Offeror Name: _____

RFP NO 2018-03

Construction Manager-At-Risk

Construction of Records Storage Building, Police Parking, and Animal Services Building Repairs

PROPOSALS DUE March 05, 2019
2:00 P.M.

RFP NO 2018-03

RFQ No. 2018-03 City of Lake Worth Request For Proposals		
Task		**Due Date**
Advertise Solicitation 1st		02/15/2019
Advertise Solicitation 2nd		01/22/2019
Pre-Bid Conference 3805 Adam Grubb, Lake Worth Texas		02/19/2019 @ 10 AM
Due Date for Proposals		03/05/2019
Tentative Award Date		03/12/2019

Request for Proposals

The City of Lake Worth accepting Sealed Proposals - RFP # 2018-03 **Construction Manager-At-Risk** for **construction of Records Storage building, Police Parking and Animal Services building repairs**.

All Proposal Packets, including a "NO RESPONSE", are due in the City Secretary's office by the due date in sealed envelopes or boxes. All packets must be clearly marked with the RFP Number, the name of the company submitting the proposal, and date and time of opening on the outside of the envelope/box and/or Air bill/Delivery Receipt. Original packets must be clearly marked "ORIGINAL" and contain all original signatures.

Pursuant to the provisions of Chapter 2269, Subchapter F, of the Local Government Code, it is the intention of the City of Lake Worth to select a Construction Manager-At-Risk in a one-step process for the construction of a new Record Storage building, Police parking lot, and repairs to existing Animal Services building. Sealed submittals are to include the information requested in this packet in the sequence and format prescribed. In addition to and separate from the requested information, submitting organizations may provide supplementary materials further describing their capabilities and experience (under separate cover).

Proposals must be actually received by the Owner by 2:00 pm, March 05, 2019. Proposals may only be submitted by U.S. Mail, overnight courier, or hand-delivery and must be received by the submittal deadline. Proposals submitted electronically, including by e-mail or facsimile, will not be accepted. Five (5) 8 ½" x 11" bound copies and one unbound, signed original of the proposal shall be submitted in sealed envelopes and clearly marked "RFP # 2018-03 Proposal". The cover of each bound copy should clearly display the title of the Proposal: "RFP # 2018-03 Proposal", along with the Offeror's name. Proposals should be addressed and submitted to:

City Secretary's Office
At 3805 Adam Grubb Drive
Lake Worth, Texas 76135

Any proposal packet received after 2:00 pm, March 05, 2019 will not be accepted. An Offeror whose proposal packets are received after the date and/or hour set will be notified and advised by City Secretary as to the disposition by either pick up, return at Offeror's expense, or destroyed with written authorization of the offeror.

Proposal packets may be withdrawn by an Offeror at any time prior to the official opening. Alterations made before opening time must be initialed by Offeror guaranteeing authenticity. After the official opening, proposal packets become the property of the City of Lake Worth and may not

be amended, altered or withdrawn. Lake Worth is exempt from Federal Excise and State Sales Tax; therefore, tax must not be included in this bid.

Lake Worth reserves the right waive any informality and to reject any or all proposal packets.

Queries about the project should be addressed to:

Monica Solko, TRMC
Fax: (817) 237-9684
Email: msolko@lakeworthtx.org

All documents relating to this RFP will be posted under the RFP number on the City of Lake Worth website, www.lakeworthtx.org and available for download by Offerors and other interested parties. It is the Offeror's sole responsibility to review this site and retrieve all related documents up to the deadline submittal date.

PROJECT, SCOPE OF WORK AND ANTICIPATED SCHEDULE

The following project narratives are to assist you in responding to the RFP.

Construction at 3805 Adam Grubb:

The project consists of an approximately 3,000 square foot, air-conditioned Records Storage building and associated site improvement at the existing City Hall along with reconstruction of the existing Police parking area. The structure of the Records Storage building will likely be single story, pre-engineered metal building frame with masonry cladding.

Construction Repair at 7209 Comanche Trail:

Existing Animal Service Building will be repaired cosmetically and a 40'x60' outdoor dog run with fencing will be constructed.

Construction Budget: **$468,135.00**

Anticipated Construction Start: **TBD**

Anticipated Construction Completion: **180 days from contract acceptance**

City will require the use of AIA Documents A133-2009 and A201-2007 as modified in a form acceptable to the City.

The following describes the anticipated services expected during design and construction by the selected Offeror:

- Manage the Guaranteed Maximum Price (GPM) Documentation
- Establish budget by bid package for design phases
- Prepare sub-contractor bid or proposal packages
- Conduct pre-bid meetings
- Receive bids
- Conduct award of contracts/purchase orders
- Provide coordination and management of sub-contractors
- Summarize monthly reports
- Provide change order and contingency funds control
- Establish a quality management program
- Provide for job safety functions
- Provide accounting functions
- Provide jobsite security functions
- Provide post construction services
- Provide value engineering and management of constriction schedule
  Attend pre-construction meeting with City personnel

QUESTIONNAIRE

Please provide the following information in the sequence and format prescribed by this questionnaire. Supplement materials providing additional information may be included under separate cover attached, but the information requested below is to be provided in this format.

1. FIRM INFORMATION

1.1 Name of firm
1.2 Address of Principal office
1.3 Phone
1.4 Fax
1.5 Form of Business Organization (Corporation, Partnership, Individual, etc.)
1.6 Year founded
1.7 Primary individual to contact

2. ORGANIZATION

2.1 How many years has your organization been in business in its current capacity?
2.2 How many years has your organization been in business under its present name? Under what other or former name(s) has your organization operated?
2.3 If your organization is a corporation, please provide date of incorporation, State of incorporation and list all officers of the corporation.
2.4 If your organization is a partnership, answer the following: Date of organization, type of partnership (if applicable), and names of managing partner(s).
2.5 If your organization is individually owned, answer the following: Date of organization, name of owner.
2.6 If the form of your organization is other than those listed above, describe it and name the principals.
2.7 Information of the individual that will be the lead on this project.

3. LICENSING

3.1 List jurisdictions and trade categories in which your organization is legally qualified to do business and indicate registration or license numbers, if applicable.
3.2 List jurisdictions in which your organization's partnership or trade name is filed.

4. EXPERIENCE

4.1 List the categories of work that your organization normally performs with its own forces.
4.2 List any subcontractors in which your organization has some ownership and list the categories of work those subcontractors normally perform.
4.3 Claims and suits (if the answer to any of the questions below is yes, please attach details).
4.3.1 Has your organization ever failed to complete any work awarded to it?

