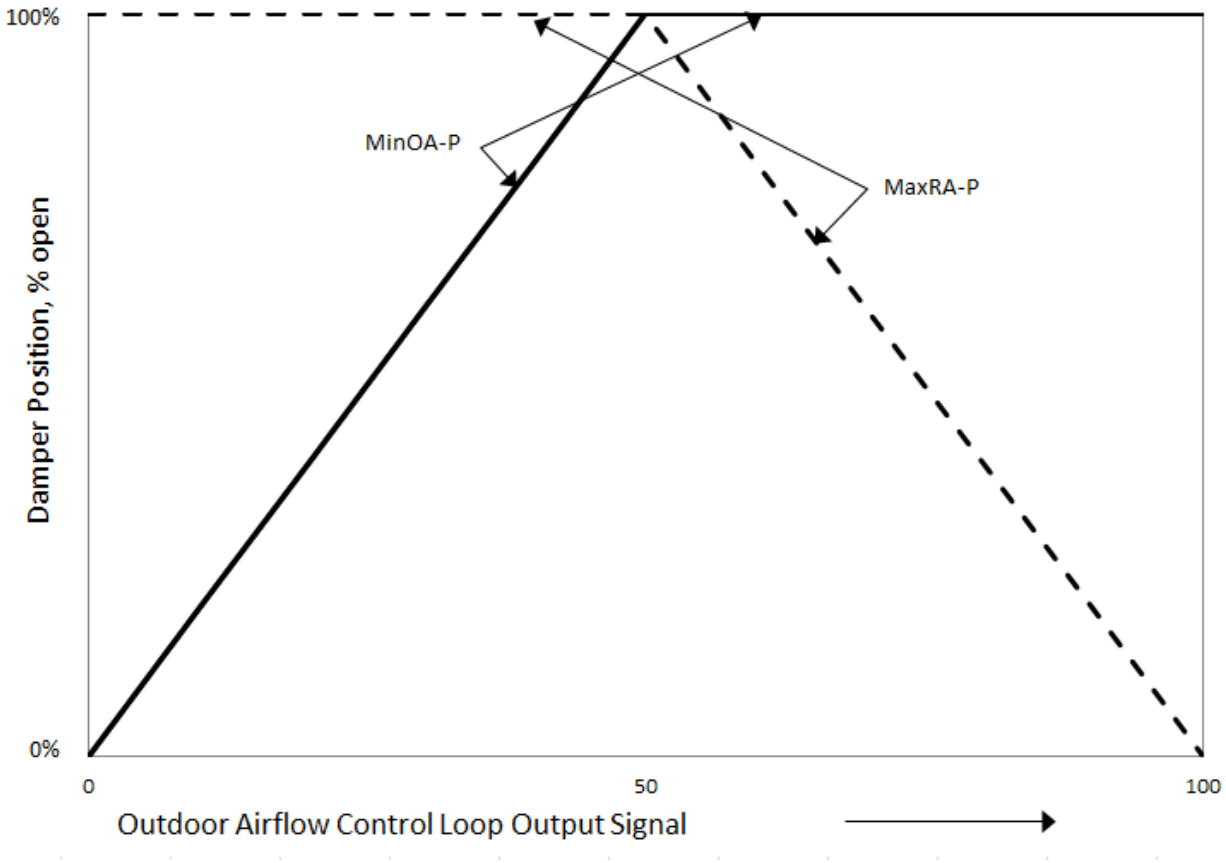
4. Minimum Outdoor Air Control

a. See zone CO_2 controls under VAV zone controls.
b. Outdoor air absolute minimum and design minimum setpoints are recalculated continuously based on the Mode of the zones being served.

1) AbsMinOA* is the sum of Varea-min for all zones in all Zone Groups that are in Occupied Mode, but shall be no larger than the absolute minimum outdoor air rate, “Abs Min OA” scheduled on Drawings.
2) DesMinOA* is the sum of OA-min for all zones in all Zone Groups that are in Occupied Mode, but shall be no larger than the design minimum outdoor air rate, “Occ Min OA” scheduled on Drawings.

c. OA Setpoint (MinOAsp). The minimum outdoor air setpoint (MinOAsp) shall be reset based on the highest zone CO_2 PID loop signal from AbsMinOA* at 50% signal to DesMinOA* at 100% signal.
d. Minimum Outdoor Air Control Loop

1) Minimum outdoor air control loop is enabled when the AHU is in Occupied Mode and disabled and output set to zero otherwise.
2) The outdoor airflow rate shall be maintained at the minimum outdoor air setpoint MinOAsp by a reverse-acting PID loop whose output is mapped to minimum outdoor air damper signal, MinOA-P, and maximum return air damper signal, MaxRA-P, as indicated in the figure below.



5. Economizer Lockout: The normal sequencing of the economizer dampers (above) shall be disabled whenever the outdoor air temperature exceeds 65 °F and enabled otherwise. Enthalpy wheel shall be energized and bypass dampers closed when economizer is locked out. Once the economizer is disabled, it shall not be re-enabled within 10 minutes, and vice versa. When economizer is enabled, MaxOA-P = 100%, enthalpy wheel disabled and bypass dampers opened. When economizer is first disabled, the return air damper shall be fully opened, wait 15 seconds, then set MaxOA-P to MinOA-P and release return air damper for minimum outdoor air control (enthalpy wheel is enabled and bypass dampers closed). See minimum outdoor air control above for minimum outdoor air and maximum return air damper setpoints.

6. Relief Fan (all four relief fans shall receive the same output signal)

    a. Relief fans shall be enabled when the associated supply fan is enabled in Occupied Mode (note: the associated economizer does not have to be enabled) and shall be disabled otherwise.
    b. Building static pressure shall be time averaged with a sliding 5 minute window (to dampen fluctuations). The averaged value shall be that displayed and used for control.
    c. A P-only control loop maintains the building pressure at a setpoint of 0.05 inches (adjustable) with an output ranging from 0 to 100%. The loop is disabled and output set to zero when relief system is disabled.
    d. Fan speed signal to all operating fans shall be the same and shall be equal to the PID signal but no less than the minimum speed. See VFD minimum speed described herein for minimum speed setpoint. Except for Stage 0, discharge dampers of all relief fans shall be open only when fan is commanded on. (The logic below is intended to use barometric relief as the first stage then maintain fans on at low speed to minimize noise and reduce losses through discharge dampers and louvers.)

1) Stage 0: When relief system is enabled and the PID loop output is above 5%, open the motorized dampers to all relief fans serving the building that are enabled; close the dampers when the loop output drops to 0% for 5 minutes.
2) Stage Up: When PID loop is above minimum speed plus 10%, enable relief fans. Fan speed signal to all enabled relief fans shall be the same and shall be equal to the control lop signal but no less than the minimum speed. When control loop signal drops to minmimum speed for 1 minute, fans shall stop but relief dampers shall remain open for barometric relief per item 1) above.

e. For fans in alarm, discharge damper shall be closed.

7. Freeze Protection

a. If the leaving pre-heat coil air temperature drops below 40°F for 5 minutes, send two (or more, as required to ensure that heating plant is active) Hot Water Requests, override the outside air damper to the minimum position, and modulate the pre-heat coil to maintain a leaving pre-heat coil air temperature of at least 42°F. Disable this function when leaving pre-heat coil air temperature rises above 45°F for 5 minutes.
b. If the leaving pre-heat coil air temperature drops below 38°F for 5 minutes, fully close the outdoor air damper for one hour, and set a Level 3 alarm noting that minimum ventilation was interrupted. After one hour, the unit shall resume minimum outdoor air ventilation and enter the previous stage of freeze protection (see 0).
c. Upon signal from the freezestat or if supply air temperature drops below 38°F for 15 minutes or below 34°F for 5 minutes, shut down supply and return/relief fan(s), close outdoor air damper, make the minimum cooling coil valve position 20%, and energize the hot water and chilled water pump systems. Also send two (or more, as required to ensure that heating plant is active) Hot Water Requests, modulate the heating coil to maintain the higher of the supply air temperature or the mixed air temperature at 80°F, and set a Level 2 alarm indicating the unit is shut down by freeze protection.

1) If a freeze protection shutdown is triggered by a low air temperature sensor reading, it shall remain in effect until it is reset by a software switch from the operator's workstation. (If a freeze stat with a physical reset switch is used instead, there shall be no software reset switch.)

8. Alarms

a. Maintenance interval alarm when fan has operated for more than 1500 hours: Level 5. Reset interval counter when alarm is acknowledged.
b. Fan alarm is indicated by the status input being different from the output command after a period of 15 seconds after a change in output status.

1) Commanded on, status off: Level 2
2) Commanded off, status on: Level 4

c. Filter pressure drop exceeds alarm limit: Level 5. The alarm limit shall vary with fan speed as follows:

$$DP_x = DP_{100}(x)^{1.4}$$

Where DP_{100} is the high limit pressure drop at design cfm (determine limit from filter manufacturer) and DP_x is the high limit at speed signal x (expressed as a fraction of full signal). For instance, the setpoint at 50% of full speed would be $(0.5)^{1.4}$ or 38% of the design high limit pressure drop.

d. High supply air temperature (more than 5 °F above setpoint) off cooling coils when coil control loop is active for longer than 15 minutes: Level 3.
e. If the outside air temperature is above the supply air temperature setpoint and the economizer is enabled and the mixed air temperature is more than 2 °F different from the outside air temperature for more than 30 minutes continuously; OR if the outdoor air temperature is more than 5 °F below the supply air temperature setpoint and the chilled water valve is open: Level 4 indicating economizer damper control problems.
f. Low static pressure (more than 0.25 inches below setpoint) when fan control loop is active for longer than 5 minutes: Level 3.
g. Outdoor airflow less than setpoint by 10% for 10 minutes when loop is active: Level 3.
h. High building pressure (more than 0.10" for 10): Level 3
i. Low building pressure (less than 0.0"): Level 4

9. Testing/Commissioning Overrides: Provide software points that interlock to a chilled and hot water system level to

    a. Force chilled water valve full open
    b. Force chilled water valve full closed
    c. Force hot water valve full open
    d. Force hot water valve full closed

10. Plant Requests

    a. Heating HWST Reset Requests

        1) If the HW valve is less than 85%, send 0 requests.
        2) If the HW valve is greater than 95%, send 1 request.
        3) If the supply air temperature is below setpoint sufficient to generate a Level 3 alarm (see alarms above), send 2 requests.

H. Fan Coil units

1. See paragraph 3.1E for zone controls.
2. Fan starts and stops based on time schedule.
3. Supply fan speed control: constant volume/constant speed
4. Supply Air Temperature Setpoint Control

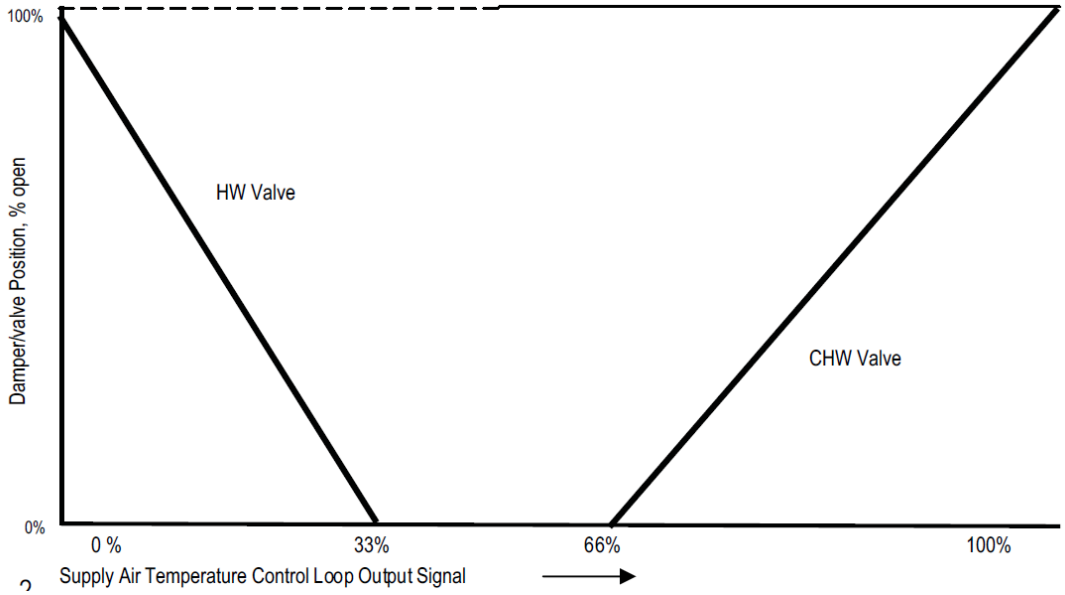
    a. When supply fan is proven on, heating and cooling shall be controlled as follows:

        1) When the zone served by the system is in the Deadband Mode, supply air temperature setpoint shall be average of the active heating and cooling setpoints.
        2) When the zone served by the system is in the Cooling Mode, supply air temperature shall be reset from Deadband setpoint at 0% cooling PID signal down to 53 ˚F (adjustable) at 50% PID signal.
        3) When the zone served by the system is in the Heating Mode, supply air temperature shall be reset from Deadband setpoint at 0% heating PID signal up to 90 ˚F (adjustable) at 50% PID signal.

5. Supply Air Temperature Control

    a. Control loop is enabled when the supply air fan is proven on, and disabled and output set to zero otherwise. When loop is disabled, slowly reduce loop output to zero to prevent sudden pressure changes in the CHW and HW flow distribution systems.
    b. Supply air temperature shall be controlled to setpoint using a PID loop whose output is the

chilled water valve and hot water valve positions as shown in the figure below.



6. Alarms

   a. Maintenance interval alarm when fan has operated for more than 1500 hours: Level 5. Reset interval counter when alarm is acknowledged.
   b. Fan alarm is indicated by the status input being different from the output command after a period of 15 seconds after a change in output status.

      1) Commanded on, status off: Level 2
      2) Commanded off, status on: Level 4

   c. High supply air temperature (more than 5 ˚F above setpoint) when coil control loop is active for longer than 15 minutes and chilled water pumps are proven on: Level 3.
   d. Low supply air temperature (more than 5 ˚F below setpoint) when coil control loop is active for longer than 15 minutes and hot water pumps are proven on: Level 3.

7. Testing/Commissioning Overrides: Provide software points that interlock to a chilled and hot water system level to

   a. Force chilled water valve full open
   b. Force chilled water valve full closed
   c. Force hot water valve full open
   d. Force hot water valve full closed

8. Plant Requests

   a. Heating HWST Reset Requests

      1) If the HW valve is less than 85%, send 0 requests.
      2) If the HW valve is greater than 95%, send 1 request.
      3) If the supply air temperature is below setpoint sufficient to generate a Level 3 alarm (see alarms above), send 2 requests.

I. Toilet and other EMCS controlled exhaust fans.

1. Exhaust fans shall enabled when any of the associated system supply fans are proven on and system is in the occupied mode. Fans shall be disabled otherwise.
2. Alarms

    a. Maintenance interval alarm when fan has operated for more than 3000 hours: Level 5 Reset interval counter when alarm is acknowledged.
    b. Fan alarm is indicated by the status input being different from the output command after a period of 60 seconds after a change in output status.

        1) Commanded on, status off: Level 2.
        2) Commanded off, status on: Level 4.

J. Restroom exhaust fan (Motion detector controlled)

1. Restroom exhaust fan shall be controlled via a motion detector. Fan shall be enabled upon detection of motion in the space. Fan shall continue to run for 15 minutes (adjustable) after last motion sensing and then shall be disabled. Fan shall be off otherwise.

K. Thermostat controlled exhaust fan

1. The fan shall run when zone is in Cooling Mode. It shall be off otherwise.
2. Alarms

    a. Maintenance interval alarm when fan has operated for more than 3000 hours: Level 5 Reset interval counter when alarm is acknowledged.
    b. Fan alarm is indicated by the status input being different from the output command after a period of 60 seconds after a change in output status.

        1) Commanded on, status off: Level 2.
        2) Commanded off, status on: Level 4.

    c. High space temperature (>10 ˚F above setpoint) when control loop is active for longer than 15 minutes: Level 3

L. Humidistat controlled exhaust fan

1. Upon a rise in crawlspace humidity above the humidistat setpoint, the exhaust fan shall be enabled. Once the crawlspace humidity fall below the humidistat setpoint the exhaust fan shall be disabled.

M. HW Heat Exchanger and HW pumps

1. The HW heat exchanger shall be enabled when any heating control valve signal is greater or equal to 15% for 10 minutes and shall stop when all are 0% for 1 minute or all are less than 5% for 5 minutes. Once disabled, the heat exchanger shall stay disabled for a minimum of 10 minutes.
2. HW pumps shall be lead/lag alternated per Paragraph 3.1A.9.
3. Once the HW heat exchanger is enabled, the lead pump shall start and its speed mapped from its minimum speed to 100% as the DP Loop signal ranges from 0% to 100%. The lead pump shall stop when the HW heat exchanger is disabled.
4. Differential pressure setpoint shall be determined within the range of 1 psi to DP-MAX by a slow direct-acting control loop whose control point is the position of the most open valve and whose setpoint is 90% open. In other words DP setpoint is reset to maintain the valve requiring the most

differential pressure at 90% open. DP-MAX is the design DP setpoint determined in conjunction with the balancing agency. See Sections 23 05 93 Testing, Adjusting and Balancing.

5. HW Supply Temperature Control

    a. Hot Water Supply Temperature Reset

        1) Hot water supply temperature setpoint shall be reset using Trim & Respond logic (see Trim & Respond logic description herein) based on hot water pump status with the following parameters:

Variable	Definition
SP_0	SPmax
SP_{min}	90°F
SP_{max}	140°F
T_d	10 minutes
T	5 minutes
I	2
R	Heating HWST Reset Requests
SP_{trim}	-2°F
SP_{res}	+3°F
$SP_{res-max}$	+7°F

    b. Campus Loop HW Valve Control

        1) Control loop is enabled when the HW heat exchanger is enabled
        2) HW supply temperature shall be controlled to setpoint using a PID loop whose output is the HW valve position.

6. Alarms

    a. Maintenance interval alarm when pump has operated for more than 1500 hours: Level 5. Reset interval counter when alarm is acknowledged.
    b. Low heat exchanger leaving hot water temperature (more than 15°F below setpoint) for more than 15 minutes when heat exchanger has been enabled for longer than 15 minutes: Level 3.
    c. Pump alarm is indicated by the status input being different from the output command after a period of 15 seconds after a change in output status. If lead pump alarm is enabled, standby pump shall become lead pump and operate as such.

        1) Commanded on, status off: Level 2
        2) Commanded off, status on: Level 4

N. Chilled Water Heat Exchanger and CHW pumps

1. The CHW heat exchanger shall be enabled when any cooling control valve signal is greater or equal to 15% for 10 minutes and shall stop when all are 0% for 1 minute or all are less than 5% for 5 minutes. Once disabled, the heat exchanger shall stay disabled for a minimum of 10 minutes.
2. CHW pumps shall be lead/lag alternated per Paragraph 3.1A.9.
3. Once the CHW heat exchanger is enabled, the lead pump shall start and its speed mapped from its minimum speed to 100% as the DP Loop signal ranges from 0% to 100%. The lead pump shall stop when the CHW heat exchanger is disabled.
4. Differential pressure setpoint shall be determined within the range of 1 psi to DP-MAX by a slow direct-acting control loop whose control point is the position of the most open valve and whose

setpoint is 90% open. In other words DP setpoint is reset to maintain the valve requiring the most differential pressure at 90% open. DP-MAX is the design DP setpoint determined in conjunction with the balancing agency. See Sections 23 05 93 Testing, Adjusting and Balancing.

5. CHW Supply Temperature Control

    a. Chilled Water Supply Temperature = 44°F
    b. Campus Loop CHW Valve Control

        1) Control loop is enabled when the CHW heat exchanger is enabled
        2) CHW supply temperature shall be controlled to setpoint using a PID loop whose output is the CHW valve position.

6. Alarms

    a. Maintenance interval alarm when pump has operated for more than 1500 hours: Level 5. Reset interval counter when alarm is acknowledged.
    b. Low heat exchanger leaving hot water temperature (more than 15°F below setpoint) for more than 15 minutes when heat exchanger has been enabled for longer than 15 minutes: Level 3.
    c. Pump alarm is indicated by the status input being different from the output command after a period of 15 seconds after a change in output status. . If lead pump alarm is enabled, standby pump shall become lead pump and operate as such.

        1) Commanded on, status off: Level 2
        2) Commanded off, status on: Level 4

O. Hot Water Unit Heater

1. The unit heater shall be enabled when zone is in Heating Mode. It shall be disabled otherwise.
2. Fan shall run when unit heater is enabled.
3. HW control valve shall cycle open and closed to maintain the zone heating setpoint.
4. Alarms

    a. Low zone temperature (more than 10°F below setpoint) for more than 15 minutes when unit heater has been enabled for longer than 15 minutes: Level 3.

P. Domestic Water Heater

1. Domestic water heater shall be enabled when the associated zone group is in the occupied mode. Domestic water heater shall be disabled otherwise.

    a. EWH-1 on Level 1 shall be enabled when AHU - 1 or AHU -2 are in the occupied mode
    b. EWH-2 on Level 2 shall be enabled when AHU - 3 is in the occupied mode
    c. EWH-3 on Level 3 shall be enabled when AHU - 4 is in the occupied mode

Q. Ductless Split Systems

1. The ductless split system shall be enabled by the EMCS 24/7 and shall run subject to its own internal safeties and wall mounted thermostat control.
2. EMCS shall monitor zone temperature
3. Alarms

    a. Low zone temperature (more than 10°F below setpoint) for more than 15 minutes when ductless split system has been enabled for longer than 15 minutes: Level 3.
    b. High zone temperature (more than 10°F above setpoint) for more than 15 minutes when ductless split system has been enabled for longer than 15 minutes: Level 3.

R. Miscellaneous Alarms

1. Points in Hand (Operator Override) via Workstation command (including name of operator who made the command) or via supervised HOA switch at output: Level 4.
2. Equipment alarm (for equipment with alarm contacts such as VFDs, emergency generator, etc.): Level 2.
3. Panel or LAN failure: Level 2
4. Loss of communication with any device via Gateway (e.g. VFD) for more than 30 seconds: Level 2 (alarm shall indicate which specific device is not responding).

END OF SECTION 23 09 29

SECTION 23 09 33 – EMCS SYSTEM COMMISSIONING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. These heating, ventilating and air conditioning (HVAC) provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.2 WORK INCLUDED

A. Provide the following:

1. EMCS and equipment testing and start-up
2. Validation of proper and thorough installation of EMCS and equipment
3. Functional testing of control systems
4. Demonstration testing of control systems
5. Documentation of tests, procedures, and installations
6. Coordination of EMCS training
7. Documentation of EMCS Operation and Maintenance materials

B. Refer to Section 23 09 00 for general requirements.

1.3 RELATED WORK AND REQUIREMENTS

A. Section 23 05 93 Testing, Adjusting, and Balancing

B. Section 23 09 00 Energy Management and Control System (EMCS) − General

C. Section 23 09 13 EMCS Basic Materials and Devices

D. Section 23 09 16 EMCS Operator Interfaces

E. Section 23 09 19 EMCS Field Panels

F. Section 23 09 23 EMCS Communication Devices

G. Section 23 09 26 EMCS Software and Programming

H. Section 23 09 29 EMCS Points and Sequence of Operation

I. Section 01 91 00 Commissioning

J. Section 23 08 00 Mechanical Commissioning

1.4 COORDINATION

A. Assist Commissioning Coordinator as specified in Section 01 91 00 Commissioning, including

attending commissioning meetings.

B. Testing, Adjusting, and Balancing

1. Coordinate with TAB contractors in test and balance work as specified in Section 23 05 93 Testing, Adjusting, and Balancing. A significant number of balancing procedures require the EMCS to be operational and require Contractor time to assist the TAB contractor in their work.
2. Terminal unit calibration:

a. Provide software and/or portable devices for terminal unit calibration per Section 23 09 26.
b. Connections shall be provided local to the device being calibrated. For instance, for VAV boxes, connection of the operator's terminal shall be either at the sensor or at the terminal box.

C. Coordinate with Division 23 and 26 contractors in the performance of pre-functional, functional, and post-occupancy commissioning activities.

1.5 SEQUENCING

A. The following list outlines the general sequence of events for submittals and commissioning:

1. Submit Submittal Package 1 (Hardware and Shop Drawings) and receive approval.
2. Initiate installation of EMCS hardware, devices and wiring.
3. Develop point database and application software.
4. Simulate sequencing and debug programming off-line to the extent practical.
5. Submit Submittal Package 2 (Programming and Graphics) and receive approval.
6. Complete installation of EMCS hardware, devices and wiring.
7. Install point database and application software in field panels.
8. Submit Submittal Package 3 (Functional Testing) and receive approval.
9. Perform EMCS Pre-functional Tests (start up, calibration and tuning) and submit Pre-functional Tests for approval.
10. Field test application programs prior to functional testing.
11. Receive EMCS Pre-functional Test Report approval and approval to schedule Functional Tests.
12. Prepare and initiate commissioning Trend Logs.
13. Assist TAB contractor in TAB tests and determining setpoints as specified in Section 23 05 93.
14. Perform and record functional tests and submit Functional Test Report for approval.

a Some tests may not be possible due to weather conditions. These tests may be deferred to post-occupancy period.

15. Submit Package 4 (Training Materials) and receive approval.
16. Receive EMCS Functional Test Report approval and approval to schedule Demonstration Tests.
17. Perform Demonstration Tests to Commissioning Coordinator and Professional and submit Demonstration Test Report.
18. Receive acceptance of Demonstration Tests.
19. Train Using Agency personnel on EMCS operation and maintenance.
20. Substantial Completion.
21. Submit Package 5 (Post-Construction Trend Logs) in format specified for review and approval.

22. Receive approval of successful Trend Log tests, or retest as required.
23. Complete all items in Completion Requirements per Section 23 09 00.
24. Provide administration level password access to the Using Agency.
25. Final Acceptance.
26. Begin Warranty Period.
27. Prepare and initiate post-occupancy Trend Logs.
28. Perform deferred alternate season functional tests and submit amended Functional Test Report for approval.
29. Receive amended EMCS Functional Test Report approval.
30. Two months prior to end of Warranty Period, submit Package 6 (End-of-Warranty Trend Logs) in format specified for review and approval.
31. Receive approval of successful Trend Log tests, or retest as required.
32. Revise and submit record documents and O&M Manuals.
33. Update all software as specified.
34. End of Warranty Period.

1.6 FUNCTIONAL TEST DOCUMENTATION

A. Pre-functional Tests

1. Prepare forms to document the proper startup of the EMCS.
2. All equipment shall be included test forms including but not limited to:

    a. Wiring: End-to-end checkout of all wiring at terminations. Power to all controllers and actuators. Confirmation of emergency power where specified.
    b. Digital Outputs: proper installation, normal position, response to command at CU
    c. Digital Inputs: proper installation, device test, response at CU
    d. Analog Outputs: proper installation of devices, verification of maximum and minimum stroke
    e. Analog Inputs: proper installation of sensors, calibration
    f. Panels: Confirmation of location, power source (electrical circuit used), confirmation of emergency power where specified.
    g. Alarms and Safeties: Verification of alarm routing to all specified devices and correct hierarchy. Example: confirm alarm routing to cell phones, email, servers, remote workstations. Confirm that appropriate alarm levels are routed to appropriate devices.
    h. Loop Tuning: Document setting of P/I parameters for all loops, chosen setpoints, time delays, loop execution speed.
    i. Network Traffic: Document speed of screen generation, alarm and signal propagation in system with all required commissioning trends active.

3. Each form shall have a header or footer where the technician performing the test can indicate his/her name and the date of the test.
4. Submit forms for approval in Submittal Package 3.
5. Complete work, document results on forms, and submit for approval as Pre-Functional Test Report.

B. Functional Tests

1. Professional will prepare functional testing forms after Submittal Package 2 has been reviewed and approved. Tests will be designed to test all sequences in a formal manner with simulations and expected outcomes.
2. Review tests and recommend changes that will improve ease of testing or avoid possible system damage, etc.
3. Adapt forms from Professional into electronic format. Each form shall have a header or

footer where the technician performing the test can indicate his/her name and the date of the test.

4. Complete work, document results on forms, and submit for approval as Functional Test Report.

C. Assist Commissioning Authority/Coordinator/Professional as specified in Section 01 91 00 Commissioning, including attending commissioning meetings.

D. Coordinate with Work specified in Division 23 Mechanical Commissioning and Division 26 Electrical Commissioning.

PART 2 - PRODUCTS

2.1 INSTRUMENTATION

A. Instrumentation required to verify readings, calibrate sensors, and test the system and equipment performance shall be provided by Contractor.

B. All equipment used for testing and calibration shall be NIST/NBS traceable and calibrated within the preceding 6-month period. Certificates of calibration shall be submitted.

C. Test equipment used for testing and calibration of field devices shall be at least twice as accurate as respective field device (e.g., if field device is ±0.5% accurate, test equipment shall be ±0.25% accurate over same range).

PART 3 - EXECUTION

3.1 PRE-FUNCTIONAL TESTS

A. General

1. Inspect the installation of all devices. Review the manufacturer's installation instructions and validate that the device is installed in accordance with them.
2. Verify proper electrical voltages and amperages, and verify that all circuits are free from faults.
3. Verify integrity/safety of all electrical connections.
4. Verify that shielded cables are grounded only at one end.
5. Verify that all sensor locations are as indicated on drawings and are away from causes of erratic operation.
6. Ensure that minimum speed settings programmed into variable speed drive are at or below the minimum speed settings in control sequences.

B. Digital Outputs

1. Verify that all digital output devices (relays, solenoid valves, two-position actuators and control valves, magnetic starters, etc.) operate properly and that the normal positions are correct.

C. Digital Inputs

1. Adjust setpoints, where applicable.

a. For current switches used as status on fans, adjust current setpoint so that fan status is

"off" when fan discharge damper (if present) is fully closed and when belt is broken (temporarily remove belt).

b. For current switches used as status on pumps, adjust current setpoint so that pump status is "off" when pump is dead-headed (temporarily close discharge valve).

c. For differential pressure sensors on pumps and fans, set so that status is on when pump operating with all valves open (out on its curve).

D. Analog Outputs

1. Verify start and span are correct and control action is correct.
2. Check all control valves and automatic dampers to ensure proper action and closure. Make any necessary adjustments to valve stem and damper blade travel.
3. Check all normal positions of actuators with spring return.
4. For outputs to reset other manufacturer's devices (for example, chiller setpoint) and for feedback from them, calibrate ranges to establish proper parameters.

E. Analog Input Calibration

1. Sensors shall be calibrated as specified on the points list. Calibration methods shall be one of the following:

   a. Factory. Calibration by factory, to standard factory specifications. Field calibration is not required.
   b. Handheld. Field calibrate using a handheld device with accuracy meeting the requirements of Paragraph 2.1.
   c. Drywell Bath. Field calibrate using a 2-point procedure, using a drywell calibrator block constructed for that purpose, or an ice bath with a reference standard.

2. The calibrating parameters in software (e.g. slope and intercept) shall be adjusted as required. A calibration log shall be kept and initialed by the technician showing date and time, sensor and hand-held readings, and calibration constant adjustments and included in the Pre-functional Test Report.

3. Inaccurate sensors must be replaced if calibration is not possible.

F. Alarms and Interlocks:

1. A log shall be kept and initialed by the technician showing date and time, alarm/interlock description, action taken to initiate the alarm/interlock, and resulting action, and included in the Pre-functional Test Report.
2. Check each alarm separately by including an appropriate signal at a value that will trip the alarm.
3. Coordinate with Division 26 to test fire and life safety systems alarm contacts.
4. Interlocks shall be tripped using field contacts to check the logic, as well as to ensure that the fail-safe condition for all actuators is in the proper direction.
5. Interlock actions shall be tested by simulating alarm conditions to check the initiating value of the variable and interlock action.

G. Variable Frequency Drive Minimum Speed

1. Minimum speed for VFD-driven fans and pumps shall be determined in accordance with this Paragraph. Tests shall be done for each piece of equipment, except that for multiple pieces of identical equipment used for identical applications, only one piece of equipment need be tested with results applied to all. Note that for fans and pumps, there is no minimum speed required for motor cooling. Power drops with cube of speed, causing motor losses to be

minimal at low speeds.

2. The work shall be done only after fan/pump system is fully installed and operational.
3. Determine the minimum speed setpoint as follows:

    a. Start the fan or pump.
    b. Manually set speed to 6 Hz (10%) unless otherwise indicated in control sequences. For cooling towers with gear boxes, use 20% or whatever minimum speed is recommended by tower manufacturer.
    c. Observe fan/pump in field to ensure it is visibly rotating.

        1) If not, gradually increase speed until it is.

    d. The speed at this point shall be the minimum speed setpoint for this piece of equipment.
    e. Record minimum speeds in log and store in software point as indicated in Section 23 09 29.

H. Tuning

1. Tune all control loops to obtain the fastest stable response without hunting, offset or overshoot. Record tuning parameters and response test results for each control loop in the Pre-functional Test Report. Except from a startup, maximum allowable variance from set point for controlled variables under normal load fluctuations shall be as follows. Within 3 minutes of any upset (for which the system has the capability to respond) in the control loop, tolerances shall be maintained (exceptions noted):

Controlled Variable	Control Accuracy
Duct Pressure	±0.1" w.g.
Building and relief plenum	±0.01" w.g.
Airflow and waterflow	±10%
Space Temperature	±1.5ºF
Chilled Water Temperature	±1ºF
Hot Water Temperature	±3ºF
Duct Temperature	±2ºF
Water Differential Pressure	±1.5 psi
Others	±2 times reported accuracy

I. Interface and Control Panels:

1. Ensure devices are properly installed with adequate clearance for maintenance and with clear labels in accordance with the Record Drawings.
2. Ensure that terminations are safe, secure and labeled in accordance with the Record Drawings.
3. Check power supplies for proper voltage ranges and loading.
4. Ensure that wiring and tubing are run in a neat and workman-like manner, either bound or enclosed in trough.
5. Check for adequate signal strength on communication networks.
6. Check for standalone performance of controllers by disconnecting the controller from the LAN. Verify the event is annunciated at Operator Interfaces. Verify that the controlling LAN reconfigures as specified in the event of a LAN disconnection.
7. Ensure that buffered and/or volatile information is held through power outage.
8. With all system and communications operating normally, sample and record update/annunciation times for critical alarms fed from the panel to the Operator Interface.

9. Check for adequate grounding of all DDC panels and devices.

J. Operator Interfaces:

1. Verify that all elements on the graphics are functional and are properly bound to physical devices and/or virtual points, and that hot links or page jumps are functional and logical.
2. Verify that the alarm printing, logging, paging, emailing etc. is functional and per requirements.

K. Trending/Network Traffic Test. Perform this test to verify that system has been design adequately to simultaneously capture trends and allow proper operation of the control system.

1. The test shall be performed after the verification trends (see paragraph 3.5A) have been set up and are operational.
2. Test 1:

a. Randomly select a device whose failure will generate a Level 1 or 2 alarm and manually shut it off. The status points for the device must indicate the change of state of the device at the Operator Workstation within 5 seconds.
b. The test shall be repeated for four devices in each building.

3. Test 2:

a. A clock signal from a field controller randomly selected will be sent as a programmable point to up to 3 BCs. The clock signal stored in BCs shall be sampled with the rest of the trend data. The system shall be considered acceptable if these clock signals are no more than 2 seconds off of the system clock as sampled concurrently during data collection.

4. If the system fails any test, the system architecture shall be revised as required (e.g. more trend memory, more controllers with trend storage capability, network repeaters to allow an increase in network speed, etc.) followed by additional tests.

3.2 TESTING, ADJUSTING, AND BALANCING (TAB) COORDINATION

A. Coordinate with Work performed under Section 23 05 93 Testing, Adjusting, and Balancing. Some balancing procedures require the EMCS to be operational and require Contractor time and assistance.

B. Calibration Software

1. Software shall be provided free of charge on at least a temporary basis to allow calibration of terminal box airflow controls and other Work specified under Section 23 05 93 Testing, Adjusting and Balancing.
2. Software shall be provided for installation on POT(s) provided by Others or Contractor shall loan a POT or handheld device with software installed for the duration of Work specified under Section 23 05 93 Testing, Adjusting, and Balancing.
3. Provide sufficient training to those performing Work specified under Section 23 05 93 Testing, Adjusting, and Balancing to allow them to use the software for balancing and airflow calibration purposes. Contractor shall include a single training session for this purpose.

C. Setpoint Determination

1. Perform pre-functional tests described in Section 23 09 29 before assisting in setpoint

determination.

2. Coordinate with Work performed under Section 23 05 93 Testing, Adjusting, and Balancing to determine fan and pump differential pressure setpoints, outdoor air damper minimum positions and DP setpoints, etc. as indicated in Section 23 05 93 Testing, Adjusting and Balancing.

D. Coil Valve Leak Check

1. Coordinate test procedures with those outlined in Section 23 05 93 Testing, Adjusting and Balancing to provide control valve leak check tests.
2. Test conditions for each hydronic system:

a. Tests shall be done when central plant cooling and heating systems are operational.
b. Close all control valves
c. Start all fans associated with control valves
d. Open bridge connection control valve.
e. Start both pumps.
f. Observe flow meter. If reading changes after pumps start, there is a leaking valve.
g. Observe supply air temperature at each coil after test starts.
h. Should any supply air temperature rise, close the isolation valves to the coil to see if temperature changes. If so, this validates the valve is not fully closing.
i. Remedy the condition by adjusting the stroke and range, increasing the actuator size/torque, replacing the seat, or replacing the valve as applicable.

3.3 FUNCTIONAL TESTS

A. Test schedule shall be coordinated with the Commissioning Authority, Commissioning Coordinator and/or Professional.

B. Functional tests may be witnessed by the Professional at the Using Agency's option.

C. All approved Functional Tests shall be conducted by the Contractor with results confirmed and signed by the Contractor's start-up technician.

1. Seasonal Impacts: It shall be assumed that not all tests will be possible due to weather conditions. Those that are not possible shall be deferred until the next season, performed during the warranty period.

D. Test documentation shall be submitted to the Using Agency for review and approval.

3.4 DEMONSTRATION TEST

A. Demonstration tests consist of a small representative sample of functional tests and systems randomly selected by the Using Agency. Tests will be designed to occur over no longer than ***2*** days.

B. Schedule the demonstration with the Professional 1 week in advance. Demonstration shall not be scheduled until the Functional Test Report has been approved.

C. The Contractor shall supply all personnel and equipment for the demonstration, including, but not limited to, instruments, ladders, etc. Contractor-supplied personnel shall be those who conducted the Functional tests or who are otherwise competent with and knowledgeable of all project-specific hardware, software, and the HVAC systems.

D. The system will be demonstrated following procedures that are the same or similar to those used in the Pre-Functional and Functional Tests. The Professional will supply the test forms at the site at the start of the tests.

E. Demonstration tests may be witnessed by the Professional at the Using Agency's option.

F. Contractor shall conduct tests as directed by and in the presence of the Professional and complete test forms. Completed forms shall be submitted as the Demonstration Test Report to the Using Agency and Commissioning Coordinator after tests are complete.