4.3.2 Are there any judgments, claims, arbitration proceedings or suits filed or outstanding against your organization or its officers for the last 5 years?

4.3.3 Has your organization filed any lawsuits or requested arbitration with regards to construction contracts within the last 5 years?

4.4 Within the last 5 years, has any officer or principal of your organization ever been an officer or principal of another organization when it failed to complete a construction contract? (if the answer is yes, please attach details).

4.5 Current work:
List the major construction projects your organization has in progress (noting method of selection, i.e.: CM at Risk, Bid, Proposal or other), giving the name and location of project owner, architect/engineer, contract amount, percent complete, and scheduled completion date.

4.6 Work over last 5 years:
List major projects (particularly public facilities) constructed by your firm. For each project, provide the name, nature of the project/function of the building, size of building (SF), location, cost, completion date, owner, architect, and method selection (i.e.: CM @ Risk, Bid, Proposal or other).

5. FINANCIAL INFORMATION

5.1 Attach a financial statement, preferable audited, including your organization's latest balance sheet and income statement showing the following items:

- Current assets (e.g., cash, joint venture accounts, accounts receivable, notes receivable, accrued income, deposits, materials inventory, and prepaid expenses).
- Non-current assets (e.g., net fixed assets, other assets).
- Current liabilities (e.g., account payable, notes payable (current), accrued expenses, provisions for income taxes, advances, accrued salaries, and accrued payroll taxes).
- Non-current liabilities (e.g., notes payable).
- Capital accounts and retained earnings (e.g., capital, capital stock, authorized and outstanding shares par value, earned surplus, and retained earnings).

5.2 Name and address of firm preparing attached financial statement and date thereof.

5.3 Is the attached financial statement for the identical organization named under item 1 above? If not, explain the relationship and financial responsibility of the organization whose financial statement is provided (e.g., parent, subsidiary).

5.4 Will the organization whose financial statement is attached act as guarantor of the contract for construction?

5.5 Provide name, address, and phone number for bank reference.

6. INSURANCE AND BOND INFORMATION

6.1 Attach a letter of intent from a bonding agent indicating the offeror's bond ability for the projects.

6.2 Attach a sample certificate of insurance or a letter of intent from an insurance company indicating the insurability of the Offeror for the described projects.

6.3 The surety and insurance companies shall each acknowledge that the firm may be covered for construction of the projects with a potential maximum construction cost of **$468,135.00**.

6.4 The Contractor shall procure and maintain the following types of insurance coverage in at least the following amounts (unless the contract specifies different coverage or amounts).

Workers' Compensation:	Statutory
Comprehensive General Liability:	$1,000,000.00 each occurrence $1,000,000.00 in the aggregate
Comprehensive Automobile Liability:	(Any auto, hired auto, non-owned auto)
a) Bodily Injury:	$1,000,000.00 each person $1,000,000.00 each occurrence
b) Property Damage:	$1,000,000.00 each occurrence
Owner's and Contractor's Protective:	$1,000,000.00
Builder's Risk:	Full value of construction costs
General Liability Umbrella Policy:	$5,000,000.00 each occurrence

7. EXPERIENCE WITH CONCEPTS FOR WORKING AS A CONSTRUCTION MANAGER-AT-RISK

7.1 Describe your organization's concepts for working in a team relationship with the Owner and Architect during the design and construction of major projects. Describe your organization's methods for estimating costs, and for scheduling during the design/document phases. Describe how your company will benefit this project using Construction Manager at Risk.

7.2 Cost Estimates:
Attach a sample conceptual cost estimate prepared during the design phase of the project and a sample of the final cost estimate/breakdown used to fix the contract amount for the construction of the same project. (The identity of the project may

be concealed. The intent is to see the nature and format of the cost information provided).

7.3 Savings:

Describe your organization's concept for the disposition of savings realized during construction. Is the full amount or a percentage thereof returned to the Owner?

7.4 Contingencies:

Describe your organization's concept for cost contingencies during design? During construction? What is your organization's concept for the disposition of contingency funds after the completion of the project? Give a history of project cost based on bid cost versus final cost noting reasons and amounts of change orders. What percentage contractor contingency do you carry with 100% construction documents?

7.5 Cost Information:

Your firm would be required to make all cost information during design and construction available to owner and architect. Describe how this information would be furnished and how the owner and architect would be assured that it is complete and accurate.

8. SAFETY

Provide information as pertains to your firm's accident frequency rate and modifier for the last five years. List any OSHA citations in the last five years. List any deaths that have occurred on your projects in the last five years.

9. SCHEDULES

Provide samples of schedules that will be used to control various project phases. Give a history of your ability to deliver projects on time for the past 5 years. Describe methods employed to keep projects on schedule and methods of corrective action to overcome schedule deficiencies.

10. REFERENCES

For the projects listed above (re: item 4.6), identify a representative of the owner and a representative of the architect (provide name, phone/fax numbers) whom we could contact as references regarding your organization's services. Ideally, some of the references should be for municipal projects of comparable scope. (

11. FEES AND GENERAL CONDITIONS

Having carefully examined all the requirements of this RFP, the proposed form of Agreement, and addendum, the undersigned proposes to furnish Construction Manager at Risk services as required for this Project on the following terms:

A. ESTABLISHMENT OF THE CONSTRUCTION COST LIMITATION: City has established a Construction Cost Limitation (CCL) amount of _____ for the Records Storage Building along with reconstruction of existing Police Parking area at 305 Adam Grubb, and _____ for the repairs to the existing animal service building at 7209 Comanche Trail, which includes the Construction Services Guaranteed Maximum Price.

B. OFFEROR'S PRE-CONSTRUCTION PHASE FEE: Using the CCL identified above, the Offeror shall identify a Pre-Construction Phase Fee percentage, pursuant to the Construction Manager at Risk Agreement:

Offeror's Pre-Construction Phase Fee Percentage for the work at:

3805 Adam Grubb _____ _____%
7209 Comanche Trail _____ ___%

Offeror's Pre-Construction Phase Fee Amount for the work at:

3805 Adam Grubb _____$
7209 Comanche Trail _____ _____$
(percentage times the CCL above)

C. OFFEROR'S CONSTRUCTION PHASE FEE: Using the CCL identified above, the Offeror shall identify a Construction Phase Fee percentage:

Offeror's Construction Phase Fee Percentage for the work at:

3805 Adam Grubb _____%
7209 Comanche Trail _____%

Offeror's Construction Phase Fee Amount for the work at:

3805 Adam Grubb _____$
7209 Comanche Trail _____$
(percentage times the CCL above)

Offeror's Overtime Fee Rate $ _____

D. OFFEROR'S NOT-TO-EXCEED GENERAL CONDITIONS COSTS: The Offeror shall identify a General Conditions not-to-exceed percentage and amount for each project.

Offeror's General Conditions Percentage _____ %

Offeror's Estimated General Conditions Amount
(percentage times the CCL above) $ _____

Offeror's General Conditions Over Time Rate $ _____

Using the not-to-exceed General Conditions costs identified above, the Offeror shall identify all project management, bonds, insurance, field office and office supply costs for each Project as listed below:

Allowable General Condition Line Item Category	Estimated Total
Cost On-Site Project Management Staff subtotal	$ _____
Over Time subtotal	$ _____
Bond, Permits and Insurance subtotal	$ _____
Field Offices & Office Supplies subtotal	$ _____
Equipment Rental/Miscellaneous subtotal	$ _____

Estimated On-Site Project Management Staff and Rates

Position	Quantity	Months	Monthly Salary Rate
Project Executive	_____	_____	$ _____
Project Manager	_____	_____	$ _____
Superintendent(s)	_____	_____	$ _____
Assistant Superintendent(s)	_____	_____	$ _____
Project Engineer/Expeditor(s)	_____	_____	$ _____
Field/Office Engineer(s)	_____	_____	$ _____
Field Office Support Staff	_____	_____	$ _____
CPM Scheduler	_____	_____	$ _____
Safety Coordinator/Assistant(s)	_____	_____	$ _____

CRITERIA FOR SELECTION

The City Council of Lake Worth will make the final selection of Offeror; however, proposals will be evaluated and ranked by the City Manager and her designees based on the following selection criteria and according to the following weighted values:

EXPERIENCE- (50% of scoring)

The reputation of the vendor and of the vendor's services;
The relevant experience of the vendor;
The quality of the vendor's goods or services;
Past performance of the vendor; and
The vendor's past relationship with the City.

CITY'S NEEDS - (25% of scoring)

Offeror's proposed fees;
The extent to which the goods or services meet the City's needs;
Vendors methodology for the project; and
The impact on the ability of the City to comply with laws and rules relating to historically under-utilized businesses.

ORGANIZATION, FINANCIAL INFORMATION, PERSONNEL,– (25% of scoring)

Vendor's safety record;
Proposed personnel for the project;
Financial capability of Offeror;
Any other relevant factor that the City would consider in selecting a vendor; and

Request for Proposal Responses

Proposal packets submitted by Offerors in response to the City's Request for Proposals may be subject to disclosure under the Texas Public Information Act (Texas Government Code, Chapter 552.001, et seq.). The City of Lake Worth may seek to withhold, redact, and/or request an opinion from the Texas Attorney General concerning any information that is clearly marked as confidential and/or proprietary in your submittal.

However, that information may still be subject to release if it is finally determined not to be confidential or proprietary under Texas law.

By having an authorized officer of the company sign below, this Offeror agrees to indemnify the City of Lake Worth for any and all attorney fees, penalties, costs or other expenses that the City of Lake Worth may incur in defending the withholding of such information.

Furthermore, this Offeror agrees to waive any rights or claims for damages it may have against the City that are caused by or alleged to be caused by the release of said confidential or proprietary information.

Construction Manager at Risk Candidate

_____

Name (Type or Print): _____
Title: _____
Date: _____

WAIVER OF CLAIMS:

EACH OFFEROR BY SUBMISSION OF A PROPOSAL TO THIS RFP WAIVES, TO THE EXTENT ALLOWED BY LAW, ANY CLAIMS IT HAS OR MAY HAVE AGAINST OWNER'S CONSULTING ENGINEERS, OR ANY OTHER CONSULTANTS, AND THEIR RESPECTIVE EMPLOYEES, OFFICERS, MEMBERS, DIRECTORS AND PARTNERS, AND OWNER, ITS EMPLOYEES, OFFICERS, AGENTS, REPRESENTATIVES, AND THE MEMBERS OF OWNER'S GOVERNING BODY, CONNECTED WITH OR ARISING OUT OF THIS RFP, INCLUDING THE ADMINISTRATION OF THE REQUEST FOR PROPOSALS, THE PROPOSAL EVALUATIONS, AND THE SELECTION OF THE OFFEROR. SUBMISSION OF A PROPOSAL INDICATES OFFEROR'S ACCEPTANCE OF THE EVALUATION TECHNIQUE AND OFFEROR'S RECOGNITION THAT SOME SUBJECTIVE JUDGMENTS MUST BE MADE BY OWNER DURING THE SELECTION PROCESS. WITHOUT LIMITING THE GENERALITY OF THE FOREGOING, EACH OFFEROR ACKNOWLEDGES THAT OWNER SHALL DOCUMENT THE BASIS OF ITS SELECTION AND SHALL MAKE THE EVALUATIONS PUBLIC NOT LATER THAN THE 7TH DAY AFTER THE DATE THE CONTRACT IS AWARDED, AND EACH OFFEROR WAIVES ANY CLAIM IT HAS OR MAY HAVE AGAINST THE ABOVE-NAMED PERSONS, DUE TO INFORMATION CONTAINED IN SUCH EVALUATIONS.

CITY OF LAKE WORTH RECORD STORAGE

3805 Adam Grubb

Lake Worth, Texas

OWT Project Number: 2018.019.00

December 19, 2018

OXLEY WILLIAMS THARP

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12.19.2018

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SECTION 00 7200

GENERAL CONDITIONS

FORM OF GENERAL CONDITIONS

1.01 THE GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION (AIA DOCUMENT A201), AS MODIFIED BY OWNER HEREAFTER REFERRED TO AS THE "GENERAL CONDITIONS" ARE HEREBY MADE PART OF THESE CONTRACT DOCUMENTS TO THE SAME EXTENT AS IF CONTAINED HEREIN IN FULL, EXCEPT AS MODIFIED, AMENDED, REVISED, RESCINDED OR SUPPLEMENTED BY THE REMAINING CONTRACT DOCUMENTS.