G. Demonstration Tests shall be successfully completed and approved prior to Substantial Completion.

3.5 TREND LOG TESTS

A. Trends shall be fully configured to record and store data to the OWS or server for the points and at the interval listed in Section 23 09 29 as follows:

1. Commissioning: Configure trends prior to functional testing phase. Retain configuration until post-construction trend review has been completed successfully and accepted by the Professional. Trends shall be deactivated after acceptance.
2. Continuous: After system acceptance, configure trends for the purpose of long term future diagnostics. Configure trends to overwrite the oldest trends at the longest interval possible without filling the server hard disk beyond 80%.

B. Commissioning (Post Construction) Trend Test

1. Trend logging shall not commence until Demonstration Tests are successfully completed.
2. Hardware Points: Contractor shall configure points to trend as indicated in the Commissioning Trend column listed in Section 23 09 26 points list with the following qualifications.

    a. For equipment of identical function, such as VAV zones and AHUs with identical components and control sequences, only a sample of such equipment need be trended. The sampling shall be 10% of the identical components, but no more than 10 and no less than three. Review with Professional before setting up trends.
    b. All points trended for one HVAC subsystem (e.g. air handling unit, chilled water system, etc.) shall be trended during the same trend period and the same time intervals so that data may be easily plotted using a spreadsheet.

3. Software Points: Include the following in trends of systems and zones whose hardware points are being trended as called for above. Time interval shall be the same as associated hardware point.

    a. All setpoints and limits that are automatically reset, such as supply air temperature and fan static pressure setpoints, plus the points that are driving the reset, such as zone level cooling and static pressure requrests.
    b. All setpoints that are adjustable by occupants
    c. Outputs of all control loops, other than those driving a single AO point that is already being trended.
    d. System mode points (e.g. Warm-up, Occupied, etc.)
    e. Global overrides such as demand shed signals.

f. Calculated performance monitoring points, such as chiller efficiency

4. Submit for review and approval by the Commissioning Authority and/or Professional a table of points to be trended along with trend intervals or change-of-value a minimum of 14 days prior to trend collection period.
5. Trends shall be uploaded to the OWS or Server in data format dspecified in Section 23 09 26.
6. Trend logs of all points indicated above shall be collected for a 3 week Trend Period.
7. At the completion of the Trend Period, data shall be reviewed by the Contractor to ensure that the system is operating properly. If so, data shall be submitted to the Professional in an electronic format agreed to by the Using Agency and Contractor (e.g. CD-ROM or via direct access to the OWS or server via the internet).
8. Data will be analyzed over approximately a two- to three-week period by the Commissioning Authority and/or Professional.
9. The system shall be accepted only if the trend review indicates proper system operation without malfunction, without alarm caused by control action or device failure, and with smooth and stable control of systems and equipment in conformance with these specifications. If any but very minor glitches are indicated in the trends, steps 4 to 6 above shall be repeated for the same Trend Period until there is a complete Trend Period of error free operation.

C. Post Occupancy Trend Tests

1. After successfully completing the Commissioning Trend Tests, the Contractor shall configure all points to trend as indicated in the Continuous Trend column listed in Section 23 09 29 points list.
2. Archive trends up to the OWS or server without overwriting stored data for the entire Warranty Period.
3. The system shall be accepted and warranty period considered complete only if the trend review indicates proper operation without malfunction without alarm caused by control action or device failure, and with smooth and stable control of systems and equipment in conformance with these specifications. If any but very minor glitches are indicated in the trends, steps 3.5.6 to 3.5.8 above shall be repeated until there is a complete Trend Period of error free operation.

3.6 REMEDIAL WORK

A. Repair or replace defective Work, as directed by Professional in writing, at no additional cost to the Using Agency.

B. Restore or replace damaged Work due to tests as directed by Professional in writing, at no additional cost to the Using Agency.

C. Restore or replace damaged Work of others, due to tests, as directed by Professional in writing, at no additional cost to the Using Agency.

D. Remedial work identified by site reviews, review of submittals, demonstration test, trend reviews, etc. shall be performed to the satisfaction of the Professional, at no additional cost to the Using Agency.

E. Contractor shall compensate Professional and Commissioning Authority on a time and material basis at standard billing rates for any additional time required to witness additional demonstration tests or to review additional EMCS trends beyond the initial tests, at no additional cost to the Using Agency.

3.7 TRAINING

A. Coordinate schedule and materials with Professional and/or Commissioning Authority.

B. Interim Training

1. Provide minimal training so the operating staff can respond to occupant needs and other operating requirements during start-up and commissioning phase.

C. Formal Training.

2. Provide training sessions at locations and for personnel indicated in § 3.7G.
3. Training shall be conducted after all commissioning is complete and systems are fully operational.
4. The length of each training period will depend on the complexity of the system and the audience, described below. Minimum training shall be as listed below, but period shall be longer if required to complete the training tasks described below.

    a. On site job training: Include 40 hours total of on-site training to assist personnel in becoming familiar with site-specific issues, systems, control sequences, etc. (including general EMCS system training).

5. Training may be in non-contiguous days at the request of the Using Agency.
6. Contractor shall be video training sessions, see Section 23 00 10 Mechanical General Provisions.
7. During the warranty period, provide unlimited telephone support for all trained operators.

D. Operators are divided into three categories and shall receive training including but not limited to the tasks listed.

1. Day-to-day Operators shall be trained to:

    a. Proficiently operate the system
    b. Understand control system architecture and configuration
    c. Understand EMCS system components
    d. Understand system operation and control sequences
    e. Operate the workstation and peripherals
    f. Log on and off the system
    g. Access graphics, point reports, and logs
    h. Adjust and change system set points, time schedules, and holiday schedules
    i. Recognize malfunctions of the system by observation of the printed copy and graphical visual signals
    j. Understand and acknowledge alarms
    k. Understand system drawings, and Operation and Maintenance manual
    l. Understand the Project layout and location of control components
    m. Print point and predefined reports

2. Advanced Operators shall be trained to do all items for Day-to-day operators plus:

    a. Make and change graphics on the workstation
    b. Create, delete, and modify alarms, including annunciation and routing
    c. Create, delete, and modify point trend logs, and graph or print these both on an ad-hoc basis and at user-definable time intervals
    d. Create, delete, and modify reports
    e. Add, remove, and modify system’s physical points

f. Create, modify, and delete programming
g. Add control panels
h. Add Operator Workstations
i. Create, delete, and modify system displays — both graphical and otherwise
j. Perform EMCS system field checkout procedures
k. Perform EMCS controller unit operation and maintenance procedures
l. Perform workstation and peripheral operation and maintenance procedures
m. Perform EMCS system diagnostic procedures
n. Configure hardware including PC boards, switches, communication, and I/O points
o. Maintain, calibrate, troubleshoot, diagnose, and repair hardware
p. Adjust, calibrate, and replace system components
q. Maintain software and prepare backups

3. System Managers/Administrators shall be trained to do all items for Day-to-day operators plus:

a. Maintain software and prepare backups
b. Create and print custom reports, including tenant billing summaries.
c. Interface with job-specific, third-party operator software
d. Add new users and understand password security procedures

E. Training materials shall include step-by-step instructions (including illustrations, screen captures, etc.) for how to perform all task identified in herein such that a new Operator, who has not attended the training in person and has minimal familiarity with this EMCS system, can easily follow the instructions and successfully perform all of the identified tasks. One copy of training material shall be provided per student. An electronic copy of the materials shall be stored on the OWS.

F. The instructor(s) shall be factory-trained instructors experienced in presenting this material.

G. The type and number of personnel and location for training shall include.

a. Day-to-day Operator: 2
b. Advanced Operator: 1
c. System Managers/Administrators: 1

END OF SECTION 23 09 33

SECTION 23 11 00 - FUEL GAS PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. These heating, ventilating and air conditioning (HVAC) provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.2 SUMMARY

A. This Section includes fuel gas piping, specialties and accessories within the building.

1.3 PROJECT CONDITIONS

A. Site Gas System Pressure: 50 psig (CONTRACTOR SHALL VERIFY)

B. Building Gas System Pressure: Primary pressure is 5 psig reduced to secondary pressure of 8 Inch of Water Column. (CONTRACTOR SHALL VERIFY)

1.4 RELATED WORK AND REQUIREMENTS

A. Section 01 91 00 – Commissioning

B. Section 23 21 14 – Piping Specialties, for pressure gages

C. Section 22 13 19 – Plumbing Specialties

1.5 SUBMITTALS

A. See Section 23 00 10 – Mechanical General Provisions

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Piping (below ground and above ground	R			R
Valves, all types	R			R
Meters	R	R		R
Pressure regulators	R			R

Specialties	R	R		R

C. Field quality-control test reports. Indicate an interpret test results for compliance with performance requirements.

1.6 QUALITY ASSURANCE

A. FM Standard: Provide components listed in FM's Fire Protection Approval Guide if specified to be FM approved.

B. IAS Standard: Provide components listed in IAS's Directory of AGA and CGA Certified Appliances and Accessories if specified to be IAS listed.

C. UL Standard: Provide component listed in UL's Gas and Oil Equipment Directory if specified to be UL listed.

D. ANSI Standard: Comply with ANSI Z223.1 and NFPA 54 (2009 Edition), "National Fuel Gas Code."

1.7 COORDINATION

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Using Agency or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Using Agency not less than seven days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Professional's written permission.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Appliance Connector Valves

a. Conbraco Industries, Inc.: Apollo Div.
b. Mueller Co.: Mueller Gas Products Div.
c. Watts Industries, Inc.: Water Products Div.
d. Brass Craft Manufacturing Co.
e. American Valve.

2. Gas Valves, NPS 2 and Smaller

a. Nibco, Inc.
b. Flow Control Equipment, Inc.
c. Grinnell Corp.
d. Honeywell, Inc. Co.
e. Crane Valves.

f. McDonald: A.Y. McDonald Mfg. Co.
g. Milwaukee Valve Co., Inc.
h. Mueller Co.: Mueller Gas Products Div.
i. Watts Industries, Inc.: Water Products Div.

3. Plug Valves, NPS 2-1/2 and Larger

a. Walworth Co.
b. Olson Technologies, Inc.; Homestead Valve Div.
c. Milliken Valve Co., Inc.

4. Service Meters: As approved by the Utility Provider or Using Agency
5. Line Pressure Regulators

a. American Meter Co.
b. Equimeter, Inc.
c. Fisher Controls International, Inc.
d. Schlumberger Industries: Gas Div.

6. Appliance Pressure Regulators

a. Eaton Corp.: Controls Div.
b. Harper Wyman Co.
c. Maxitrol Co.

2.2 PIPING MATERIALS

A. Steel Pipe: ASTM A 53; Type E or S; Grade B (Grade A for pipe 1-1/2 inch and smaller) Schedule 40; black.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern, with threaded ends according to ASME B1.20.1.
2. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends according to ASME B1.20.1.
3. Cast-Iron Flanges and Flanged Fittings: ASME B16.1, Class 125.
4. Steel Welding Fittings: ASME B16.9, wrought steel or ASME B16.11, forged steel.
5. Steel Threaded Fittings: ASME B16.11, forged steel with threaded ends according to ASME B1.20.1.
6. Joint Compound and Tape: Suitable for natural gas.
7. Steel Flanges and Flanged Fittings: ASME B16.5.
8. Gasket Material: Thickness, material, and type suitable for natural gas.

B. Polyethylene Pipe: All polyethylene pipe used in the Project must comply with ASTM D-2513 and be manufactured in the United States

1. Pipe and Fitting Material. All pipes shall conform to the requirements of the currently approved ASTM D-25 13 specification “Thermoplastic Gas Pressure Pipe, Tubing and Fittings.” All fittings shall conform to the requirements of ASTM D-2683 specification “Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe” or ASTM D3261 “Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.” All pipes shall be manufactured of virgin material, with the exception of the clean rework material that is generated from the manufacturer’s own production, as long as the pipe and/or fittings meet the required specifications. All pipe formulation must have suitable outdoor weather resistance. The color of all polyethylene

pipes shall be either orange or yellow.

2. Pipe Design. All pipe shall be designed for direct burial as specified in D.O.T. Title 49, Part 192, “Transportation of Natural and Other Gas By Pipeline: Minimum Federal Safety Standards,” through current Amendment, for natural gas mains and services operated at 60p.s.i.g. Orless. The pipe must also be suitable for replacing old steel mains and services. The pipe must be homogeneous and be free of holes, cracks, foreign material, blisters or other deleterious faults. The minimum design stress must comply with the requirements of ASTMD-2513.
3. Any defect such as a groove, notch, or gouge, greater than ten percent (10%) of the wall thickness of the pipe, shall not be used

C. Transition Fittings: Type, material, and end connections to match piping being joined.

D. Common Joining Materials: Refer to Section 23 05 00 Basic Plumbing Materials and Methods for joining materials not in this Section.

2.3 PIPING SPECIALTIES

A. Flexible Connectors: ANSI Z21.24, copper alloy.

B. Quick-Disconnect Devices: ANSI Z21.41, convenience outlets and matching plug connector.

2.4 SPECIALTIES VALVES

A. Valves, NPS 2 and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.

B. Valves, NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.

C. Appliance Connector Valves: ANSI Z21.15 and IAS listed.

D. Gas Stops: Bronze body with AGA stamp, plug type with bronze plug and flat or square head, ball type with chrome-plated brass ball and lever handle, or butterfly valve with stainless-steel disc and fluorocarbon elastomer seal and lever handle; 2-psig minimum pressure rating.

E. Gas Valves, NPS 2 and Smaller: ASME B16.33 and IAS-listed bronze body and 125-psig pressure rating.

1. Tamperproof Feature: Include design for locking.

F. Plug Valves, NPS 2-1/2 and Larger: ASME B16.38 and MSS SP-78 cast-iron, lubricated plug valves, with 125-psig pressure rating.

1. Tamperproof Feature: Include design for locking.

G. Automatic Gas Valves: ANSI Z21.21, with electrical operator for actuation by appliance automatic shutoff device.

2.5 GAS REGULATORS

A. Description: Single stage and suitable for fuel gas service. Include steel jacket and corrosion-resistant components, elevation compensator, and atmospheric vent.

1. NPS 2 and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.
2. NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.
3. Line Pressure Regulators: ANSI Z21.80.
4. Appliance Pressure Regulators: ANSI Z21.18. Regulator may include vent limiting device, instead of vent connection, if approved by Professional

B. Pressure Regulator Vents: Factory- or field-installed, corrosion-resistant screen in opening if not connected to vent piping.

2.6 METERS

A. Natural gas meter: Provide outside adjacent to mechanical room entrance, a meter for the Using Agency's use in determining the gas usage for this building. Meter shall be pipe or pedestal mounted, rotary style, enamel coated steel case. Provide combined register totalizer, water escape hole in housing and means for sealing against tampering. Provide with a pulse sensor so the building meter reading system can connect to the gas meter.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Refer to Division 22 - Excavation Backfill and Compaction for Utilities

B. Refer to Division 31 – Earthwork and Grading

C. Refer to Division 31 – Trenching, Backfilling and Compacting

3.2 INSTALLATION

A. Coordinate with Work of other trades

B. See Section 23 08 00 – Mechanical Commissioning

3.3 PREPARATION.

A. Close equipment shutoff fuel gas to premises or section of piping. Perform leakage test as specified in Article entitled, Field Quality Control, to determine that all equipment is turned off in affected piping section.

B. Comply with ANSI Z223.1, paragraph entitled, Prevention of Accidental Ignition.

3.4 SERVICE ENTRANCE PIPING

A. Extend fuel gas piping and connect to fuel gas distribution for service entrance to building.

B. Install dielectric fitting downstream from and adjacent to each service meter unless meter is supported from service-meter bar with integral dielectric fitting. Install shutoff valve downstream

from and adjacent to dielectric fitting. Refer to Section 23 05 00 – Basic Mechanical Materials and Methods for dielectric fittings.

3.5 PIPING APPLICATIONS

A. Flanges, unions, transitions and special fittings with pressure ratings same as or higher than system pressure rating may be used in applications below, provided compliance with the IPC is maintained.

B. Fuel Gas Piping above ground: Use the following:

1. NPS 2 and Smaller: Steel pipe, malleable-iron threaded fittings, and threaded joints.
2. NPS 2-1/2 and Larger: Steel pipe, steel welding fittings, and welded joints.

C. Fuel Gas Piping below ground:

1. Thermoplastic gas pressure pipe, tubing and fittings, ASTM D2513 with transition riser.

3.6 VALVE APPLICATIONS

A. Appliance Shutoff Valves for Pressure 0.5 psig or Less.: Appliance connector valve or gas stop.

B. Appliance Shutoff Valves for Pressure 0.5 to 2 psig: Gas stop or gas valve

C. Appliance Shutoff Valves for Pressure 2 to 5 psig: Gas valve

D. Piping Line Valves, NPS 2 and Smaller: Gas valve.

E. Piping Line Valves, NPS 2-1/2 and Larger: Plug valve or general-duty valve.

3.7 PIPING INSTALLATION

A. Refer to Section 23 05 00 - Basic Mechanical Materials and Methods for basic piping installation requirements and piping joint construction.

B. Install regulator assemblies aboveground. Include gas valve or plug valve for each assembly.

1. Install gas valve or plug valve and strainer upstream from each service pressure regulator.
2. Install service pressure regulators with vent outlet turned down and with corrosion-resistant-metal insect screen.

C. Service Entrance Piping: Extend fuel gas piping and connect to fuel gas distribution for service entrance to building.

1. Exterior service meter will be provided by gas utility.

D. Concealed Locations: Except as specified below, install concealed gas piping in airtight conduit constructed of Schedule 40, seamless, black steel pipe with welded joints. Vent conduit to outside and terminate with screened vent cap.

1. Above-Ceiling Locations: Gas piping may be installed in accessible spaces, subject to

approval of authorities having jurisdiction, whether or not such spaces are used as plenums. Do not locate valves above ceilings.

2. In Partitions: Do not install concealed piping in solid partitions. Protect tubing from physical damage when installed inside partitions or hollow walls.
3. In Walls: Gas piping with welded joints and protective wrapping specified in "Protective Coating" Article in Part 2 may be installed in walls, subject to approval of authorities having jurisdiction.
4. Prohibited Locations: Do not install gas piping in or through circulating air ducts, chimneys or gas vents (flues), ventilating ducts, or elevator shafts.

    a. Exception: Accessible above-ceiling space specified above.

E. Drips and Sediment Traps: Install drips at points where condensate may collect. Include outlets of service meters. Locate where readily accessible for cleaning and emptying. Do not install where condensate would be subject to freezing.

1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use minimum-length nipple of 3 pipe diameters, but not less than 3 inches long, and same size as connected pipe. Install with space between bottom of drip and floor for removal of plug or cap.

F. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings and in floor channels, unless indicated to be exposed to view.

G. Install fuel gas piping at uniform grade of 0.1 percent slope upward toward risers.

H. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

I. Connect branch piping from top or side of horizontal piping.

J. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment, and elsewhere as indicated. Unions are not required on flanged devices.

K. Installed corrugated, stainless-steel tubing system according to manufacturer’s written instructions. Include striker plates to protect tubing from puncture where tubing is restrained and cannot move.

L. Install strainer on inlet of each line pressure regulator and automatic and electrically operated valve.

M. Install pressure gage upstream and downstream from each line pressure regulator.

N. Install flanges on valves, specialties, and equipment having NPS 2-1/2 and larger connections.

O. Install vent piping for gas pressure regulators and gas trains, extend outside building, and vent to atmosphere. Terminate vents with turned-down, reducing-elbow fittings with corrosion-resistant insect screens in large end.

P. Purging Pipes and Fittings: A combustible gas indicator shall be used when purging mains and piping. When purging gas from abandoned lines, the air and the gas must be discharged aboveground and directed away from power lines or structures. When purging air from new

lines, installation of a 3/4 service saddle and non-corrodible riser is required four (4) feet from each deadend on all new installations of pipe in order to purge air from all deadends simultaneously. Release gas into new lines at a rate that will prevent formation of a hazardous mixture of gas and air or precede natural gas with a slug of inert gas.

Q. Pipe Placement and Backfill.

1. When installing polyethylene pipe, sufficient slack shall be provided to allow for possible contraction. The polyethylene pipe shall not have a bend that is less than 25 times the outside diameter of the pipe. If a bend is required that is less than 25 times the outside diameter of the pipe, then an approved polyethylene elbow fitting is required. A fusion joint shall not be placed at a bend. During extremely high temperature conditions it may be necessary to cool the pipe before the last connection.
2. No polyethylene gas line shall be installed above ground. During maintenance, repair, and tie-in work, temporary polyethylene gas lines may be used above ground.
3. The minimum clearance required between the distribution piping and other underground structures is twelve (12) inches. Trench width and minimum cover shall comply with another Section of specification, Excavation, Trenching and Backfilling for Utilities. Unless otherwise shown on plans, pipe embedment shall be select material and remainder of trench may be backfilled with spoil from trenching operation.

3.8 VALVE AND VALVE BOXES

A. Provide valves and valve boxes plumb. All boxes shall be installed flush with the finished grade. Support box with brick or other approved material. Adequate backfill shall be placed around the valve boxes and valve extension boxes to prevent any damage or settlement to the pipeline that may be transferred to the pipe through the valve box. Protective sleeves shall be installed over fusion joints and extend through the valve boxes on the polyethylene valve installations.

3.9 HANGERS AND SUPPORTS

A. Refer to Section 23 05 29 - Hangers and Supports for pipe hanger and support devices.

3.10 CONNECTIONS

A. Install piping adjacent to appliances to allow service and maintenance. Connect piping to appliances using gas with shutoff valves and unions. Install valve upstream from and within 72 inches of each appliance. Install union downstream from valve.

B. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance using gas.

C. Ground equipment

1. Tighten electrical connectors and terminals according to manufacturer’s published torque-tightening values. If manufacturer’s torque values are not indicated, use those specified in UL 486A and UL 486B.
2. Do not use gas pipe as grounding electrode.

3.11 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each service meter, pressure regulator and specialty valve.

1. Text: In addition to name of identified unit, distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.
2. Refer to Section 23 05 53 – Mechanical System Identification for nameplates and signs.

3.12 PAINTING

A. Use materials and procedures in Division 09 – Painting

B. Paint exterior pipe, fittings, pressure regulators, specialty valves, etc.

1. Pipe and Fittings, Color: Yellow (Confirm color with Professional prior to painting)
2. Pressure Regulators, Specialty valves, Etc., Color: Red (Confirm color with Professional prior to painting)

C. Paint exposed interior pipe, fittings, pressure regulators, specialty valves, etc.

1. Pipe and Fittings, Color: Yellow (Confirm color with Professional prior to painting)
2. Pressure Regulators, Specialty valves, Etc., Color: Red (Confirm color with Professional prior to painting)

3.13 FIELD QUALITY CONTROL

A. Inspect, test, and purge piping according to ANSI Z223.1, Part 4 "Inspection, Testing, and Purging," and requirements of authorities having jurisdiction.

B. Repair leaks and defects with new materials and retest system until satisfactory results are obtained.

C. Report test results promptly and in writing to Professional.

D. Verify capacities and pressure ratings of pressure regulators, valves and specialties.

E. Verify correct pressure settings for pressure regulators.

F. Verify that specified piping tests are complete

3.14 ADJUSTING

A. Adjust controls and safety devices. Replace damaged and malfunctioning controls and safety devices.

END OF SECTION 23 11 00

SECTION 23 23 00 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. These heating, ventilating and air conditioning (HVAC) provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.2 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Refrigerant system piping

B. Related Sections

1. Section 23 00 10 – Mechanical General Provisions
2. Section 23 05 00 – Basic Mechanical Materials and Methods

1.3 REFERENCE STANDARDS

A. ANSI/ARI 495 – Refrigerant Liquid Receivers

B. ANSI/ARI 710 – Liquid Line Dryers

C. ANSI/ASHRAE 34 – Number Designation of Refrigerants

D. ANSI/ASTM B32 – Solder Metal

E. ANSI/ASTM B88 – Seamless Copper Water Tube

F. ASTM B280 – Seamless Copper Tube for Air Conditioning and Refrigeration Field Service

G. ANSI/AWS A5.8 – Brazing Filler Metal

H. ANSI/AWS D1.1 – Structural Welding Code

1.4 QUALITY ASSURANCE

A. Each length of pipe, fitting, trap, fixture or device used in any piping system shall be stamped or indelibly marked with

1. Weight or quality

2. Maker's name or mark

B. Examine piping layouts and determine requirements for piping offsets, loops or expansion joints to adequately protect systems.

1. Determine locations and design of anchors and pipe guides to maintain proper piping alignment.
2. Determine anchor reaction forces and coordinate locations of anchors with Contracting Officer.

C. Coordinate expansion and flexibility requirements of this Section with seismic bracing requirements of Section 23 05 48 – Mechanical Sound and Vibration Control.

D. Conform to ANSI/ASME B31.1

1.5 SUBMITTALS

A. See Section 23 00 10 – Mechanical General Provisions

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Piping materials	R			R
Valves and specialties	R			R
Solder	R			

1.6 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-410A

1. Suction Lines for Air-Conditioning Applications: 300 psig
2. Suction Lines for Heat-Pump Applications: 535 psig
3. Hot-Gas and Liquid Lines: 535 psig

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 280, Type ACR.

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

E. Brazing Filler Metals: AWS A5.8.

F. Flexible Connectors:

1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
2. End Connections: Socket ends.
3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch- long assembly.
4. Pressure Rating: Factory test at minimum 500 psig.
5. Maximum Operating Temperature: 250 deg F.

2.2 VALVES AND SPECIALTIES

A. Service Valves:

1. Body: Forged brass with brass cap including key end to remove core.
2. Core: Removable ball-type check valve with stainless-steel spring.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Copper spring.
5. Working Pressure Rating: 500 psig.

B. Solenoid Valves: Comply with ARI 760 and UL 429; listed and labeled by an NRTL.

1. Body and Bonnet: Plated steel.
2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Threaded.
5. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch (16-GRC) conduit adapter, and 24-V ac coil.
6. Working Pressure Rating: 400 psig.
7. Maximum Operating Temperature: 240 deg F
8. Manual operator.

C. Thermostatic Expansion Valves: Comply with ARI 750.

1. Body, Bonnet, and Seal Cap: Forged brass or steel.
2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
3. Packing and Gaskets: Non-asbestos.
4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
5. Suction Temperature: See DX Coil (AHU) Schedule.
6. Superheat: Adjustable.
7. Reverse-flow option (for heat-pump applications).
8. End Connections: Socket, flare, or threaded union.
9. Working Pressure Rating: 700 psig.

D. Moisture/Liquid Indicators:

1. Body: Forged brass.
2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
3. Indicator: Color coded to show moisture content in ppm.
4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
5. End Connections: Socket or flare.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 240 deg F.

E. Replaceable-Core Filter Dryers: Comply with ARI 730.

1. Body and Cover: Painted-steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets.
2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
3. Desiccant Media: Activated alumina.
4. End Connections: Socket.
5. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
6. Maximum Pressure Loss: 2 psig
7. Working Pressure Rating: 500 psig.
8. Maximum Operating Temperature: 240 deg F.

2.3 REFRIGERANTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Atofina Chemicals, Inc.
2. DuPont Company; Fluorochemicals Div.
3. Honeywell, Inc.; Genetron Refrigerants.

B. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A.

A. Suction Lines NPS 3-1/2 and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

B. Hot-Gas and Liquid Lines: Copper, Type ACR, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered.

3.2 VALVE AND SPECIALTY APPLICATIONS.

A. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve. Install

solenoid valves in horizontal lines with coil at top.

B. Install thermostatic expansion valves as close as possible to distributors on evaporators.

1. Install valve so diaphragm case is warmer than bulb.
2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

C. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary.

D. Install filter dryers in liquid line between compressor and thermostatic expansion valve.

E. Install flexible connectors at condensing units.

3.3 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

K. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels if valves or equipment requiring maintenance is concealed behind finished surfaces.

L. Install refrigerant piping in protective conduit where installed belowground.

M. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

N. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Liquid lines may be installed level.

O. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

P. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

Q. Identify refrigerant piping and valves according to Section 23 05 53 – Mechanical System Identification.

R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 23 05 00 – Basic Mechanical Materials and Methods.

S. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 23 05 00 – Basic Mechanical Materials and Methods.

T. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 23 05 00 – Basic Mechanical Materials and Methods.

3.4 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or soldering, to prevent scale formation.

D. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

3.5 HANGERS AND SUPPORTS

A. Hanger, support, and anchor products are specified in Section 23 05 29 Hangers and Supports.

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
2. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:

1. NPS 1/2: Maximum span, 60 inches; minimum rod size, 1/4 inch.
2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch .
3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch.
4. NPS 1-1/4: Maximum span, 96 inches ; minimum rod size, 3/8 inch.
5. NPS 1-1/2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
6. NPS 2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
7. NPS 2-1/2: Maximum span, 108 inches; minimum rod size, 3/8 inch.

D. Support multifloor vertical runs at least at each floor.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.

    a. Fill system with dry nitrogen to the required test pressure.
    b. System shall maintain test pressure at the manifold gage throughout duration of test.
    c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
    d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.7 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Install core in filter dryers after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum

holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
4. Charge system with a new filter-dryer core in charging line.

3.8 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:

1. Verify that compressor oil level is correct.
2. Open compressor suction and discharge valves.
3. Open refrigerant valves except bypass valves that are used for other purposes.

E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 23 23 00

SECTION 23 31 13 – DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. These heating, ventilating and air conditioning (HVAC) provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.2 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Ductwork
2. Plenums
3. Fasteners and Sealants
4. Boiler flues and breechings
5. Exceptions: Where integral with manufactured piece of equipment

B. Related Sections

1. Section 01 91 00 – Commissioning
2. Section 23 00 10 – Mechanical General Provisions
3. Section 23 05 00 – Basic Mechanical Materials and Methods

1.3 REFERENCE STANDARDS

A. SMACNA HVAC Duct Construction Standards, latest edition

1.4 DEFINITIONS

A. Seam: locks or weld applied longitudinally to close section of duct, for example longitudinal seam, spiral seam.

B. Joint: abutting connection between duct sections for continuity of air passage, for example cross joint, transverse joint, coupling.

C. Reinforcement: hardware applied to strengthen duct, for example girth angles, tie rods, fasteners (not connectors), and the like.

D. Stiffening: folding, bending, beading, crossbreaking or corrugating of sheets to achieve strength through shape, for example pocket lock secures joint and is transverse stiffener, with girth angle and fasteners applied (not connectors), joint or stiffener is reinforced.

E. Duct Classification

1. Velocity

    a. Low: to 2000 feet per minute
    b. High: above 2000 feet per minute

2. Pressure classification: except as indicated on the Drawings

    a. Low: to 2 inches water gage
    b. Medium: above 2 inches to 6 inches water gage. Default 3 inches if not otherwise indicated on the Drawings
    c. High: above 6 inches water gage

1.5 QUALITY ASSURANCE

A. Regulatory Requirements

1. Entire ductwork system, including materials and installation, installed in accordance with NFPA 90A
2. Ductwork and components shall be listed as U.L. 181, 181A and 181B, Class I air duct, flame rating not to exceed 25 and smoke rating not to exceed 50.
3. Flues shall conform to the requirements of NFPA-211. Products shall be listed to UL-103 and shall carry the appropriate UL listing mark or label.

1.6 QUALITY ASSURANCE

A. See Section 23 00 10 Mechanical General Provisions

B. Submit product data, O&M data, and samples and show item on shop and coordination drawings according to the following table.

1. “R” means required
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Ductwork materials and fittings	R			R
Flexible ducts	R			R
Duct sealants	R			
Flue	R			R
Duct pressure testing reports		R		

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Spiral oval and round ducts

1. United Sheet Metal Division, United McGill
2. Semco Manufacturing, Inc.
3. Eastern Sheetmetal
4. Lindab, Inc.

C. Duct Connection Systems

1. Ductmate Industries, Inc.
2. Fabriduct Transverse Duct Connection system
3. Ward Industries, Inc.

D. Flexible Connections

1. Ventfabrics
2. Duro Dyne
3. Or equal

E. Flexible Ducts

1. Thermaflex
2. ATCO Rubber Products, Inc.
3. Hart & Cooley
4. Flexmaster

F. Duct Sealants

1. Minnesota Mining and Manufacturing Company
2. Foster Products Corporation
3. Miracle Adhesive Corporation
4. United Sheet Metal Division United McGill Corporation
5. Hardcast Corporation, Inc.
6. Mon Eco Industries
7. Nashua
8. 3M

G. Flexible Duct Clamps

1. Panduit
2. Dura Dyne
3. Ideal Division Parker Hannifin Corporation
4. Tridon Corporation
5. Young Regulator Company

H. Hi-Efficiency Branch Take-Off Fittings

1. Flexmaster
2. Crown
3. Sheet Metal Connectors
4. Or equal

I. Flue

1. Selkirk Metalbestos

2. Ampco
3. Metal-Fab, Inc.
4. American Metal Products Amerivent
5. Simpson Dura-Vent
6. Or equal

2.2 MATERIALS

A. Galvanized Steel Sheet Metal

1. Cold rolled soft steel sheets
2. ASTM A653 and A924
3. Galvanizing: 1-1/4 ounces per square foot, total both sides

    a. General: G-90
    b. Exposed to weather: G-90
    c. Plenum walls and blank-offs where in contact with cooling coil: G-90

4. Lock-forming quality

B. Stainless Steel Sheet Metal

1. ASTM A480
2. Type 304 unless otherwise specified herein
3. Lock-forming quality
4. Finish

    a. No. 3 or 4 finish on ducts exposed to occupant view
    b. No. 2B or 3 finish on concealed ducts.

C. Miscellaneous Products

1. Screws and rivets

    a. Same material as sheet, except as indicated on the Drawings
    b. On aluminum sheets, provide cadmium plated or stainless steel
    c. Zinc or cadmium plated, permitted on galvanized sheets
    d. Minimum screw size: No. 10
    e. Minimum rivet size: 4 pound

2. Duct Sealants

    a. Sealing compound: UL-181 approved, Safetee Duct Sealant 32-17, Foster Products Corporation, Design Polymerics DP-1010, or equal
    b. Tape: Nashua or equal, comply with UL 181B
    c. Gaskets

        (1) Continuous, reinforced, inert self-conforming type
        (2) 1/8 inch thick
        (3) Width: to match angle connection.
        (4) 3M Weatherban Ribbon Sealant PF5422 or equal

3. Hard-setting joint tape, two-part

a. Two part tape
b. Mineral impregnated woven fiber tape
c. Impregnated with activator/adhesive of polyvinyl acetate type
d. UL Listed
e. Flame spread: 10
f. Smoke contributed: 0
g. Equal to Hardcast RTA-50 sealant and DT-5400 4 inch tape

4. Spring Fasteners

a. Oval head stud and receptacle
b. Screwdriver slot
c. Self-ejecting
d. Dzus or equal

5. Angles, tie rod and shapes for reinforcing ducts: In accordance with SMACNA HVAC Duct Construction Standards, except as indicated on the Drawings
6. Duct connection system

a. Transverse bolted duct joints
b. Flanges with permanent, non-hardening sealant
c. Ductmate Industries Ductmate 25 and 35, Fabriduct TDC, or equal

D. Flexible Connections

1. Conforming to UL Standard No. 214 and NFPA 90A
2. SMACNA HVAC Duct Construction Standards, except as indicated on the Drawings
3. With metal edges at each end: No. 24 USSG galvanized steel
4. Length of fabric connections

a. Minimum: 4 inch
b. Maximum: 10 inch

5. Materials

a. Coated glass fabric
b. Flame spread rating: 25
c. Smoke development rating: 50
d. 30 ounces per sq yard
e. Sewed and cemented seams
f. Indoors

(1) Neoprene
(2) Ventfabrics, Inc. Ventglas or equal

g. Outdoors

(1) Weather-resistant
(2) Fiberglass with Hypalon
(3) UV, sunlight, and ozone resistant
(4) Ventfabrics, Inc. Ventlon or equal

h. Fume Hood

(1) Fabric coated with Teflon fluorocarbon resins

(2) Meets UL Standard #214 for flammability and NFPA 102 requirements
(3) Ventfabrics, Inc. Ventel or equal

E. Turning vanes

1. Galvanized steel ductwork: galvanized steel or painted black steel, except as indicated on the Drawings
2. Other ductwork: same material as ductwork
3. Construction per SMACNA HVAC Duct Construction Standards for

   a. Single wall vanes with 3/4 inch trailing edge
   b. Double wall vanes: Not acceptable
   c. Vane length: Provide separate equal size sections for vane length greater than those indicated in referenced Standards.
   d. Vane runners: Type 1 or 2 acceptable

4. Vane radius

   a. 2 inch radius: duct width up to 36 inches
   b. 4-1/2 inch radius: duct with 36 inches or larger

5. Vane shall be at the correct angle for airflow (leading edge in line with the entering duct section; leaving edge in line with existing duct section). If only 45° angles are available, turning vanes shall only be used in 90° elbows where the entering width equals the exiting width; all other elbows shall be full radius type unless otherwise indicated on the drawings.

F. Low pressure round duct take-off fittings in rectangular duct

1. Factory-fabricated hi-efficiency take-off fitting
2. 26 gauge body, G90 galvanized steel
3. 1” wide mounting flange with fully closed corners and pre-punched screw holes, adhesive coated gasket on flange.
4. Balancing damper

   a. 20 gauge blade
   b. G90 galvanized steel 3/8” square control shaft.
   c. Nylon shaft bearings/bushings
   d. 2” high insulation stand-off
   e. Duro Dyne KR-3 Locking hand quadrant or equal

5. No scoop allowed for any application
6. Flexmaster STOD or equal

2.3 RECTANGULAR DUCT

A. General: Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction with galvanized sheet metal, according to SMACNA’s “HVAC Duct Construction Standards – Metal and Flexible.” Comply with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.

1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure classification.
2. Materials: free from visual imperfections such as pitting, seam marks, roller marks, stains, and discolorations.

B. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 0.0359 inches thick or less, with more than 10 square feet of unbraced panel area, unless ducts are lined.

2.4 ROUND AND OVAL DUCTWORK

A. General

1. Factory-fabricated spiral lock seam duct

a. Snap lock is not acceptable
b. Factory-fabricated longitudinal seam acceptable for ducts larger than standard factory sizes
c. Ducts up to 20 Inches in Diameter: Interior, center-beaded slip coupling, sealed before and after fastening, attached with sheet metal screws.
d. Ducts 21 to 72 Inches in Diameter: Three-piece, gasketed, flanged joint consisting of two internal flanges with sealant and one external closure band with gasket.
e. Ducts larger than 72 Inches in Diameter: Companion angle flanged joints per SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," Fig. 3-2.
f. Round Ducts: Prefabricated connection system consisting of double-lipped, EPDM rubber gasket. Manufacture ducts according to connection system manufacturer's tolerances.
g. Flat Oval Ducts: Prefabricated connection system consisting of two flanges and one synthetic rubber gasket.

2. Fittings

a. Same material and construction as duct in which installed
b. For ductwork exposed to occupant view, do not use fabricated fitting at taps to VAV boxes and outlets. Instead use saddle tap cut into continuous spiral duct. Intent is for spiral duct to be continuous for aesthetic reasons. Saddle tap flange shall be 0.5 inches or less.
c. 90 degree tees, laterals, and conical tees

(1) Fabricate to comply with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible", with metal thicknesses specified for longitudinal-seam straight ducts.
(2) Center-line take-off, unless otherwise indicated on the Drawings

d. Elbows

(1) Seams

a) 4 inch and higher pressure class and all ducts exposed to occupant view: continuously welded seams
b) 1 inch to 3 inch pressure: spot welded with bonded (sealed) seams

(2) Gores

a) 2 gores - less than or equal to 30 degrees
b) 3 gores - 31 degrees through 45 degrees
c) 4 gores – 46 degrees through 60 degrees
d) 5 gores - over 61 degrees

2.5 ROUND AND FLAT OVAL DOUBLE WALL DUCT AND FITTINGS

A. Diameter as applied to flat-oval ducts in this Article is the diameter of a round duct with a circumference equal to the perimeter of a given size of flat-oval duct.

B. Round, Longitudinal- and Spiral Lock-Seam Ducts: Fabricate supply ducts of galvanized steel according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible." Ducts to have a perforated inner liner, a 1-inch layer of fiberglass insulation (1-1/2 pounds per cubic foot density) and an outer pressure cell.

1. Acceptable Manufacturers: Ductmate Industries, Inc.; Lindab Inc.; McGill Air Flow Corp.; SEMCO Inc.; Spiral Pipe of Texas, Inc.

C. Duct Joints:

1. Ducts up to 20 Inches in Diameter: Interior, center-beaded slip coupling, sealed before and after fastening, attached with sheet metal screws.
2. Ducts 21 to 72 Inches in Diameter: Three-piece, gasketed, flanged joint consisting of two internal flanges with sealant and one external closure band with gasket.
3. Ducts larger than 72 Inches in Diameter: Companion angle flanged joints per SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," Fig. 3-2.
4. Round Ducts: Prefabricated connection system consisting of double-lipped, EPDM rubber gasket. Manufacture ducts according to connection system manufacturer's tolerances.

    a. Acceptable Manufacturers: Ductmate Industries, Inc.: Lindab Inc.: McGill Airflow Corp.: Spiral Pipe of Texas, Inc.

5. Flat Oval Ducts: Prefabricated connection system consisting of two flanges and one synthetic rubber gasket.

    a. Acceptable Manufacturers: Ductmate Industries, Inc.: Lindab Inc.: McGill Airflow Corp.: SEMCO Inc.; Spiral Pipe of Texas, Inc.

D. 90-Degree Tees and Laterals and Conical Tees: Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," with metal thicknesses specified for longitudinal-seam straight ducts. .

E. Diverging-Flow Fittings: Fabricate with reduced entrance to branch taps and with no excess material projecting from fitting onto branch tap entrance.

F. Fabricate elbows using die-formed, gored, pleated, or mitered construction. Unless elbow construction type is indicated, fabricate elbows as follows:

1. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
2. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from minus 2- to plus 2-inch wg:

    a. Ducts 3 to 36 Inches in Diameter: 0.034 inch.
    b. Ducts 37 to 50 Inches in Diameter: 0.040 inch.
    c. Ducts 52 to 60 Inches in Diameter: 0.052 inch.
    d. Ducts 62 to 84 Inches in Diameter: 0.064 inch.

3. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from 2- to 10-inch wg:

    a. Ducts 3 to 36 Inches in Diameter: 0.034 inch.
    b. Ducts 37 to 50 Inches in Diameter: 0.040 inch.
    c. Ducts 52 to 60 Inches in Diameter: 0.052 inch.
    d. Ducts 62 to 84 Inches in Diameter: 0.064 inch.

4. Flat Oval Mitered Elbows: Welded construction with same metal thickness as longitudinal-seal flat oval duct.
5. Round Elbows 8 Inches and Less in Diameter: Fabricate die-formed elbows for 45- and 90-degree elbows and pleated elbows for 30, 45, 60, and 90 degrees only. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
6. Round Elbows 9 through 14 Inches in Diameter: Fabricate gored or pleated elbows for 30, 45, 60, and 90 degrees unless space restrictions require mitered elbows. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
7. Round Elbows Larger Than 14 Inches in Diameter and All Flat-Oval Elbows: Fabricate gored elbows unless space restrictions require mitered elbows.
8. Die-Formed Elbows for Sizes through 8 Inches in Diameter and All Pressures 0.040 inch thick with 2-piece welded construction.
9. Round Gored-Elbow Metal Thickness: Same as non-elbow fittings specified above.

2.6 FLEXIBLE DUCTS

A. Flexible ducts

1. Use only where indicated on the Drawings
2. UL 181, Class I Air Duct
3. Labeled for compliance with IMC
4. Minimum working pressure

    a. 0 to 4 inch positive static pressure class: 4 inches
    b. 0 to 1 inch negative static pressure class: 1 inch

5. Acoustic Performance

    a. Regenerative noise due to air turbulence within the duct shall not exceed the following sound power levels for a 12 inch diameter duct with an air speed of 1,000 feet per minute.

	Sound Power Levels, dB re. 10^{-12} Watts, at Octave Band Center Frequency, Hz				
	125	*250*	*500*	*1000*	*2000*
Maximum Regenerative Noise	*30*	*31*	*30*	*22*	*20*

6. Insulated Flexible Duct

    a. Chlorinated polyethylene (CPE) inner liner duct permanently bonded to a vinyl or zinc coated spring steel wire helix
    b. Fiberglass insulating blanket; minimum R-value

(1) Ducts outside the conditioned space and in conditioned envelope: 4.2
(2) Ducts outside conditioned space and conditioned envelope: 8.0

c. Low permeability outer vapor barrier of fiberglass bi-directional reinforced metallized film laminate
d. Flexmaster Type 8M

7. Uninsulated Flexible Duct

a. Woven fiberglass fabric with flame retardant coating permanently bonded to a vinyl or zinc coated spring steel wire helix
b. Flexmaster Type 4NI

B. Flexible ductwork clamps

1. Straps listed for use with flexible ductwork
2. Stainless-steel strap with cadmium-plated hex screw to tighten band with a worm-gear action.

a. Adjustable toggle type
b. Dura Dyne Dyna-Clamps or equal

2.7 FLUES

A. Category I appliances

1. Type B, double wall, factory-built, UL 441 listed for Category I appliances burning natural gas for flue gases less than 550 degrees Fahrenheit.
2. The vent shall have an inner gas carrying pipe of aluminum alloy or stainless steel. The outer jacket shall be G-90 galvanized or aluminum coated steel. The space between the inner and outer pipe, the thickness of materials, and construction of the modular sections and accessories shall be as specified by the terms of the product's UL Listing.
3. The stack system shall be from one manufacturer and shall be complete with caps, supports, and bracing.
4. Where exposed to weather, the outer closure band shall be sealed to prevent rainwater from entering the space between inner and outer walls.
5. Metal-Fab Model M, Selkirk Metalbestos RV, or equal

B. Category III appliances

1. Positive pressure, double wall, factory-built, UL 01738 listed for Category III appliances burning natural gas
2. The vent shall have an inner gas carrying pipe of Type 304 stainless steel. The outer jacket shall be aluminum coated steel. The space between the inner and outer pipe, the thickness of materials, and construction of the modular sections and accessories shall be as specified by the terms of the product's UL Listing.
3. The stack system shall be from one manufacturer and shall be complete with caps, supports, and bracing.
4. Where exposed to weather, the outer closure band shall be sealed to prevent rainwater from entering the space between inner and outer walls.
5. Metal-Fab Model PIC, Selkirk Metalbestos PS, or equal

C. Category IV appliances

1. Positive pressure, double wall, factory-built, UL 1738 listed for Category IV appliances burning natural gas
2. The vent shall have an inner gas carrying pipe of AL-29-4C superferritic stainless steel. The outer jacket shall be 430 stainless steel. The space between the inner and outer pipe, the thickness of materials, and construction of the modular sections and accessories shall be as specified by the terms of the product's UL Listing.
3. The stack system shall be from one manufacturer and shall be complete with caps, supports, and bracing.
4. Where exposed to weather, the outer closure band shall be sealed to prevent rainwater from entering the space between inner and outer walls.
5. Metal-Fab Model CG, Selkirt Saf-T Vent CI Plus, or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate with work of other trades

B. See Section 23 09 00 – Energy Management & Control Systems

C. See Section 23 08 00 – Mechanical Commissioning

3.2 MOUNTING AND ALIGNMENT

A. See Section 23 05 48 – Mechanical Sound and Vibration Control

3.3 DUCT CLASSIFICATION

A. Minimum operating pressure for each duct system, general

1. Scheduled static pressure for each fan or unit, positive or negative, unless otherwise indicated on the Drawings
2. Adjust upward to nearest pressure class tabulated in SMACNA HVAC Duct Construction Standards

B. Static pressure class, unless otherwise indicated on the Drawings

Application	SMACNA Pressure Class
Discharge of air handlers through shaft fire/smoke damper	4 inches
Air distribution duct from fire/smoke damper to VAV terminal boxes	3 inches
VAV downstream of terminal boxes	1 inch
Toilet exhaust	-2 inches
Return	-2 inches
Other fans systems	Per fan static
Return air transfers	1 inch negative

3.4 DUCTWORK INSTALLATION

A. General

1. Install ducts in accordance with manufacturer's written installation instructions
2. Ductwork exposed to occupant view shall be run straight and true, in line with building elements. No sagging or out-of-true straight runs shall be acceptable. Sidewall taps and duct joints shall be clean and free of visual blemishes and all sealant shall be internal to joint and not visible. Ducts shall have no external markings or tags. All duct beads shall be parallel.
3. Construct with gages, joints, bracing, reinforcing, and other details per latest IMC, ASHRAE, SMACNA and NFPA, unless specified otherwise

    a. Comply with most stringent
    b. Provide ducts with IMC gages or thicker when traversing rated corridors
    c. Combustion air ducts: Minimum 24 gage

4. Construct of galvanized sheet metal, except where otherwise indicated herein or on Drawings
5. Provide for duct rigidity by either of these methods

    a. Beading at 12 inches on center, maximum
    b. Crossbreak outward in ducts having positive internal pressure
    c. Crossbreak inward in ducts having negative internal pressure

        (1) Exception: All ducts exposed to rain shall outward crossbreak on top of the duct.

6. Duct dimensions indicated are outside duct dimensions (OD) unless indicated on the Drawings as inside dimension (ID or net, clear dimension).
7. Alter duct sizes on basis of equal friction where required to facilitate installation. Reflect changes in shop drawings for review by Professional.
8. At duct penetrations of walls, floors and ceilings where exposed to occupant view, provide sheet metal angle type escutcheons with no sharp corners or edges

    a. Clearance from duct to opening shall not exceed 2 inches
    b. Escutcheons shall overlap wall, floor, or ceiling surface by ½ inch minimum

9. Frame, trim, caulk and seal all duct penetrations through acoustical walls and partitions
10. Tapers

    a. Pitch sides of duct in diverging or converging airflow maximum of 1 to 4 taper
    b. Abrupt, bushing type fitting not allowed

11. Duct openings

    a. Provide openings where required to accommodate thermometers, smoke detectors, controllers, and the like. Insert through airtight rubber grommets.
    b. Where openings are provided in insulated ductwork for insertion of instruments, install insulation material inside metal ring for use as plug.
    c. At fire dampers allow adequate length of duct to install access door.

12. Avoid penetration of ducts; provide airtight seal at unavoidable penetrations of hanger rods
13. No exposed sharp metal allowed

    a. All exposed pins, screws and sharp objects shall be covered with hardening silicon
    b. All exposed sheet metal edges shall be hemmed with exposed corners rounded smooth
    c. Remove all sheet metal fish hooks

14. Install lining in ducts and plenums as specified in Section 23 07 00 – Mechanical Insulation.
15. Flexible Connections

    a. Coated glass fabric
    b. For indoor or outdoor use
    c. Use diaphragm type at plug fan inlets
    d. Install at connections to fans and air handling units and as indicated on Drawings
    e. 2 inch slack in fabric; install to allow minimum movement of 1 inch in both tension and compression
    f. Protect from direct solar and rain exposure with sheet metal shroud where outdoors

16. Volume dampers: Install dampers as specified in Section 23 33 00 – Duct Accessories

B. Elbows and Splits

1. Use radius elbows in rectangular ducts unless otherwise indicated on the Drawings: Centerline radius dimension shall not be less than 1-1/2 duct width
2. Where space does not permit duct radius specified above install short radius splitter vanes per SMACNA HVAC Duct Construction Standard

    a. Number of vanes determined by ratio of inner radius (R) to duct width in plane of radius (W)
    b. One vane: Radius to width ratio above 0.3
    c. Two vanes: Radius to width ratio between 0.1 to 0.3
    d. Three vanes: Radius to width ratio 0.1 and smaller

3. Use square turns with turning vanes in rectangular ductwork, unless otherwise indicated on the Drawings, at following locations

    a. Use only where full radius elbow cannot fit
    b. Use only in ducts with 2000 fpm or less design velocity
    c. In high and medium pressure ductwork spot weld turning vane to duct

C. Rectangular Duct Joints

1. Transverse Joints

    a. In medium pressure ductwork shall be Fabriduct TDC or Ductmate or equal
    b. In low pressure ductwork shall be Fabriduct TDC or equal except that ducts under 19 inches longest side may be slip & drive (S&D)

2. Longitudinal seams shall be Pittsburgh. Snap lock not allowed

D. Plenum walls, blank-offs, and casings

1. Construct per SMACNA HVAC Duct Construction Standard, Casings and Plenums
2. Static pressure class

    a. Upstream of fan: -2 inches
    b. Downstream of fan: fan static pressure or greater

3. Seal all joints, edges, and penetrations as per HVAC ducts as specified herein.

E. Round and oval ductwork

1. Joints between ducts

    a. Made with beaded sleeve joints as scheduled
    b. Duct sealer applied to male end
    c. Mechanically fastened with sheet metal screws or pop rivets
    d. Over joint and screw or rivet heads, apply coating of duct sealer.

        (1) Duct where exposed to occupant view: Sealant shall be within joint only and not visible

2. Joints, duct and fitting

    a. Slip projecting collar of fittings into duct: Per SMACNA HVAC Duct Construction Standard
    b. Apply duct sealer: Seal and tape as specified above
    c. Mechanically fasten: Fastening schedule: Per SMACNA HVAC Duct Construction Standard

3. Branch take-offs

    a. Medium pressure: 45 degrees (fittings)
    b. Low pressure: straight 90 degrees (fittings)

4. Horizontal supports

    a. One or two piece clamp band strap
    b. Minimum: one per section
    c. Support fittings as required to prevent sagging

5. Vertical Supports: one of the following

    a. Clamp bands with extended ends supported by floor
    b. Clamp bands with knee bracing
    c. Pedestal at base of vertical

F. Flexible ductwork

1. Not allowed for:

    a. Product conveying systems such as kitchen exhaust and laboratory exhaust
    b. Dryer exhaust (other than final exposed connection at dryer)
    c. Medium and high pressure ducts

2. Continuous, single pieces
3. Length

    a. Low pressure

        (1) Maximum 5 feet, except where longer lengths are indicated on drawings. Where longer lengths are shown, the last 3 feet to 5 feet shall be wire flex duct and remaining ductwork shall be aluminum flex duct.
        (2) Minimum length: 3 feet

4. End Connections

a. Connect to duct collars, terminal unit connections and round air outlets per manufacturer's instructions
b. Secure with strap clamps specified above

5. Installation

a. Support adequately to avoid excessive droop
b. Minimum inside bending radius not less than one duct diameter
c. Install as straight as possible except as shown on drawings for sound attenuation
d. Cut ducts to lengths required rather than create bends to take up excess lengths except as shown on drawings for sound attenuation

G. Grille connections

1. Provide at entry to diffuser collar either

a. Straight duct for 1 duct diameters or greater
b. Full radius elbow
c. Side inlet plenum

(1) Height: 4 inches minimum taller than top of grille to provide room for uniform airflow to grille
(2) Width/length: 2 inches wider than duct or round diffuser collar, whichever is larger
(3) Internal surfaces lined with minimum 1/2 inch thick Type AL duct liner as specified under Section 23 07 00 – Mechanical Insulation
(4) At contractor’s option, where plenum is required at round neck diffuser, square neck diffuser with length and width equal to diffuser diameter may be substituted

d. Flexmaster FlexRight Elbow or equal

2. Connections at grilles shall be insulated to the extent the duct is insulated including the final register box.
3. Seal connections at grilles per seal class of upstream ductwork.

H. Duct hangers and supports

1. General

a. Support horizontal ducts with hangers of size and spacing as indicated in pertinent SMACNA HVAC Duct Construction Standards
b. Attachment to structure: See Section 23 05 29 – Hangers and Supports

2. Horizontal Duct Supports

a. Install hangers at each change in direction of duct
b. Strap hangers

(1) Extend strap down both sides of ducts
(2) Turn under bottom one inch minimum
(3) Metal screw hangers to

a) Bottom of duct
b) Upper and lower sides of ducts

c) Not more than 12 inches on center

c. Angle hangers

(1) Provide angle hangers formed by extended vertical bracing angles
(2) Or by rods connecting to bottom angles if size or bracing angles conform to hanger schedule

3. Vertical duct supports

a. Support vertical ducts at every floor
b. Use angles or channels mechanically fastened to ducts with screws or pop rivets.
c. Set angles or channels on floor slab or structural steel members placed in opening, unless otherwise indicated on the Drawings

I. Ducts exposed to weather

1. Make ducts subject to rain watertight.
2. Construct as follows to assure water run-off

a. Arrange standing seams to not act as dams
b. Longitudinal seams at bottom of duct
c. Construct all ducts subject to rain watertight and to insure water runoff by one or more of following techniques

(1) Slope entire top of duct down toward side.
(2) Vertical struts within duct to bow top panels of duct into convex shape

3. Seal as specified herein.

J. Sound-rated duct packing

1. Wherever possible avoid duct penetrations through sound-rated walls, floors and ceilings.
2. Provide packing for unavoidable duct penetrations per Section 23 05 48 Mechanical Sound, and Vibration Control.

K. Joint Sealing

1. Seal ducts per the Seal Levels tables below

a. Provide more stringent sealing if required to meet requirements of Paragraph 3.6 and 3.7.

Seal Level Requirement				
Duct Location	Duct Type			
	Supply		Exhaust	Return
	≤2 in. water column[b]	>2 in. water column[b]		
Outdoors	A	A	A	A
Unconditioned Spaces	A	A	A	A
Return Air Plenums	A	A	A	A

Conditioned Spaces	A	A	A	A
[b] Duct design static pressure classification.				

Seal Level Definitions	
Seal Level	Sealing Requirements
A	All transverse joints, longitudinal seams, and duct wall penetrations
B	All transverse joints and longitudinal seams
C	Transverse joints only

Longitudinal seams are joints oriented in the direction of airflow. Transverse joints are connections of two duct sections oriented perpendicular to airflow. Duct wall penetrations are openings made by any screw fastener, pipe, rod or wire. Spiral lock seams in round and flat oval duct need not be sealed. All other connections are considered transverse joints, including but not limited to taps and other branch connections, access door frames and jambs, duct connections to equipment, etc.

2. Ducts not exposed to weather: Seal using one of the following:

    a. Duct sealer per Paragraph 2.2C.2.a
    b. Gasketted TDC or Duct-Mate
    c. Flexible duct

        (1) Secure with straps or clamps as specified herein.
        (2) Supplement with duct tape, both inner and outer liner.

3. Duct exposed to weather

    a. TDC or Duct-Mate joints: Utilize interior joint gasket material plus a bead of butyl rubber sealant at the joint and continuous metal clip or cleat over the top of all four joints (top bottom and sides).
    b. Apply two part hard-setting joint tape to

        (1) Longitudinal joints
        (2) Horizontal joints
        (3) Transverse joints
        (4) TDC or Duct-Mate joints
        (5) Duct penetrations
        (6) Screws through duct
        (7) Gores of elbows

4. Indoor duct where exposed to occupant view: Sealant shall be within joint only and not visible
5. Fire and fire/smoke dampers: Sealant shall be listed as approved on manufacturer's UL installation sheet.
6. Seal punched holes and corner cracks
7. Seal all factory fabricated ducts, including transverse joints on gored elbows
8. Seal end caps
9. After installation and testing reseal joints found to be leaking at no additional cost to the Using Agency. See Paragraph 3.7.

3.5 FLUE INSTALLATION

A. Install in accordance with manufacturer's installation instructions and UL listing requirements and with local codes.

B. Category 1 Appliances: Minimum stack height shall be in accordance with GAMA Venting Tables for Category I Appliances and IMC

C. Support from building structure using rigid structural shapes for attachment of fixed point supports. Anchor supports to structure by welding, bolting, steel expansion anchors, or concrete inserts. Size of structural shapes shall be in accordance with manufacturer's recommendations.

D. Roof penetration pieces shall be UL listed products of the chimney manufacturer. Where roof is pitched up to 45° roof penetration pieces shall be of the pitched type so that it is not necessary to provide a horizontal roof curb. If roof pitch exceeds 45°, provide a curb around roof opening.

E. All inner pipe joints shall be held together by means of formed vee bands and sealed with P077 Silicone Sealant for flue gas temperature up to 600°F, or P071 High Temperature Sealant for flue gas temperatures over 600°F.

F. Screws shall be of the hex head type with shoulder stops and tapered leading threads for easy starting. Nuts for the inner and outer bands shall be retained by means of a free-floating cage to allow easy alignment.

G. Where exposed to weather

1. The outer closure band shall be sealed with the same sealant as the inner joint.
2. Paint with one coat of corrosion and heat resistant primer and cone coat heat resistant paint. Paint color selected by Professional.

H. Termination:

1. Roof termination: Terminate with listed wind resistant flue cap 3 feet above the highest point where it pass through a roof and at least 2 feet higher than any portion of the building within a horizontal distance of 10 feet.
2. Wall termination: Terminate with listed 45° miter cut with bird screen unless otherwise indicated on plans.

3.6 DUCT PRESSURE TESTING

A. Scope of Testing

1. HVAC Ductwork and Plenums

a. Supply

(1) Test only 1-inch (positive or negative) pressure class and greater Standard 90.1 requires 3 inches and above.
(2) Test representative sections totaling no less than 100% of the total installed duct area for the designated pressure class in each system: Duct sections to be tested are to be chosen by Professional. Do not proceed with tests until test sections are designated.
(3) Test field installed supply fan plenums

b. Return: Required
c. Exhaust: Not required
d. Outdoor air: Not required

B. General

1. Pretesting shall be conducted prior to conducting test in presence of Professional. Once all required ductwork has passed the pretest duct pressure test, the Professional shall be notified to visit the site for witness testing.
2. Use portable high pressure blower and necessary instruments to indicate amount of leakage
3. Conduct tests as prescribed in SMACNA HVAC Air Duct Leakage Test Manual, and make test before duct sections are concealed
4. Procedure

    a. Seal openings in ducts and plenums to be tested.
    b. Connect test apparatus to test section using flexible duct connection or hose.
    c. Close damper on blower suction side, to prevent excessive buildup of pressure.
    d. Start blower and gradually open damper on suction side of blower.
    e. Build up pressure in test section equal to static pressure class.
    f. Noise generated from duct leakage not acceptable. Seal as required.
    g. Determine amount of air leakage by makeup air flow measurements:

        (1) Maximum permitted leakage for HVAC ductwork shall be:

$$CFM_{max} = \left(\frac{A}{100}\right) C_L P^{0.65}$$

        Where,

        CFM_{max} = The maximum permitted leakage, cubic feet per minute (cfm).
        A= Surface area of the tested duct sections, square feet.
        C_L= Duct leakage class, cfm/100 square feet at 1 inch water column.
        = 6 for rectangular sheet metal, rectangular fibrous ducts, and round flexible ducts
        = 3 for round/flat oval sheet metal or fibrous glass ducts
        P= Test pressure which shall be equal to the design duct pressure class rating, inches water column.

        (2) Allowable leakage can also be calculated as 1 percent of the design operating air volume for the entire system. If this method is used, the total system leakage must first be determined and then compared with the 1 percent (of system volume flow) allowable leakage. Acceptance is indicated if the actual measured leakage of the entire system is less than the calculated allowable leakage.
        (3) Maximum permitted leakage for life safety ductwork shall be per IMC.
        (4) If leakage exceeds permitted limit, repair leaks and retest duct sections at no additional cost to the Using Agency until permitted leakage limits are obtained.

5. Visually mark tested sections with certification sticker and initials of field test inspector.

C. Documentation

1. Submit certification of test results of compliance to Commissioning Authority.
2. Include certified test results showing compliance per Section 23 00 10 – Mechanical General Provisions.

3.7 SYSTEM LEAK TESTING

A. Scope of Testing

1. Supply: All supply air duct systems
2. Return: All return air duct systems
3. Exhaust: Systems greater than 10,000 cfm design capacity
4. Outdoor air: Not required
5. Seal Class B and C ducts not required to be tested

B. General

1. Tests shall be done after air balancing; see 23 05 93 – Testing, Adjusting and Balancing
2. Determine the maximum allowable leakage per system using the methodology in Paragraph 3.6B.5.g. The duct surface area shall be all ductwork downstream of the fan through the air outlets.
3. Or use the 1 percent allowable leakage as described above.

C. Test conditions

1. Fan balance complete and operating at design airflow conditions
2. For variable volume fans, set all the variable volume boxes to design maximum airflow rates and operate the fan at optimum static pressure setpoint; (see 23 05 93 Testing, Adjusting and Balancing); fan and boxes to remain in a static state during the testing

D. Leakage testing

1. Collect the following information from air balance reports for each tested fan system. (This work is already required in Section 23 05 93 Testing, Adjusting and Balancing, so no new work is required.)

   a. Pitot traverse in the supply (exhaust) duct downstream, positive pressure side (downstream, negative pressure side) of the fan, and
   b. Totaling the readings of individual air outlets or terminals

2. Subtract the readings in Paragraph 3.7D.1. If the difference in the readings, accounting for the accuracy of the test instruments, is greater than the amount allowed in Paragraph 3.7B.3, repair air leaks as required and retest.
3. If leakage exceeds permitted limit, repair leaks and retest duct sections at no additional cost to the Using Agency until permitted leakage limits are obtained.

E. Documentation

1. Submit certification of test results of compliance to Commissioning Authority
2. Include certified test results showing compliance per Section 23 00 10 – Mechanical General Provisions

3.8 PROTECTION

A. Adhere to SMACNA Duct Cleanliness for New Construction Guidelines for Intermediate Level Duct Cleanliness unless more stringent requirements are indicated herein.

B. Storage: Porous materials, such as lined and flexible duct, shall be stored where they will not be exposed to rain or other moisture sources.

C. Temporary closure: Provide temporary closure of polyethylene film or other covering which will prevent entrance of dust and debris at the following conditions:

1. Exposed ends of unlined installed ducts at the end of each day
2. Exposed ends of lined ducts or plenums whether in storage or installed

D. Duct cleaning

1. Using the connected fan(s) force air at high velocity through duct to remove accumulated dust
2. Protect equipment and spaces, which may be harmed by excessive dirt with filters, or bypass during cleaning
3. In areas, which must be kept dust free, seal all outlets duct tight. When closures are removed avoid spilling dust in room

3.9 INSPECTION

A. Verify that adequate clearance between ducts and adjacent walls or equipment is available to permit proper sealing, maintenance and repairs.

3.10 PRE-OPERATING CHECKS

A. Before operating the duct systems: Set all manual dampers in full open position

B. Complete the attached Pre-Functional Test Data Sheet, in specification 23 08 00, for each duct system.

3.11 TESTING AND ADJUSTING

A. Before starting the duct systems

1. Clean the duct system. See Paragraph 3.8D
2. See Section 01 91 00 – Commissioning

B. After starting the duct systems: Check for noise and leakage. See Paragraphs 3.6 and 3.7. Repair as required at no additional cost to the Using Agency.

C. See Section 23 05 93 – Testing, Adjusting, and Balancing: Coordination with Balance Agency:

1. Provide services of a sheet metal installer familiar with the system ductwork to provide assistance to the balancing agency during the initial phases of air balancing in locating all sheet metal dampers
2. Install missing dampers

D. See Section 23 08 00 – Mechanical Commissioning

END OF SECTION 23 31 13

SECTION 23 33 00 – DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. These heating, ventilating and air conditioning (HVAC) provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.2 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Access Doors
2. Balancing Dampers
3. Backdraft Dampers
4. Fire dampers
5. Fire and Smoke Dampers
6. Sound Attenuators
7. Wall Louvers
8. Combination Louvers/dampers
9. Drain Pans
10. Belt Guards
11. All duct accessories except, where integral with manufactured piece of equipment.

B. Related Sections

1. Section 01 91 00 – Commissioning
2. Section 23 00 10 – Mechanical General Provisions
3. Section 23 05 00 – Basic Mechanical Materials and Methods

1.3 QUALITY ASSURANCE

A. Fire, smoke, and fire/smoke dampers shall be UL listed and constructed in accordance with UL Standard 555 Fire Dampers and UL Standard 555S.

B. Demonstrate operation of smoke dampers to authorities having jurisdiction and Professional as part of life safety testing.

C. Access doors shall be UL labeled.

D. Damper pressure drop and leakage ratings shall be based on tests and procedures performed in accordance with AMCA 500 - Test Methods for Louvers, Dampers and Shutters.

1.4 SUBMITTALS

A. See Section 23 00 10 Mechanical General Provisions

B. Submit product data, O&M data, and samples and show item on shop and coordination drawings according to the following table.

1. "R" means required
2. "R2" means required only for products and equipment differing for the specified manufacturer and model and for "or equals" where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Access doors	R2			R
Balancing dampers	R2			R
Automatic dampers	R	R		R
Backdraft dampers	R2			R
Fire dampers	R	R		R
Smoke dampers	R	R		R
Fire/Smoke dampers	R	R		R
Sound attenuators	R	R		R
Wall louvers	R			R
Combination louvers/dampers	R	R		R
Drain pans	R2			R
Condensate pumps	R	R		
Belt guards	R2			

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Access Doors, Ducts

1. Ventfabrics, Inc.
2. Duo Dyne, Corporation
3. Ruskin Mfg. Company
4. PCI Industries – Pottorff
5. Ductmate

C. Access Doors, Plenum

1. Ventfabrics, Inc.
2. Duo Dyne, Corporation
3. Elgen Manufacturing Company

D. Balancing and Automatic Dampers

1. Ruskin Manufacturing Company

2. Air Balance Inc.
3. American Warming and Ventilating Inc.
4. Johnson Controls
5. PCI Industries - Pottorff

E. Backdraft Dampers

1. Greenheck Fan Corp
2. Ruskin Manufacturing Company
3. Air Balance, Inc.
4. American Warming and Ventilating Inc.

F. Damper Hardware

1. Ventfabrics, Inc.
2. Duo Dyne, Corporation
3. Young Regulator Company

G. Fire Dampers and Combination Smoke and Fire Dampers

1. Ruskin Manufacturing Company
2. Greenheck Fan Corp.
3. Air Balance Inc.
4. PCI Industries - Pottorff

H. Sound Attenuators

1. Vibro-Acoustics
2. Industrial Acoustics, Inc.
3. Quiet Duct
4. Price Industries
5. Kinetics

I. Wall Louvers and Combination Louver/dampers

1. Ruskin Manufacturing Company
2. Greenheck Fan Corp.

J. Acoustical Plenums

1. Aerosonics, Inc.
2. Industrial Acoustics Inc.
3. Rink
4. Environmental Elements Corporation, Koppers Company
5. United McGill Corporation

2.2 DUCT ACCESS DOORS

A. In accordance with SMACNA Duct Construction Manuals, except as indicated in the Drawings

B. In ductwork

1. Construction

a. Galvanized steel
b. Rating same as duct pressure class
c. Where duct is insulated

(1) Fiberglass insulation, thickness to match duct insulation installed R-value, see 23 07 00 – Mechanical Insulation
(2) Double wall

d. Removable type with safety chain linking door permanently to frame
e. Positive seal polyethylene gasket
f. Paired progressive cam-locks, quantity as required for tight, low leakage fit
g. No tools required for opening and closing

2. Size

a. 20 inches x 14 inches unless otherwise indicated in the Drawings
b. Ducts less than 16 inches: one dimension 20 inches; other dimension 2 inch less than duct width
c. Larger sizes where required for access

3. Provide in following locations

a. Coils in ducts (including at VAV boxes)

(1) Entering and leaving side for cooling coils
(2) Entering side for heating coils

b. Automatic dampers: linkage side
c. Smoke dampers
d. Fire dampers
e. Smoke detection heads
f. At the top of each lined duct riser accessible from the fan room floor (for inspection of duct liner)
g. Fan bearings enclosed in ducts
h. Sprinkler heads in ducts
i. Motors, actuators or other accessories that require access or service inside ducts
j. Outdoor air plenums as required to clean plenum from dirt and debris.
k. Where otherwise indicated on the Drawings

2.3 DAMPERS

A. Volume Dampers

1. Conform to requirements of SMACNA HVAC Duct Construction Standards.
2. General

a. Blades of same material as duct where damper is located
b. Damper Hardware

(1) Ventlok 400 and 4000 series or equal; for low pressure systems 2 inch SMACNA pressure class and less
(2) Ventlok HiVel hardware or equal; for greater than 2 inch SMACNA pressure class

c. Actuating quadrants typical for single and multi-blade dampers; provide closed bearing

on opposite end from quadrant to prevent air leakage: Ventlok No. 609 or equal
d. Bearing at one end of damper rod: Ventlok No. 609 or equal
e. Sealed bushings installed at both ends to avoid duct leakage
f. Accessible quadrant at other end of damper rod

(1) With lever and lock screw: Ventlok No. 635 or equal
(2) Insulated ducts

a) Quadrants mounted on collar to clear insulation
b) Ventlok Nos. 637, 638, or 639 or equal
c) Selection based on insulation thickness

g. For dampers above non-removable ceilings and without ceiling access panels provide Ventlok No. 677 or equal concealed damper regulator

(1) With paintable cover plate
(2) Required interconnecting hardware

3. Single blade dampers

a. Galvanized steel ductwork: galvanized steel, except as indicated in the Drawings
b. Blade: Two gages heavier than duct gage, or 18 gage, whichever is lighter

4. Multi-blade Dampers

a. Low Pressure/Low Velocity Systems (2 inch water column or less static pressure class and 1500 fpm or less face velocity)

(1) Opposed blade damper
(2) Ruskin Model CD35 or equal

b. High Pressure/High Velocity Systems (greater than 2 inch water column static pressure class or greater than 1500 fpm face velocity):

(1) Rectangular

a) Opposed blade damper
b) Ruskin Model CD60 or equal

(2) Round and Oval

a) Oval: Ruskin Model CDR25 and DO25 or equal
b) Round: Up to 20 inch diameter: Ruskin Model MDRS25 or equal
c) Round: Larger than 20 inch diameter: Ruskin Model CDRS25 or equal

B. Automatic Dampers

1. Refer to Section 23 73 13 – Air Handling Units dampers provided with factory packaged air handling equipment.
2. Actuators: See Section 23 09 13 – EMCS Basic Materials and Control System
3. Construction

a. Return air dampers (AHUs)

(1) Class 2 smoke-rated Ruskin Model SD-36 or equal

(2) End switches: Provide end switch to indicate fully-closed position.

b. Blade Action

(1) Throttling duty: opposed
(2) Mixing duty: parallel
(3) Two-position: parallel or opposed

c. Bearings: Molded synthetic sleeve, turning in extruded hole in frame.
d. Seals:

(1) Blade: Inflatable PVC coated fiberglass material or neoprene mechanically attached to blade edge.
(2) Jamb: Flexible metal compression type.

e. Linkage: concealed in frame. External linkage and jack-shafts will not be accepted.
f. Axles: Minimum 1/2 inch diameter plated steel, hex-shaped, mechanically attached to blade. Side access for direct-coupled actuator.

4. Finish: Mill galvanized
5. Damper area: See Drawings for sizes
6. Low Pressure/Low Velocity Systems (2 inch water column or less static pressure class and 1500 fpm or less face velocity)

a. Ruskin Model CD36 or equal
b. Integral, heavy-duty factory-installed motorized damper acceptable for exhaust fans unless otherwise scheduled

7. High Pressure/High Velocity Systems (greater than 2 inch water column static pressure class or greater than 1500 fpm face velocity):

a. Ruskin Model CD60 or equal

C. Backdraft Dampers

1. Required locations

a. Where indicated on the Drawings
b. In suction or discharge of all exhaust fans as listed in equipment schedule

(1) Integral, heavy-duty factory-installed type acceptable unless otherwise scheduled

2. General Applications

a. Construction

(1) Extruded aluminum construction
(2) Extruded vinyl locked into blade edge
(3) Blade ends overlapping frame

b. Performance

(1) Start to open: .02 inches w.g. or less
(2) Fully open: .05 inches w.g. or less
(3) Leakage for 24 inch wide damper: 25 cfm per ft^2 or less.

c. Ruskin Series CBD4 or equal

3. High Velocity Applications

a. Applies to discharge of air handlers and where velocity exceeds 1500 fpm. Damper shall be specifically designed for location at turbulent fan discharge.
b. Frame

(1) Minimum 12 gage galvanized steel channel
(2) Bolt Holes: Both flanges

c. Blades

(1) Airfoil-shaped with integral structural reinforcing tube running full length of each blade
(2) Material: 7 inches x minimum 0.080 inch Alloy 6063-T5 extruded aluminum
(3) For multiple section dampers, provide galvanized steel or aluminum bracket to link dampers so they operate together.

d. Axles: Minimum 3/4 inch diameter plated steel
e. Bearings: Bolt-on bearings with re-lube ball bearings
f. Linkage

(1) 3/16 inch thick x 3/4 inch plated steel tie bar with minimum 16 gage plated steel linkage arms; stainless steel pivot pins
(2) Located out of airstream (side or external linkage)

g. Counterbalance: Located out of airstream
h. Seals

(1) Blade

a) Mechanically attach blade seals to blade
b) Silicone rubber, rated for 300 degrees Fahrenheit

(2) Jamb: Vinyl

i. Ruskin CBS92 or equal

2.4 FIRE DAMPERS

A. Ratings (test conditions and label) per UL Standard 555

1. 250 degrees Fahrenheit minimum
2. 1-1/2 hour fire rating, unless otherwise indicated in the Drawings
3. Dynamic (closes against air flow)

B. Factory sleeve

C. Damper

1. Multi-bladed, equipped with fusible link, spring loaded type
2. Style

a. As indicated on the Drawings
b. Ducted, rectangular duct: Style B (out of airstream)
c. Ducted, round duct: Style A (in airstream) with damper sleeve 2” in each dimension larger than duct; plus cap and collar.
d. Unducted: Style A (in airstream)

D. Fusible link

1. UL listed
2. Fusible links on fire dampers shall be constructed to UL Standard 33 – Fusible Links for Fire Protection Service
3. Temperature rating: Per code

E. Type: as indicated on the Drawings

F. Type:

1. Rectangular type up to 1000 feet per minute: Ruskin DIBD2 or DIBD10 Style A or equal
2. Rectangular type 1000 feet per minute and higher: Ruskin DIBD2 or DIBD10 Style B or equal
3. Circular and oval type: Ruskin DIBD2 Style CR and CO, or DIBD10 Style R and LO or equal

G. Status end switches:

1. Where indicated on the Drawings
2. Ruskin SP100 or equal Switch Package

2.5 COMBINATION SMOKE AND FIRE DAMPERS

A. Fire ratings (test conditions and label) per UL Standard 555

1. 250 degrees Fahrenheit minimum
2. 1-1/2 hour fire rating, unless otherwise indicated in the Drawings

B. Factory sleeve

C. Damper

1. Two-position duty: Either parallel blade or opposed blade
2. Leakage class as scheduled, minimum Class 2, rated per UL 555S
3. 120 volt actuator
4. Locate damper in sleeve starting at approximately 3” from end of the sleeve opposite the damper actuator end. (Damper shall be installed with this end protruding 3 inches out from inside surface of wall.)