1.02 COPIES OF THE DOCUMENT MAY BE EXAMINED AT THE ARCHITECT'S OFFICE.

RELATED REQUIREMENTS

2.01 SECTION 01 4216 - DEFINITIONS.

END OF SECTION

COM*check* Software Version 4.1.1.0

Envelope Compliance Certificate

Project Information

Energy Code:	2015 IECC
Project Title:	Lake Worth Records Storage
Location:	Lake Worth, Texas
Climate Zone:	3a
Project Type:	New Construction

Construction Site:
3805 Adam Grub St.
Lake Worth, TX 76135

Owner/Agent:
City of Lake Worth
3805 Adam Grub St
Lake Worth, TX 76135

Designer/Contractor:
Andrew Oxley
OWT Architects
509 Pecan St
Suite 100
Fort Worth, TX 76102
817-993-9844
aoxley@owtarchitects.com

Additional Efficiency Package(s)

Reduced interior lighting power. Requirements are implicitly enforced within interior lighting allowance calculations.

Building Area	Floor Area
1-Warehouse : Nonresidential	2760

Envelope Assemblies

Assembly	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Proposed U-Factor	Budget U-Factor(a)
Roof 1: Other Metal Building Roof: High Albedo Roof Exempt, High Albedo Roof Exemption = Steep Sloped Roof, [Bldg. Use 1 - Warehouse] (b)	2760	---	---	0.035	0.035
Floor 1: Slab-On-Grade:Unheated, [Bldg. Use 1 - Warehouse] (c)	211	---	---	0.730	0.730
NORTH					
Exterior Wall - North: Other Metal Building Wall, [Bldg. Use 1 - Warehouse] (b)	1101	---	---	0.079	0.079
Door 1: Insulated Metal, Swinging, [Bldg. Use 1 - Warehouse]	51	---	---	0.600	0.610
EAST					
Exterior Wall - East: Other Metal Building Wall, [Bldg. Use 1 - Warehouse] (b)	1200	---	---	0.079	0.079
Door 2: Insulated Metal, Swinging, [Bldg. Use 1 - Warehouse]	45	---	---	0.600	0.610
SOUTH					
Exterior Wall - South: Other Metal Building Wall, [Bldg. Use 1 - Warehouse] (b)	1101	---	---	0.079	0.079
Door 3: Insulated Metal, Swinging, [Bldg. Use 1 - Warehouse]	25	---	---	0.600	0.610
Door 4: Insulated Metal, Non-Swinging, [Bldg. Use 1 - Warehouse]	100	---	---	0.125	0.179
WEST					
Exterior Wall - West: Other Metal Building Wall, [Bldg. Use 1 - Warehouse] (b)	1200	---	---	0.079	0.079

(a) Budget U-factors are used for software baseline calculations ONLY, and are not code requirements.
(b) 'Other' components require supporting documentation for proposed U-factors.
(c) Slab-On-Grade proposed and budget U-factors shown in table are F-factors.

Envelope PASSES: Design 1% better than code

Envelope Compliance Statement

Compliance Statement: The proposed envelope design represented in this document is consistent with the building plans, specifications, and other calculations submitted with this permit application. The proposed envelope systems have been designed to meet the 2015 IECC requirements in COM*check* Version 4.1.1.0 and to comply with any applicable mandatory requirements listed in the Inspection Checklist.

Name - Title	Signature	Date
Grant Hamilton - Project Coordinator		12-19-2018

COM*check* Software Version 4.1.1.0

Inspection Checklist

Energy Code: 2015 IECC

Requirements: 7.0% were addressed directly in the COM*check* software

Text in the "Comments/Assumptions" column is provided by the user in the COMcheck Requirements screen. For each requirement, the user certifies that a code requirement will be met and how that is documented, or that an exception is being claimed. Where compliance is itemized in a separate table, a reference to that table is provided.

Section # & Req.ID	Plan Review	Complies?	Comments/Assumptions
C103.2 [PR1][1]	Plans and/or specifications provide all information with which compliance can be determined for the building envelope and document where exceptions to the standard are claimed.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	
C402.4.1 [PR10][1]	The vertical fenestration area <= 30 percent of the gross above-grade wall area.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	
C402.4.1 [PR11][1]	The skylight area <= 3 percent of the gross roof area.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	
C402.4.2 [PR14][1]	In enclosed spaces > 2,500 ft2 directly under a roof with ceiling heights >15 ft. and used as an office, lobby, atrium, concourse, corridor, storage, gymnasium/exercise center, convention center, automotive service, manufacturing, non-refrigerated warehouse, retail store, distribution/sorting area, transportation, or workshop, the following requirements apply: (a) the daylight zone under skylights is >= half the floor area; (b) the skylight area to daylight zone is >= 3 percent with a skylight VT >= 0.40; or a minimum skylight effective aperture >= 1 percent.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	
C406 [PR9][1]	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the additional energy efficiency package options.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.

Additional Comments/Assumptions:

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)

Section # & Req.ID	Footing / Foundation Inspection	Complies?	Comments/Assumptions
C303.2 [FO4][2]	Slab edge insulation installed per manufacturer's instructions.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	
C303.2.1 [FO6][1]	Exterior insulation protected against damage, sunlight, moisture, wind, landscaping and equipment maintenance activities.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	
C402.2.5 [FO3][2]	Slab edge insulation R-value.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	*See the Envelope Assemblies table for values.*
C402.2.6 [FO12][3]	Radiant heating systems panels insulated to >=R-3.5 on face opposite space being heated.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply. *See the Envelope Assemblies table for values.*

Additional Comments/Assumptions:

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)

Section # & Req.ID	Framing / Rough-In Inspection	Complies?	Comments/Assumptions
C303.1.3 [FR12][2]	Fenestration products rated in accordance with NFRC.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	
C303.1.3 [FR13][1]	Fenestration products are certified as to performance labels or certificates provided.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	
C402.4.3 [FR10][1]	Vertical fenestration SHGC value.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	*See the Envelope Assemblies table for values.*
C402.4.3, C402.4.3.4 [FR8][1]	Vertical fenestration U-Factor.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	*See the Envelope Assemblies table for values.*
C402.4.4 [FR14][2]	U-factor of opaque doors associated with the building thermal envelope meets requirements.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	*See the Envelope Assemblies table for values.*
C402.5.1 [FR16][1]	The building envelope contains a continuous air barrier that is sealed in an approved manner and either constructed or tested in an approved manner. Air barrier penetrations are sealed in an approved manner.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	
C402.5.2, C402.5.4 [FR18][3]	Factory-built fenestration and doors are labeled as meeting air leakage requirements.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	
C402.5.7 [FR17][3]	Vestibules are installed on all building entrances. Doors have self-closing devices.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	