D. Actuator

1. 120 volt
2. Two-position unless otherwise indicated on drawings
3. Spring return normally closed unless otherwise indicated on drawings
4. Electronic cut-out at full-open so that actuator creates no noise holding open
5. Permanently lubricated gears
6. Direct coupled with steel clamp; aluminum clamp and external linkage not acceptable

E. Controls

1. Heat-actuated electric release
2. Controlled closure to prevent duct and HVAC component damage
3. Time to drive from full closed to open and or spring from full open to closed shall not exceed the following:

   a. FSD's: 15 seconds
   b. All others: 75 seconds.

4. Damper to automatically reopen after a test, smoke detection or power failure condition. In the event of heat activated closure, the damper must be manually reset at the damper.
5. Release temperature: as scheduled on drawings or use the following: 165 ºF. This must be <286 ºF for life safety system or whatever design-fire temperature is for exhaust dampers. Should be about 50°F above normal temperature, not less than 160°F per IBC. In non-life safety buildings, use 165ºF. For life safety bldgs with smoke control, use 250ºF which is more than 50ºF above the design smoke temperature, typically 165ºF.

6. Ruskin EFL or equal

F. Status end switches: None required.

G. Status end switches:

3. Where indicated on the Drawings
4. Ruskin SP100 or equal Switch Package

H. Type: as indicated on the Drawings

I. Type

1. Ruskin Type FSDR25, or equal for round ducts. (UL R5531, CSFM #3230-245:108)
2. Ruskin Type FSD36, or equal for 1800 feet per minute and below. (UL R5531, CSFM #3235-0245:0124)
3. Ruskin Type FSD60 or equal for 1800 feet per minute and above. (UL R5531, CSFM #3235-0245:0126).
4. Alternative Ruskin Type FSD60FA or equal for 1800 feet per minute and above. (UL R5531, CSFM #3230-245:116 respectively).
5. Ruskin Type FSD60M, for short sleeve where needed. (UL R5531, CSFM #3230-245:110)

J. Smoke Detector

1. Detects presence of smoke in the airstream of ductwork in HVAC systems without a minimum operating velocity including no flow operation.
2. UL Listed
3. CSFM Listing
4. Ruskin DSDN, or as provided by Div-26 or equal

2.6 DRAIN PANS

A. Field Installed Drain Pans

1. Required at field installed

a. Cooling coils

2. Pan material

a. 20 gage stainless steel

3. Supports: galvanized steel
4. Extend under coil casing

a. Upstream: minimum 3 inches
b. Downstream: minimum 18 inches or half the coil finned-height, whichever is larger

5. Extend on sides

a. To wall of casing
b. To receive condensate from piping and controls

6. Provide additional intermediate pans for coils mounted more than one section high
7. Slope to drain. Level installation not acceptable.
8. Drain connection:

a. Size per IMC based on coil capacity
b. Mounted in bottom of pan at lowest point or outside with a flush mount that allows complete draining

B. Auxiliary Drain Pans

1. Required at following locations:

a. Fan-coil units with cooling located in attics or above furred ceilings where required by IMC – Condensate Control. Not required if main drain pan includes secondary drain connection for this purpose

1) Size to capture any overflow from unit condensate drain pan

b. Fan-coil units with cooling located within rooms housing electrical equipment such as power panels, control panels, transformers, and computer equipment

1) Size to capture any overflow from unit condensate drain pan and extended to capture drips from control valves, strainers, and unions

2. Construction: galvanized steel

2.7 SOUND ATTENUATORS

A. Factory prefabricated

B. General

1. Transitions on inlet and outlet will not be accepted. Silencers shall fit the ducting system they are installed in without requiring duct fittings/transitions. Silencer inlet and outlet must match duct dimensions. See contract documents for silencer configuration.
2. Silencers shall be constructed in accordance with ASHRAE and SMACNA standards for the pressure and velocity classification specified for the air distribution system in which it is

installed. Material gauges noted in other sections are minimums. Material gauges shall be increased as required for the system pressure and velocity classification. The silencers shall not fail structurally when subjected to a differential air pressure of 8 inches water gauge.

3. All casing seams and joints shall be lock-formed and sealed or stitch welded and sealed except as noted in Section G below, to provide leakage-resistant construction. Airtight construction shall be achieved by use of a duct-sealing compound supplied and installed by the contractor at the jobsite.
4. All perforated steel shall be adequately stiffened to insure flatness and form.

C. Shell

1. Galvanized steel – G90: minimum 22 gage
2. Leakproof at pressure differential of 8 inches water gage

D. Media:

1. Flamespread: maximum 25
2. Fuel contributed and smoke developed: maximum 50
3. Minimum 4.5 pounds per cubic foot density glass or mineral fiber packed under 5 percent compression
4. Media shall meet erosion test method described in UP Publication No. 181
5. Filler to be inert, vermin and moisture proof
6. Surfaces in contact with airstream shall comply with ASHRAE 62.1-2010.

E. Internal construction: Galvanized perforated steel baffles: minimum 24 gauge

F. Principal Sound-Absorbing Mechanism

1. Dissipative silencers:

a. Media shall be of acoustic quality, shot-free glass fiber insulation with long, resilient fibers bonded with a thermosetting resin. Glass fiber density and compression shall be as required to insure conformance with laboratory test data. Glass fiber shall be packed with a minimum of 15% compression during silencer assembly. Media shall be resilient such that it will not crumble or break, and conform to irregular surfaces. Media shall not cause or accelerate corrosion of aluminum or steel. Mineral wool will not be permitted as a substitute for glass fiber.

G. Attenuator Performance

1. See schedule on the Drawings for

a. Net insertion ratings
b. Maximum allowable air pressure drop
c. Model number

H. Certified tests

1. Submit a laboratory certified test data for pressure drop and insertion loss ratings

a. For square or rectangular attenuators: 24 inch x 24 inch cross-section attenuator
b. For round attenuators: 24 inch diameter conical attenuator
c. Certification data for pressure drop and net insertion loss: based on tests of same attenuator

d. Attenuators and tests: subject to inspection upon request

I. Price, Vibro-Acoustics, Kinetics, Industrial Acoustics, Inc. Quiet-Duct

J. Critical area attenuator

1. General: as specified above
2. Media enclosed in polyvinyl
3. Removable internal parts for cleaning
4. Industrial Acoustics Company, Type HS-3 Clean-Flow or equal

K. Expansion Plenums

1. As indicated on the Drawings

2.8 CONDENSATE PUMP

A. Manufacturer: Little Giant, Diversitech, or equal

B. Provide where scheduled

C. Contractor shall verify pumping head requirements

D. Features

1. Discharge check valve
2. 115-volt with grounded plug connection
3. High level alarm contact

2.9 BELT GUARDS

A. Fabricated per OSHA and SMACNA Duct Construction Standards

2.10 WALL LOUVERS & COMBINATION LOUVER/DAMPERS

A. Louvers licensed to bear AMCA Certified Ratings Seal. Ratings based on tests and procedures performed in accordance with AMCA 511 and comply with AMCA Certified Ratings Program. AMCA Certified Ratings Seal applies to air performance and water penetration ratings.

B. Materials

1. Frame

a. Extruded aluminum, Alloy 6063-T5
b. Wall Thickness: 0.081 inch, nominal
c. Depth: 6 inches minimum
d. Downspouts and caulking surfaces

2. Blades

a. Horizontal rain resistant style
b. Extruded aluminum, Alloy 6063-T5

c. Wall Thickness: 0.081 inch, nominal
d. 2 inch blade spacing

C. Screen

1. Aluminum wire screen
2. 14 gage
3. 3/4 inch x 0.051 inch mesh
4. Frame: Removable, rewireable
5. Mounted on inside of louver

D. Gutters: Drain gutter in head frame

E. Downspouts: Downspouts in jambs to drain water from louver for minimum water cascade from blade to blade

F. Vertical Supports: Hidden vertical supports to allow continuous line appearance up to 120 inches

G. Sill: Steeply angled integral sill eliminating areas of standing or trapped moisture where mold or mildew may thrive and effect indoor air quality

H. Assembly: Factory assemble louver components; mechanically fastened

I. Blank off panels for unused portions of louvers: 20 gage galvanized sheet metal

J. Factory Finish

1. Standard mill finish
2. Kynar 500 (70% Kynar Resin) 2-Coat Fluoropolymer Coating or equal

a. Conform to AAMA 2605-98
b. Apply coating following cleaning and pretreatment
c. Cleaning: AA-C12C42R1X
d. Dry louvers before final finish application
e. Total Dry Film Thickness: Approximately 1.2 mils, when baked at 450 degrees Fahrenheit for 10 minutes
f. Warranty: Limited 20 year warranty on standard colors
g. Color: Color as selected by Professional from manufacturer's standard colors

3. Baked Enamel, 50% Kynar Resin 2-Coat Coating or equal

a. Conform to AAMA 2604-98, sections 4.2 & 4.3
b. Apply coating following cleaning and pretreatment
c. Cleaning: AA-C12C42R1X
d. Dry louvers before final finish application
e. Total Dry Film Thickness: Approximately 1.2 mils, when baked at 450 degrees Fahrenheit for 10 minutes
f. Warranty: Limited 20 year warranty on standard colors
g. Color: Color as selected by Professional from manufacturer's standard colors

4. Color Anodize Finish

a. Comply with Aluminum Association AA-C22A44
b. Apply finish following chemical etching and pretreatment
c. Electrolytically deposited color anodized finish

d. Minimum Thickness: 0.7 mils
e. Color: coordinate with Professional.

5. Clear Anodize Finish

   a. Comply with Aluminum Association AA-C22A31; clear anodize finish 204-R1
   b. Apply finish following chemical etching and pretreatment
   c. Minimum Thickness: 0.4 mils, 30 minute anodizing process

6. Prime Coat

   a. Apply alkyd prime coat following chemical cleaning and pretreatment
   b. Primer preparation for field painting

7. Outside air intake: Greenheck EHH-601 or equal. 6-inch deep wind-driven rain louver
8. Exhaust outlet: Greenheck EHH-601 or equal. 6-inch deep wind-driven rain louver
9. Combination louver/damper: Greenheck EACA-601 or equal, 6” frame

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate with work of other trades

B. Install duct accessories in accordance with manufacturer’s written installation instructions

C. See Section 23 31 13 – Ducts

D. Volume dampers

1. Provide at locations indicated on the Drawings

   a. Volume dampers shall be installed as far away from air outlets as functionally reasonable to avoid noise in the occupied space.
   b. Provide also in wyes and branch take-offs to outlets whether indicated on the Drawings or not, except

      (1) Where dampers are not indicated on the Drawings above inaccessible ceilings
      (2) To sidewall outlets in exposed ducts (opposed blade dampers in outlets shall be provided)

2. Additional locations where dampers appear to be required for balancing, place request for information with Engineer prior to construction.
3. For ductwork exposed to occupant view, volume damper handles shall be on top of duct or otherwise concealed from occupant view.

E. Fire and smoke dampers

1. Provide in ducts and openings as indicated in the Drawings
2. Provide access door in duct adjacent to each in location where damper may be inspected and internal fusible link or fire-stat may be replaced
3. Install duct smoke detector provided by Division 26 if required; see Division 26 drawings
4. Smoke and fire dampers installed in tunnel corridors shall have weight of damper supported

from structure above.

F. Control dampers

1. Field mounted control dampers installed with concealed linkage shaft accessible on side of damper with space for direct-coupled actuator
2. Actuator installation: See Section 23 09 13 – EMCS Basic Materials and Devices

G. Install belt guards at all exposed belts

H. Drain pans

1. See Section 22 13 16 – Sanitary Waste and Vent Piping
2. Condensate drain pans (including pans on fan-coils, packaged units, and air handlers)

a. Slope to drain connection to allow complete draining of pan
b. Provide condensate pump where scheduled.
c. Piping from intermediate drain pan to lowest pan

(1) Pipe to within 1 inch of and discharge into lowest drain pan

d. Piping from lowest pan drain connection to sewer

(1) Trap height and offset must allow water seal to remain and to allow complete drainage of pan both when fan is operating or not

e. Field test

(1) Test all drain pans after installation to ensure proper slope and drainage and to prevent conditions of water stagnation that result in microbial growth.
(2) Drainage shall be considered acceptable if after covering the entire pan with 1/2 inch water, the pan drains within 3 minutes to leave puddles no more than 2 inch in diameter and no more than 1/8 inch deep.
(3) Test with the fan system in operation for pans on the suction side of the fan, and with the fan off for pans on the discharge side of the fan.
(4) Document tests: See Section 23 00 10 – Mechanical General Provisions

3. Auxiliary drain pans

a. Piping: See Section 23 21 12 Heating and Cooling Piping
b. Separate drain from main drain pan.
c. Discharge where water flow is readily observed but not over any material or equipment that may be damaged by water.

3.2 MOUNTING AND ALIGNMENT

A. Install all accessories to prevent air leakage.

B. Install closed bearing end on all damper blades that penetrate duct to prevent air leakage.

C. Support extra weight of duct accessories. See Section 23 05 48 – Mechanical Sound and Vibration Control

3.3 INSPECTION

A. Verify that adequate clearance between duct accessories and adjacent walls or equipment is available to permit maintenance and repairs.

3.4 PRE-OPERATING CHECKS

A. Before operating duct accessories: Set all components in normal operating condition

3.5 TESTING AND ADJUSTING

A. Before operating duct accessories see Section 01 91 00 – Commissioning

B. After starting duct accessories

1. Check for noise and leakage; repair as required at no additional cost to the Using Agency
2. Operation test: Test each piece of equipment to show that it will operate in accordance with requirements.

C. See Section 23 05 93 – Testing, Adjusting, and Balancing

D. See Section 23 80 00 – Mechanical Commissioning

END OF SECTION 23 33 00

SECTION 23 34 00 - FANS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. These heating, ventilating and air conditioning (HVAC) provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.2 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Centrifugal fans
2. Propeller fans
3. Centrifugal inline fans
4. Ceiling exhaust fans
5. Roof mounted fans
6. Axial flow fans
7. Roof type gravity ventilators
8. All fans except where integral with manufactured piece of equipment

B. Related Sections

1. Section 01 91 00 – Commissioning
2. Section 23 00 10 – Mechanical General Provisions
3. Section 23 05 00 – Basic Mechanical Materials and Methods

1.3 REFERENCE STANDARDS

A. ANSI/AFBMA Standard 9 – Load Rating and Fatigue Life for Ball Bearings

B. AMCA 99 – Standards Handbook

C. AMCA 210 – Laboratory Methods of Testing Fans for Aerodynamic Performance Rating

D. AMCA 300 – Reverberant Room Method for Sound Testing of Fans

E. AMCA 301 – Methods for Calculating Fan Sound

F. ANSI/AFBMA 11 – Load Ratings and Fatigue Life for Roller Bearings

1.4 QUALITY ASSURANCE

A. AMCA certified ratings per applicable AMCA standard based on the testing conducted in an independent laboratory

B. Performance Ratings: Conform to AMCA 210 and bear the AMCA Certified Rating Seal

C. Sound Ratings: AMCA 301; tested to AMCA 300 and bear the AMCA Certified Sound Rating Seal

D. Fabrication: Conform the AMCA 99

E. Conform to AMCA Bulletins regarding construction and testing

1. Fans shall bear AMCA certified rating seal

F. Scheduled equipment performance is minimum capacity required.

G. Scheduled electrical capacity shall be considered as maximum available.

1.5 SUBMITTALS

A. See Section 23 00 10 – Mechanical General Provisions

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. "R" means required.
2. "R2" means required only for products and equipment differing for the specified manufacturer and model and for "or equals" where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Fans	R	R		R
Fan accessories	R	R		

C. Include

1. Complete graph of fan curves, not just curve for design conditions
2. Sound power levels

a. Fans 1 horsepower and larger: dB by octave bands
b. Fans less than 1 horsepower: sones

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Greenheck Fan Corporation

C. Loren Cook Company

D. PennBarry

2.2 GENERAL

A. AMCA certification in accordance with ARI Standard 210 and 211, and AMCA Standard 2408 for centrifugal fans

B. Fans used shall not increase motor size, increase noise level, or increase tip speed by more than 10 percent, or increase inlet air velocity by more than 20 percent, from specified criteria.

C. Performance

1. See fan schedule on the Drawings
2. Capacities: minimum as scheduled on the Drawings
3. Brake horsepower rating: Maximum 10 percent above that scheduled on the Drawings
4. Fans and drives shall be capable of accommodating static pressure variations of plus or minus 10 percent
5. Motor horsepower: No larger than that scheduled on the Drawings, or compensate Division 26 contractor for any associated cost to increasing motor size

D. Wheels

1. Class as stated per AMCA rating for static pressure.
2. Formed steel or extruded aluminum
3. Statically and dynamically balanced in its own bearings with a maximum full amplitude shaft deflection at bearings not to exceed 0.001-inch at 1200 RPM
4. Exposed fan wheels protected by finger proof screen

E. Motors: See Section 23 05 13 – Motors and Controllers

F. Housing

1. Heavy gage steel, spot welded for AMCA 99 designated Class I and II fans, and continuously welded for Class III, adequately braced, designed to minimize turbulence with spun inlet bell and shaped cut-off.
2. Factory finish before assembly with enamel or prime coat
3. Provide bolted construction
4. Weatherproof motor and drive covers at utility sets
5. Provide inspection access panels at the wheels of all blowers
6. Externally paint fans exposed to weather to provide corrosion resistance to the environment
7. Provide 3/4-inch threaded scroll drain.

G. Direct Drive

1. Less that 1 horsepower: Internal thermally protected motor

H. Belt Drive

1. Matched, multiple V-belt
2. Capacity: minimum 1.5 times motor horsepower
3. Pulleys
   a. Cast iron
   b. Variable pitch diameter

(1) Except motors with variable speed drives
(2) Fans up to 7-1/2 hp motor
(3) Fans from 10 hp to 25 hp, under 1000 rpm

c. Fixed pitch diameter

(1) All motors with variable speed drives
(2) Fans 10 hp and over 1000 rpm

d. Select at mid-point of range
e. For fans that operate as part of the life safety system, provide a minimum of two belts

4. Companion sheaves to maintain belts parallel
5. Drive guards

a. Comply with requirements of State OSHA
b. Provide holes in belt guards for tachometer readings
c. Indoor Belt Drives: 16 gage expanded metal or wire screen enclosure with 70 percent free area and steel frame
d. Outdoor Belt Drives: 16 gage solid galvanized sheet metal with stamped louvers near top and bottom for ventilation

I. Bearings

1. Ball, roller or taper

a. Pressure type lubricating fittings with pressure relief fittings

(1) Extended to accessible locations
(2) Lubricating fittings: Equal to Alemite
(3) Pressure relief fittings: Equal to Keystone.

2. Air Handling Quality Bearings
3. Bearing shaft mounting mechanism shall be concentric mount, not set screw mount.
4. Life rating: minimum L10-200,000 hours per AFBMA Standard 9 rating, at maximum catalog rating

J. Painting

1. Prime coat fan wheels and housing factory inside and outside: Prime coating on aluminum parts is not required
2. Provide two additional coats of paint on fans handling air downstream of humidifiers
3. Finish painting not required for fans with corrosion resistant coatings

K. Variable Speed Drive: See Section 23 05 13 – Motors and Controllers

L. Discharge: As indicated on the Drawings

M. Removable flanged screens at inlets or outlets where no connecting ductwork is indicated: Exclude inlets to fans in field erected casings

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate with work of other trades

B. Install fans in accordance with manufacturer's written installation instructions.

C. See Section 23 31 13 – Ducts for duct connections

D. See Section 23 09 00 – Energy Management & Control Systems

E. See Section 23 08 00 – Mechanical Commissioning

F. Flexible duct connection at inlet and outlet: See Section 23 31 13 – Ducts

G. Backdraft Dampers

1. Comply with ASHRAE 90.1 and IMC
2. Provide backdraft or shutoff dampers for suction or discharge of every exhaust fan as scheduled on the Drawings
3. See schedules on the Drawings and Section 23 33 00 – Duct Accessories for where fan manufacturer may provide dampers and when specialty damper manufacturer must provide them.

H. Propeller Fans

1. Secure housing or sleeve to wall
2. Provide additional support from overhead construction or floor by steel rods or angles if fan extends more than approximately 24 inches from wall.

I. Roof Mounted Fans

1. Install on factory fabricated curbs

    a. Exception: Install Utility fans as indicated on the Drawings

2. See Division 7 Thermal and Moisture Protection for waterproofing and roofing.
3. Roof curbs

    a. Secured to structure with hold down methods as detailed
    b. Made fully weatherproof

J. Pipe scroll drains to code compliant waste receptacle

3.2 MOUNTING AND ALIGNMENT

A. See Section 23 05 48 – Mechanical Sound and Vibration Control

3.3 INSPECTION

A. Verify that adequate clearance between fans and adjacent walls or equipment is available to permit maintenance and repairs.

3.4 PRE-OPERATING CHECKS

A. Before operating fans

1. See Section 01 91 00 – Commissioning
2. Complete the attached Pre-Functional Test Data Sheet, specification 23 08 00, for each fan

B. Do not operate fans for any purpose, temporary or permanent, until

1. Ductwork is clean
2. Filters in place
3. Bearings lubricated

3.5 TESTING AND ADJUSTING

A. Before starting fans

1. See Paragraph 3.4B
2. See Section 01 91 00 – Commissioning
3. Install belt and motor guards

B. Start and test fans in accordance with manufacturers written installation instructions.

C. Start up and adjust fans to insure proper operation.

D. The submitted sound power level shall be verified through actual measurements and calculations in accordance with AMCA standards 300 and 301.

1. In the event the sound power level data measured or being submitted exceeds the designed level, provide additional sound traps or other sound attenuating devices to supplement the design in order to comply with sound power level specifications. Perform this work, including the additional noise control and any increase in motors Hp and increase in electrical service at no additional cost to the Using Agency. Submit calculations or measurement results to the Professional, which substantiate that sound power level produced by the submitted equipment and any required sound attenuating devices do not exceed the specified sound power levels.

E. After starting fans: Check for objectionable noise or vibration. Correct as needed at no additional cost to the Using Agency.

F. Balancing: See Section 23 05 93 – Testing, Adjusting and Balancing

G. Commissioning: See Section 23 08 00 – Mechanical Commissioning

3.6 TRAINING

A. See Section 23 00 10 – Mechanical General Provisions and Section 23 08 00 – Mechanical Commissioning

END OF SECTION 23 34 00

SECTION 23 37 00 - AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. These heating, ventilating and air conditioning (HVAC) provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.2 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following: All air outlets, inlets, grilles, registers and diffusers except where integral with manufactured piece of equipment

B. Related Sections

1. Section 01 91 00 – Commissioning
2. Section 23 00 10 – Mechanical General Provisions
3. Section 23 05 00 – Basic Mechanical Materials and Methods

1.3 REFERENCE STANDARDS

1.4 QUALITY ASSURANCE

A. Comply with ARI Standard 650 – Air Outlets and Inlets

B. Comply with ASHRAE Standard 70 – Methods of Testing for Rating the Airflow Performance of Outlets and Inlets

C. Comply with AMCA Standard 500 – Laboratory Methods of Testing dampers for Rating

D. Comply with NFPA Standard 90A – Installation of Air Conditioning and Ventilating Systems

E. Comply with BSR/NFPA 90B – Standard for the Installation of Warm Air Heating and Air Conditioning Systems

F. Provide outlets and inlets that have, as minimum, throw and noise criteria ratings for each size device as listed in manufacturer's current data, rated as required by the above standards.

1.5 SUBMITTALS

A. See Section 23 00 10 – Mechanical General Provisions

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. "R" means required.
2. "R2" means required only for products and equipment differing for the specified manufacturer and model and for "or equals" where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Grilles, registers, and diffusers	R			R
Accessories	R			

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Titus

C. Price

D. MetalAire

2.2 GENERAL

A. Manufacturer shall examine and approve of application of each outlet.

B. Noise level at design capacities: no larger than diffuser selection indicated on the drawings.

C. Volume dampers

1. Do not provide dampers built into grille or directly attached to the grille unless specifically called out on drawings or in this Section.
2. Volume damper key-operated adjustable from face of diffuser on register except as noted
3. Opposed blade

D. Diffuser frame

1. Frame type shall be coordinated with ceiling type. Refer to architectural reflected ceiling Drawings.
2. Plaster or drywall ceilings: lay-in diffuser with drywall frame (to allow for ceiling access through grille). Drywall frame to match diffuser color.
3. No visible screw allowed on diffusers or frames, unless otherwise indicated on the Drawings.

E. Outlets may be steel or aluminum unless otherwise indicated on the Drawings.

F. Color

1. Face and frame: Factory-baked #26 white enamel unless otherwise indicated on the Drawings

2. Internal parts of grille visible from occupied space, including all parts behind perforated face diffusers and visible parts of plenums: flat black

2.3 STYLES

A. General

1. See diffuser schedule on the Drawings for outlet style and size
2. Throw pattern per the Drawings
3. Specific frame, border, and other product references refer to Price Products
4. Provide square to round adapters where required

B. T-Bar Diffuser Price TBD375

1. Two (2) 3/4" slots
2. Extruded aluminum center T painted white.
3. External aluminum foil backed fiberglass insulation

C. Square Cone Diffuser Price SCD

1. 3 cones

D. Louvered Face Diffuser Price SMDA

1. Adjustable air pattern

E. Round Cone Diffuser Price RCD

1. 3-position adjustment
2. Removable inner assembly of cones that extend below the diffuser face
3. Air flow pattern, field adjustable

F. Double Deflection Supply Register Price 620

1. 3/4" blade spacing, fully adjustable.
2. Front set of blades shall run parallel with the short grille dimension.
3. Drywall frame with recessed screw holes.
4. Register with aluminum opposed blade damper.

G. Egg Crate Grille Price 80

1. 1/2" x 1/2" x 1/2" aluminum grid core.
2. Drywall frame with recessed screw holes.

H. Fixed Grille 45° Deflection Price 630

1. 3/4" blade spacing, fully adjustable.
2. Front set of blades shall run parallel with the short grille dimension.
3. Drywall frame with recessed screw holes.
4. Register with aluminum opposed blade damper.

2.4 SCREENED OPENINGS

A. Mesh

1. 3/4 in. square pattern
2. No. 16 galvanized wire
3. Interwoven
4. Welded or secured to frame

B. Frames:

1. 1 inch by 1 inch by 1/8 inch galvanized steel angles
2. Continuous around perimeter of screen (welded at corners)

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate with work of other trades.

B. Install air outlets and inlets in accordance with manufacturer's written installation instructions and Section 23 31 13 – Ducts.

C. Return and exhaust registers: Install with blades oriented to prevent sight through outlets.

D. Grille backs or plenums visible through grilles painted flat black

E. Transfer grilles

1. See indications on the Drawings
2. Wall installations, unless otherwise indicated, provide two grilles

a. One on each side of wall, except where open to return air plenum
b. Connecting sheet metal collar with 18 inch elevation offset for sound and light attenuation

F. Provide duct screens at termination ducts as indicated on the Drawings

3.2 MOUNTING AND ALIGNMENT

A. See Section 23 05 48 – Mechanical Sound and Vibration Control

B. All air outlets and inlets shall be secured to building

1. Ceiling grilles shall be secured to prevent falling from ceiling during construction or service with minimum of two 16-gage ceiling wires, two 22-gage by 1 inch galvanized sheet metal strap or two #10 sheet metal screws.
2. Comply with IBC

C. Mount directional grilles as indicated on the Drawings.

D. Adjust grille throw patterns

1. As indicated on the Drawings

2. For double-deflection grilles, adjust rear blades horizontal and front blades in 45 degree pattern at each end gradually rotating to be almost straight at blades in center of grille.
3. Prior to test and balance

3.3 INSPECTION

A. Verify mounting, direction and adjustments are installed as indicated on the Drawings.

3.4 TESTING AND ADJUSTING

A. See Section 01 91 00 – Commissioning

B. See Section 23 05 93 – Testing, Adjusting and Balancing

C. See Section 23 08 00 – Mechanical Commissioning

END OF SECTION 23 73 00

SECTION 23 40 00 - AIR CLEANING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. These heating, ventilating and air conditioning (HVAC) provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.2 WORK INCLUDED

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Filter media
2. Filter frames in built-up systems

B. Related Sections

1. Section 01 91 00 – Commissioning
2. Section 23 00 10 – Mechanical General Provisions
3. Section 23 05 00 – Basic Mechanical Materials and Methods

1.3 REFERENCE STANDARDS

A. ASHRAE Standard 52.1-1992 – Gravimetric and Dust Spot Procedures for Testing Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter

B. ASHRAE Standard 52.2-1999 – Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size

C. ANSI/UL 900 – Test Performance of Air Filter Units

1.4 QUALITY ASSURANCE

A. All filters shall be dust-spot rated in accordance with ASHRAE/ANSI Standard 52.1 – Atmospheric Dust Spot Method.

B. Filters shall have MERV ratings in accordance with ASHRAE Standard 52.2-1999 – Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.

1.5 SUBMITTALS

A. See Section 23 00 10 – Mechanical General Provisions

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop

drawings are required) according to the following table.

1. "R" means required.
2. "R2" means required only for products and equipment differing for the specified manufacturer and model and for "or equals" where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Filters	R			
Filter frames	R			
Filter gauges	R	R		

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Filter Media and Frames

1. Camfil/Farr Filtration Group
2. Flanders/Precisionaire
3. American Air Filter
4. Or equal

2.2 FILTERS

A. General

1. Underwriters' Laboratories as Class 2
2. Disposable type
3. Each filter shall consist of media, media support grid and enclosing frame.

B. Type 1: Pleated Filter

1. 2 inch or 4 inch pleated
2. Media: Cotton & synthetic media (no polyester)
3. Minimum performance:

    a. 25 percent to 30 percent dust spot efficiency, complying with ASHRAE 52.1
    b. MERV 8, complying with ASHRAE 52.2

4. Maximum initial pressure drop at 500 feet per minute face velocity shall not to exceed 0.3 inches water column. Final pressure drop shall be no less than 1.0 inch water column.
5. Equal to Camfil/Farr Aeropleat IV

C. Type 2: Cartridge Filter

1. Media assembled in compact enclosing frame

2. Minimum depth: 12 inches as indicated on the Drawings
3. Enclosing frame

    a. Galvanized steel
    b. Media support contour stabilizers mechanically fastened to diagonal support members.

4. Media

    a. Microfine glass (no polyester)
    b. Mechanically and chemically bonded within the frame to prevent air bypass

5. Minimum performance

    a. 80 percent to 85 percent dust spot efficiency, complying with ASHRAE 52.1
    b. MERV 13 complying with ASHRAE 52.2
    c. 90 percent to 95 percent dust spot efficiency complying with ASHRAE 52.1
    d. MERV 14 complying with ASHRAE 52.2

6. Maximum initial pressure drop at 500 feet per minute face velocity shall not to exceed 0.5 0.7 inches water column. Final pressure drop shall be no less than 1.0 inch water column.
7. Equal to Camfil/Farr Riga-Flo

D. Type 3: Bag Filters

1. Deep pleated replaceable element
2. Minimum depth: 30 inches as indicated on the Drawings
3. Enclosing frame

    a. Galvanized steel frame and galvanized steel pocket retainers
    b. Header bonded to the media to prevent air bypass

4. Media

    a. Lofted microfine glass (no polyester)
    b. Chemically bonded to permeable media support backing

5. Minimum performance

    a. 80 percent to 85 percent dust spot efficiency complying with ASHRAE 52.1
    b. MERV 13 complying with ASHRAE 52.2
    c. 90 percent to 95 percent dust spot efficiency complying with ASHRAE 52.1
    d. MERV 14 complying with ASHRAE 52.2

6. Maximum initial pressure drop at 500 feet per minute face velocity shall not to exceed 0.4 0.55 inches water column. Final pressure drop shall be no less than 1.0 inch water column.
7. Equal to Camfil/Farr Hi-Flo

E. Type 4: HEPA Filters

1. Filter depth of 12 inches
2. Wetlaid water-resistant microfine glass media
3. Performance: Filters shall be capable of maintaining rated efficiency at 275 FPM face velocity with initial pressure drop of 1.0 inch and final pressure drop of 2.0 inches.
4. UL 900 Class I listed
5. Rating: (99.97)(99.99) percent efficiency on 0.3 microns based on IES RP-1 requirements

6. Frame: 20-gage galvanized steel or extruded aluminum with 3/4-inch wide by 1/4-inch thick closed cell neoprene gasket
7. Testing: Each filter shall be individually tested and certified to have a penetration of no more than 0.3 percent and a resistance of no more than 1.0 inch water column at 500 feet per minute velocity in accordance with Military Standard 282. The filter shall be so certified on a permanently affixed label. A letter of certification shall accompany each filter.

2.3 FRAMES

A. For air handlers and fan-coils, see individual specifications Sections.

B. Field-Built Bag Filter Frames

1. 16 gage galvanized steel
2. Hardware and fasteners zinc plated
3. Prefilter tracks
4. Closed cell foam gasket and woven pile barrier shall provide seal for installed filters
5. Filter holding brackets
6. Front access

2.4 FILTER GAUGE

A. See Section 23 09 00 – Energy Management & Control Systems (DP sensors with LCD display).

B. Differential pressure type

C. Accurate to 2 percent of full range

D. Sensing probes and shut off valves for each gauge port

E. Field adjustable to 2 inches water gauge

F. Dwyer 2000 Magnehelic gauge or equal

PART 3 - EXECUTION

3.1 FILTER MEDIA

A. Media as selected in equipment schedules on the Drawings

B. Construction filters

1. Type 1 for all equipment; roll media not acceptable

3.2 INSTALLATION

A. Factory installed in air handling equipment

B. Coordinate with work of other trades

C. Install Air Cleaning Devices in accordance with manufacturer's written installation instructions.

D. Filter gauges:

1. Required only for filters with MERV 8 and greater and on systems greater than 2000 cfm.
2. Install filter gauge to filter or AHU housing in a position where reading will be visible but not block maintenance access.
3. Mount probes on upstream and downstream side of filter and pipe to gauge ports with soft copper tubing per gauge manufacturer's instructions.

E. See Section 23 09 00 – Energy Management & Control Systems

F. See Section 23 05 93 – Testing, Adjusting and Balancing

G. See Section 23 08 00 – Mechanical Commissioning

3.3 START-UP PROCEDURES

A. Do not operate air handling unit fan systems for any reason until spaces served have been cleaned of dust and debris, to avoid contamination of supply air or return air paths and equipment.

B. Supply fans shall not be operated unless filters are installed, including temporary filters for use during test and balance.

C. If the final pressure drop of the temporary filters is reached during test and balance, replace them with a spare set.

D. Immediately before turning system over to Using Agency, remove temporary construction filters and install clean final filters. See also Section 23 05 93 – Testing, Adjusting and Balancing and Section 23 00 10 – Mechanical General Provisions for media installation during test and balance.

3.4 INSPECTION

A. Verify that adequate clearance between Air Cleaning Devices and adjacent walls or equipment is available to permit maintenance and replacement of filters.

B. Verify that filters are firmly seated in frame to minimize bypass.

3.5 TRAINING

A. See Section 23 00 10 – Mechanical General Provisions and Section 23 08 00 – Mechanical Commissioning

END OF SECTION 23 40 00

SECTION 23 54 00 - FURNACES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. These heating, ventilating and air conditioning (HVAC) provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.2 SUMMARY

A. Work Included in This Section: Materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Condensing furnaces and accessories complete with controls.
2. Direct-expansion cooling coils with refrigerant piping.
3. Filter housing for furnaces.

B. Related Sections include the following:

1. Section 01 91 00 – Commissioning
2. Section 23 00 10 – Mechanical General Provisions
3. Section 23 05 00 – Basic Mechanical Materials and Methods
4. Section 23 23 00 – Refrigerant Piping

1.3 DEFINITIONS

A. Condensing Furnace: Furnace with annual fuel utilization efficiency rating more then 88 percent; designed to vent saturated flue gas.

B. CPVC: Chlorinated polyvinyl chloride.

C. PVC: Polyvinyl chloride.

1.4 SUBMITTALS

A. See Section 23 00 10 – Mechanical General Provisions.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Furnace	R	R		R
Furnace controls	R	R		
Furnace accessories	R	R		R

C. Product Data: For each furnace. Include rated capacities of selected models; shipping, installed, and operating weights; furnished specialties; and accessories. Include plan and elevation views of units, minimum clearances, and data on ratings and capacities.

D. Wiring Diagrams: Power, signal, and control wiring.

E. Operation and Maintenance Data: For each furnace to include in emergency, operation, and maintenance manuals.

F. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of furnaces and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace the following components of furnaces that fail in materials or workmanship within specified warranty period:

1. Furnace heat exchanger.
2. Control circuit board.

B. Warranty Period: 10 years from date of Final Completion for both heat exchangers in each furnace. Five (5) years limited parts warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

2.2 GAS-FIRED CONDENSING FURNACES

A. Acceptable Manufacturers:

1. Lennox
2. Trane
3. York

B. Description: Factory assembled, piped, wired, and tested; complying with ANSI Z21.47, "Gas-Fired Central Furnaces," and NFPA 54, "National Fuel Gas Code"; and bearing label of American Gas Association.

C. Convertible from upflow, to horizontal with left or right airflow

D. Single wire twinning

E. Cabinet: Steel, with interior insulation around heat exchanger. Lift-out panels expose burners and all other items requiring access for maintenance.

1. Interior Insulation: Mineral-fiber board thermal insulation manufactured with glass fibers a minimum of 1/2 inch thick, bonded with a thermosetting resin. Comply with ASTM C 612, Type IB, with aluminum foil jacket.
2. Hinged blower door

F. Finish of External Casings and Cabinets: Factory painted, manufacturer's standard color.

G. Fan: Centrifugal, factory balanced, resilient mounted, direct drive.

H. Fan Motors: Constant torque Electrically Commutated Motor (ECM). See Section 23 05 13 – Motor and Controllers.

I. Type of Gas: Natural Gas (convertible to L.P.).

J. Heat Exchanger:

1. Primary: Stainless-steel tubing.
2. Secondary: Stainless-steel tubing with turbulators.

K. Burner Controls: Solid state; control gas valve and ignition with self-diagnostics.

1. Gas Valve: 24 V, 100 percent safety gas shutoff, pressure regulator, and manual shutoff.
2. Ignition: Electric pilot ignition, with electric spark igniter.

L. Automatic Controls: Solid-state board delays fan start and shutdown.

M. Accessories:

1. Concentric Combustion-Air Intake and Vent Termination: PVC plastic fitting to combine combustion-air inlet and vent through roof.
2. Condensate neutralizer kit.

2.3 CONTROLS

A. Furnace Controls: Include components required for satisfactory operation of furnaces and

auxiliary equipment in all seasons.

B. Control Transformer: 24-V ac output, factory installed, and wired in furnace.

C. Cooling Relay: To start condensing unit.

D. Blower Fan Control: Fan on-automatic.

E. See Section 23 09 00 – Energy Management and Control System (General) for additional control details.

2.4 FILTER HOUSING FOR FURNACES

A. Description: Factory assembled, side or top service housings, constructed of 18 gage galvanized steel with integral track to receive 2-inch filters.

B. Access Door: Continuous gasket on perimeter and locking device which does not require use of any tools to open or close.

C. Sealing: Size of housing shall match the size of the inlet of the furnace being served. Incorporate positive-sealing gasket material between furnace and filter housing and filter housing and return air plenum to prevent bypass of unfiltered air.

2.5 COOLING FEATURES

A. Evaporator Coil: Copper tubes mechanically expanded into aluminum fins. Comply with ARI 210/240, "Unitary Air-Conditioning and Air-Source Heat Pump Equipment." Match size with furnace. Match remote condensing unit specified in Section 23 81 14 - Condensing Units with type, capacity, pressure-drop ratings, restricted distributor, or expansion valve. Include condensate drain pan with accessible drain outlet.

B. Evaporator coil shall be constructed with 1/2 inch O.D. copper tube with 12 fins per inch of corrugated aluminum for maximum heat transfer. Maximum face velocity shall be less than 500 feet per minute.

C. Evaporator Coil Enclosure: Steel, matching furnace and evaporator coil, with access panel and flanges for integral mounting at or on furnace cabinet and non-corrosive (plastic or stainless steel) drain pan. Drain pan shall be double sloped for drainage. Properly sized and installed condensate drain trap is required and shall be furnished and piped by the installing contractor. Partial coil enclosures are not acceptable.

D. Thermal Expansion Device: Non-bleed thermal expansion valve or as recommended by manufacturer.

2.6 PLASTIC VENT MATERIALS

A. Provide with concentric vent kit.

B. CPVC Plastic, Schedule 40 Pipe: ASTM F 441/F 441M.

1. CPVC Plastic, Schedule 40 Fittings: ASTM F 438, socket type.
2. CPVC Solvent Cement: ASTM F 493.

C. PVC Plastic, Schedule 40 Pipe: ASTM D 1785.

1. PVC Plastic, Schedule 40 Fittings: ASTM D 2466, socket type.
2. PVC Solvent Cement: ASTM D 2564.

PART 3 - EXECUTION

3.1 FURNACE INSTALLATION

A. Install units level and plumb

B. Install gas-fired furnaces and associated fuel and vent features and systems according to NFPA 54

C. Control Wiring: Install control wiring as specified in Section 23 09 00 – Energy Management and Control System (General)

D. Identify furnaces according to Section 23 05 53 – Mechanical System Identification

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect gas piping according to Section 23 11 00 - Fuel Gas Piping

C. Vent and Outside-Air Connection, Condensing, Gas-Fired Furnaces: Connect plastic piping vent material to furnace connections and extend thru roof. Terminate vent outdoors with a concentric vent termination kit that protects against entry of birds, insects, and dirt.

1. Plastic pipe joint construction is specified in Section 23 05 00 - Basic Mechanical Materials and Methods.

D. Connect ducts according to Section 23 31 13 - Ducts

E. Install piping adjacent to machine to allow service and maintenance

F. Ground equipment according to Division 26.

G. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 MANUFACTURER’S FIELD SERVICE

A. Manufacture’s Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections.

1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
2. Verify bearing lubrication.
3. Verify proper motor rotation.
4. Test Reports: Prepare a written report to record the following:

    a. Test procedures used.
    b. Test results that comply with requirements.
    c. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

B. Tests and Inspections

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation

C. Remove and replace malfunctioning units and retest as specified above

D. Prepare test and inspection reports

3.4 ADJUSTING

A. Adjust initial temperature and humidity set points.

B. Set controls, burner, and other adjustments for optimum heating performance and efficiency. Adjust heat-distribution features, including shutters, dampers, and relays, to provide optimum heating performance and system efficiency.

3.5 CLEANING

A. After completing installation, clean furnaces internally according to manufacturer's written instructions.

B. Install new filters in each furnace prior to performing TAB work.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Using Agency’s maintenance personnel to adjust, operate, and maintain furnaces.

END OF SECTION 23 54 00

SECTION 23 55 23 - FUEL-FIRED RADIANT HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. These heating, ventilating and air conditioning (HVAC) provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.2 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Gas-Fired Radiant Heaters

1.3 RELATED SECTIONS

1. Section 01 91 00 – Commissioning
2. Section 23 00 10 – Mechanical General Provisions
3. Section 23 05 00 – Basic Mechanical Materials and Methods

1.4 SUBM ITTALS

A. See Section 23 00 10 – Mechanical General Provisions.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Radiant Heaters	R	R		R
Controls	R	R		
Accessories	R			

C. See Section 23 00 10 – Mechanical General Provisions

D. Product Data: Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

E. Shop Drawings:

1. Wiring Diagrams: Power, signal, and control wiring.

F. Field Quality-Control Test Reports: From Contractor.

G. Operation and Maintenance Data: For fuel-fired radiant heaters to include in emergency, operation, and maintenance manuals. Refer to Division 15 Section “Operation and Maintenance Data”.

E. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

B. Source Limitations: Obtain fuel-fired radiant heaters through one source from a single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of fuel-fired radiant heaters and are based on the specific system indicated. Refer to Division 1 Section "Product Substitutions".

D. Equipment shall be certified to the ANSI Z83.20 standard and bear the CSA certification label.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace heat exchanger of fuel-fired radiant heater that fails in materials or workmanship within specified warranty period.

B. Warranty Period: Five years from date of Final Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Modine.

C. Reznor/Thomas & Betts.

D. Reverberray (Detroit Radiant Products Company)

2.2 GAS-FIRED, LOW INTENSITY INFRARED HEATERS

A. Description: Factory assembled, piped, and wired, and comp lying with ANSI Z83.6, "Gas-Fired Infrared Heaters."

1. AGA Approval: Designed and certified by and bearing label of American Gas Association.
2. Type of Gas: Designed and built to burn natural gas with characteristics same as those of gas available at Project site.

B. Fuel type: Burner shall be designed for natural gas having characteristics same as those of gas available at project site.

C. Burner type: Unit shall be a positive pressure power burner with a combustion fan upstream of the burner and exhaust gases. Negative pressure (pull through) type appliances will not be allowed.

D. Burner: Stainless-steel venturi burner. The flame anchoring screen shall have a minimum temperature rating equivalent to 304 grade stainless steel. Non stainless steel burners shall not be permitted.

E. Gas control: Operation shall include a defined input differential. Heater must be CSA Design Certified to operate at an input differential of at least 30% between the low and nominal rated input modes.

F. Combustion chamber: shall be 4 inch O.D. 16ga. Titanium stabilized aluminized steel (150-200MBH to allow for the operating temperature to exceed the 1030F as set forth in the ANSI Z83.20 standard) or aluminized steel (below 150 MBH), finished with a high emissivity rated, corrosion resistant, black coating with an emissivity level documented at .92 or higher.

G. Emitter tube: shall be 4 inch O.D. 16ga. aluminized steel finished with a high emissivity rated, corrosion resistant, black coating with an emissivity level documented at .92 or higher.

H. Fan enclosure: Combustion fan shall be totally housed inside burner control box and not exposed.

I. Tube connections: The heater’s combustion chamber and radiant emitter tube shall incorporate a 4 inch slip-fit, interlocking connection in which the upstream tube slides into the next tube and is held by a bolted clamp.

J. Ignition system: Hot surface silicon carbide capable of temperatures achieving 2400 F. Ignitor shall be readily accessible and serviceable without the use of tools.

K. Reflectors: Shall be .025 polished aluminum with a multi-faceted design which includes reflector end caps. Reflector shall have a polished bright finish with clear visual reflection ability. (A sample will be required at time of submittal). Reflector shall have a minimum of 7 sheet metal bends in its fabrication to optimize downward radiation. Reflectors shall be rotatable from 0 to 45 degrees when required. The heater’s reflector hanging system shall be designed to permit expansion while minimizing noise and/or rattles.

L. Control box: Heater's exterior control chassis shall be constructed of corrosion resistant enameled steel.

1. The heater's top cover shall be constructed of ABS plastic material.
2. Air intake: An air intake collar shall be supplied as part of the burner control assembly to accept a 4 inch O.D. supply duct.
3. The heater's control compartment shall be accessible without the use of tools and serviceable while heater is operating.
4. Outdoor modifications are required for any application that will be placed in space defined as outdoors. The rating label shall bear the outdoor certification approval.

M. Heaters shall be equipped with a sight glass allowing a visual inspection of ignitor and burner operation from the floor.

N. The heaters shall utilize a downstream turbulator baffle for maximum heat transfer.

O. Heater shall be supplied with a stainless steel flexible gas connector.

P. Burner Safety Controls:

1. Heater controls shall include a safety differential pressure switch to monitor combustion air flow, as to provide complete burner shutdown due to insufficient combustion air or flue blockage.
2. The heater shall incorporate a self-diagnostic ignition module, and recycle the heater after an inadvertent shutdown.
3. The heater's control system shall be designed to shut off the gas flow to the main burner in the event either a gas supply or power supply interruption occurs.
4. The heater's blower motor shall be thermally protected and the motor's impeller shall be balanced.
5. Heater control assembly shall include three indicator lights that define the units operating input ranges. One indicator shall validate air flow. Two indicator lights shall indicate low and high stages.
6. The heater's air flow control system shall provide a 45 second pre-purge prior to initiating burner operation and a 90 second post-purge upon completion, effectively removing all products of combustion from heat exchanger and/or radiant tubes.
7. No condensation shall form as a result of combustion in the combustion chamber or radiant tubes while at operating temperatures.
8. Thermostat control shall be two-stage operating on 24 volts.

Q. Venting: shall be per manufacturer approval and specifications.

R. Accessories:

1. Wire grid for increased efficiency.
2. Protective screen.
3. Heat-deflector shield. (where scheduled)
4. Stainless-steel flexible connector with manual valve.
5. Hanger chain with "S" hooks.
6. Preassembled chain mounting kit.

2.3 TEMPERATURE CONTROL

A. Wires and cables are specified in Division 16 Section.

B. Sensors, Components, and Wiring: Specified in Section 23 09 00 – Energy Management and Control System (General)

C. Thermostat: 2-stage, digital programmable wall-mounting type with 50 to 90 deg F operating range.

D. Control Transformer: Integrally mounted.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for radiant heater piping systems to verify actual locations of piping connections before equipment installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Coordinate with work of other trades

B. Install fans in accordance with manufacturer’s written installation instructions.

C. Install radiant heaters level and plumb.

D. Install and connect gas-fired radiant heaters and associated fuel features and systems according to NFPA 54, applicable local codes and regulations, and manufacturer's written installation instructions.

E. Suspended Units: Suspend from substrate using chain hanger kits and building attachments.

F. Maintain manufacturers' published clearances to combustibles.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow service and maintenance.

C. Gas Piping: Comply with applicable requirements in Section 23 11 00 - Fuel Gas Piping. Connect gas piping to gas train inlet; provide union with enough clearance for burner removal and service. Provide AGA-approved flexible units.

D. Electrical: Comply with applicable requirements in Division 26 Sections.

1. Install electrical devices furnished with heaters but not specified to be factory mounted.

E. Ground equipment according to Division 26 Section.

F. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections.

1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
2. Test Reports: Prepare a written report to record the following:

   a. Test procedures used.
   b. Test results that comply with requirements.
   c. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

3.5 ADJUSTING

A. Adjust initial temperature set points.

B. Adjust burner and other unit components for optimum heating performance and efficiency.

3.6 TRAINING

A. Engage a factory-authorized service representative to train Using Agency's maintenance personnel to adjust, operate, and maintain fuel-fired radiant heaters. Refer to Section 23 00 10 – Mechanical General Provisions.

END OF SECTION 23 55 23

SECTION 23 81 14 - CONDENSING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. These heating, ventilating and air conditioning (HVAC) provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.2 SUMMARY

A. Work Included in This Section: Materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Air-cooled condensing units.

B. Related Sections include the following:

1. Section 01 91 00 – Commissioning
2. Section 23 00 10 – Mechanical General Provisions
3. Section 23 05 00 – Basic Mechanical Materials and Methods
4. Section 23 21 12 – Heating and Cooling Piping

1.3 SUBMITTALS

A. See Section 23 00 10 Mechanical General Provisions

B. Submit product data, O&M data, and samples and show item on shop and coordination drawings (where shop and coordination drawings are required) according to the following table.

1. “R” means required
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Condensing Units	R	R		R
Specialties	R	R		R
Accessories	R	R		R

1.4 QUALITY ASSURANCE

A. Listing and Labeling: Provide electrically operated equipment specified in this Section that is listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.

B. Fabricate and label refrigeration system according to ASHRAE 15, "Safety Code for Mechanical Refrigeration."

C. Comply with NFPA 70.

D. Comply with UL 303, "Refrigeration and Air-Conditioning Condensing and Compressor Units."

1.5 COORDINATION

A. Coordinate size and location of concrete support pad. Concrete, reinforcement, and formwork requirements are specified in Division 03 Section "Cast-in-Place Concrete."

1.6 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Professional of other rights the Professional may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty: A written warranty, executed by Contractor and signed by manufacturer, agreeing to replace components that fail in materials and workmanship within the specified warranty period, provided manufacturer's written instructions for installation, operation, and maintenance have been followed.

1. Warranty Period: Manufacturers standard, but not less than 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

2.2 AIR COOLED CONDENSING UNITS (1 to 5 tons)

A. Acceptable Manufacturers:

1. Lennox
2. Trane
3. Johnson Controls

B. Description: Factory assembled and tested, air cooled; consisting of compressors, condenser coils, fans, motors, refrigerant reservoirs, and operating controls.

C. Refrigerant: R-410A

D. Compressor: Scroll compressor hermetically sealed and isolated for vibration.

1. Motor: Include thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
2. Thermostatically controlled sump heater
3. Roto lock suction and discharge refrigeration connections
4. Centrifugal oil pump
5. Low vibration and noise

E. Condenser: Aluminum-tube, aluminum-fin coil, with liquid subcooler.

1. Coil: 5/16 inch O.D. seamless aluminum
2. Fin: aluminum continuous glued to coil
3. Lab tested to withstand 2,000 psi
4. Protected on all sides by louvered panels

F. Condenser Fan: Direct-drive, aluminum propeller fan; with permanently lubricated fan motor with thermal-overload protection.

G. Accessories include the following:

1. Liquid line dryer
2. Anti-short cycle timer
3. Electro-mechanical high and low pressure controls
4. Rubber isolator kit
5. Evaporator defrost control
6. Low ambient kit to permit operation down to 30 °F
7. Crankcase heater
8. Automatic reset timer to prevent compressor rapid cycle
9. Hard start kit for single phase units
10. 3-leg, compressor - overload protection

H. Casing: Steel, finished with baked enamel; with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Mount service valves, fittings, and gage ports on exterior of casing.

I. Coil Guards: Coil guards shall be constructed of louvered steel panels or 16 gauge expanded galvanized steel as detailed on the drawings. Guard finish shall match that of the condensing unit.

2.3 AIR COOLED CONDENSING UNITS (6 to 25 tons)

A. Acceptable Manufacturers:

1. Lennox
2. Trane
3. Johnson Controls

B. Description: Factory assembled and tested, air cooled; consisting of compressors, condenser coils, fans, motors, refrigerant reservoirs, and operating controls.

C. Refrigerant: R-410A

D. Compressor: Hermetic scroll compressor(s) designed for service with crankcase sight glass, crankcase heater, and backseating service access valves on suction and discharge ports.

1. Single Compressor Units

a. Single circuit with integral subcooling circuit
b. Suction gas-cooler motor w/±10% voltage utilization range of unit nameplate voltage
c. Crankcase heater
d. Internal temperature and current sensitive motor overloads
e. Factory installed liquid line filter drier
f. Phase loss/reverse rotation monitor
g. Liquid line service valve with gauge port
h. Suction line service valve with gauge port
i. External high and low pressure cutout devices
j. Evaporator defrost control
k. Loss of charge protection

2. Dual Compressor Units

a. Two separate and independent refrigerant circuits, each circuit with integral subcooling circuit
b. Suction gas-cooler motors w/±10% voltage utilization range of unit nameplate voltage
c. Crankcase heaters
d. Internal temperature and current sensitive motor overloads
e. Factory installed liquid line filter driers
f. Phase loss/reverse rotation monitor
g. Liquid line service valves with gauge port
h. Suction line service valves with gauge port
i. External high and low pressure cutout devices
j. Evaporator defrost control
k. Loss of charge protection

E. Condenser: Seamless copper-tube, aluminum-fin coil, with separate and independent refrigeration circuit for each compressor. Include liquid accumulator and subcooling circuit and backseating liquid-line service access valve. Factory test coils at 600 psig, then dehydrate by drawing a vacuum and fill with a holding charge of nitrogen.

1. 3/8 inch internally enhanced copper tube mechanically boded to lanced aluminum plate fins
2. Provide with factory installed perforated steel hail guards

F. Condenser Fans: Propeller-type vertical discharge; direct driven. Include the following:

1. Permanently lubricated ball-bearing motors
2. Separate motor for each fan
3. Motors with thermal-overload cutouts
4. Dynamically and statically balanced fan assemblies
5. Low Ambient Control: Factory-installed damper assembly, fan-speed control, or fan-cycling control

G. Operating and safety controls include the following:

1. Manual reset, electromechanical low pressure and high pressure cutout switches
2. Low oil pressure cutout switch

3. Anti-short cycle timer
4. Modulating low ambient (operation down to 0 °F)
5. Compressor-winding thermostat cutout switch
6. Crankcase heater
7. 3-leg, compressor-overload protection
8. Control transformer
9. Magnetic contactors for compressor and condenser fan motors
10. Automatic, nonrecycling pump down and a timing device to prevent excessive compressor cycling

H. Unit Casings: Designed for outdoor installation with weather protection for components and controls and with removable panels for required access to compressors, controls, condenser fans, motors, and drives. Additional features include the following:

1. Steel, galvanized or zinc coated, for exposed casing surfaces, treated and finished with manufacturer's standard paint coating
2. Shall comply with ASTM B117, 672 hour salt spray test
3. Lifting lugs to facilitate rigging of units
4. Unit base provisions for forklift and/or crane lifting
5. Gasketed control panel door
6. Unfused disconnect switch, factory mounted and wired, for single external electrical power connection

I. Coil Guards: Coil guards shall be constructed of louvered steel panels or 16 gauge expanded galvanized steel as detailed on the drawings. Guard finish shall match that of the condensing unit.

J. Accessories include the following:

1. Vibration isolators
2. BACnet MS/TP communication interface

2.4 MOTORS

A. Refer to Section 23 05 13 - Motor and Controllers

B. Motor Construction: NEMA MG 1, general purpose, continuous duty, Design B.

2.5 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate condensing units according to ARI 210/240 for units smaller than 135,000 BTUH.

B. Testing Requirements: Factory test sound-power-level ratings according to ARI 270.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install condensing units according to manufacturer's written instructions.

B. Install units level and plumb, firmly anchored in locations indicated; maintain manufacturer's

recommended clearances.

C. Install ground-mounted units on 4-inch- thick, reinforced concrete base, 4 inches larger than condensing unit on each side or as indicated on Contract Drawings whichever is greater. Concrete, reinforcement, and formwork requirements are specified in Division 3. Coordinate installation of anchoring devices.

3.2 CONNECTIONS

A. Connect refrigerant piping to air-cooled condensing units; maintain required access to unit. Install furnished field-mounted accessories.

B. Ground equipment: Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

A. Leak Test: After installation, charge systems with refrigerant and oil and test for leaks. Repair leaks and replace lost refrigerant and oil.

B. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation, product capability, and compliance with requirements.

1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units with new units and retest.

D. Field installed options shall be installed by factory authorized personnel in strict accordance with the manufacturer's instructions. Installation shall be inspected by a factory employed service representative and written approval provided to the Professional at substantial completion.

3.4 CLEANING

A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Clean units to remove dirt and construction debris and repair damaged finishes.

3.5 COMMISSIONING

A. Verify that units are installed and connected according to the Contract Documents.

B. Complete installation and startup checks according to manufacturer's written instructions and do the following:

1. Inspect for physical damage to unit casing.
2. Verify that access doors move freely and are weathertight.
3. Clean units and inspect for construction debris.
4. Check that all bolts and screws are tight.
5. Adjust vibration isolation and flexible connections.
6. Verify that controls are connected and operational.

C. Lubricate bearings on fans.

D. Verify that fan wheel is rotating in the correct direction and is not vibrating or binding.

E. Start unit according to manufacturer's written instructions.

1. Complete manufacturer's starting checklist.

F. Measure and record airflow over coils.

G. Check operation of condenser capacity control device.

H. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.

I. After startup and performance test, lubricate bearings and adjust belt tension.

3.6 DEMONSTRATION

A. Startup Services: Engage a factory-authorized service representative to train Using Agency's maintenance personnel as specified below:
1. Train Using Agency's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.
2. Review data in the maintenance manuals. Refer to Section 23 00 10 - Mechanical General Provisions.
3. Schedule training with Using Agency, through Professional, in accordance with Section 23 00 10 - Mechanical General Provisions.

END OF SECTION 23 81 14

SECTION 26 05 11 - ELECTRICAL GENERAL AND WORK IN EXISTING FACILITIES

PART 1 – GENERAL

1.1 GENERAL

A. All work shall conform to the latest editions of the National Electrical Code (NEC) [National Fire Protection Association (NFPA) 70], the Standard for Electrical Safety in the Workplace (NFPA 70E), the Life-Safety Code (NFPA 101), the International Building Code, the Americans with Disabilities Act, and all other applicable federal, state, and local codes and regulations.

B. All work shall be performed in strict compliance with NFPA 70E. Submission of bid shall stand as an agreement by the Contractor to indemnify and hold harmless the Engineer and Owner from all liability related to damage and/or injury to personnel and equipment during the installation of the project.

C. The contract documents are schematic in nature and are intended to convey the intent of the electrical work to be performed on this project. Provide all material, labor, equipment, etc., necessary to provide complete and operable electrical systems.

D. The General Conditions, Supplementary Conditions, General Requirements, Information to Bidders, and all other parts of this set of Contract Documents are hereby adopted and are applicable to the Division 26, 27, and 28 Contractor.

1.2 SCOPE OF WORK

A. Visit site prior to bid. Devise a plan for installation of complete and operable electrical systems meeting the requirements and intent of the Contract Documents. Submission of Bid stands as evidence that the Contractor accepts the Contract Documents as sufficient and complete for the work to be performed. Notify the engineer at least two weeks prior to bid of any discrepancies between the Contract Documents and actual field conditions. No change orders will be granted due to existing conditions that could have been observed during a site visit.

B. Provide temporary power and lighting during construction. Coordinate with the General Contractor for the exact requirements.

C. Electrical switchgear and panelboard layouts are based on sizes of Square D equipment. Equipment manufactured by General Electric, Siemens, and Cutler Hammer are equally acceptable. However, the Electrical Contractor is responsible for selecting and furnishing gear that will fit in the spaces provided and shall be responsible for arranging the gear to meet the required code clearances. Regardless of the manufacturer, the Electrical Contractor shall provide a drawn-to-scale electrical layout with the equipment brochures for all rooms in which panelboards, motor control centers, switchboards, or switchgear are placed. The drawings shall include the work of all other trades including mechanical system piping, ductwork, sprinkler piping, etc. No conduits shall be installed until layouts have been approved.

D. Locate junction boxes, pull boxes, disconnects, and other equipment requiring access in such a manner that they are accessible at the end of construction. Notify the Architect where it is impossible to plan conduit routing or equipment placement in such a manner, and provide the necessary access panels in the ceiling or wall as required. The access panel type and style shall be subject to the Architect's approval. Employ a painter to provide the appropriate coatings as directed by the Architect.

E. Relocate, or recircuit, all electrical equipment, conduit, and circuitry conflicting with or obstructing work on this project. Where the electrical systems are owned by other entities, pay them to relocate, or recircuit, their facilities.

F. Arrange for connection of service to all electrical systems by the appropriate utility company. Coordinate completely with all utility company requirements even if they are different than the contract documents. If utility company requirements are different from the contract documents, notify the engineer at least ten days prior to bid. Pay all utility company charges necessary for installation and connection of service. **No change orders will be granted for utility company connection fees.**

G. Provide all necessary equipment, raceway, circuitry, fittings, lugs, terminations, labor, etc. and connect to all equipment and appliances requiring electrical connections furnished herein, by the Owner, or by other Contractors. Prior to ordering electrical equipment and roughing in for equipment furnished by the Owner or other Contractors, verify all connection types, connection locations, connection heights, voltages, number of phases, conductor sizes, disconnecting means, breaker sizes, etc. Furnish the proper electrical equipment for the equipment actually being supplied.

1.3 WORK IN EXISTING FACILITIES

A. All work shall be scheduled and coordinated through the General Contractor with the Owner. Provide necessary costs for all work during both normal and premium work hours in bid.

B. Provide continuous uninterrupted power to all existing facilities to remain during the entire construction process. Any required power outages must be scheduled and approved by the Owner in writing at least three days prior to the outage.

1.4 SCOPE OF WORK IN EXISTING FACILITIES

A. Prior to beginning work, survey existing electrical systems. Document, in writing, signed by the Owner any portions of existing systems that are not operating properly before construction begins. Any electrical systems found inoperable at the end of the construction process that has not been so documented shall be repaired at the end of construction.

B. Remove electrical equipment in areas being demolished and electrical equipment feeding other equipment being demolished. Remove raceways and circuitry back to the panel of origination. Where raceways are installed in inaccessible areas, remove conductors back to the panel of origination. Where circuits are not being completely demolished, remove conductors back to a junction box or other connection point outside of the renovated area and recircuit existing electrical equipment that is to remain as required. Where necessary, completely refeed existing electrical equipment that is to remain. It is the intent of this specification that all existing equipment to remain be left completely operable at the end of the construction process.

C. Survey existing panel board circuitry and provide new typewritten directories giving complete as-built circuitry information for all pane lboards affected by the construction on this project.

D. Where new circuit breakers are installed in existing equipment, the new circuit breakers shall be manufactured for installation in that equipment. The Amperes Interrupting Current (AIC) Rating shall equal the AIC rating of the existing equipment. A breaker with a lower AIC rating may be used if the contractor provides calculations showing that the breaker rating is sufficient to handle the available fault current. Submit these calculations for approval prior to ordering the breaker. An AIC rating on an existing breaker in the panelboard or switchboard does not

demonstrate sufficient proof that the available fault current is less than that breaker's AIC rating.

1.5 SUBMITTALS AND SHOP DRAWINGS

A. Within 30 days after award of Contract and prior to beginning work, provide six bound copies of manufacturers' cut sheets containing information concerning each article of electrical equipment to be furnished on this project. These cut sheets shall contain sufficient information to prove compliance with the contract documents. Information addressing the requirements of the contract documents shall be highlighted. Each bound set shall bear the stamp of the Electrical Contractor as well as the General Contractor.

B. Within 30 days after award of Contract and prior to beginning work, provide six sets of full size shop drawings showing exact equipment locations with all equipment drawn to scale. Show all raceways with their junction boxes and pull boxes. Show all connection types, locations, and heights to equipment. Provide mounting and support details for all raceways and equipment. Coordinate with all other trades to ensure that there are no conflicts between systems. Each set of shop drawings shall bear the stamp of the Electrical Contractor, the General Contractor, and all Project Sub-Contractors. Failure to submit these Shop Drawings will render the Electrical Contractor responsible for resolving all conflicts between trades at his own expense.

C. Submittals and Shop Drawings are reviewed to determine quality of materials. Approval of submittals and shop drawings does not relieve the Contractor of meeting the requirements and intent of the Contract Documents.

D. Outlet, light fixture, and device locations are shown in their approximate locations on the drawings. Coordinate with Architectural drawings to get final locations. Mount all electrical outlets shown at counters such that the bottom of the box is two inches above the backsplash or six inches above a counter with no backsplash. The Owner reserves the right to relocate outlets, light fixtures, and devices a distance not to exceed twenty feet prior to the installation of outlet boxes.

PART 2 - PRODUCTS

2.1 All electrical equipment and materials shall be new. All equipment and materials shall be stored on the job site in weatherproof enclosures. Electronic equipment shall be stored in facilities where the temperature and humidity are controlled. In addition, comply completely with all manufacturers' requirements for storage and handling.

2.2 All equipment shall be UL listed for the application in which it is used and shall be labeled as evidence of its UL listing.

2.3 Each circuit breaker supplying a multiwire branch circuit shall be installed with a manufacturer supplied handle tie to simultaneously disconnect all ungrounded conductors. Each multi-wire branch circuit shall comply with NEC article 210.4.

2.4 Products shall be selected to maintain or improve the aesthetics of the facility. Gain approval of the Architect or Engineer prior to ordering or installing any electrical equipment or raceway.

PART 3 – EXECUTION

3.1 WORKMANSHIP

All work shall be performed with an emphasis on neatness. The Engineer, Architect, and Owner retain the right to reject work that is, in their judgment, unsatisfactory.

3.2 EXPERIENCE

The Contractor shall have completed at least two jobs of similar size and scope within the past five years. The Engineer reserves the right to reject Contractors based on their inability to submit evidence of their experience, or based on experience with the Contractor on previous projects.

3.3 PERMITS

Obtain and pay for all permits required for work.

3.4 FIREPROOFING

A. Fireproof all penetrations through firewalls with a fireproofing compound listed to maintain the rating of the wall through which the raceway passes.

B. The fire-stopping caulk shall be a one-part, intumescent, latex elastomer. The caulk shall be capable of expanding a minimum of 3 times at 1000°F. The material shall be thixotropic and be applicable to overhead, vertical and horizontal fire-stops. The caulk shall be listed by independent test agencies such as UL or FM and be tested to, and pass the criteria of, ASTM E 814 Fire Test, tested under positive pressure. It shall comply with the requirements of the NEC (NFPA-70), BOCA, ICBO, SBCCI and NFPA Code 101. Fire-stopping caulk shall be paintable, but shall be non-hardening. Fire-stopping caulk shall be 3M Fire barrier CP or approved equal.

C. The fireproofing materials shall be installed by individuals certified to perform such work. Submit evidence of personnel certifications with electrical equipment brochures.

D. Where cable trays are shown crossing firewalls, terminate the cable tray on each side of the wall and run the conductors through conduits installed in the wall. Fireproof around the conductors after installation.

E. Provide mineral wool packing and all other materials recommended by the manufacturer for a complete installation.

3.5 FLASHING

Provide all necessary equipment and flash all roof penetrations in such a manner to ensure that all penetrations are completely sealed and all roof warranties remain in effect. Where there are no roof warranties, the Electrical Contractor shall guarantee the electrical penetrations against leaking for a period of one year from project completion. Employ a professional roofing contractor to perform all flashing.

3.6 PROTECTION

A. Keep energized equipment covered during all phases of construction. Use enclosures, doors, covers, etc., to ensure that neither personnel nor machinery contact live electrical equipment.

B. Replace electrical equipment that is damaged during construction.

3.7 DAMAGED FACILITIES

A. Locate all existing site equipment and utilities prior to beginning construction. Repair all equipment and utilities damaged during construction, or pay for the repair of the equipment and utilities where required by the Owner of the damaged facilities.

B. Coordinate the routing of all circuits and the locations of all devices with the Architect or Engineer and the Owner. Shop drawings shall describe completely the locations and elevations of all raceways, boxes, fittings, and equipment.

3.8 EXCAVATION AND BACKFILL

A. Excavate in such a manner as to minimize erosion of the soil. Backfill trenches around conduits with fine sand that is free of rocks, clods, and debris. Fill sand a minimum of 4" over conduits. Backfill the rest of the trench in six inch increments, wetted, and tamped. Final compaction shall be a minimum of 95% of that of the adjacent earth. Resurface the grade with the same material as that excavated from the grade whether it be paving, concrete, sod, etc. Repair work shall be comparable to the quality of the original site prior to excavation.

B. Provide a 3" wide plastic labeled marker tape 12" below grade over all electrical conduits buried underground. Tapes for power circuits shall have a warning such as "Caution: Buried Electrical Line Below." Labels on tapes for telephone, data, cable television, and other facilities shall adequately describe the line over which they are buried.

C. Provide a #12 AWG wire in each buried conduit run labeled accordingly on each end.

3.9 IDENTIFICATION

A. Label all switchboards, panel boards, motor starters, disconnects, and motor control centers furnished under Division 26, 27, and 28 and other divisions of this contract with engraved rigid plastic nameplates having letters at least ¼ inch high. Nameplates shall be bolted to the enclosure. All labels shall indicate the voltage, number of phases, the AIC rating, and the panelboard and circuit number from which the device is fed.

B. All circuit breakers in Switchboards, Motor Control Centers, Square D I-Line, and similar pane lboards shall be labeled with plastic nameplates (as described in Part A) providing the name of the load served and the ampacity and number of poles of the breaker.

C. All Square D NQOD, NF and similar panel boards shall have typewritten circuit directories.

D. Label all conductors at all junction boxes, pull boxes, and terminations with typewritten adhesive markers indicating the panel board or switchboard name and circuit number of the conductor. Labels shall be Brady Datatab or approved equal.

E. Label all junction boxes and pull boxes with stenciled painted letters containing the name of the panel board and circuit numbers of the circuits contained within. Use black paint for normal circuits, red paint for emergency circuits, and orange paint for fire alarm circuits. The Contractor may select other colors for junction boxes and pull boxes for auxiliary systems.

F. Label all conduits in the most likely direction of access and view every 50' and on both ends of each bend with stenciled painted letters containing the name of the panel board and circuit numbers of the circuits contained within. Use black paint for normal circuits, red paint for emergency circuits, and orange paint for fire alarm circuits. The Contractor may select other colors for conduits for auxiliary systems.

3.10 AS-BUILT DRAWINGS

Maintain one set of drawings during construction for as-built markings. Mark these drawings in red to indicate field changes. Provide these drawings to the Engineer at the end of the construction process. Where required under the General Conditions, Special Conditions, or other portions of this contract, provide revised computer drawn as-built drawings to the Engineer at the end of construction.

3.11 TESTING

A. Test all systems, or pay testing agencies as required, for compliance with the requirements of all regulatory agencies.

B. Test the electrical power service ground using a Biddle Three-Terminal Ground Resistance Tester, or approved equal. Grounds shall meet the requirements of the NEC, or of Specification 26 05 26, whichever is more stringent. Test grounds only when the earth is dry. Provide additional ground rods as necessary to achieve the required results.

C. Prior to making final equipment connections, test all service, feeder, and branch circuit conductors for continuity, phase-to-phase faults, and phase-to-ground faults using a Megger BM100 or approved equal test instrument generating 500 Vdc. Insulation resistance shall be a minimum of 500,000 Ohms between any conductor and ground and 1,000,000 Ohms between any two conductors.

D. Test other systems as required in their respective specifications.

E. Provide three bound copies of all test results to the Engineer at the end of the construction process. No Recommendation of Substantial Completion will be granted until all testing reports have been submitted.

3.12 WARRANTY

Provide the Owner a written guarantee to repair, or replace, all faulty equipment and systems for a period of one year from date of Substantial Completion. During this one-year period, a representative of the Contractor shall be on the site actively working on the repairs within 24 hours of the Owner’s telephone call. During this period of time, the Owner shall not be charged for any repair work or expenses related with the repair work unless the Contractor can prove that the Owner has damaged the equipment or system.

END OF SECTION

SECTION 26 05 19 – 600V CONDUCTORS

PART 1 – GENERAL

Provide all circuitry, terminations, splices, connectors, lugs, and other equipment necessary for connection of all equipment requiring electrical connections.

PART 2 – PRODUCTS

2.1 All electrical conductors shall be soft-drawn annealed copper having 98% conductivity and an insulation rating of 600V.

2.2 Conductors shall be UL listed for installation in the raceway in which they are to be installed.

2.3 Conductors shall be rated 90 degrees C for use in residential, commercial, industrial, and institutional facilities, and shall be listed as 105 degrees C appliance wire. Conductors shall be listed under UL 83, UL 1063, and UL 758. If XLP or EPR insulation is used, conductors shall be listed under UL 44 and NEMA WC7.

2.4 Conductors used for branch circuits, feeders, auxiliary systems, and controls run in dry locations shall have PVC insulation and a Nylon outer jacket. They shall be THHN/THWN or XHHW-2.

2.5 Conductors used for branch circuits, feeders, auxiliary systems, and controls run in wet locations shall have XLP or EPR insulation and be type XHHW-2.

2.6 Conductors used for operating room isolation panels and associated branch circuits shall be copper stranded conductor having a cross-linked polyethylene insulation or equivalent with a dielectric constant of 3.5 or less. Wire-pulling compounds that increase the dielectric constant shall not be used on the secondary conductors of isolation panels. The isolated circuit conductors shall be identified as follows:

Isolated Circuit #1 – Orange
Isolated Circuit #2 – Brown

For 125 volt, 15 & 20 ampere receptacles: The orange conductor shall be connected to the terminal on the receptacle that is identified in accordance with NEC 200.10(B) for connection to the grounded circuit conductor.

2.7 Conductors used for services shall be type SE for aerial services or type USE-2 for underground services.

2.8 Sizes #10 and #12 shall be solid conductors except where used for controls. All controls conductors shall be stranded.

2.9 Use minimum #14 AWG conductors for controls and auxiliary circuits. Use larger conductors as required to compensate for voltage drops exceeding 3% of the system voltage.

2.10 Conductors shall be furnished in the colors described below unless local ordinances require different colors. Conductors #8 and smaller shall be furnished with colored insulation; conductors larger than #8 shall be taped with the appropriately colored tape for a length of at least 2” at each panelboard, junction box, pull box, load, or other exposed location. Ground conductors shall be taped green for their entire exposed length.

SystemVoltage	208Y/120V, 3-Phase, 4-Wire	120/240V, 3-Phase, 4-Wire	480Y/277V, 3-Phase, 4-Wire

Phase A	Black	Black	Brown
Phase B	Red	Orange	Orange
Phase C	Blue	Blue	Yellow
Neutral	White	White	Gray
Ground	Green	Green	Green

2.11 Conductor sizing chart:

Voltage Drop Chart for 20amp single pole circuits		
Voltage	Circuit Length	Conductor size (awg)
120	< 90'	#12
120	> 90'	#10
120	> 145'	#8
120	> 230'	#6
277	< 200'	#12
277	> 200'	#10
277	> 325'	#8
277	> 525'	#6

A. Circuit sizes indicated on the drawings are minimum NEC requirements. Refer to this chart for upsizing conductors based on circuit length.
B. Do not connect conductors larger than #10 directly to a receptacle or a switch. Provide a junction box to downsize the conductor to #12 at the device.
C. For circuits longer than those listed above, consult with the Engineer for conductor sizes.

PART 3 – EXECUTION

3.1 Install conductors carefully using a minimum of two tradesmen – one feeding the conductors into the conduit, and the other pulling the conductors into the conduit.

3.2 Each branch circuit and multiwire branch circuit shall be run with its own neutral conductor complying with NEC article 200.4.

3.3 Join stranded conductors with appropriate mechanical or compression lugs. Wire nuts may be used for solid conductors only.

3.4 Splices shall only be made in approved enclosures. Splices shall not be pulled inside conduits.

3.5 Provide cable supports and strain relief connectors as required by the NEC.

3.6 Furnish junction boxes, pull boxes, handholes, manholes, etc. as required to ensure that the maximum number of bends allowed by the NEC are not exceeded and to ensure that the cables are not damaged during installation.

END OF SECTION

SECTION 26 05 26 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 GENERAL

Ground all equipment, systems, structures, etc., per the latest edition of the National Electrical Code (NEC).