Additional Comments/Assumptions:

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)

Section # & Req.ID	Mechanical Rough-In Inspection	Complies?	Comments/Assumptions
C402.5.5, C403.2.4.3 [ME3][3]	Stair and elevator shaft vents have motorized dampers that automatically close.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	

Additional Comments/Assumptions:

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)

Section # & Req.ID	Insulation Inspection	Complies?	Comments/Assumptions
C303.1 [IN3][1]	Roof insulation installed per manufacturer's instructions. Blown or poured loose-fill insulation is installed only where the roof slope is <=3 in 12.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	
C303.1 [IN10][2]	Building envelope insulation is labeled with R-value or insulation certificate providing R-value and other relevant data.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	
C303.2 [IN7][1]	Above-grade wall insulation installed per manufacturer's instructions.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	
C303.2.1 [IN14][2]	Exterior insulation is protected from damage with a protective material. Verification for exposed foundation insulation may need to occur during Foundation Inspection.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	
C402.1.3 [IN19][3]	Non-swinging opaque doors have R-4.75 insulation.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	
C402.2.1 [IN17][3]	Insulation intended to meet the roof insulation requirements cannot be installed on top of a suspended ceiling. Mark this requirement compliant if insulation is installed accordingly.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	
C402.2.3 [IN6][1]	Above-grade wall insulation R-value.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	*See the Envelope Assemblies table for values.*
C402.2.5 [IN8][2]	Floor insulation R-value.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	*See the Envelope Assemblies table for values.*
C402.2.6 [IN18][3]	Radiant panels and associated components, designed for heat transfer from the panel surfaces to the occupants or indoor space are insulated with a minimum of R-3.5.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	
C402.3 [IN5][3]	High-albedo roofs satisfy one of the following: 3-year-aged solar reflectance >= 0.55 and thermal emittance >= 0.75 or 3-year-aged solar reflectance index >= 64.0.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	
C402.2.2 [IN2][1]	Roof R-value. For some ceiling systems, verification may need to occur during Framing Inspection.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	*See the Envelope Assemblies table for values.*
C402.5.1.1 [IN1][1]	All sources of air leakage in the building thermal envelope are sealed, caulked, gasketed, weather stripped or wrapped with moisture vapor-permeable wrapping material to minimize air leakage.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	

Additional Comments/Assumptions:

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)

Section # & Req.ID	Final Inspection	Complies?	Comments/Assumptions
C402.5.3 [FI51][3]	Where open combustion air ducts provide combustion air to open combustion fuel burning appliances, the appliances and combustion air opening are located outside the building thermal envelope or enclosed in a room, isolated from inside the thermal envelope. Such rooms are sealed and insulated.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	
C402.5.6 [FI37][1]	Weatherseals installed on all loading dock cargo doors.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	
C402.5.8 [FI26][3]	Recessed luminaires in thermal envelope to limit infiltration and be IC rated and labeled. Seal between interior finish and luminaire housing.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	

Additional Comments/Assumptions:

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)

GEOTECHNICAL ENGINEERING STUDY
RECORD STORAGE BUILDING
3805 ADAM GRUBB STREET
LAKE WORTH, TEXAS

Presented To:

City of Lake Worth

November 2018

PROJECT NO. 419-18-04

CMJ ENGINEERING, INC.

7636 Pebble Drive
Fort Worth, Texas 76118
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November 01, 2018
Report No. 419-18-04

City of Lake Worth
3805 Adam Grubb Street
Lake Worth, Texas 76135

Attn: Ms. Stacy Almond, City Manager

GEOTECHNICAL ENGINEERING STUDY
RECORD STORAGE BUILDING
3805 ADAM GRUBB STREET
LAKE WORTH, TEXAS

Dear Ms. Almond:

Submitted here are the results of a geotechnical engineering study for the referenced project. This study was performed in general accordance with our Estimate No. 18-7049 dated October 3, 2018. The geotechnical services were authorized on October 4, 2018.

Engineering analyses and recommendations are contained in the text section of the report. Results of our field and laboratory services are included in the appendix of the report. We would appreciate the opportunity to be considered for providing the construction material testing services during the construction phase of this project.

We appreciate the opportunity to be of service to City of Lake Worth and their consultants. Please contact us if you have any questions or if we may be of further service at this time.

Respectfully submitted,
CMJ ENGINEERING, INC.
TEXAS FIRM REGISTRATION NO. F-9177

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1.0 INTRODUCTION

1.1 Project Description

The project site is located at 3805 Adam Grubb Street in Lake Worth, Texas. The project, as currently planned, consists of a single-story record storage building with a footprint of 2,760 square feet. Structural loads are anticipated to be relatively light and no basements are planned. Plate A.1, Plan of Borings, presents the project vicinity and approximate locations of the exploration borings.

1.2 Purpose and Scope

The purpose of this geotechnical engineering study has been to determine the general subsurface conditions, evaluate the engineering characteristics of the subsurface materials encountered, and develop recommendations for the type or types of foundations suitable for the project.

To accomplish its intended purposes, the study has been conducted in the following phases: (1) drilling sample borings to determine the general subsurface conditions and to obtain samples for testing; (2) performing laboratory tests on appropriate samples to determine pertinent engineering properties of the subsurface materials; and (3) performing engineering analyses, using the field and laboratory data to develop geotechnical recommendations for the proposed construction.

The design is currently in progress and the location and/or elevation of the building could change. Once the final design is near completion (80-percent to 90-percent stage), it is recommended that CMJ Engineering, Inc. be retained to review those portions of the construction documents pertaining to the geotechnical recommendations, as a means to determine that our recommendations have been interpreted as intended.

1.3 Report Format

The text of the report is contained in Sections 1 through 10. All plates and large tables are contained in Appendix A. The alpha-numeric plate and table numbers identify the appendix in which they appear. Small tables of less than one page in length may appear in the body of the text and are numbered according to the section in which they occur.

Units used in the report are based on the English system and may include tons per square foot (tsf), kips (1 kip = 1,000 pounds), kips per square foot (ksf), pounds per square foot (psf), pounds per cubic foot (pcf), and pounds per square inch (psi).

2.0 FIELD EXPLORATION AND LABORATORY TESTING

2.1 Field Exploration

Subsurface materials at the project site were explored by two (2) vertical soil borings drilled to a depth of 25 feet in the area of the proposed building. The borings were drilled using continuous flight augers at the approximate locations shown on the Plan of Borings, Plate A.1. The boring logs are included on Plates A.4 and A.5 and keys to classifications and symbols used on the logs are provided on Plates A.2 and A.3.

Undisturbed samples of cohesive soils were obtained with nominal 3-inch diameter thin-walled (Shelby) tube samplers at the locations shown on the logs of borings. The Shelby tube sampler consists of a thin-walled steel tube with a sharp cutting edge connected to a head equipped with a ball valve threaded for rod connection. The tube is pushed into the soil by the hydraulic pulldown of the drilling rig. The soil specimens were extruded from the tube in the field, logged, tested for consistency with a hand penetrometer, sealed, and packaged to limit loss of moisture.

The consistency of cohesive soil samples was evaluated in the field using a calibrated hand penetrometer. In this test a 0.25-inch diameter piston is pushed into the relatively undisturbed sample at a constant rate to a depth of 0.25 inch. The results of these tests, in tsf, are tabulated at respective sample depths on the logs. When the capacity of the penetrometer is exceeded, the value is tabulated as 4.5+.

To evaluate the relative density and consistency of the harder formations, a modified version of the Texas Cone Penetration test was performed at selected locations. Texas Department of Transportation (TxDOT) Test Method Tex-132-E specifies driving a 3-inch diameter cone with a 170-pound hammer freely falling 24 inches. This results in 340 foot-pounds of energy for each blow. This method was modified by utilizing a 140-pound hammer freely falling 30 inches. This results in 350 foot-pounds of energy for each hammer blow. In relatively soft materials, the penetrometer cone is driven 1 foot and the number of blows required for each 6-inch penetration is tabulated at

respective test depths, as blows per 6 inches on the log. In hard materials (rock or rock-like), the penetrometer cone is driven with the resulting penetrations, in inches, recorded for the first and second 50 blows, a total of 100 blows. The penetration for the total 100 blows is recorded at the respective testing depths on the boring logs.

2.2 Laboratory Testing

Laboratory soil tests were performed on selected representative samples recovered from the borings. In addition to the classification tests (liquid limits and plastic limits), moisture content, unit weight, and unconfined compressive strength tests were performed. Results of the laboratory classification tests, moisture content, unit weight, and unconfined compressive strength tests conducted for this project are included on the boring logs.

A swell test was performed on a specimen from a selected sample of the soils. This test was performed to help in evaluating the swell potential of soils in the area of the proposed building. The results of the swell test are presented on Plate A.6.

The above laboratory tests were performed in general accordance with applicable ASTM procedures, or generally accepted practice.

3.0 SUBSURFACE CONDITIONS

3.1 Soil Conditions

Specific types and depths of subsurface strata encountered at the boring locations are shown on the boring logs in Appendix A. The generalized subsurface stratigraphies encountered in the borings are discussed below. Note that depths on the borings refer to the depth from the existing grade or ground surface present at the time of the investigation, and the boundaries between the various soil types are approximate.

Crushed asphalt is present at the surface in Boring B-1 with a thickness of 5 inches. Soils encountered consist of dark brown, brown, dark reddish brown, reddish brown and light reddish brown silty clays and clays containing calcareous nodules, calcareous deposits and gravel. The overburden soils are noted as fill in both borings. Ironstone nodules are present above 2 feet and

iron stains are present from 3 to 4 feet in Boring B-2. In addition, abundant limestone fragments, gravel and pebbles are present below 4 feet in Borings B-1 and B-2.

The various clays encountered in the borings had tested Liquid Limits (LL) ranging from 35 to 56 with Plasticity Indices (PI) ranging from 22 to 40 and are classified as CL and CH by the Unified Soil Classification System (USCS). The various clayey soils were generally stiff to hard (soil basis) in consistency with pocket penetrometer values ranging from 2.0 to over 4.5 tsf. Tested unit weight values range from 97 to 104 pcf and tested unconfined compressive strengths were 1,950 and 4,150 psf.

Tan limestone containing clay seams is next present at depths of 6 to 8 feet in both borings. The tan limestone contains light gray limestone seams below 17½ feet in Boring B-1, and is considered hard to very hard (rock basis), with Texas Cone Penetration (THD) test values of ⅜ to 1¾ inches per 100 blows.

Gray limestone is next present in the borings at depths of 18 to 20 feet and continues through boring termination at a depth of 25 feet. The gray limestone is very hard (rock basis), with Texas Cone Penetration (THD) test values of ⅜ inch per 100 blows.

The Atterberg Limits tests indicate the various clays encountered at this site are moderately active to highly active with respect to moisture induced volume changes. Active clays can experience volume changes (expansion or contraction) with fluctuations in their moisture content.

3.2 Ground-Water Observations

The borings were drilled using continuous flight augers in order to observe ground-water seepage during drilling. Ground-water seepage was not encountered during drilling. Both borings were dry at completion of drilling operations.

While it is not possible to accurately predict the magnitude of subsurface water fluctuation that might occur based upon these short-term observations, it should be recognized that ground-water conditions will vary with fluctuations in rainfall. Seepage near the observed levels should be anticipated throughout the year.

Fluctuations of the ground-water level can occur due to seasonal variations in the amount of rainfall; site topography and runoff; hydraulic conductivity of soil strata; and other factors not evident at the time the borings were performed. During wet periods of the year, seepage can occur in joints in the clays or atop or within the tan limestone. The possibility of ground-water level fluctuations should be considered when developing the design and construction plans for the project.

4.0 EXISTING FILLS

Fills were encountered in Borings B-1 and B-2 to depths of 6 to 8 feet. Samples of the fills were reasonably dense and free of significant voids. However, in the absence of documented density control, the possibility of undercompacted zones or voids exists. Removal and replacement of all the fill following the recommendations in subsequent sections of this report is the only method eliminating the risk of unusual settlement.

Methods less extreme than complete removal are discussed in the Floor Slabs and Exterior Flatwork section of this report. These methods are intended to represent a reasonable approach for construction of slabs on-grade; however, they will not eliminate the risk of unexpected movements in some areas.

5.0 FOUNDATION RECOMMENDATIONS

5.1 General Foundation Considerations

Two independent design criteria must be satisfied in the selection of the type of foundation to support the proposed structure. First, the ultimate bearing capacity, reduced by a sufficient factor of safety, must not be exceeded by the bearing pressure transferred to the foundation soils. Second, due to consolidation or expansion of the underlying soils during the operating life of the structure, total and differential vertical movements must be within tolerable limits. The recommended foundation alternatives for the proposed structure are discussed below.