PART 2 – PRODUCTS

2.1 Use mechanical bolted connections in dry locations that are accessible.

2.2 Use exothermic welds in wet locations and locations that will be inaccessible at the end of construction.

2.3 Ground rods shall be UL listed 3/4” x 10’ copper-clad steel ground rods with a minimum copper cladding thickness of 10 mils.

PART 3 – EXECUTION

3.1 Ground rods shall be installed with their tops no less than 6” below grade.

3.2 Bond ground connections to metal raceways at each end of the conduit run. Provide grounding bushings where required by the NEC. Where cable trays are used, bond the ground conductor to each section and fitting of the tray.

3.3 Provide all circuits with an equipment grounding conductor sized per the NEC, or as shown on the drawings. Circuitry shown on drawings does not include the required equipment grounding conductor. Where multiple circuits are run with a common neutral, only one equipment grounding conductor is needed. The equipment grounding conductor shall be furnished with green insulation for conductors #8 AWG and smaller; where larger than #8, the equipment grounding conductor shall be taped green for its entire exposed length.

3.4 The grounding electrode conductor(s) shall be bare or shall be colored green for its entire exposed length.

3.5 Individual ground conductors shall be installed in PVC conduit sized per the NEC.

3.6 Provide receptacles, luminaires, and other devices with a green conductor that bonds the receptacle grounding screw or pigtail, the outlet box grounding screw, and the equipment grounding conductor together.

3.7 In health care facilities, where two or more different panel boards serve the same patient-care area, an 8 AWG insulated continuous copper conductor shall bond these different panel boards together.

3.8 Telephone, cable television, and other auxiliary systems shall be bonded to the electrical building service ground using a conductor no smaller than #6 AWG.

END OF SECTION

SECTION 26 05 33 – RACEWAYS, OUTLET BOXES AND JUNCTION BOXES FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 GENERAL

A. All electrical systems circuitry shall be contained in raceways unless expressly listed in the specification for that system.

B. Outlet Boxes and Junction Boxes

1. Furnish and install all outlet boxes and junction boxes in accordance with this specification and the requirements of the NEC.

2. Provide outlet boxes for all switches, receptacles, luminaires, telephone jacks, cable jacks, and other devices furnished in this Contract. Provide all necessary hardware including, but not limited to, additional structural support, support brackets, screws, bolts, fixture studs, etc.

3. Outlet boxes and junction boxes in dry locations shall be galvanized stamped steel boxes sized per the latest edition of the National Electrical Code (NEC), but no less than 4” x 4” x 2 1/8” deep. The thickness of the steel shall be in compliance with the requirements of the NEC. Provide stamped steel covers for all junction boxes manufactured to fit the particular box on which it is used.

4. Outlet boxes used in concrete and masonry walls and ceilings shall be of the concrete type manufactured for such applications.

5. Outlet boxes and junction boxes in wet locations shall be of cast metal construction with gasketed waterproof covers. All conduit connections to the boxes shall be made watertight.

6. Wall outlet boxes shall be 4” x 4” x 2 1/8”, or larger as required, with plaster rings provided for final flush installation. Plaster rings shall have single-gang openings unless the equipment mounted inside requires two-gang installation.

7. Floor boxes in slabs on grade shall be deep rectangular, cast iron, fully adjustable boxes with brass rings. Covers shall be made of brass and shall provide flip top access to the power or data jacks inside. Screw-on covers are not acceptable unless a flip-top cover is unavailable for the device installed in the floor box. Provide the box sized as required for the number of devices shown installed. Boxes shall be as follows, or approved equal:

   a. Single-Gang Boxes: Hubbell B2436
   b. Single-Gang Cover Plates: Hubbell S3825
   c. Double-Gang Boxes: Hubbell B4233
   d. Double-Gang Cover Plates: Two Hubbell S3825 Cover Plates
   e. Triple-Gang Boxes: Hubbell B4333
   f. Triple-Gang Cover Plates: Three Hubbell S3825 Cover Plates

8. In slabs above grade, use cast iron, semi-adjustable shallow boxes as follows, or approved equal:

   a. Single-Gang Boxes: Hubbell B2414
   b. Two-Gang Boxes: Hubbell B4214
   c. Three-Gang Boxes: Hubbell B4314

9. Receptacles installed in floor boxes shall be as described in Specification 26 09 23, Switches and Receptacles. Data, Telephone, or Combination Data and Telephone Outlets shall consist of Category 5 rated RJ45 jacks mounted in a Hubbell DJOI strap for use under a S3825 flip top cover plate.

10. In existing slabs above grade, use poke thru boxes as follows, or equal:

    a. Hubbell System One

11. Size all boxes per the requirements of the latest NEC.

1.2 SCOPE OF WORK

A. Raceways

1. Provide all raceways, fittings, couplings, anchors, supports, hangers, etc. for complete raceway systems.

2. Use Schedule 40 polyvinyl chloride (PVC) conduit for circuits run underground and in slabs on grade level. Provide PVC-coated galvanized rigid steel elbows and PVC-coated galvanized rigid steel conduit for all vertical runs extending to a point at least 6” above grade. Galvanized Rigid steel conduit coated with two complete coats of asphaltum or bituminous paint may be used in lieu of PVC-coated galvanized rigid steel conduit.

3. Use Galvanized Rigid Steel (GRS) conduit for all applications where circuits are run above ground exposed to the weather.

4. Use Intermediate Metal Conduit (IMC) for all branch circuits, feeders, and auxiliary circuits requiring conduit 1 ¼” nominal trade size or larger in dry locations.

5. Use Electrical Metallic Tubing (EMT) for all branch circuits and feeders less than 1 ¼” nominal trade size in dry locations and in slabs above grade level.

PART 2 – PRODUCTS

2.1 Products for Raceways

A. PVC conduits, fittings, couplings, adapters, and accessories shall be UL listed and approved for use with 90 degree Celsius conductors. The UL label shall be affixed to each ten foot length of conduit and each fitting. Conduits shall comply with NEMA Specification TC-2 and UL 651. Fittings shall comply with NEMA TC-3 and UL 514b.

B. PVC-coated conduits, fittings, couplings, adapters, and accessories shall be UL listed with PVC as the primary corrosion protection. They shall be hot dipped galvanized rigid steel conduit with threads electro-galvanized after cutting. The conduit shall meet UL 6. The fittings shall meet UL 514B. The PVC coating shall be uniformly applied to the interior and exterior of all conduit and fittings. The coating shall be nominally 2 mils thick. The PVC coating shall extend one pipe diameter or two inches, whichever is less, at every male fitting except unions to fit over the joining female connection. Couplings shall contain a series of longitudinal ribs, 40 mils in thickness, to protect the coating from damage by tools during installation. PVC-coated conduits shall be ETL Verified PVC-001. Fittings shall be manufactured to the same standard. PVC-coated conduit shall be Robroy Plastibond or approved equal.

C. GRS conduits, fittings, couplings, adapters, and accessories shall be UL listed. They shall be hot-dipped galvanized steel. They shall meet the safety standards of UL 6, and shall be manufactured to ANSI C80.1. Threads shall be hot galvanized after cutting.

D. IMC conduits, fittings, couplings, adapters, and accessories shall be UL listed. They shall be hot-galvanized steel. Fittings, couplings, adapters, and accessories shall be the same as those for GRS conduit described above. IMC shall meet UL 1242 and ANSI C80.6. Threads shall be hot galvanized after cutting. The inside of the conduit shall be finished with a corrosion-resistant coating.

E. EMT conduits, fittings, couplings, adapters, and accessories shall be UL listed. They shall be hot galvanized steel and shall be produced in accordance with UL 797 and ANSI C80.3. The inside shall be finished with a corrosion-resistant lubricating coating.

F. Conduit fittings used with EMT conduits may be set screw indenter type or compression type. All metallic fittings for IMC and Rigid conduit shall be compression type fittings.

G. Flexible metallic conduit shall be constructed of galvanized steel and shall be UL listed as compliant with UL 1 and UL 1479.

H. Liquidtight flexible conduit shall be constructed of galvanized steel and shall be coated with a PVC jacket to resist liquids, dirt, grease, and oils. All fittings shall be designed, constructed, and installed to maintain the integrity of the liquidtight connections. Liquidtight flexible conduit shall comply with UL 360.

2.2 ACCEPTABLE MANUFACTURERS FOR OUTLET BOXES AND JUNCTION BOXES.

A. Outlet boxes and junction boxes shall be manufactured by Raco, Steel City, Crouse Hinds, or Appleton.

PART 3 – EXECUTION

3.1 CONDUIT EXECUTION

A. Conduits run underground shall be buried no less than 24” deep. Services and primary conduits feeding transformers shall be buried no less than 48” deep.

B. **Do not install conduits in or below ground floor slabs, except for service conduits, site lighting, and where specifically indicated on the drawings.**

C. Do not install conduits within 6” of the deck where a screw down type roof system is utilized.

D. PVC-coated conduits may be field-bent provided that manufacturer-approved tools are used. Individuals installing PVC-coated conduits shall be trained for installation by factory-certified trainers. Provide evidence of training with equipment brochures.

E. Support and install all conduits per the latest edition of the National Electrical Code. Support groups of conduits with electrical strut supported by threaded rods anchored to the building structure. Supports shall be designed to hold no less than twice the weight of the conduit and conductors to be supported plus an additional 250 pounds at midspan.

F. All conduits shall be grouped and run parallel to each other and to building walls.

G. All conduits shall be assembled according to the manufacturer’s instructions.

H. Conduits run underground shall be assembled to be watertight.

I. Cap all conduits during installation. Pull a mandrel sized for that conduit and a cleaning brush through each conduit before installation of any conductors.

J. Conduits that are obviously damaged and field bends that are obviously out of round shall be replaced.

K. Provide final connections to equipment with flexible metallic conduit. In wet or damp locations, use liquidtight flexible conduit. Flexible conduit shall not exceed 72".

L. Terminate conduits entering boxes with a locknut inside the box and a locknut outside the box. Provide protective bushings on all conduit threads. Use watertight hubs where conduit terminations are exposed to moisture.

M. Use grounding bushings on all feeder conduits, all underground conduits, and where required by the National Electrical Code.

N. Conduits shall be run no closer than 12" to hot water pipes.

O. Where conduits are run through the ceiling and are required to make connections to equipment within the room that is not located near a wall, support the conduit from the structural ceiling and provide a flange bolted to the floor. Install a tee conduit fitting in the vertical run of conduit, and make the connection to the equipment with a piece of flexible conduit extending from the tee conduit fitting to the equipment.

P. Provide expansion fittings where conduits cross building expansion joints. Provide grounding jumpers between the conduits.

Q. Provide EMT conduit sleeves where conduits pass through walls, floors, or footings sized a minimum of two nominal trade sizes larger than the conduit that must pass through the sleeve.

R. Equip all empty conduits with a pullwire or string capable of withstanding 200 pounds of pulling tension.

3.2 Execution for Outlet Boxes and Junction Boxes.

A. All devices shall be flush mounted unless specific written permission is obtained from the Engineer for a particular device in a particular location.

B. Install outlet boxes in walls, and provide plaster rings such that wall finish contractor's finish is flush against the edge of the plaster ring. Workmanship will not be accepted where the hole in the wall shows behind the cover plate, or the wall finish is uneven or unpainted at the edge of the cover plate.

C. Use round or square ceiling outlet boxes as required for the device being installed. The ceiling shall be finished flush against the box; the fixture shall completely cover the box and mount tight against the ceiling. Coordinate the requirements of the fixture prior to installing the box.

D. Provide junction boxes, pull boxes, and conduit fittings where required by the NEC to limit the number of bends in the raceway, and where required to prevent damage to conductors due to long runs.

E. Junction boxes and pull boxes installed in the ground outside shall be Quazite Composolite or approved equal. Mount the boxes over 24" of washed gravel fill. If splices are to be made inside

the boxes, the boxes shall be of the type furnished with a bottom, and all conduit connections shall be watertight. In addition, all conductor splices shall be made watertight using an appropriate splice kit as manufactured by 3M, or an approved equal.

END OF SECTION

SECTION 26 09 23 - SWITCHES AND RECEPTACLES

PART 1 – GENERAL

Furnish and install all switches and receptacles in accordance with this specification and the requirements of the NEC.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

Switches and receptacles shall be manufactured by Hubbell, Cooper Wiring Devices, Leviton, or Pass & Seymour.

2.2 GENERAL

A. Switches and receptacles shall be specification grade. They shall have ampacity and voltage ratings suitable for the application in which they are used.

B. Consult architect or engineer for device colors prior to ordering devices.

C. Provide brushed stainless steel cover plates for all devices. A single cover plate shall cover all devices in one box.

D. Light switches shall be 20 Ampere, 120-277V back-wired and side-wired toggle switches. They shall be rated up to 2 HP at 240V. Each switch shall be equipped with a grounding screw. Switches shall be Hubbell CSB series or approved equal.

E. Duplex NEMA 5-20R receptacles shall be Hubbell HBL 5362A or approved equal.

F. Duplex GFI NEMA 5-20R receptacles shall be Hubbell HBL GF5362A or approved equal.

G. Weatherproof while-in-use cover plates shall be Teddico #34017-7 or approved equal. Cover plates shall be single gang, lockable, and constructed of heavy duty die cast metal.

H. All 125V, 15 and 20 ampere receptacles installed in dwelling units shall be of the tamper-resistant type.

I. All 15 and 20 ampere, 125 and 250V non-locking receptacles installed in wet or damp locations shall be listed as the weather-resistant type.

J. Devices furnished in this Contract, but not listed above, shall be of the same standard of quality as those items listed.

PART 3 – EXECUTION

3.1 Flush mount all devices unless specific written permission is obtained from the Engineer for a particular device in a particular location.

3.2 Install all devices vertically unless the drawings specifically state that the particular device should be mounted horizontally.

3.3 Install receptacles with the ground slot up.

END OF SECTION

SECTION 26 09 25 - OCCUPANCY SENSORS

PART 1 - GENERAL

1.1 Furnish and install a complete system of Occupancy sensors as shown on the drawings and as specified herein. The drawings are provided to show the general scope of the work, and show the absolute minimum components required. Actual system components, quantities, and locations shall be determined by the motion detector vendor and provided to the Contractor with the installation shop drawings.

1.2 The Contractor and Sales Representatives are advised to take notice of specified component characteristics when attempting to select and propose substitutions. It is highly unlikely that substitutions on a one-for-one component basis will produce results that provide acceptable system performance.

1.3 Provide all power packs, hardware, software, devices, circuitry, and other components, material, and labor required to install, configure, and test the entire system to the satisfaction of the Architect, Owner, and Engineer.

1.4 Submit six sets of manufacturer's cut sheets describing completely all equipment, and six sets of shop drawings showing all circuitry including terminal-to-terminal connections.

1.5 The wiring diagrams on these drawings are based on our best interpretation of the manufacturer's data that was available at the time of design; however, they shall not be used for system installation and configuration. The controls equipment vendor is expected to be thoroughly knowledgeable of the equipment that is being proposed, and shall provide detailed shop drawings tailored for each circuit and lighting zone on the project. General manufacturer's data sheets shall not be acceptable. The shop drawings shall be suitable for the installing electrician to use for complete installation of the circuitry without referring to data sheets or installation manuals for connection of lighting control equipment. These requirements shall be followed whether the specified equipment, or products of other manufacturers, is provided.

PART 2 - PRODUCTS

2.1 Wireless Occupancy Sensor: Wireless occupancy sensors shall be passive infrared, ceiling-mounted units. They shall be Lutron #LRF2-OCR2B-P-WH or approved equal.

2.2 Areas up to 500 Square Feet: Occupancy sensors used in areas up to 500 square feet shall be dual technology infrared and microphonics, ceiling-mounted units with a 360 degree, 500 square foot coverage.

2.3 Areas up to 2000 Square Feet: Occupancy sensors used in areas up to 2000 square feet shall be dual technology infrared and microphonics, ceiling-mounted units with a 360 degree, 2000 square foot coverage. They shall be Lutron #LOS-CDT-2000-WH or approved equal.

2.4 Power Packs: Power packs shall be of the same manufacturer as the occupancy sensors. Each shall be capable of controlling a 20 ampere circuit. They shall be rated for operation at the voltage of the system on which they will be used.

2.5 Circuitry: Provide control circuitry as required by the manufacturer for optimum system operation, but no less than the following: Control cables shall be 3-conductor #22 AWG copper with an overall jacket. Adjust conductor sizes as required to overcome unacceptable voltage drop.

PART 3 - EXECUTION

3.1 Occupancy sensors shall be provided so that their coverage areas overlap and there are no dead zones in the rooms where persons may stand and not be detected.

3.2 All work shall be done by qualified system technicians.

3.3 Wiring, including control wiring, shall be in Raceways meeting Specification 16110.

3.4 Guarantee workmanship and material for a period of one year after final acceptance. During the warranty period, repair or replace faulty equipment at no cost to the Owner for labor, material, or expenses.

3.5 Upon completion of job, test entire system. After testing submit a certificate to the Architect stating verification of the following:

A. All devices have been tested and are working properly.

PART 4 – CLOSE-OUT DOCUMENTS

4.1 Provide the following documents to the Architect for delivery to the Owner at the time of substantial completion:

A. Written Guarantee
B. Two sets of data prepared by the manufacturer for each item of electrical equipment completely describing each piece of equipment. The data shall include parts lists, a description of operation, shop drawings, wiring diagrams, maintenance procedures, and other literature required for operation and maintenance of equipment.

4.2 Instruct the Owner on system operational procedures. Notify the Owner and Architect at least one week in advance of the training session. Provide written step-by-step instructional material.

4.3 Notify the General Contractor that you are to present during the Pre-final Inspection. During that inspection, demonstrate all system functionality and capabilities; remove cover plates and panels covers as required to show the quality of the installation. The Owner, Architect, and Engineer reserve the right to reject unsuitable workmanship or performance.

END OF SECTION

SECTION 26 22 00 - TRANSFORMERS

PART 1 – GENERAL

Provide all equipment, labor, and materials required for complete and operable installation of transformers as shown on the drawings and specified herein.

PART 2 – PRODUCTS

2.1 Transformers 1000 KVA and smaller shall be listed by UL. They shall conform to the requirements of ANSI/NFPA 70. They are to be manufactured and tested in accordance with NEMA ST20.

2.2 Transformers shall be designed for operation at 60 Hz. Unless otherwise shown on the drawings, each transformer shall be a three-phase unit with a 480 volt, delta connected primary, and a 208Y/120 volt secondary.

2.3 Transformer shall be of the energy-efficient type.

2.4 Where transformers are shown on the drawings to be K-rated, they shall be UL listed and labeled for the K-rating indicated based on the sum of fundamental and harmonics per UL 1561. They shall be listed for 115 degrees C average temperature rise. K-rated transformers shall have an impedance of 3% to 5% with a minimum reactance of 2% in order to help reduce neutral current when supplying loads with large amounts of third harmonic current.

2.5 All insulating materials shall exceed NEMA ST20 standards and be rated for 220 degrees Celsius according to UL's component recognized insulation system.

2.6 Transformers 15 KVA and larger shall be rated for 150 degrees C temperature rise above an ambient temperature of 40 degrees C. Transformers 25 KVA and above shall have four 2.5% full capacity primary taps (two above and two below).

2.7 The maximum temperature of the top of the enclosure shall not exceed 50 degrees C above an ambient temperature of 40 degrees C.

2.8 Furnish transformers located outside with factory-furnished weatherproof enclosures.

2.9 Transformer coils shall be of continuous wound construction.

2.10 Transformer cores are to be visibly grounded to the enclosure by means of a flexible grounding conductor sized in accordance with applicable UL and NEC standards.

2.11 Transformers shall be ventilated and fabricated of heavy gauge sheet steel. The entire enclosure shall be finished utilizing a continuous process of degreasing, cleaning and phosphatizing, followed by electrostatic deposition of polymer polyester powder coating and baking to provide a uniform coating of all edges and surfaces.

2.12 Sound levels shall be warranted by the manufacturer not to exceed the following:

- 15 to 50 KVA – 45 dB
- 51 to 150 KVA – 50 dB
- 151 to 300 KVA – 55 dB
- 301 to 500 KVA – 60 dB
- 501 to 700 KVA – 62 dB

- 701 to 1000 KVA – 64 dB
- 1001 to 1500 KVA – 65 dB
- 1501 to 2000 KVA – 66 dB

PART 3 – EXECUTION

3.1 Install transformers in strict compliance with the manufacturer's instructions and the latest version of the National Electrical Code.

3.2 Provide concrete housekeeping pads for transformers mounted indoors. Housekeeping pads shall consist of 3.5" thick pads containing #4 reinforcing bars on 6" centers in both horizontal directions in the center of 3000 psi concrete. Where transformers are located outside, the pad shall extend at least 6" above grade and shall have a 12" wide footing at least 4" below the frost line; the footing shall be a minimum of 12" deep.

3.3 Transformers not exceeding 75 KVA may be wall-mounted where sufficient proof is provided that the structure can support the weight and where factory-provided wall brackets are used.

END OF SECTION

SECTION 26 24 00 - PANELBOARDS

PART 1 – GENERAL

1.1 Furnish and install all panelboards, complete with their circuit breakers, phase buses, neutral buses, ground buses, structural supports, and other equipment necessary for complete systems.

1.2 The equipment vendor shall perform all calculations necessary and provide complete Arc Flash Labels as required by the National Electrical Cod (NEC) and the drawings. Note: The drawings typically require more detail than required by the NEC.

PART 2 – PRODUCTS

2.1 GENERAL

A. Panelboards shall be designed, manufactured, and tested to be in compliance with NEMA PB 1, UL 50, UL 67, UL 489, NFPA 70, and the ASTM.

B. Circuit breakers shall be designed, manufactured, and tested to be in compliance with NEMA AB 1, UL 489, and Federal Specification W-C-375B/GEN.

C. Panelboards shall be UL listed for service entrance where used for that purpose.

D. Panelboard ampere interrupting current (AIC) ratings shall equal the lowest rated device in the panelboard. Provide panelboards with the AIC ratings shown on the Contract Drawings. Buses shall be braced to withstand the AIC rating shown on the drawings. Series ratings shall only be used where shown on the panelboard schedules.

E. All panelboards shall be furnished with dead-front, door-in-door construction.

F. Lug locations shall be determined during the creation of shop drawings for proper arrangement with the raceway system.

G. Buses shall be constructed of 98% conductivity copper or tin-plated copper.

H. Panelboard enclosures shall be NEMA 1 when they are to be mounted indoors, and NEMA 3R when they are to be mounted outdoors. Provide special enclosures where shown on the Contract Drawings.

2.2 ACCEPTABLE MANUFACTURERS

Panelboards shall be manufactured by Siemens, Square D, General Electric, or Cutler Hammer.

2.3 PANELBOARD CLASSES

A. Power distribution panelboards shall be available with mains and branch devices up to 1200 amperes. AIC ratings shall be available up to 200,000 Amperes. Power distribution panelboards shall be equipped with a nameplate containing the appropriate system voltage, number of wires, and number of phases for the system on which they are installed.

B. In 480Vac and less applications where a main breaker not exceeding 600 Amperes is required, the AIC rating does not exceed 65,000 Amperes, and no branch breakers exceed 125Amperes, Square D NF and equivalent panelboards may be used.

C. In 480Vac and less applications where a main breaker not exceeding 225 Amperes is required, the AIC rating does not exceed 14,000 Amperes, and no branch breakers exceed 100Amperes, Square D NEHB and equivalent panelboards may be used.

D. In 240Vac and less applications where a main breaker not exceeding 400 Amperes or main lugs not exceeding 600 Amperes is required, the AIC rating does not exceed 22,000 Amperes, and no branch breakers exceed 125 Amperes, Square D NQOD and equivalent panelboards may be used.

2.4 CIRCUIT BREAKERS

A. Circuit breakers shall be thermal magnetic, molded-case with quick-make, quick-break contact action. They shall have thermal and magnetic tripping elements on each pole. Breakers with multiple poles shall have common tripping of all poles. Circuit breaker ampere ratings shall be stamped on the handle. Interrupting ratings of the circuit breakers shall be equivalent to the specified AIC rating of the panelboard. Breakers handles shall reside in a position between “ON” and “OFF” after a trip condition. Breakers shall be rated HACR when used for heating, air-conditioning, and refrigeration; HID when used with High Intensity Discharge fixtures; and shall be rated SWD when used for switching duty.

B. Circuit breaker sizes for motor loads are based on Square D recommendations for use of their breakers at the motor horsepowers listed on the mechanical drawings. If equipment is used other than Square D, adjust breaker sizes per the manufacturer’s recommendations.

C. Each circuit breaker supplying a multiwire branch circuit shall be installed with a manufacturer supplied handle tie to simultaneously disconnect all ungrounded conductors. Each multiwire branch circuit shall comply with NEC article 210.4.

D. Circuit breakers with slash ratings, such as 120/240V or 480Y/277V, shall be used in solidly grounded systems where the nominal voltage of any conductor to ground does not exceed the lower of the two values of the breaker’s voltage rating and the nominal voltage between any two conductors does not exceed the higher value of the circuit breaker’s voltage rating.

E. Circuit breakers with straight voltage ratings, such as 240V or 480V, shall be used in systems other than solidly grounded systems (Corner-Grounded Delta, Ungrounded, Impedance Grounded, etc.) where the nominal voltage between any two conductors does not exceed the circuit breaker’s voltage rating. A two-pole circuit breaker shall not be used to protect a three-phase, Corner-Grounded Delta system unless the circuit breaker is marked 1Φ-3Φ.

PART 3 – EXECUTION

3.1 Install panelboards in complete compliance with all manufacturers’ installation instructions.

3.2 Install conductors neatly in panelboards. Group and tie-wrap circuits that share a common neutral.

3.3 Number circuits exactly as shown on the contract drawings.

END OF SECTION

SECTION 26 28 00 - DISCONNECTS AND SEPARATELY-MOUNTED CIRCUIT BREAKERS

PART 1 – GENERAL

Furnish and install all disconnects and separately mounted circuit breakers as shown on the drawings, specified herein, and required by the NEC.

PART 2 – PRODUCTS

2.1 GENERAL

A. Disconnects shall be of the heavy-duty type, and shall be UL listed for service entrance use. They shall meet or exceed the requirements of NEMA Standard KS1. Provide fuses sized to appropriately protect the load served. Equipment manufacturer's recommendations shall take precedence over the Contract Drawings.

B. Fuses shall be dual element, time-delay, Class J fuses. They shall be Bussman Low-Peak or approved equal.

C. Circuit breakers shall be thermal magnetic, molded-case with quick-make, quick-break contact action. They shall have thermal and magnetic tripping elements on each pole. Breakers with multiple poles shall have common tripping of all poles. Circuit breaker ampere ratings shall be stamped on the handle. Interrupting ratings of the circuit breakers shall be equivalent to the specified AIC rating of the panelboard. Breakers handles shall reside in a position between "ON" and "OFF" after a trip condition. Breakers shall be rated HACR when used for heating, air-conditioning, and refrigeration; HID when used with High Intensity Discharge fixtures; and shall be rated SWD when used for switching duty.

D. Circuit breaker sizes for motor loads are based on Square D recommendations for use of their breakers at the motor horsepowers listed on the mechanical drawings. If equipment is used other than Square D, adjust breaker sizes per the manufacturer's recommendations.

E. Circuit breakers with slash ratings, such as 120/240V or 480Y/277V, shall be used in solidly grounded systems where the nominal voltage of any conductor to ground does not exceed the lower of the two values of the breaker's voltage rating and the nominal voltage between any two conductors does not exceed the higher value of the circuit breaker's voltage rating.

F. Circuit breakers with straight voltage ratings, such as 240V or 480V, shall be used in systems other than solidly grounded systems (Corner-Grounded Delta, Ungrounded, Impedance Grounded, etc.) where the nominal voltage between any two conductors does not exceed the circuit breaker's voltage rating. A two-pole circuit breaker shall not be used to protect a three-phase, Corner-Grounded Delta system unless the circuit breaker is marked 1Φ-3Φ.

G. Disconnect and individually-mounted circuit breaker ampere interrupting current (AIC) ratings shall equal the rating of the panelboard from which they are fed unless otherwise noted.

H. Buses shall be constructed of 98% conductivity copper or equivalently rated aluminum.

I. Switches shall be horsepower rated where used to serve motors.

J. Enclosures shall be NEMA 1 when they are to be mounted indoors, NEMA 3R when they are to be mounted outdoors, and NEMA 4X where they are subject to washdown. Provide special enclosures where shown on the Contract Drawings.

2.2 ACCEPTABLE MANUFACTURERS

Disconnects and separately-mounted circuit breakers shall be manufactured by Siemens, Square D, General Electric, or Cutler Hammer.

PART 3 – EXECUTION

3.1 Install disconnects and individually-mounted circuit breakers in complete compliance with all manufacturers' installation instructions. Where necessary, provide structural supports and bracing for installation.

3.2 Disconnects are to be surface-mounted.

3.3 Individually-mounted circuit breakers are to be flush-mounted unless otherwise shown.

END OF SECTION

SECTION 26 36 23 – AUTOMATIC TRANSFER SWITCHES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes transfer switches rated 600 V and less, including the following:

1. Automatic transfer switches

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.

1. Technical data on all major components of all transfer switches and other products described in this section. Data is required for the transfer switch mechanism, control system, cabinet, and protective devices specifically listed for use with each transfer switch. Include steady state and fault current ratings, weights, operating characteristics, and furnished specialties and accessories.

2. Single-Line Diagram: Show connections between transfer switch, bypass/isolation switch, power sources, and load; and show interlocking provisions for each combined transfer switch and bypass/isolation switch.

B. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.

1. Dimensioned outline drawings of assembly, including elevations, sections, and details including minimal clearances, conductor entry provisions, gutter space, installed features and devices and material lists for each switch specified.
2. Internal electrical wiring and control drawings.
3. Interconnection wiring diagrams, showing recommended conduit runs and point-to-point terminal connections to generator set.
4. Installation and mounting instructions, including information for proper installation of equipment to meet seismic requirements.

C. Manufacturer and Supplier Qualification Data

1. The transfer switch manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.
2. The manufacturer of this equipment shall have produced similar equipment for a minimum period of 10 years. When requested, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

D. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Features and operating sequences, both automatic and manual.
2. List of all factory settings of relays, timers and protective devices; provide setting and calibration instructions where applicable.

E. Warranty documents demonstrating compliance with the project's contract requirements.

1.4 QUALITY ASSURANCE

A. Only approved bidders shall supply equipment provided under this contract.

B. Manufacturer Qualifications: The equipment supplier shall maintain a service center capable of providing training, parts, maintenance and emergency repairs to equipment, including transfer switch generator sets and remote monitoring equipment (if applicable) at the site within a response period of less than twenty-four (24) hours from time of notification.

1. The transfer switch shall be serviced by technicians employed by, and specially trained and certified by, the generator set supplier and the supplier shall have a service organization that is factory-certified in both generator set and transfer switch service. The supplier shall maintain an inventory of critical replacement parts at the local service organization, and in service vehicles. The service organization shall be on call 24 hours per day, 365 days per year.
2. Submit names, experience level, training certifications, and locations for technicians that will be responsible for servicing equipment at this site.
3. The manufacturer shall maintain model and serial number records of each transfer switch provided for at least 20 years.

C. Source Limitations: All transfer switches are to be obtained through one source from a single manufacturer. The generator set manufacturer shall warrant transfer switches to provide a single source of responsibility for products provided.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked as suitable for use in emergency, legally required or optional standby use as appropriate for the connected load.

E. The automatic transfer switch installation and application shall conform to the requirements of the following codes and standards:

1. Transfer switches and enclosures shall be UL 1008 listed and labeled as suitable for use in emergency, legally required, and optional standby applications.
2. CSA 282, Emergency Electrical Power Supply for Buildings, and CSA C22.2, No. 14-M91 Industrial Control Equipment
3. NFPA 70, National Electrical Code. Equipment shall be suitable for use in systems in compliance with Articles 700, 701 and 702.
4. Comply with NEMA ICS 10-1993 AC Automatic Transfer Switches
5. IBC 2006 – The transfer switch(es) shall be prototype-tested and third-party certified to comply with the requirements of IBC group III or IV, Category D/F. The equipment shall be shipped with the installation instructions necessary to attain installation compliance
6. IEEE 446 – Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
7. EN55011, Class B Radiated Emissions and Class B Conducted Emissions
8. IEC 1000-4-5 (EN 61000-4-5); AC Surge Immunity
9. IEC 1000-4-4 (EN 61000-4-4) Fast Transients Immunity
10. IEC 1000-4-2 (EN 61000-4-2) Electrostatic Discharge Immunity

11. IEC 1000-4-3 (EN 61000-4-3) Radiated Field Immunity
12. IEC 1000-4-6 Conducted Field Immunity
13. IEC 1000-4-11 Voltage Dip Immunity
14. IEEE 62.41, AC Voltage Surge Immunity
15. IEEE 62.45, AC Voltage Surge Testing

F. Comply with NFPA 110 – Emergency and Standby Power Systems. The transfer switch shall meet all requirements for Level 1 systems, regardless of the actual circuit level.

G. The manufacturer shall warrant the material and workmanship of the transfer switch equipment for a minimum of one (1) year from registered commissioning and start-up, or eighteen (18) months from date of shipment.

H. The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, and etc. during the minimum noted warranty period described above.

1.5 COORDINATION

A. Size and location of concrete bases and anchor bolt inserts shall be coordinated. Concrete, reinforcement and formwork must meet the requirements specified in Division 03. See section 3.1 for additional information on installation

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cummins Power Generation
2. Russelectric
3. ASCO

B. Equipment specifications for this Project are based on automatic transfer switches manufactured by Cummins Power Generation. Switches manufactured by Russelectric or ASCO that meet the requirement of this specification are acceptable, if approved not less than two weeks before scheduled bid date. Proposals must include a line-by-line compliance statement based on this specification.

C. Transfer switches utilizing molded case circuit breakers do not meet the requirements of this specification and will not be accepted.

2.2 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

A. Provide transfer switches in the number and ratings that are shown on the drawings. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer.

B. Fault-Current Closing and Withstand Ratings: UL 1008 WCR ratings must be specifically listed as meeting the requirements for use with protective devices at installation locations, under specified fault conditions. Withstand and closing ratings shall be based on use of the same set of contacts for the withstand test and the closing test.

C. Solid-State Controls: All settings should be accurate to +/- 2% or better over an operating temperature range of - 40 to + 60 degrees C (- 40 to + 140 degrees F).

D. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.

E. Electrical Operation: Accomplished by a non-fused, momentarily energized solenoid or electric motor operator mechanism, mechanically and electrically interlocked in both directions (except that mechanical interlock is not required for closed transition switches).

F. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.

1. Switches using molded-case switches or circuit breakers, or insulated case circuit breaker components are not acceptable.
2. Transfer switches shall be double-throw, electrically and mechanically interlocked, and mechanically held in the Source 1 and Source 2 positions.
3. Main switch contacts shall be high-pressure silver alloy. Contact assemblies shall have arc chutes for positive arc extinguishing. Arc chutes shall have insulating covers to prevent inter-phase flashover.
4. Contacts shall be operated by a high-speed electrical mechanism that causes contacts to open or close within three electrical cycles from signal.
5. The transfer switch operation shall include the ability to switch to an open position (both sources disconnected) for the purpose of load shedding from the generator set.
6. The power transfer mechanism shall include provisions for manual operation under load with the enclosure door closed. Manual operation may be electromechanical or mechanical, but must be coordinated with control function.
7. Transfer switch shall be provided with flame retardant transparent covers to allow viewing of switch contact operation but prevent direct contact with components that could be operating at line voltage levels.
8. The transfer switch shall include the mechanical and control provisions necessary to allow the device to be field-configured for operating speed. Transfer switch operation with motor loads shall be as is recommended in NEMA MG1.
    a. Phase angle monitoring/timing equipment is not an acceptable substitute for this functionality
9. Transfer switches designated on the drawings as “4-pole” shall be provided with a switched neutral pole switched which is switched simultaneously with phase poles.
10. Transfer switches designated on the drawings as “3-pole” shall have a full current-rated neutral bar with lugs.
11. Transfer switches designated on the drawings as “isolation-bypass” switches shall meet the requirements of section 2.4 of this specification.
12. Transfer switches designated on the drawings as “non-automatic” switches shall meet the requirements of section 2.5 of this specification.
13. Transfer switches designated on the drawings as “closed transition” switches shall meet the requirements of section 2.6 of this specification.
14. Transfer switches designated on the drawings as “service entrance” switches shall meet the requirements of section 2.7 of this specification.

G. Control: Transfer switch control shall be capable of communicating with the genset control, other switches and remote programming devices over a high-speed network interface.

H. Factory wiring: Transfer switch internal wiring shall be composed of pre-manufactured harnesses that are permanently marked for source and destination. Harnesses shall be connected to the control system by means of locking disconnect plug(s), to allow the control system to be easily disconnected and serviced without disconnecting power from the transfer switch mechanism

I. Terminals: Terminals shall be pressure type and appropriate for all field wiring. Terminal arrangement and cabinet space must be such that feeder conductors can enter from the top, side or bottom of the switch, at the installer's discretion. Control wiring shall be equipped with suitable lugs, for connection to terminal strips.

J. Enclosures: All enclosures shall be third-party certified for compliance to NEMA ICS 6 and UL 508, unless otherwise indicated:

1. The enclosure shall provide wire bend space in compliance to the latest version of NFPA70, regardless of the direction from which the conduit enters the enclosure.
2. Exterior cabinet doors shall provide complete protection for the system's internal components. Doors must have permanently mounted key-type latches. Bolted covers or doors are not acceptable.
3. Transfer switches shall be provided in enclosures that are third party certified for their intended environment per NEMA requirements.

    a. Transfer switches mounted in a controlled indoor environment shall be provided in NEMA Type 1 enclosures (IEC type IP30).
    b. Transfer switches installed indoors shall be NEMA Type 12 (IEC type IP61) if the Project environment requires dust-proof and/or drip-proof equipment.
    c. Transfer switches located outdoors shall be supplied in NEMA Type 3R (IEC IP34) when dust-proof and/or rain-proof enclosures are required.
    d. Transfer switches that are installed outdoors or in any other uncontrolled environment shall be supplied with NEMA Type 4 or 4X (stainless steel) enclosures (IEC IP65).

2.3 AUTOMATIC TRANSFER SWITCHES

A. Comply with requirements for Level 1 equipment according to NFPA 110.

B. Indicated current ratings:

1. Refer to the Project drawings for specifications on the sizes and types of transfer switch equipment, withstand and closing ratings, number of poles, voltage and ampere ratings, enclosure type, and accessories.
2. Main contacts shall be rated for 600 VAC minimum.
3. Transfer switches shall be rated to carry 100% of rated current continuously in the enclosure supplied, in ambient temperatures of -40 to +60 degrees C (-40 to +140 degrees F), relative humidity up to 95% (non-condensing), and altitudes up to 10,000 feet (3000 meters).

C. Manual Switch Operation: The power transfer mechanism shall include provisions for manual operation under load with the enclosure door closed. Manual operation may be electromechanical or mechanical, but must be coordinated with control function

D. Relay Signal: Control shall include provisions for addition of a pre-transfer relay signal, adjustable from 0 to 60 seconds, to be provided if necessary for elevator operation, based on equipment provided for the project.

E. Control: Transfer switch control shall be provided with necessary equipment and software to communicate with the genset control, other transfer switches, remote annunciation equipment, and other devices over a high speed control network.

F. Neutral Switching: Transfer switches designated on the drawings as 4-pole shall be provided with a switched neutral pole. The neutral pole shall be of the same construction and have the same ratings as the phase poles. All poles shall be switched simultaneously using a common crossbar. Substitute equipment using overlapping neutral contacts is not acceptable.

G. Transfer switches that are designated on the drawings as 3-pole shall be provided with a neutral bus and lugs. The neutral bus shall be sized to carry 100% of the current designated on the switch rating.

H. The transfer switch physically located closest to the generator and not more than 50 ft (15 meters) away, except those served by generator paralleling equipment, shall be provided with a battery charger suitable for the requirements of the application and in compliance with NFPA 110 requirements for Level 1 systems. If no transfer switch is located within this distance, a battery charger shall be installed on the generator set.

I. Automatic Transfer Switch Control Features

1. The transfer switch control system shall be configurable in the field for any operating voltage level up to 600 VAC. Voltage sensing shall be monitored based on the normal voltage at the site. Systems that utilize voltage monitoring based on standard voltage conditions that are not field configurable are not acceptable.
2. All transfer switch sensing shall be configurable from an operator panel or from a Windows XP or later PC-based service tool. Designs utilizing DIP switches or other electromechanical devices are not acceptable.
3. The transfer switch shall be configurable to accept a relay contact signal and a network signal from an external device for load shedding purposes. On receipt of this signal, the transfer switch shall switch to a neutral position when connected to Source 2. If Source 1 is available when the load-shed signal is received, the transfer switch shall connect to Source 1.
4. The transfer switch shall be configurable to accept a relay contact signal and a network signal from an external device to prevent transfer to the generator service.
5. The transfer switch shall provide a relay contact signal prior to transfer or re-transfer. The time period before and after transfer shall be adjustable in a range of 0 to 50 seconds.
6. The control system shall be designed and prototype tested for operation in ambient temperatures from - 40 degrees C to + 60 degrees C (- 40 to +140 degrees F). It shall be designed and tested to comply with the requirements of the noted voltage and RFI/EMI standards.
7. The control shall have optically isolated logic inputs, high isolation transformers for AC inputs and relays on all outputs, to provide optimum protection from line voltage surges, RFI and EMI.
8. The transfer switch network monitoring equipment, when supplied, shall be provided with a battery-based auxiliary power supply to allow monitoring of the transfer switch when both AC power sources are non-operational. The battery power supply shall be monitored for proper condition, and the transfer switch shall include an alarm condition to indicate low battery condition.

J. Transfer Switch Control Panel: The transfer switch shall have a microprocessor-based control with a sealed membrane panel incorporating pushbuttons for operator-controlled functions, and LED lamps for system status indicators. The panel shall also include an alphanumeric display for detailed system information. Panel display and indicating lamps shall include permanent labels.

1. The indicator panel LEDs shall display:
   a. Which source the load is connected to (Source 1 or Source 2)

b. Which source or sources are available
c. When switch is not set for automatic operation, because the control is disabled or the bypass switch is in use
d. When the switch is in test/exercise mode

2. The indicator shall have pushbuttons that allow the operator to activate the following functions:
   a. Activate pre-programmed test sequence
   b. Override programmed delays, and immediately go to the next operation
   c. Reset the control by clearing any faults
   d. Test all of the LEDs by lighting them simultaneously

3. The alphanumeric digital display shall be vacuum fluorescent-type, clearly visible in both bright sunlight and no-light conditions over an angle of 120 degrees, and shall display the following:
   a. AC voltage for all phases, normal and emergency
   b. Source status: connected or not connected.
   c. Load data, including voltage, AC current, frequency, KW, KVA, and power factor.

4. The display panel shall be password-protected, and allow the operator to view and make adjustments:
   a. Set nominal voltage and frequency for the transfer switch
   b. Adjust voltage and frequency sensor operation set points
   c. Set up time clock functions
   d. Set up load sequence functions
   e. Enable or disable control functions including program transition
   f. View real-time clock data, operation log (hours connected, times transferred, failures) and service history

K. Control Functions: Functions managed by the control shall include:

1. Software adjustable time delays:
   a. Engine start (prevents nuisance genset starts in the event of momentary power fluctuation): 0 to 120 seconds (default 3 sec)
   b. Transfer normal to emergency (allows genset to stabilize before load is transferred): 0 to 120 seconds (default 3 sec)
   c. Re-transfer emergency to normal (allows utility to stabilize before load is transferred from genset): 0 to 30 minutes (default 3 sec)
   d. Engine cooldown: 0 to 30 minutes (default 10 min)
   e. Programmed transition: 0 to 60 seconds (default 3 sec)

2. Undervoltage sensing: three-phase normal, three-phase emergency source.
   a. Pickup: 85 to 98% of nominal voltage (default 90%)
   b. Dropout: 75 to 98% of nominal voltage (default 90%)
   c. Dropout time delay: 0.1 to 1.0 seconds (default 0.5 sec)
   d. Accurate to within +/- 1% of nominal voltage

3. Over-voltage sensing: three-phase normal, three-phase emergency source.
   a. Pickup: 95 to 99% of dropout setting (default 95%)
   b. Dropout: 105 to 135% of nominal voltage (default 110%)
   c. Dropout time delay: 0.5 to 120 seconds (default 3 sec)
   d. Accurate to within +/- 1% of nominal voltage

4. Over/under frequency sensing:
   a. Pickup: +/- 5 to +/-20% of nominal frequency (default 10%)

b. Dropout: +/-1% beyond pickup (default 1%)
c. Dropout time delay: 0.1 to 15.0 seconds (default 5 sec)
d. Accurate to within +/- 0.2%

5. Voltage imbalance sensing:
   a. Dropout: 2 to 10% (default 4%)
   b. Pickup: 90% of dropout
   c. Time delay: 2.0 to 20 seconds (default 5 sec)

6. Phase rotation sensing:
   a. Time delay: 100 msec

7. Loss of single-phase detection:
   a. Time delay: 100 msec

L. Control features shall include:

1. Programmable genset exerciser: A field-programmable control shall periodically start the generator, transfer the load to generator for a preset time, then re-transfer and shut down the generator after a preset cool-down period.

   a. Push-button programming control shall have a selection of eight different schedules for exercising generator, with or without load.

2. In event of a loss of power to the control, all control settings, real-time clock setting and the engine start-time delay setting will be retained.
3. The system continuously logs information including the number of hours each source has been connected to the load, the number of times transferred, and the total number of times each source has failed. An event recorder stores information, including time and date-stamp, for up to 50 events.
4. Transfer Override Switch: Overrides automatic re-transfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light to indicate override status.

M. Control Interface

1. Provide one set Form C auxiliary contacts on both sides, operated by transfer switch position, rated 10 amps 250 VAC.
2. The transfer switch shall be provided with a network communication card, and configured to allow network-based communication with the transfer switch and other network system components, including the generator set(s) provided for the Project.
3. Unassigned Auxiliary Contacts: Two normally open, 1-pole, double-throw contacts for each switch position, rated 10A at 240 VAC.

N. Engine Starting Contacts
1. One isolated and normally closed, and one isolated and normally open; rated 10A at 32 VDC minimum.

2.4 SERVICE ENTRANCE TRANSFER SWITCHES

A. Transfer switches must be specifically intended for service entrance applications, and labeled “Suitable for service entrance use only”
B. Transfer switch shall meet NEC requirements for emergency, legally required and standby applications as specified in UL 1008.

C. Entire transfer switch including enclosure must be listed and labeled to UL 1008; switches with only the mechanism listed are not acceptable.
D. Molded case circuit breaker must be UL 489 listed.

2.5 REMOTE ANNUNCIATOR SYSTEM

A. Functional Description: Remote annunciator panel shall annunciate conditions for indicated transfer switches. Annunciation shall include the following:

1. Sources available, as defined by actual pickup and dropout settings of transfer-switch controls.
2. Switch position.
3. Switch in test mode.
4. Failure of communication link.

B. Annunciator Panel: LED-lamp type with audible signal and silencing switch.

1. Indicating Lights: Grouped for each transfer switch monitored.
2. Label each group, indicating transfer switch it monitors, location of switch, and identity of load it serves.
3. Mounting: Flush, modular, steel cabinet, unless otherwise indicated.
4. Lamp Test: Push-to-test or lamp-test switch on front panel.

C. Malfunction of annunciator, annunciation and control panel, or communication link shall not affect functions of automatic transfer switch. In the event of failure of communication link, automatic transfer switch automatically reverts to stand-alone, self-contained operation.

D. Automatic transfer-switch sensing, controlling, or operating function shall not depend on remote panel for proper operation. The remote annunciation system shall not prevent transfer to the alternate source when the primary power source fails, nor prevent return to the primary source if the alternate source fails

PART 3 - EXECUTION

3.1 INSTALLATION

A. Design each fastener and support to carry load indicated by seismic requirements and according to seismic-restraint details. See Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

B. Floor-Mounting Switch: Anchor to floor by bolting.

1. Floor-mounted transfer switches (except drawout switches supported by wheeled carriages, which must be rolled out at floor level) shall be mounted on concrete bases complying with the following requirements:

a. Concrete Bases: 4 inches (100 mm) high, reinforced, with chamfered edges. Extend base no more than 4 inches (100 mm) in all directions beyond the maximum dimensions of switch, unless otherwise indicated or unless required for seismic support. Construct concrete bases according to Division 26 Section "Hangers and Supports for Electrical Systems."

B. Annunciator and Control Panel Mounting: Flush in wall, unless otherwise indicated.

C. Identify components according to Division 26 Section "Identification for Electrical Systems."

D. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

3.2 CONNECTIONS

A. Wiring to Remote Components: Match type and number of cables and conductors to control and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.

B. Field control connections shall be made on a common terminal block that is clearly and permanently labeled.

C. Transfer switch shall be provided with AL/CU mechanical lugs sized to accept the full output rating of the switch. Lugs shall be suitable for the number and size of conductors shown on the drawings.

D. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

E. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 SOURCE QUALITY CONTROL

A. Prior to shipping, factory shall test and inspect components, assembled switches, and associated equipment to ensure proper operation.

B. Factory shall check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements.

C. Factory shall perform dielectric strength test complying with NEMA ICS 1.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: The supplier of the transfer switch(es) and associated equipment shall inspect, test, and adjust components, assemblies, and equipment installations, including connections, and report results in writing.

B. Manufacturer’s representative shall perform tests and inspections and prepare test reports.

C. After installing equipment and after electrical circuitry has been energized, installer shall test for compliance with requirements.

1. Perform recommended installation tests as recommended in manufacturer’s installation and service manuals.
2. After energizing circuits, demonstrate interlocking sequence and operational function for each switch.

    a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
    b. Verify time-delay settings.
    c. Verify that the transfer switch is accurately metering AC voltage and current (when provided).

d. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.
e. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.

3. Ground-Fault Tests (if integral to transfer switch): Coordinate with testing of ground-fault protective devices for power delivery from both sources.

a. Verify grounding connections and locations and ratings of sensors.

D. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switch. Remove all access panels so joints and connections are accessible to portable scanner.

1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.
2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
3. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 DEMONSTRATION

A. After generator set installation, the generator and transfer switch supplier shall conduct a complete operation, basic maintenance, and emergency service seminar covering generator set and transfer switch equipment, for up to 10 people employed by the Owner.

1. The seminar shall include instruction on operation of the transfer equipment, normal testing and exercise, adjustments to the control system, use of the PC based service and maintenance tools provided under this contract, and emergency operation procedures.
2. The class duration shall be at least 8 hours in length, and include practical operation with the installed equipment.

3.6 SERVICE AND SUPPORT

A. The manufacturer shall supply the Owner with a complete set of the service and maintenance software required to support the product. The software shall be provided at a training class attended by the user, to qualify the user in proper use of the software. The software shall have the following features and capabilities:

1. The software shall be 32 bit and shall be XP and Vista compatible.
2. The software shall use the Windows Explorer format, for ease of use and commonality with other software in use at the facility.
3. The software shall allow adjustment of all functions described herein, adjustment of operating levels of all protective functions, and programming of all optional functions in the controller. Adjustments shall be possible over modem from a facility that is remote from the generator set.
4. The software shall be capable of storing and displaying data for any function monitored by the generator set control. This data shall be available in common file formats, and on graphical “strip chart” displays.
5. The software shall automatically record all control operations and adjustments performed by any operator or software user, for tracking of changes to the control.

6. The software shall display all warning, shutdown, and status changes programmed into transfer switch controller. For each event, the control shall provide information on the nature of the event, when it last occurred, and how many times it has occurred.

END OF SECTION

SECTION 26 43 00 - SURGE PROTECTIVE DEVICES (SPDs)

PART 1 – GENERAL

1.1 SCOPE

A. The Contractor shall furnish and install the Surge Protective Device (SPD) equipment having the electrical characteristics, ratings, and modifications as specified herein and as shown on the contract drawings. To maximize performance and reliability and to obtain the lowest possible let-through voltages, the ac surge protection shall be integrated into electrical distribution equipment such as switchgear, switchboards, panelboards, busway (integrated within bus plug), or motor control centers. Refer to related sections for surge requirements in:

1.2 RELATED SECTIONS

A. Section 26 24 00 – Panelboards

1.3 REFERENCES

A. SPD units and all components shall be designed, manufactured, and tested in accordance with the latest applicable UL standard (ANSI/UL 1449 3rd Edition).

1.4 SUBMITTALS – FOR REVIEW/APPROVAL

A. The following information shall be submitted to the Engineer:

1. Provide verification that the SPD complies with the required ANSI/UL 1449 3rd Edition listing by Underwriters Laboratories (UL) or other Nationally Recognized Testing Laboratory (NRTL). Compliance may be in the form of a file number that can be verified on UL's website or on any other NRTL's website, as long as the website contains the following information at a minimum: model number, SPD Type, system voltage, phases, modes of protection, Voltage Protection Rating (VPR), and Nominal Discharge Current (I_n).
2. For sidemount mounting applications (SPD mounted external to electrical assembly), electrical/mechanical drawings showing unit dimensions, weights, installation instruction details, and wiring configuration.

B. Where applicable the following additional information shall be submitted to the engineer:

1. Descriptive bulletins
2. Product sheets

1.5 SUBMITTALS – FOR CONSTRUCTION

A. The following information shall be submitted for record purposes:

1. Final as-built drawings and information for items listed in Section 1.04 and shall incorporate all changes made during the manufacturing process

1.6 QUALIFICATIONS

A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.

B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

D. The SPD shall be compliant with the Restriction of Hazardous Substances (RoHS) Directive 2002/95/EC.

1.7 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of manufacturer's instructions shall be included with the equipment at time of shipment.

1.8 OPERATION AND MAINTENANCE MANUALS

A. Operation and maintenance manuals shall be provided with each SPD shipped.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Eaton Cutler-Hammer

The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features, and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Engineer ten (10) days prior to bid date.

2.2 VOLTAGE SURGE SUPPRESSION – GENERAL

B. Electrical Requirements

1. Unit Operating Voltage – Refer to drawings for operating voltage and unit configuration.
2. Maximum Continuous Operating Voltage (MCOV) – The MCOV shall not be less than 125% of the nominal system operating voltage.
3. The suppression system shall incorporate thermally protected metal-oxide varistors (MOVs) as the core surge suppression component for the service entrance and all other distribution levels. The system shall not utilize silicon avalanche diodes, selenium cells, air gaps, or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.
4. Protection Modes – The SPD must protect all modes of the electrical system being utilized. The required protection modes are indicated by bullets in the following table:

	Protection Modes			
Configuration	L-N	L-G	L-L	N-G
Wye	●	●	●	●
Delta	N/A	●	●	N/A
Single Split Phase	●	●	●	●
High Leg Delta	●	●	●	●

5. Nominal Discharge Current (I_n) – All SPDs applied to the distribution system shall have a 20kA I_n rating regardless of their SPD Type (includes Types 1 and 2) or operating voltage. SPDs having an I_n less than 20kA shall be rejected.
6. ANSI/UL 1449 3rd Edition Voltage Protection Rating (VPR) – The maximum ANSI/UL 1449 3rd Edition VPR for the device shall not exceed the following:

Modes	208Y/120	480Y/277	600Y/347
L-N; L-G; N-G	700	1200	1500
L-L	1200	2000	3000

C. SPD Design

1. Maintenance Free Design – The SPD shall be maintenance free and shall not require any user intervention throughout its life. SPDs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.
2. Balanced Suppression Platform – The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV. Designs incorporating replaceable SPD modules shall not be accepted.
3. Electrical Noise Filter – Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be up to 50 dB from 10 kHz to 100 MHz using the MIL-STD-220A insertion loss test method. Products unable able to meet this specification shall not be accepted.
4. Internal Connections – No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be soldered, hardwired with connections utilizing low impedance conductors.
5. Monitoring Diagnostics – Each SPD shall provide the following integral monitoring options:
   a. Protection Status Indicators - Each unit shall have a green / red solid-state indicator light that reports the status of the protection on each phase.

      i. For wye configured units, the indicator lights must report the status of all protection elements and circuitry in the L-N and L-G modes. Wye configured units shall also contain an additional green / red solid-state indicator light that reports the status of the protection elements and circuitry in the N-G mode. SPDs that indicate only the status of the L-N and L-G modes shall not be accepted.

      ii. For delta configured units, the indicator lights must report the status of all protection elements and circuitry in the L-G and L-L modes.

      iii. The absence of a green light and the presence of a red light shall indicate that damage has occurred on the respective phase or mode. All protection status indicators must indicate the actual status of the protection on each phase or mode. If power is removed from any one phase, the indicator lights must continue to indicate the status of the protection on all other phases and protection modes. Diagnostics packages that simply indicate whether power is present on a particular phase shall not be accepted.

   b. Remote Status Monitor – The SPD must include Form C dry contacts (one NO and one NC) for remote annunciation of its status. Both the NO and NC contacts shall change state under any fault condition.

c. Audible Alarm and Silence Button – The SPD shall contain an audible alarm that will be activated under any fault condition. There shall also be an audible alarm silence button used to silence the audible alarm after it has been activated.

d. ∃Surge Counter – The SPD shall be equipped with an LCD display that indicates to the user how many surges have occurred at the location. The surge counter shall trigger each time a surge event with a peak current magnitude of a minimum of 50 ± 20A occurs. A reset pushbutton shall also be standard, allowing the surge counter to be zeroed. The reset button shall contain a mechanism to prevent accidental resetting of the counter via a single, short-duration button press. In order to prevent accidental resetting, the surge counter reset button shall be depressed for a minimum of 2 seconds in order to clear the surge count total.

i. The ongoing surge count shall be stored in non-volatile memory. If power to the SPD is completely interrupted, the ongoing count indicated on the surge counter's display prior to the interruption shall be stored in non-volatile memory and displayed after power is restored. The surge counter's memory shall not require a backup battery in order to achieve this functionality.

6. Overcurrent Protection

a. The unit shall contain thermally protected MOVs. These thermally protected MOVs shall have a thermal protection element packaged together with the MOV in order to achieve overcurrent protection of the MOV. The thermal protection element shall disconnect the MOV(s) from the system in a fail-safe manner should a condition occur that would cause them to enter a thermal runaway condition.

7. Fully Integrated Component Design – All of the SPD's components and diagnostics shall be contained within one discrete assembly. SPDs or individual SPD modules that must be ganged together in order to achieve higher surge current ratings or other functionality shall not be accepted.

8. Safety Requirements

a. The SPD shall minimize potential arc flash hazards by containing no user serviceable / replaceable parts and shall be maintenance free. SPDs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.

b. SPDs designed to interface with the electrical assembly via conductors shall require no user contact with the inside of the unit. Such units shall have any required conductors be factory installed.

c. Sidemount SPDs shall be factory sealed in order to prevent access to the inside of the unit. Sidemount SPDs shall have factory installed phase, neutral, ground and remote status contact conductors factory installed and shall have a pigtail of conductors protruding outside of the enclosure for field installation.

2.3 SYSTEM APPLICATION

A. The SPD applications covered under this section include distribution and branch panel locations, busway, motor control centers (MCC), switchgear, and switchboard assemblies. All

SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C, B, and A environments.

B. Surge Current Capacity – The minimum surge current capacity the device is capable of withstanding shall be as shown in the following table:

Minimum surge current capacity based on ANSI / IEEE C62.41 location category			
Category	Application	Per Phase	Per Mode
C	Service Entrance Locations (Switchboards, Switchgear, MCC, Main Entrance)	250 kA	125 kA
B	High Exposure Roof Top Locations (Distribution Panelboards)	160 kA	80 kA
A	Branch Locations (Panelboards, MCCs, Busway)	120 kA	60 kA

C. SPD Type – all SPDs installed on the line side of the service entrance disconnect shall be Type 1 SPDs. All SPDs installed on the load side of the service entrance disconnect shall be Type 1 or Type 2 SPDs.

2.4 LIGHTING AND DISTRIBUTION PANELBOARD REQUIREMENTS

A. The SPD application covered under this section includes lighting and distribution panelboards. The SPD units shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category B environments.

1. The SPD shall not limit the use of through-feed lugs, sub-feed lugs, and sub-feed breaker options.
2. SPDs shall be installed immediately following the load side of the main breaker. SPDs installed in main lug only panelboards shall be installed immediately following the incoming main lugs.
3. The panelboard shall be capable of re-energizing upon removal of the SPD.
4. The SPD shall be interfaced to the panelboard via a direct bus bar connection. Alternately, an SPD connected to a 30A circuit breaker for disconnecting purposes may be installed using short lengths of conductors as long as the conductors originate integrally to the SPD. The SPD shall be located directly adjacent to the 30A circuit breaker.
5. The SPD shall be included and mounted within the panelboard by the manufacturer of the panelboard.
6. The SPD shall be of the same manufacturer as the panelboard.
7. The complete panelboard including the SPD shall be UL67 listed.

B. Sidemount Mounting Applications Installation (SPD mounted external to electrical assembly)
1. Lead length between the breaker and suppressor shall be kept as short as possible to ensure optimum performance. Any excess conductor length shall be trimmed in order to minimize let-through voltage. The installer shall comply with the manufacturer's recommended installation and wiring practices.

C. Switchgear, Switchboard, MCC and Busway Requirements

1. The SPD application covered under this section is for switchgear, switchboard, MCC, and busway locations. Service entrance located SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C environments.

2. The SPD shall be of the same manufacturer as the switchgear, switchboard, MCC, and busway
3. The SPD shall be factory installed inside the switchgear, switchboard, MCC, and/or bus plug at the assembly point by the original equipment manufacturer
4. Locate the SPD on the load side of the main disconnect device, as close as possible to the phase conductors and the ground/neutral bar.
5. The SPD shall be connected through a disconnect (30A circuit breaker). The disconnect shall be located in immediate proximity to the SPD. Connection shall be made via bus, conductors, or other connections originating in the SPD and shall be kept as short as possible.
6. The SPD shall be integral to switchgear, switchboard, MCC, and/or bus plug as a factory standardized design.
7. All monitoring and diagnostic features shall be visible from the front of the equipment.

2.5 ENCLOSURES

A. All enclosed equipment shall have NEMA 1 general purpose enclosures, unless otherwise noted. Provide enclosures suitable for locations as indicated on the drawings and as described below:

1. NEMA 1 – Constructed of a polymer (units integrated within electrical assemblies) or steel (sidemount units only), intended for indoor use to provide a degree of protection to personal access to hazardous parts and provide a degree of protection against the ingress of solid foreign objects (falling dirt).
2. NEMA 4 – Constructed of steel intended for either indoor or outdoor use to provide a degree of protection against access to hazardous parts; to provide a degree of protection of the equipment inside the enclosure against ingress of solid foreign objects (dirt and windblown dust); to provide a degree of protection with respect to the harmful effects on the equipment due to the ingress of water (rain, sleet, snow, splashing water, and hose directed water); and that will be undamaged by the external formation of ice on the enclosure. (sidemount units only)
3. NEMA 4X – Constructed of stainless steel providing the same level of protection as the NEMA 4 enclosure with the addition of corrosion protection. (sidemount units only)

PART 3 – EXECUTION

3.1 EXAMINATION

3.2 FACTORY TESTING

A. Standard factory tests shall be performed on the equipment under this section. All tests shall be in accordance with the latest version of NEMA and UL standards.

3.3 INSTALLATION

A. The Contractor shall install all equipment per the manufacturer's recommendations and the contract drawings.

3.4 WARRANTY

A. The manufacturer shall provide a full ten (10) year warranty from the date of shipment against any SPD part failure when installed in compliance with manufacturer's written instructions and any applicable national or local code.

END OF SECTION

SECTION 26 51 00 - LIGHTING

PART 1 – GENERAL

1.1 Provide all lighting fixtures (luminaires), lamps, end caps, connectors, fittings, structural support members, supports, brackets, etc., for a complete and operable lighting system.

PART 2 – SUBMITTALS

2.1 SHOP DRAWINGS

A. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.

B. Provide photometric calculations where luminaires are proposed for substitution.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, and installed accessories; include model number nomenclature clearly marked with all proposed features.

2.2 Certificates for Dimming Ballasts: Manufacturer's documentation of compatibility with dimming controls to be installed.

2.3 Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

2.4 Operation and Maintenance Data: Instructions for each product including information on replacement parts.

2.5 Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

PART 3 – PRODUCTS

3.1 DELIVERY, STORAGE, AND PROTECTION

A. Receive, handle, and store products according to NECA/IESNA 500 and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

3.2 LUMINAIRES

A. Luminaires are shown in the Luminaire Schedule on the drawings to establish a standard of quality. Manufacturer’s names and model numbers shall not be interpreted as a proprietary specification. Notify the engineer at least two weeks prior to bid if an equivalent for a fixture listed in the schedule is not readily available.

B. Prior to submitting electrical equipment brochures for review and approval, coordinate with the General Contractor and verify that the fixtures are appropriate for the ceiling types in which they

are shown to be installed. Also verify that the voltage on the submittals is appropriate for the electrical system on which the fixtures are to be installed (regardless of voltage listed in the part number in the Fixture Schedule). Submit with equipment brochures a certificate stating that these items of coordination have been completed.

C. Coordinate the work to provide ballasts/drivers compatible with the lighting controls to be installed.

D. Color samples for all fixture finishes shall be submitted to the Architect for approval prior to ordering fixtures.

E. Emergency Power Supply Units: Suitable for use with indicated luminaires, complying with NFPA 101, all applicable state and local codes, and listed and labeled as complying with UL 924.

3.3 LAMPS

A. T8 fluorescent lamps shall be rapid-start with a Color Rendering Index (CRI) of 75 and a color temperature of 3500K.

B. T5 & T5HO fluorescent lamps shall be rapid-start with a Color Rendering Index (CRI) of 82 and a color temperature of 3500K.

C. HID Lamps shall be clear unless otherwise noted. They shall have a color temperature of 3500K. Coordinate base size with fixture socket prior to ordering lamps.

D. LED lamps shall be LM79 and LM80 tested.

3.4 LED DRIVERS

A. General Requirements:

1. Operate for at least 50,000 hours at maximum case temperature and 90 percent non-condensing relative humidity.

2. Provide thermal fold-back protection by automatically reducing power output (dimming) to protect LED driver and LED light engine/fixture from damage due to over-temperature conditions that approach or exceed the LED driver's maximum operating temperature at calibration point.

3. UL 8750 recognized or listed as applicable.

4. Class A sound rating; Inaudible in a 27 dBA ambient.

5. Demonstrate no visible change in light output with a variation of plus or minus 10 percent change in line-voltage input.

6. LED drivers of the same family/series to track evenly across multiple fixtures at all light levels.

7. Offer programmable output currents in 10 mA increments within designed driver operating ranges for custom fixture length and lumen output configurations, while meeting a low-end dimming range of 100 to 1 percent or 100 to 5 percent as applicable.

8. Employ integral fault protection up to 277 V to prevent LED driver damage or failure in the event of incorrect application of line-voltage to communication link inputs.

9. LED driver may be remote located up to 100 feet (30 m) from LED light engine depending on power outputs required and wire gauge utilized by installer.

B. Driver Control:

1. Provide integral fault protection to prevent driver failure in the event of a mis-wire.

2. Operate from input voltage of 120 V through 277 V at 50/60 Hz.

3. Drivers and their associated controls shall be coordinated to ensure they are compatible.

3.5 BALLASTS

A. Fluorescent luminaires shall be furnished with energy-saving, high power factor (0.9 or greater), electronic ballasts. Ballasts shall operate lamps without noticeable flicker and shall operate within the IES recommended noise levels. Ballasts shall operate at a frequency no less than 20,000 Hz. Total harmonic distortion shall be less than 10%. Ballasts shall be able to withstand voltage transients in accordance with IEEE C62.41, Category A for normal and common modes. Ballasts shall be compatible with the lamps furnished. Furnish number and size of ballasts as required to operate the number of lamps indicated with the control schemes shown.

B. Fluorescent ballasts for light fixtures controlled by occupancy sensors shall be programmed start ballasts with the lamps wired in parallel. Failure of one lamp shall leave the rest of the lamps illuminated.

C. Emergency Battery Packs: Emergency Battery Packs in fixtures shall consist of an automatic power failure device and a test switch. They shall contain a fully automatic solid state charger in a self-contained power pack. Wiring Diagrams shall be furnished with the fixture showing switching connections. The battery shall be of the sealed electrolyte type with the capacity to provide power to the lamps provided for a minimum of 90 minutes at an 1100 lumens.

The battery shall be able to operate unattended with no maintenance for a period of no less than five years. Emergency ballasts shall be fully compatible with solid state ballasts. Battery packs shall be mounted inside the fixture unless remotely mounted ballasts are shown on the drawings, or unless the fixture is of a type that does not have room for internally mounted battery packs.

D. Where quartz restrike fixtures are fed at voltages different than 120V, they shall be furnished with integral transformers and all equipment necessary to feed the quartz fixtures at 120V.

3.6 SUPPORTS

A. Provide all structural members necessary to support fixtures in locations shown on the contract drawings. Submit mounting and support details to the Architect or Engineer for approval with the project shop drawings. Notify the General Contractor prior to bid of any structural work that will be required to support the fixtures.

B. Provide hangers, cords, stems, etc., where required. Coordinate with the Architect or Engineer for proper stem lengths prior to ordering fixtures.

C. Support the ceiling grid at all four corners of recessed light fixtures.

D. Provide clips for fixtures installed in lay-in ceilings. Clips shall be equal to Erico Caddy clips # 515 or #515A.

PART 4 – EXECUTION

4.1 Raceways for lighting systems in accessible ceilings shall be run to junction boxes mounted in locations that do not interfere with the ceiling installation, the luminaire installation, or other building systems. Provide final connections to fixtures using conductors in flexible conduit. Flexible conduit whips shall not exceed six feet in length.

4.2 Coordinate locations of outlet boxes provided under Section 26 0533 as required for installation of luminaires provided under this section.

4.3 Perform work in a neat and workmanlike manner in accordance with NECA 1.

4.4 Install luminaires in accordance with NECA/IESNA 500 (commercial lighting).

4.5 Install luminaires plumb and square and aligned with building lines and with adjacent luminaires. All recessed fixtures shall be mounted with their trims flush against the ceiling.

4.6 Remote Ballasts/Drivers: Install in accessible location as indicated or as required to complete installation, using conductors per manufacturer's recommendations not exceeding manufacturer's recommended maximum conductor length to luminaire.

4.7 Comply completely with all manufacturers' installation instructions.

4.8 Fixture lengths shall be measured and submitted to the manufacturer in accordance with the manufacturer's installation requirements. Fixtures shall be of exact lengths required for the application as determined during construction. Fixtures shall be installed to the Owner, Architect, and Engineer's satisfaction.

4.9 Inspect each product for damage and defects.

4.10 Operate each luminaire after installation and connection to verify proper operation.

4.11 Test emergency power supply units to verify proper operation upon loss of normal power supply.

4.12 Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

4.13 Clean surfaces according to NECA/IESNA 500 and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

4.14 Fixtures shall be warranted for a period of one year after beneficial occupancy. Incandescent lamps shall be warranted for 90 days after beneficial occupancy. Fluorescent and HID lamps shall be warranted for 180 days after beneficial occupancy. LED lamps shall be warranted for a period of two years after beneficial occupancy.

END OF SECTION

SECTION 26 51 01 - MOTION DETECTORS

PART 1 GENERAL

1.1 Furnish and install a complete system of Motion Detectors as shown on the drawings and as specified herein. The drawings are provided to show the general scope of the work, and show the absolute minimum components required. Actual system components, quantities, and locations shall be determined by the motion detector vendor and provided to the Contractor with the installation shop drawings.

1.2 The Contractor and Sales Representatives are advised to take notice of specified component characteristics when attempting to select and propose substitutions. It is highly unlikely that substitutions on a one-for-one component basis will produce results that provide acceptable system performance.

1.3 Provide all power packs, hardware, software, devices, circuitry, and other components, material, and labor required to install, configure, and test the entire system to the satisfaction of the Architect, Owner, and Engineer.

1.4 Submit six sets of manufacturer's cut sheets describing completely all equipment, and six sets of shop drawings showing all circuitry including terminal-to-terminal connections. The shop drawings shall provide a complete schematic of all components used on this project with their interconnecting circuitry. General manufacturer's data sheets are not acceptable. Shop drawings shall be provided whether the contractor provides specified components or materials of other manufacturers.

PART 2 PRODUCTS

2.1 Motion detectors shall be furnished with the manufacture and model number shown on the drawings or an approved equal.

2.2 Power Packs: Power packs shall be of the same manufacturer as the motion detectors. Each shall be capable of controlling a 20 ampere circuit. They shall be rated for operation at the voltage of the system on which they will be used.

2.3 Circuitry: Provide control circuitry as required by the manufacturer for optimum system operation, but no less than the following: Control cables shall be 3-conductor #22 AWG copper with an overall jacket. Adjust conductor sizes as required to overcome unacceptable voltage drop.

PART 3 EXECUTION

3.1 Motion detectors shall be provided so that their coverage areas overlap and there are no dead zones in the rooms where persons may stand and not be detected.

3.2 All work shall be done by qualified system technicians.

3.3 Wiring, including control wiring, shall be in Raceways meeting Specification.

3.4 Guarantee workmanship and material for a period of one year after final acceptance. During the warranty period, repair or replace faulty equipment at no cost to the Owner for labor, material, or expenses.

3.5 Upon completion of job, test entire system. After testing, submit a certificate to the Architect stating

verification of the following:

A. All devices have been tested and are working properly.

PART 4 CLOSE-OUT DOCUMENTS

4.1 Provide the following documents to the Architect for delivery to the Owner at the time of substantial completion:

A. Written Guarantee

B. Two sets of data prepared by the manufacturer for each item of electrical equipment completely describing each piece of equipment. The data shall include parts lists, a description of operation, shop drawings, wiring diagrams, maintenance procedures, and other literature required for operation and maintenance of equipment.

4.2 Instruct the Owner on system operational procedures. Notify the Owner and Architect at least one week in advance of the training session. Provide written step-by-step instructional material.

4.3 Notify the General Contractor that you are to present during the Pre-final Inspection. During that inspection, demonstrate all system functionality and capabilities; remove cover plates and panels covers as required to show the quality of the installation. The Owner, Architect, and Engineer reserve the right to reject unsuitable workmanship or performance.

END OF SECTION

SECTION 27 05 13 - CABLE TELEVISION

PART 1 - GENERAL

1.01 SCOPE OF WORK:

A. Provide a complete and operable Cable Television System including, but not limited to, cabling, conduits, raceways, boxes, outlets, jacks, splitters, preamplifiers, amplifiers, and attenuators.

B. Comply completely with all Cable Company requirements. Include all costs associated with this compliance in bid. Notify Architect at least ten days prior to bid if Cable Company requirements differ from those described in the construction documents.

PART 2 - PRODUCTS

1. Cable for Distribution from Terminal Blocks to Outlet Jacks: Television cable shall be plenum-rated double-shielded RG6/U, #18 AWG bare copper with an aluminum polyester aluminum tape with 100% coverage and an aluminum braid with 45% coverage.

2. Jacks: Outlet boxes shall be flush mounted. Each shall be equipped with a cover plate containing a type F female connector.

3. Conduit shall be sized per the NEC for the number of cables provided, but no less than ¾" nominal trade size.

4. Conduit shall comply with the RACEWAYS specification.

5. Terminal Board: Provide a ¾" x 48" x 48" sheet of plywood, primed, and coated with two coats of enamel paint (consult architect for color and finish texture). Verify terminal board requirements with local cable company.

6. Terminal Blocks: Provide terminal blocks for termination of the Local Cable Television Cables at the New Terminal Board having the number of outlets required to serve the outlets provided in this contract plus 10% spare. Provide terminators as required on the spare outlets.

7. Amplifiers, Preamplifiers, and Attenuators: Provide amplifiers, preamplifiers, and attenuators as required for optimum system operation.

PART 3 - EXECUTION

3.01 CONDUIT ROUTING:

A. Interior conduits for the Cable Television System shall extend from the wall outlets and terminate with a bushing above the cable tray.

B. Provide a 4" PVC conduit from the Main Telephone Data Backboard to the right-of-way for the Cable Television Service. Use only long radius bends. Provide the conduit with a pull string. Coordinate with the cable company to have cable service provided to the building. Pay all costs associated with having the cable service connected.

3.02 CABLING:

Homerun one cable from each Type F jack in each outlet box to the nearest telephone data backboard.

Terminate one cable on the terminal block, or amplifier, for Local Cable Television Service.

3.03 WORKMANSHIP & TESTING:

A. Provide a television set and test each outlet for a clear signal and proper operation. Demonstrate operation of the television set at each jack in the presence of the Architect. Provide a typewritten log listing each outlet jack and obtain the Architect's signature as evidence that you have demonstrated proper operation of the system.

B. All work shall be performed by competent technicians trained and experienced for at least two years in the installation of telephone equipment.

C. The Architect and/or Owner may reject work that performs unsatisfactorily or that is not installed to be aesthetically pleasing.

END OF SECTION

SECTION 27 30 00 - TELEPHONE AND DATA SYSTEMS

PART 1 – GENERAL

1.1 Provide complete telephone and data systems in accordance with this specification and the contract drawings. All systems shall be furnished and installed to meet or exceed EIA/TIA Category 6 Standards.

1.2 Prior to the submitting equipment brochures for review, the Electrical Contractor shall coordinate with the General Contractor to call for a coordination meeting with all special systems equipment vendors, the electrical engineer of record, and the Owner's Information Technology and Security Personnel. During this coordination meeting, all aspects of the Telecommunications Cabling System, the CCTV System, the Access Control System, the Intrusion Detection System, the Paging System, and the Intercom System shall be thoroughly reviewed and discussed to ensure that the systems that will be proposed will meet all of the Owner's needs.

1.3 All new wiring on this project shall conform to the EIA TIA 568A T568A or T568B scheme. **Verify with Owner's representative at the coordination meeting which termination configuration to use.**

1.4 Prior to ordering equipment, provide six sets of manufacturer's cut sheets to the Architect or Engineer for the equipment to be installed. Also submit shop drawings showing the floor plan with all wiring tag identification and conduit and cable routing. Do not order any equipment without receiving submittals and shop drawings that have been reviewed and approved by the Engineer.

1.5 Contractors furnishing and installing telephone and data system components shall be regularly involved in furnishing and installing systems of the type specified. They shall have installed five systems similar in size and scope within the past six months. The Telephone and Data System Contractor shall pull the cable as well as install all jacks and make all other system terminations.

PART 2 – PRODUCTS

2.1 Outlet Boxes: Provide outlet boxes in accordance with Specification 26 05 33.

2.2 Plaster Rings: Plaster rings shall be furnished to provide single-gang openings in outlet boxes unless otherwise noted.