The moisture induced volume changes associated with the moderately active to highly active clays present at this site and possible indeterminate settlement of the existing fills indicate that shallow or near surface footings could be subject to differential movements of a potentially detrimental magnitude. The most positive foundation system for the proposed structure would be situated below

the fills and below the zone of most significant seasonal moisture variations. A deep foundation system transferring column loads to a suitable bearing stratum is considered the most positive foundation system. Straight drilled reinforced concrete shafts penetrating the tan or gray limestone offer a positive system and are recommended.

Consideration also can be given to a monolithic, slab-on-grade foundation system if the slab is designed to tolerate potential movements due to moisture induced volume changes in the surficial soils without inducing unacceptable distress in the foundation or structural elements. Recommendations for these systems are presented below.

5.2 Straight Shaft Design Parameters

5.2.1 *Design Criteria*

Recommendations and parameters for the design of cast-in-place straight-shaft drilled piers are outlined below. Specific recommendations for the construction and installation of the drilled piers are included in the following section, and shall be followed during construction.

Bearing Stratum	Tan LIMESTONE w/ clay seams
Depth of Bearing Stratum:	6 to 8 feet below existing grades
Required Penetration/Depth:	All piers should penetrate into the bearing strata a minimum of 5 feet. Deeper penetrations may be necessary to develop the required load carrying capacity
Allowable End Bearing Capacity:	12,000 psf
Allowable Skin Friction:	Applicable below a minimum penetration of 5 feet in the tan limestone and below any temporary casing; 2,000 psf for compressive loads and 1,300 psf for tensile loads.

OR

Bearing Stratum	Gray LIMESTONE
Depth of Bearing Stratum:	Approximately 18 to 20 feet below existing grades
Required Penetration/Depth:	All piers should penetrate into the bearing stratum a minimum of 2 feet. Deeper penetrations may be necessary to develop the required load carrying capacity.
Allowable End Bearing Capacity:	40,000 psf
Allowable Skin Friction:	Applicable in the gray limestone below any temporary casing; 6,500 psf for compressive loads and 4,500 psf for tensile loads.

Drilled shafts should extend through any fractured zones and weathered or clay seams/layers and bear only in the unweathered tan or gray limestone. The above values contain a safety factor of three (3). A minimum pier diameter of 18 inches is recommended. Penetrations greater than the minimum penetration may be required to develop additional skin friction and/or uplift resistance.

In order to develop full load carrying capacity in skin friction, adjacent shafts should have a minimum center-to-center spacing of 2.5 times the diameter of the larger shaft. Closer spacing may require some reductions in skin friction and/or changes in installation sequences. Closely spaced shafts should be examined on a case-by-case basis. As a general guide, the design skin friction will vary linearly from the full value at a spacing of 2.5 diameters to 50 percent of the design value at 1 diameter.

Settlements for properly installed and constructed straight shafts in the tan or gray limestone will be primarily elastic and are estimated to be one inch or less.

5.2.2 *Soil Induced Uplift Loads*

The drilled shafts could experience tensile loads as a result of post construction heave in the site soils. The magnitude of these loads varies with the shaft diameter, soil parameters, and particularly the in-situ moisture levels at the time of construction. For design purposes, an uplift load of 1,800 psf over a shaft length of 8 feet is estimated. This load must be resisted by the dead load on the shaft, continuous vertical reinforcing steel in the shaft, and a shaft adhesion developed within the

bearing strata. In order to aid in the structural design of the reinforcement, minimum reinforcing should be equal to 0.5 percent of the shaft area.

5.2.3 *Drilled Shaft Construction Considerations*

Drilled pier construction should be monitored by a representative of the geotechnical engineer to observe, among other things, the following items:

- Identification of bearing material
- Adequate penetration of the shaft excavation into the bearing layer
- The base and sides of the shaft excavation are clean of loose cuttings
- If seepage is encountered, whether it is of sufficient amount to require the use of temporary steel casing. If casing is needed it is important that the field representative observe that a high head of plastic concrete is maintained within the casing at all times during their extraction to prevent the inflow of water

Excavations for the shafts should be maintained in the dry. Precautions should be taken during the placement of reinforcing steel and concrete to prevent loose, excavated soil from falling into the excavation. Concrete should be placed as soon as practical after completion of the drilling, cleaning, and observation. Excavation for a drilled pier should be filled with concrete before the end of the workday, or sooner if required to prevent deterioration of the bearing material. Prolonged exposure or inundation of the bearing surface with water will result in changes in strength and compressibility characteristics. If delays occur, the drilled pier excavation should be deepened as necessary and cleaned, in order to provide a fresh bearing surface.

The concrete should have a slump of 6 inches plus or minus 1 inch. The concrete should be placed in a manner to prevent the concrete from striking the reinforcing cage or the sides of the excavation. Concrete should be tremied to the bottom of the excavation to control the maximum free fall of the plastic concrete to less than 10 feet, or focus concrete in the middle of the reinforcing cage to prevent segregation.

A drilling rig of sufficient size and weight will be necessary for drilling and/or coring through the hard layers to reach the desired bearing stratum and achieve the required penetration. It should be anticipated that hard to very hard zones can be present in the tan limestone overlying the gray

limestone and in the gray limestone. The hard to very hard layers can complicate pier drilling operations.

In addition to the above guidelines, the specifications from the Association of Drilled Shaft Contractors Inc. "Standards and Specifications for the Foundation Drilling Industry" as Revised 1999 or other recognized specifications for proper installation of drilled shaft foundation systems should be followed.

5.2.4 *Grade Beams*

All grade beams should be supported by the drilled shafts. A minimum 8-inch void space should be provided beneath all grade beams to prevent contact with the swelling clay soils. This void will serve to minimize distress resulting from swell pressures generated by the clays.

Grade beams may be cast on cardboard carton forms or formed above grade. If cardboard carton forms are used, care should be taken to not crush the carton forms, or allow the carton forms to become wet prior to or during concrete placement operations. A soil retainer should be provided to help prevent in-filling of this void.

Backfill against the exterior face of grade beams or panels should be properly compacted on-site clays. Compaction should be a minimum of 93 percent of ASTM D 698, at a minimum of 2 percentage points above the optimum moisture content determined by that test. This clay fill is intended to reduce surface water infiltration beneath the structure.