2.3 Raceways: Provide raceways in accordance with Specification 26 05 33.

2.4 Jacks: Provide outlet boxes with a strap containing the number of Jacks indicated on the drawings. Outlet jacks shall be 8-position, 8-conductor, RJ-45 jacks that are multivendor supportive accepting most phone and data plugs. Jacks shall have gold-plated (50 microinches minimum) contacts with 110 connections on the back. The jacks shall snap in the straps. The straps shall be colored to match the switches and receptacle color selected by the Architect. The straps shall be covered by a stainless steel wallplate identical to those of the receptacles and switches. Telephone outlet jacks shall be yellow; data jacks shall be blue.

2.5 Cable: All cable shall be Category 6 rated and shall conform to or exceed the EIA/TIA 578 Commercial Building Wiring Standard, Horizontal Cable Section and the EIA/TIA Technical Systems Bulletin 36 for Unshielded Twisted Pair Cables. Other standards supported shall include IEEE 802.3, Ibase5, 10BASE-T; IEEE 802.5, 4 Mbps, 16 Mbps (328 ft/100m), 104 Workstations, proposed ANSI X3T9.5 TP-PMD requirements for UTP at 100 Mbps, and 155 MB ATM. Cabling

shall be UL listed. Telephone cables shall be yellow; data cables shall be blue. All Cable shall be plenum rated.

2.6 Telephone and Data Backboard (TDBB): Wall mount a ¾" x 4' x 4' sheet of fire retardant plywood, primed and painted with two coats of fire retardant paint of the color and finish selected by the Architect. Do not paint over the fire retardant stamp. Provide a ¼" x 4" x 17.75" copper ground block (Erico Eritech TMGB-A18L23PT or approved equal) on the wall, bond a #2 AWG copper conductor to the ground block with a two hole compression lug and run the #2 AWG ground wire to the electrical power system ground. Bond the #2 AWG ground wire to the power system electrode using an exothermic weld.

2.7 Punchdown Blocks: Telephone cables shall terminate at the Telephone & Data Backboard on Punchdown Blocks. Telephone Cabling shall be terminated on 110 punchdown blocks maintaining the Category 6 rating. Furnish punchdown blocks for all telephone outlets in this contract plus 25% additional outlets.

2.8 Patch Panels: Data Cables shall terminate at the Telephone & Data Backboard in patch panels. Provide a patch panel (or panels) at each TDBB to accommodate all cabling plus 15% spare capacity. Provide crossconnecting cables as required to interconnect the patch panels providing the Owner a single connection point for a connection to a server.

2.9 Racks: Provide a freestanding, minimum 78" tall, 19" rack for mounting of the patch panels. The rack shall be mounted on the floor in front of the TDBB.

PART 3 – EXECUTION

3.1 Provide a 1" conduit extending from each outlet box to a point above equipment rack. Terminate the conduit with a protective bushing.

3.2 Route conductors from the outlet box to the patch panels through the conduits.

3.3 Provide a minimum of two data cables to each data outlet or combination telephone/data outlet. Provide one cable to each telephone outlet.

3.4 Mount plywood backboard securely to wall framing members. The bottom of the backboard shall be 6" above the finished floor.

3.5 Provide a #2 copper ground wire in 1" PVC conduit from the Telephone and Data Backboard to the Building Power System Ground.

3.6 Service Conduits: Provide two 4" PVC conduits with long radius elbows from the Telephone and Data Backboard to a point 5' outside of the building. These conduits shall be for future use by the Owner. Conduits bends shall contain radii that are no less than 10 times the conduit diameter. Furnish conduits with pullstrings. Stub conduits up 4" above the floor at the Telephone and Data Backboard and cover with plastic caps. Do not glue the caps on the conduits. Seal conduits below grade to prohibit the entrance, of dirt, water, and gases. Service conduits shall be buried 24" to 36" below grade. Mark the end of the conduits by placing a vertical stick of conduit from the end of the conduit vertically to a point at least 12" above grade. Provide physical protection as well as warning tape attached to stakes around the marker.

Equip all spare conduits with a pullwire or string capable of withstanding 500 pounds of pulling tension.

3.7 Uniquely identify and label all cables at each end using EIA/TIA Standards. Provide engraved or professionally stenciled label markings on the faceplate beside each jack.

3.8 Test each cable for opens, shorts, correct pairs, crossed wiring, and proper termination using a CT200 tester from Atcom Services, Inc. or approved equal. Replace any cable that is unable to pass the tests. Provide a written log of the test results of each cable to the Engineer at the prefinal inspection. Demonstrate testing of any cables selected by the Engineer.

END OF SECTION

SECTION 27 51 13 - PAGING SYSTEM

PART 1 – GENERAL

1.1 Provide a complete and operable Paging System as shown on the drawings and as specified herein. The drawings and this specification are provided to convey the intent of the complete system and do not indicate every cable or component necessary for the complete system that the Contractor shall provide. This specification requires the furnishing vendor to appropriately size the amplifier for the speakers to be provided.

1.2 Prior to the submitting equipment brochures for review, the Electrical Contractor shall coordinate with the General Contractor to call for a coordination meeting with all special systems equipment vendors, the electrical engineer of record, and the Owner's Information Technology and Security Personnel. During this coordination meeting, all aspects of the Telecommunications Cabling System, the CCTV System, the Access Control System, the Intrusion Detection System, the Paging System, and the Intercom System shall be thoroughly reviewed and discussed to ensure that the systems that will be proposed will meet all of the Owner's needs.

1.3 The Paging System shall consist of all components necessary to provide paging through the Owner's telephone system. Minimum system components shall include speakers, circuitry, an amplifier, and a telephone interface module. Provide all additional equipment, material, circuitry, labor, etc. for a complete and operable Paging System.

1.4 Provide all support hardware including additional steel framing, enclosures, hardware, electronics, cables, terminations, and all other components, material, and labor required to install, configure, and test the entire system to the satisfaction of the Architect, Owner, and Engineer. Notify the Electrical Contractor furnishing the power equipment, circuitry, and devices required for the intercom equipment prior to bid. The Electrical Contractor shall include all costs for powering the intercom equipment in the bid.

1.5 The specification provided is intended to establish a standard of quality – not to limit competition. Equivalent systems of other manufacturers will be acceptable. Gain approval of other manufacturers at least 10 days prior to bid. Acceptance of the manufacturer does not ensure that the actual components submitted after bid will be considered equivalent.

1.6 Submit six sets of manufacturer's cut sheets describing completely all equipment, and six sets of shop drawings showing all circuitry including terminal-to-terminal connections. The shop drawings shall provide a complete schematic of all components used on this project with their interconnecting circuitry. General manufacturer's data sheets are not acceptable.

1.02 SUBMITTALS:

Submit six sets of the following documents to the Architect for the Engineer's review and approval prior to ordering any equipment:

A. Technical specification sheets on each equipment item.
B. Complete wiring diagram indicating wire and cable numbers, terminal strip designations, and equipment model numbers.
C. Equipment mounting elevations.
D. Single line diagram.
E. Floor plans showing all equipment locations and conduit routing.
F. Amplifier Sizing Calculations

1.03 QUALIFICATIONS:

A. The Contractor furnishing and installing the system shall be a licensed distributor for the

system being installed. The Contractor shall regularly provide systems of the size, scope, and quality specified.

B. The Contractor shall have completed five projects in the last 2 years of the same complexity and dollar value.

C. The Contractor shall employ qualified electronic technicians, trained in the installation, setup, and repair of systems of the type specified.

PART 2 - PRODUCTS

2.01 All equipment shall be new, U.L. listed equipment.

2.02 Ceiling-Mounted Speakers shall be 8 inch, 6 oz., flush ceiling mount speakers with 70V impedance-matching transformers and integral volume control. Speakers shall be Bogen S86T725-BRV-CG8AW or approved equal. Furnish speakers complete with backboxes, T-grid ceiling supports where required, and aluminum baffle finished with semi-gloss white enamel. Provide appropriate mounting hardware for ceiling into which the individual speakers will be installed.

2.03 Horn Type Speakers shall be weatherproof, 15 watt horn type speakers with a 70V transformer. Horn Type Speakers shall be Bogen SPT-15A or approved equal.

2.04 Amplifier: Bogen TPU15A, TPU35B, TPU60B, TPU100B, TPU250, or approved equal. Size the amplifier for system speakers provided assuming that all are set at their highest tap. Provide attenuators as required to protect speakers from excess power.

2.05 Provide an appropriate telephone interface module at the telephone and data backboard to allow all-call pages to be made via the Owner’s telephone system.

2.06 Mounting Bracket: Mount the amplifier on the telephone and data backboard with a metallic mounting bracket manufactured for the purpose.

2.07 Terminal Blocks: All conductors in cabinets, on equipment racks, etc. shall be terminated on Siemens 66M1-50 punch blocks or approved equal.

2.08 Speaker Cabling: All speaker cabling shall be stranded, twisted, shielded pairs with PVC jacket and a tinned copper drain wire. The shield shall be an aluminum polyester foil providing 100% coverage. The conductors shall be sized as required for system to function appropriately, but shall not be less than #22 AWG.

2.09 Conduit shall be provided per Specification Section 16110, sized per the NEC, but no less than 3/4" nominal trade size.

PART 3 - EXECUTION

3.01 All wiring shall be installed in conduit. Conduit shall be run concealed in office areas.

3.02 Install all components per the manufacturer's specifications and instructions.

3.03 Furnish terminal strips, punch blocks, and connectors for all interconnections.

3.04 Identify all normally operated controls and electronic devices with an engraved plastic nameplate.

3.05 Installation Testing: Set taps and adjust speakers for Architect’s approval. Demonstrate all features of system. Submit a signed Certificate at the end of system testing certifying that all

equipment has been installed in accordance with the manufacturer's requirements and the system is operating properly.

3.06 Guarantee workmanship and/or material executed under this division for one (1) year after final acceptance. During the warranty period, the Owner shall receive repairs and replacement of faulty equipment at no cost for labor, material, or expenses. A repair technician shall respond to Owner calls by arriving at the school within twenty-four hours of any repair request.

3.07 Coordinate work with other trades. Notify the electrical power system contractor of all power requirements for your equipment prior to bid. Include all labor, installation, and equipment costs for additional power system components not shown on the contract drawings, but required by your equipment in your bid. Notify the Engineer of any conflicts at least ten days prior to bid.

3.08 Install work in accordance with the General Contractor's schedule.

Part 4 – CLOSE-OUT DOCUMENTS

4.01 Provide the following documents to the Architect for delivery to the Owner at time of substantial completion:

A. Written guarantee.

B. Two (2) sets of data prepared by the manufacturer for each item of electrical equipment completely describing each piece of equipment. The data shall include parts lists, description of operation, shop drawings, wiring diagrams, maintenance procedures and other literature required for maintenance of equipment. The data shall reflect as-built conditions.

4.02 Instruct the Owner on system operational procedures. Notify the Owner and Architect at least one week in advance of the training session. Provide written instructional material.

4.03 Notify the General Contractor that you are to be present during the system pre-final inspection. During that inspection, demonstrate all system functionality and capabilities; remove cover plates and panels as required to show the quality of the installation. The system shall demonstrate proper operation and operate without any audible hum, distortion, or erroneous noises. The Owner, Architect, and Engineer reserve the right to reject unsuitable workmanship or performance.

END OF SECTION

SECTION 27 51 23 - INTERCOM SYSTEM

PART 1 - GENERAL

1.1 Provide a complete and operable Intercom System as shown on the drawings and as specified herein. The drawings and this specification are provided to convey the intent of the complete system and do not indicate every cable or component necessary for the complete system that the Contractor shall provide.

1.2 Prior to the submitting equipment brochures for review, the Electrical Contractor shall coordinate with the General Contractor to call for a coordination meeting with all special systems equipment vendors, the electrical engineer of record, and the Owner's Information Technology and Security Personnel. During this coordination meeting, all aspects of the Telecommunications Cabling System, the CCTV System, the Access Control System, the Intrusion Detection System, the Paging System, and the Intercom System shall be thoroughly reviewed and discussed to ensure that the systems that will be proposed will meet all of the Owner's needs.

1.3 The specification provided is intended to establish a standard of quality – not to limit competition. Equivalent systems of other manufacturers will be acceptable. Gain approval of other manufacturers at least 10 days prior to bid. Acceptance of the manufacturer does not ensure that the actual components submitted after bid will be considered equivalent.

1.4 Provide all support hardware including additional steel framing, enclosures, hardware, electronics, cables, terminations, and all other components, material, and labor required to install, configure, and test the entire system to the satisfaction of the Architect, Owner, and Engineer. Notify the Electrical Contractor furnishing the power equipment, circuitry, and devices required for the intercom equipment prior to bid. The Electrical Contractor shall include all costs for powering the intercom equipment in the bid.

1.5 Submit six sets of manufacturer's cut sheets describing completely all equipment, and six sets of shop drawings showing all circuitry including terminal-to-terminal connections. The shop drawings shall provide a complete schematic of all components used on this project with their interconnecting circuitry. General manufacturer's data sheets are not acceptable.

PART 2 – PRODUCTS

2.1 Intercom Master Stations: The Intercom System shall be of the open voice selective call type. It shall mount semi-flush and be equipped with door answering, room monitoring, and privacy capabilities. The unit shall be able to place a call to every station in the system. Master Stations shall be able to place calls to Sub-stations and receive calls from the Sub-Stations. Master Units shall sound an audible tone and be equipped with an LED that illuminates upon being called from a Sub-Station or Master. Master Stations shall be Aiphone LEF-10 or approved equal.

2.2 Intercom Sub-Stations: Intercom-Sub Stations shall be surface mounted and weatherproof. They shall be compatible with the Master Stations. Sub-stations shall be equipped with a button that requests communication with the master station. They shall be Aiphone LE-D or approved equal.

2.3 Intercom Power Supply: The power supply shall be capable of supporting Two Master stations and up to three door stations. The unit shall be an Aiphone PC-12C or approved equal.

2.4 Cable: All cables shall be plenum-rated. Verify the following cabling requirements with the vendor prior to bid.:

(1) Cable for the Intercom Power Supply shall be 3-conductor 22 gauge.

(2) Cable for Master Station to Master Station shall be 10-conductor 20 gauge.
(3) Cable from the first Master Station to the Power Supply shall be 3-conductor, 20 gauge.

PART 3 - EXECUTION

3.1 All Intercom System cabling shall be installed in raceways meeting the requirements of Specification 16110 RACEWAYS.

3.2 Each cable passing from outside to inside the building shall be equipped with surge protectors at each end meeting the requirements of the TRANSIENT VOLTAGE SURGE SUPPRESSORS (TVSSs) FOR COMMUNICATIONS AND AUXILIARY SYSTEMS Specification.

3.3 Provide fuses sized per manufacturers' instructions for all system components.

3.4 Test the entire system to ensure that it is completely operable prior to the pre-final inspection. Notify the General Contractor that you are to be present at the pre-final inspection.

3.5 Provide two hours of instruction to the Owner on operation and use of the system.

3.6 Provide a one-year warranty for the system and all components. The warranty shall begin at the date of final acceptance of the building. During the warranty period, the system shall be repaired or replaced as necessary at no cost to the Owner. During the warranty period, a technician shall be on the job site within twenty-four hours of a problem report from the Owner.

END OF SECTION

SECTION 28 20 00 - INTRUSION DETECTION SYSTEM

PART 1 - GENERAL

1.1 Furnish and install a complete and operable Security System as shown on the drawings and as specified herein.

1.2 Prior to the submitting equipment brochures for review, the Electrical Contractor shall coordinate with the General Contractor to call for a coordination meeting with all special systems equipment vendors, the electrical engineer of record, and the Owner's Information Technology and Security Personnel. During this coordination meeting, all aspects of the Telecommunications Cabling System, the CCTV System, the Access Control System, the Intrusion Detection System, the Paging System, and the Intercom System shall be thoroughly reviewed and discussed to ensure that the systems that will be proposed will meet all of the Owner's needs.

1.3 Provide all enclosure, hardware, software, devices, circuitry, and other components, material, and labor required to install, configure, and test the entire system to the satisfaction of the Architect and Engineer.

1.4 Submit six sets of manufacturer's cut sheets describing completely all equipment, and six sets of shop drawings showing all circuitry including terminal-to-terminal connections. The shop drawings shall provide a complete schematic of all components used on this project with their interconnecting circuitry. General manufacturer's data sheets are not acceptable.

PART 2 - PRODUCTS

2.1 Security System Controller: The Security System Controller shall support up to 9 hardwired zones with a total of 64 zones. It shall support addressable motion detectors and door switches. The controller shall support up to 8 relays or X-10 devices. It shall be connected to the building telephone system and send coded signals to the monitoring agency of the Owner's preference. Pay the monitoring fee from the testing of the system until the General Contractor is granted the Letter of Substantial Completion. The Security System Controller shall be an ADEMCO VISTA-40 or approved equal.

2.2 Keypads: Keypads shall have a backlit display that displays system events. They shall make audible "beeps" for entry/exit delays, system status and other alarm conditions. Keypads shall be ADEMCO 6139 or approved equal.

2.3 Motion Detectors: Motion Detectors shall have a 50' x 50', 90 degree coverage and shall detect using passive infrared technology. They shall have both dip switch and serial number addressing. They shall have both horizontal and vertical patterning adjustment. Motion Detectors shall be ADEMCO 998MX or approved equal.

2.4 Glass Break Detectors: Glass Break Detectors shall detect using a dual technology audio and shock glass break detector with a 25' range from the glass. Glass Break Detectors shall be ADEMCO 2500 or equal.

2.5 Door Switches: Door Switches shall be addressable, magnetic contact, recessed type. Door Switches shall be ADEMCO 4191SN or equal.

2.6 Sirens: Sirens mounted indoors shall have an output of 95 Db at 10'. They shall be ADEMCO 747 or approved equal. Sirens mounted in damp locations, such as on the Ground Floor, shall produce 117 dB at 10'. They shall be ADEMCO 702 or approved equal.

2.7 Circuitry: Provide circuitry and cabling as required for optimum system operation, but meeting no less than the following specifications:

(1) Cable for Keypads, Motion Detectors, and Glass Break Detectors shall be 4-conductor, 22 gauge with PVC jacket.
(2) Cable for Door Switches shall be 2-conductor, 20 gauge with PVC jacket.

PART 3 - EXECUTION

3.1 All work shall be done by qualified system technicians.

3.2 Wiring shall be in Raceways meeting Specification 16110.

3.3 Connect to telephone system for complete dialing capability. Employ Owner's designated monitoring agency to monitor system. Consult Owner prior to configuring system.

3.4 Guarantee workmanship and material for a period of one year after final acceptance. During the warranty period, repair or replace faulty equipment at no cost to the Owner for labor, material, or expenses.

3.5 Upon completion of job, test entire system. After testing submit a certificate to Architect stating verification of the following:

PART 4 – CLOSE-OUT DOCUMENTS

4.1 Provide the following documents to the Architect for delivery to the Owner at the time of substantial completion:

A. Written Guarantee
B. Two sets of data prepared by the manufacturer for each item of electrical equipment completely describing each piece of equipment. The data shall include parts lists, a description of operation, shop drawings, wiring diagrams, maintenance procedures, and other literature required for operation and maintenance of equipment.

4.2 Instruct the Owner on system operational procedures. Notify the Owner and Architect at least one week in advance of the training session. Provide written step-by-step instructional material.

4.3 Notify the General Contractor that you are to present during the Pre-final Inspection. During that inspection, demonstrate all system functionality and capabilities; remove cover plates and panels covers as required to show the quality of the installation. The Owner, Architect, and Engineer reserve the right to reject unsuitable workmanship or performance.

END OF SECTION

SECTION 28 23 23 - CLOSED CIRCUIT TELEVISION (CCTV) SYSTEM

PART 1 – GENERAL

A. Provide a complete and operable IP Based Closed Circuit Television System as shown on the drawings and as specified herein. The drawings and this specification are provided to convey the intent of the complete system and do not indicate every cable or component necessary for the complete system that the Contractor shall provide.

B. Prior to the submitting equipment brochures for review, the Electrical Contractor shall coordinate with the General Contractor to call for a coordination meeting with all special systems equipment vendors, the electrical engineer of record, and the Owner's Information Technology and Security Personnel. During this coordination meeting, all aspects of the Telecommunications Cabling System, the CCTV System, the Access Control System, the Intrusion Detection System, the Paging System, and the Intercom System shall be thoroughly reviewed and discussed to ensure that the systems that will be proposed will meet all of the Owner's needs.

C. Provide all support hardware including additional steel framing, enclosures, hardware, electronics, cables, terminations, and all other components, material, and labor required to install, configure, and test the entire system to the satisfaction of the Architect, Owner, and Engineer. Notify the Electrical Contractor furnishing the power equipment, circuitry, and devices required for the CCTV equipment prior to bid. The Electrical Contractor shall include all costs for powering the CCTV equipment in the bid.

D. Submit six sets of manufacturer's cut sheets describing completely all equipment, and six sets of shop drawings showing all circuitry including terminal-to-terminal connections. The shop drawings shall provide a complete schematic of all components used on this project with their interconnecting circuitry. General manufacturer's data sheets are not acceptable.

E. Prior to submitting equipment brochures for approval, the successful Electronic Systems Contractor shall completely review the design to ensure that the lens selection is optimum for each application, that all mounting brackets are appropriate for the wall or ceiling on which they will be mounted, and that all cabling is adequate to overcome any voltage drop problems or distance limitations that may occur.

F. The POE switches, Network Attached Storage, and all camera-related networking devices shall be completely operational on a standalone network that is accessible by the Owner's network. Provide the necessary connections to interface the camera network to the Owner-supplied equipment.

G. All components required for the following basic system operation shall be furnished in the quantities required to completely implement the desired mode of operation. Additional components shall be supplied by the Contractor as required to fully implement the system described. All system components shall record and display high definition color images.

    1) A 19 inch monitor connected to the Data Storage System shall be located in the Telephone Equipment Room. It shall be capable of viewing all images.

    2) Fire Admin: Two computer systems shall be furnished, installed, and configured for viewing CCTV images. One computer shall be installed at the Reception Desk in Room 116 and at the desk in Office 204.

    3) Police Admin: Four computer systems shall be furnished, installed, and configured for viewing CCTV images. One computer shall be installed at Security A103. The other three computer systems shall be installed in locations specified by the Owner.

4) There shall be no annual charges for any equipment or software licenses for equipment and software furnished on this project. Remote viewing software shall be entirely free of charge.

PART 2 – PRODUCTS

2.1 Video Management Software

The Video Management Software shall be provided with the system free of charge, with no hidden license or update fees. It shall be a Microsoft Windows based software.

2.2 Cameras

A. Type A Cameras: Type A cameras shall be Mobotix MX-D15Di-Sec-DNight-FIX-D25N25 or approved equal. Provide with corner wall mount MX-MH-Dome where shown wall mounted.

B. Type AW Cameras: Type A cameras shall be Mobotix MX-D15Di-Sec-DNight-FIX-D25N25 or approved equal. Provide with wall mount MX-WH-Dome where shown wall mounted.

C. Type B Cameras: Type B cameras shall be Mobotix MX-Q24M-Sec-D11 or approved equal.

D. Type C Cameras: Type C cameras shall be Mobotix MX-M24M-Sec-N22 or approved equal. Provide with pole mount MX-MH-SecureFlex-ESWS where shown pole mounted.

2.3 POE Switches: The camera POE switches shall be HP ProCurve Switch 2510 Series or approved equal. A POE switch shall be mounted in the Telecommunications Equipment Rack in the Telephone Equipment Room.

2.4 Data Storage System: Provide a complete system of equipment for data storage and viewing for all camera images. All images shall be recorded continuously. Provide the network attached storage (NAS), transmitters, receivers, cabling, software, installation and all other equipment required for a complete and operable system. The NAS shall be a QNAP TS-469U-SP with 6 TB of hard drive storage included or approved equal.

2.5 Equipment Mounting: Mount the equipment in the Telecommunications Equipment Rack furnished under Section 27 30 00. The NAS and switches in the Telephone Equipment Room shall be mounted in the rack.

2.6 Computer Systems: The computer systems shall meet the following specifications:

A. Central Processing Unit (CPU): The personal computer system CPU shall be dual core @ 2.4 GHz (Core Duo Intel processor or equivalent AMD). The system shall have at least 4 gigabytes of RAM and be equipped with at least a 250 gigabyte hard drive. The unit shall be furnished with a CD-RW drive and a DVD-RW drive. The CPU shall be equipped with at least two communications ports along with all other necessary hardware and software to support all components of the system. The system shall have a parallel port, a serial port, no less than three USB ports, and a 10/100/1000 Mbps (Gigabit) Ethernet port. The system shall have a graphics card with 512 megabytes video memory or higher and DVI/HDMI ports compatible with the provided monitor. The CPU, monitor, keyboard, and entire system shall be manufactured by Hewlett Packard, Dell, Toshiba, or Sony.

B. Monitor: The monitor shall be at least a 21” Flat Screen.

C. Keyboard: The keyboard shall be a standard QWERTY keyboard with numeric keypad on the right side.

D. Mouse: The mouse shall be a Microsoft or Logitech three-button mouse. Track balls will not be accepted.

E. Software: The computer shall be furnished with the vendor's latest Windows-based software installed.

2.7 Monitor: The 19" multiplex monitor connected to the DAS shall be Pelco PMCL419HB or approved equal.

2.8 Circuitry: Provide all circuitry necessary for optimum performance of system components. Minimum requirements are provided as follows. Increase conductor sizes and modify cable types as required to compensate for voltage drop or other system or site conditions.

A. Video Signal Cable: All CCTV video cabling shall be Category 6 rated UTP, outdoor-rated cable installed in conduit.

B. Fiber Optic Cabling: Cameras at distances exceeding the limitations of Category 6 cable shall be fed with four strand, single mode fiber optic cable. Media converters shall be provided at the nearest POE switch and at the camera. Coordinate remote camera locations with the Electrical Contractor to ensure that he provides 120V power in those locations.

C. Power Cable: Coordinate remote camera locations with the Electrical Contractor to ensure that he provides 120V power in the locations where fiber optic to POE media converters are provided. Power cable shall be #12 AWG unshielded cable with PVC jacket. It shall be West Penn #227 or approved equal. Increase conductor sizes as required to accommodate voltage drop. The Owner shall not be responsible for additional 120V power as required to accommodate additional media converters.

PART 3 – EXECUTION

3.1 All CCTV cabling shall be installed in raceways meeting the requirements of the RACEWAYS specification.

3.2 Surge Protective Devices shall be installed on all cables where they leave and where they enter any building.

3.3 Test the entire system to ensure that it is completely operable prior to the pre-final inspection. Notify the General Contractor that you are to be present at the pre-final inspection.

3.4 Schedule a training session with the Owner through the General Contractor at the Owner's convenience. The training session shall be scheduled to occur after the Owner's switches have been installed and the Owner's computer network has been made operable. The installation and configuration of remote viewing of CCTV images shall be demonstrated with the completed CCTV system provided in this contract. Begin scheduling this training at least one month prior to substantial completion. Provide four hours of instruction to the Owner on operation and use of the system. Video the training session and provide a DVD of the training session to the Owner with the close-out documents. The training session shall not be conducted until all system components have been tested and verified to be operating properly.

3.5 Provide a one-year warranty for the system and all components and a five-year warranty on all fixed cameras. The warranty shall begin at the date of final acceptance of the building. During the warranty period, the system shall be repaired or replaced as necessary at no cost to the Owner. During the warranty period, a technician shall be on the job site within twenty-four hours of a problem report from the Owner.

END OF SECTION

SECTION 28 30 00 - ACCESS CONTROL SYSTEM

PART 1 - GENERAL

1.1 Provide a complete and operable Door Locking Control System as shown on the drawings and as specified herein. The drawings and this specification are provided to convey the intent of the complete system and do not indicate every cable or component necessary for the complete system that the Contractor shall provide.

1.2 Prior to the submitting equipment brochures for review, the Electrical Contractor shall coordinate with the General Contractor to call for a coordination meeting with all special systems equipment vendors, the electrical engineer of record, and the Owner's Information Technology and Security Personnel. During this coordination meeting, all aspects of the Telecommunications Cabling System, the CCTV System, the Access Control System, the Intrusion Detection System, the Paging System, and the Intercom System shall be thoroughly reviewed and discussed to ensure that the systems that will be proposed will meet all of the Owner's needs.

1.3 The specification provided is intended to establish a standard of quality – not to limit competition. Equivalent systems of other manufacturers will be acceptable.

1.4 Provide all support hardware including additional steel framing, enclosures, hardware, electronics, cables, terminations, and all other components, material, and labor required to install, configure, and test the entire system to the satisfaction of the Owner and Engineer. Notify the Electrical Contractor furnishing the power equipment, circuitry, and devices required for the Door Locking Control System equipment prior to bid. The Electrical Contractor shall include all costs for powering the Door Locking Control System equipment in the bid.

1.5 Submit six sets of manufacturer's cut sheets describing completely all equipment, and six sets of shop drawings showing all circuitry including terminal-to-terminal connections. The shop drawings shall provide a complete schematic of all components used on this project with their interconnecting circuitry. General manufacturer's data sheets are not acceptable.

PART 2 – PRODUCTS

2.1 Card Reader Controller: The controller shall be capable of controlling access to the doors shown on the drawings plus at least four more.

2.2 Personal Computer System: Provide a complete personal computer system with all hardware and software as required to program the proximity cards as well as to program and operate the locking control system. Provide all cables necessary for complete operation of the computer and peripherals. Minimum requirements for system components are provided as follows:

A. Central Processing Unit (CPU): The personal computer system CPU shall be dual core @ 2.4 GHz (Core Duo Intel processor or equivalent AMD). The system shall have at least 4 gigabytes of RAM and be equipped with at least a 250 gigabyte hard drive. The unit shall be furnished with a CD-RW drive and a DVD-RW drive. The CPU shall be equipped with at least two communications ports along with all other necessary hardware and software to support all components of the system. The system shall have a parallel port, a serial port, no less than three USB ports, and a 10/100/1000 Mbps (Gigabit) Ethernet port. The system shall have a graphics card with 512 megabytes video memory or higher and DVI/HDMI ports compatible with the provided monitor. The CPU, monitor, keyboard, and entire system shall be manufactured by Hewlett Packard, Dell, Toshiba, or Sony.

B. Monitor: The monitor shall be at least a 21" Flat Screen.

C. Keyboard: The keyboard shall be a standard QWERTY keyboard with numeric keypad on the

right side.

D. Mouse: The mouse shall be a Microsoft or Logitech three-button mouse. Track balls will not be accepted.

E. Software: The computer shall be furnished with the vendor's latest Windows-based software installed.

2.3 Power Supplies: The Power Supplies shall provide power to the Card Access Control Panel and the door locks and shall be provided with batteries for up to 24 hour operation in the event of a power outage.

2.4 Card Readers: Card readers shall be proximity type readers. They shall be suitable for indoor and outdoor use.

2.5 Biometric Readers: Biometric readers shall be a fingerprint type reader.

2.6 Cards: Furnish 200 proximity photoID cards for the Owner's use.

2.7 Provide camera and all equipment necessary for producing and installing color photographs on the cards. Provide supplies for 200 proximity cards.

2.8 Magnetic Locks: The magnetic door locks shall be rated for 1500 pounds holding force. Provide all brackets necessary for mounting on doors where magnetic locks are shown. Provide strikes on doors as required.

2.9 Motion Detectors: Provide passive infrared (PIR) motion detectors as required per NFPA 101.

2.10 Exit Pushbuttons with Timers: Each exit pushbutton shall be provided in a stainless steel wallplate on a flush-mounted single gang outlet box. They shall be of the double-pole, double-throw type and configurable with momentary or latching contact status. They shall operate within a temperature range of 32 degrees F to 158 degrees F.

2.11 Suppressor Kits: Provide two suppressor kits for each relay output. Install one suppressor kit at the Card Access Control Panel and one suppressor kit at the magnetic door lock.

2.12 Circuitry: Provide circuitry as required for optimum system performance, but meeting the following minimum requirements.

PART 3 - EXECUTION

3.1 All Door Lock Control System cabling shall be installed in raceways meeting the requirements of Specification 26 05 33 RACEWAYS.

3.2 Each cable passing from outside to inside the building shall be equipped with surge protectors at each end meeting the requirements of the manufacturer's specifications.

3.3 Provide fuses sized per manufacturers' instructions for all system components.

3.4 Test the entire system to ensure that it is completely operable prior to the pre-final inspection. Notify the General Contractor that you are to be present at the pre-final inspection.

3.5 Provide eight hours of instruction to the Owner on operation, maintenance, and modification of the system.

3.6 Provide a one-year warranty for the system and all components. The warranty shall begin at the

date of final acceptance of the building. During the warranty period, the system shall be repaired or replaced as necessary at no cost to the Owner. During the warranty period, a technician shall be on the job site within twenty-four hours of a problem report from the Owner.

END OF SECTION

SECTION 28 31 00 - FIRE ALARM SYSTEM

PART 1 – GENERAL

1.1 GENERAL

A. Furnish and install a complete and operable fire alarm system in accordance with the Contract drawings and all federal, state, and local codes. Equipment on the drawings represents the absolute minimum required for the project. Include costs for all other required devices and equipment required for a complete and operable code compliant system. Notify the engineer in writing of any devices required by code, but not shown, at least ten days prior to bid.

B. Comply completely with the latest edition of all applicable federal, state, and local codes including, but not limited to the following:

1) National Electrical Code (NFPA 70)
2) Life Safety Code (NFPA 101)
3) National Fire Alarm Code (NFPA 72)
4) The International Building Code
5) ANSI/ASME A17.1, Safety Code for Elevators and Escalators

1.2 SCOPE OF WORK

A. Provide all enclosures, hardware, software, devices, and all other components, material, and labor required to install, configure, and test the entire system to the satisfaction of the Engineer and all authorities.

B. All components of the system shall be manufactured by the same company. The system and its components shall be approved by UL and Factory Mutual.

C. All system components shall be installed by a franchised distributor of the fire alarm system having a repair and service department on call 24 hours a day, seven days a week. The repair and service department shall be located within 150 miles of the project.

D. Submit complete shop drawings showing all devices including mounting locations and heights and terminal-to-terminal connections. **Employ an independent third party testing agency that will be involved in certification of the system to review the shop drawings to ensure compliance with the contract documents and all applicable codes.**

PART 2 – PRODUCTS

2.1 Provide an intelligent, addressable fire alarm control panel complete with all equipment necessary to monitor and control the devices shown. The system shall sound a non-coded general alarm. Upon an alarm condition, the fire alarm control panel shall automatically report the alarm condition to a monitoring agency. Provide all telephone connections, circuitry, and conduit to perform this functionality back to the telephone backboard.

2.2 Provide a NiCad battery sized to operate the control panel without normal power for 24 hours, and then to alarm the panel continuously for at least five minutes (or as required by codes). Submit battery sizing calculations with the manufacturer's cut sheets and shop drawings.

2.3 All devices shall be addressable and shall be electrically supervised.

2.4 Smoke detectors shall be of the photoelectric type.

2.5 Duct detectors shall be of the air sampling type. Furnish complete with sampling tubes and duct housings.

2.6 Smoke detectors mounted under raised computer floors shall be of the photoelectric type. They shall be UL listed for installation in plenums.

2.7 Pull stations shall be of metallic construction. They shall be furnished with lexan shields and warning horns.

2.8 Horns shall be rated a minimum of 85 dB at 10'.

2.9 Speakers shall be square. They shall be wall-mounted to a 4" square box. They shall produce a minimum sound level of 85dB at 10'. They shall have adjustable taps for volume level adjustment.

2.10 Strobes shall have a nominal rating of at least 75 Cd.

2.11 Combination horn-strobe units or speaker-strobe units shall meet the specified requirements of the individual horns, strobes, and speakers.

2.12 Monitor all sprinkler system flow switches at the facility. Provide an alarm upon flow indication.

2.13 Monitor all sprinkler system tamper and supervisory switches at the facility. Provide a trouble signal upon tamper indication.

2.14 Provide duct detectors in the return duct of all air units. If a fresh air intake duct is installed, all duct detectors shall be mounted upstream of the intake duct. For air units with flow ratings greater than 15,000 CFM, provide duct detectors in both the return and supply ducts.

2.15 Provide all necessary relays and circuitry, and shut down all air units upon an alarm condition of the fire alarm system.

2.16 Provide all necessary equipment and circuitry for control of the elevator in accordance with ANSI/ASME A17.1, Safety Code for Elevators and Escalators.

2.17 Provide all necessary equipment and circuitry to automatically release the magnetic door locks upon an alarm of the Fire Alarm System.

2.18 Conductors shall be #14 AWG copper rated THHN/THWN. Provide larger conductors where required to compensate for voltage drop.

PART 3 – EXECUTION

3.1 All components and circuitry shall be assembled and installed per the requirements of all applicable codes and the manufacturer's recommendations.

3.2 All devices shall be mounted with their boxes flush in the walls.

3.3 Smoke detectors shall be mounted at least 36" away from supply and return vents.

3.4 All outlet boxes, junction boxes, and cover plates shall be painted red.

3.5 All circuitry shall be in concealed conduit sized per the NEC, but no less than 3/4" EMT. All fire alarm conduits shall be painted red.

3.6 The Fire Alarm System Contractor shall employ an independent third party testing agency to test and certify all system components, including each smoke detector, duct detector, and pull station prior to the pre-final inspection. All systems shall be completely operable prior to the request for a pre-final site observation. The system shall be tested in the presence of the Owner, Architect, and Engineer at the prefinal site observation.

3.7 Provide a one-year warranty for the system and all components. The warranty shall begin at the date of final acceptance of the building. During the warranty period, the system shall be repaired or replaced as necessary at no cost to the Owner. During the warranty period, a technician shall be on the job site within twenty-four hours of a problem report from the Owner.

END OF SECTION

ADVERTISEMENT FOR BIDS

Sealed bids will be received by the **City of Hattiesburg** at the Hattiesburg City Council Chamber located at **200 Forrest Street, Hattiesburg, MS, 39401** until **10:00 a.m.** local time on **Friday, December 21, 2018**, at which time all proposals will be opened and read aloud for:

Hattiesburg Public Safety Complex
701 James Street
Hattiesburg, Mississippi 39401

Bid documents may be obtained in hard copy form for a deposit of $500.00 per set of documents, made payable to Albert & McCleskey Associate Architects. 50% of the deposit will be refunded to all document holders upon the return of the documents to the Architect in good condition no later than 10 calendar days after the bid date. Official bid documents can be downloaded from Central Bidding at www.centralbidding.com. Electronic bids can be submitted at www.centralbidding.com. For any questions relating to the electronic bidding process, please call Central Bidding at 225-810-4814. Bid preparation shall be in accordance with Instructions to Bidders bound in the Project Manual.

A Pre-bid meeting will be held on Wednesday, December 5, 2018 at 10:00 a.m. at the Hattiesburg Public Safety Complex site. Attendance by all Bidders is strongly encouraged.

Each bid must be received in a sealed envelope which is marked in the lower left-hand corner with the legend, **"Hattiesburg Public Safety Complex Bid Package".**

No bid may be withdrawn for a period of sixty (60) days. The lowest and best proposal received will be accepted, subject to the provisions of Section 31-7-13 of the Mississippi Code of 1972, Annotated and Amended, and other applicable State law; but the Council reserves the right to reject any or all proposals received and to waive informalities or irregularities therein.

Authorized by:
Kermas Eaton
City of Hattiesburg

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