5.3 Stiffened Monolithic, Slab-On-Grade

5.3.1 *Design Considerations and Potential Vertical Movements*

The foundation should be designed by a structural engineer familiar with stiffened slab-on-grade foundations subject to differential movement. Foundation movements are anticipated due to post construction heave of the underlying soils. A monolithic, slab on-grade will be subject to movement as a result of moisture-induced volume changes in the moderately active to highly active soils. The soils expand (heave) with increases in moisture and contract (shrink) with decreases in moisture. The movement typically occurs as post construction heave. The potential magnitude of the moisture

induced movements is rather indeterminate. It is influenced by the soil properties, overburden pressures, and to a great extent by soil moisture levels at the time of construction.

Reduction in potential soil movement can be achieved using methods developed in this area to reduce on-grade slab movements. A more commonly used method consists of moisture conditioning the soils and placing a 1-foot thick select fill cap. Moisture conditioning is recommended to be achieved by mechanically reworking the soils as itemized in Section 6.3. This method also serves to rework a portion of the existing fills. Inclusion of a horizontal moisture barrier from the foundation out for a distance of 8 feet also will greatly restrict moisture mitigation and differential moisture change below the slab. The use of these methods will not eliminate the risk of unacceptable movements.

Consideration should be given to extending the moisture conditioning process beyond the building line to include entrances, sidewalks, flatwork, pavements, porte-cocheres or any other areas sensitive to movement. Outside the building, a poly barrier capped with a minimum 6 inches of select fill is recommended. The poly barrier should extend a minimum of 8 feet away from the foundation edge and should slope down slightly to shed excess moisture away from the structure. The use of these methods will not eliminate the risk of unacceptable movements.

5.3.2 *Design Criteria*

A stiffened, monolithically placed slab-on-grade foundation, either rebar or post-tensioned, used at this site must be designed with exterior and interior grade beams to provide sufficient rigidity to tolerate the differential soil movements. These differential movements typically will occur between the periphery and interior of the slab-on-grade system. Foundation movements are anticipated to occur primarily due to post construction heave of the underlying soils but also can occur due to shrinkage of the clays around the perimeter of the slab. It is recommended that all fill soils be properly placed and compacted in accordance with this report section and report Section 6.3 prior to foundation installation.

Design parameters are presented below for PVR and differential swell using the Post-Tensioning Institute's (PTI) slab-on-grade design method, 3rd Edition.

Design PVR:	1 inch (1)
Edge Moisture Variation	
Approximate Center Lift:	7.8 feet
Approximate Edge Lift:	4.0 feet
Differential Swell	
Approximate Center Lift:	1.0 inch (1)
Approximate Edge Lift:	1.5 inches (1)

(1) After 4½ feet of moisture conditioning with installation of 1-foot select fill cap per Section 6.3.

Beams may be designed based on an allowable soil bearing pressure of 1,800 pounds per square foot or less within the shallow soils. The beams should extend at least 12 inches into compacted and tested fill. The beam depth is given in regard to bearing capacity and is not intended to be a structural recommendation.

It should be recognized that a post tensioned slab-on-grade foundation system placed at this site will be subject to differential movements as indicated above. If slab stiffness is not sufficient to resist the ground movements, these movements can cause cracking of interior sheet rock walls and exterior brick walls. Poor drainage, water leaks, free water sources, long-term percolation in recessed planter areas and/or trees can result in greater differential movements. For example, should leaks develop in underground water or sewer lines or the grades around the structures are changed and cause ponding of water, unacceptable slab movements could develop. A greater risk of unsatisfactory foundation performance exists with a slab-on-grade design than for a drilled shaft design.

The key to the success of this foundation is proper design/construction, and providing control of the below-slab water. Providing excellent drainage away from the structure, preventing ponding water aside the slab, and using relatively impermeable backfill to prevent water intrusion via utility line backfill enhance the slab performance.

Soil treatments presented in this section are referenced as an alternative to the use of a pier and structurally suspended grade beam and floor slab. Slab-on-grade construction only should be considered if slab movement can be tolerated. The owner must fully understand that if the floor slab is placed on-grade, some movement and resultant cracking within the floor and interior wall partitions

may occur. This upward slab movement and cracking usually is difficult and costly to repair, and may require continued maintenance expense.

A properly engineered and constructed moisture barrier should be provided beneath the slab-on-grade.

6.0 FLOOR SLABS & EXTERIOR FLATWORK

6.1 Potential Vertical Movements

In conjunction with a drilled shaft system, lightly loaded floor slabs and/or exterior flatwork placed on-grade will be subject to movement as a result of moisture induced volume changes in the moderately active to highly active clays and possible indeterminate settlement of the existing fills present at this site. The clays expand (heave) with increases in moisture and contract (shrink) with decreases in moisture. The movement typically occurs as post construction heave. The potential magnitude of the moisture induced movements is rather indeterminate. It is influenced by the soil properties, overburden pressures, and to a great extent by soil moisture levels at the time of construction. The greatest potential for post-construction movement occurs when the soils are in a dry condition at the time of construction. Based on the conditions encountered in the borings, the potential moisture induced movements are estimated to be on the order of 3 inches for soils in a dry condition where the slabs are situated near present existing grades. Soil movements, significantly larger than estimated, could occur due to inadequate site grading, poor drainage, ponding of rainfall, and/or leaking pipelines.

Site grading will affect the potential movements. For example, fills using on-site or similar clays will increase potential movements. Cuts would decrease potential movements by removing clays. The recommendations provided below must be reviewed to evaluate the effects of grading on the potential moisture induced movements.

6.2 Structurally Suspended Floor Slab

The most positive method of preventing slab distress due to swelling soils is to structurally suspend the interior slab. Due to the expansion potential of the site clays we recommend that the suspended floor slab be constructed on carton forms with a minimum 10-inch void space or crawl space.

Care should be taken to assure that the void boxes are not allowed to become wet or crushed prior to or during concrete placement and finishing operations. Corrugated steel, placed on the top of the carton forms, could be used to reduce the risk of crushing of the carton forms during concrete placement and finishing operations. As a quality control measure during construction, "actual" concrete quantities placed should be checked against "anticipated" quantities. Significant concrete "overage" would be an early indication of a collapsed void.

Where a crawl space is provided, provisions should be made to provide drainage from under the building. Ventilation of the void below the floors should be provided if high humidity can cause problems with floor tile adhesives.

Vehicle or pedestrian ramps leading up to the building should be structurally connected to the building grade beams to avoid abrupt differential movement between the building slab and the ramps. Transitioning details will be required at the points where ramps connect with paving and slab on-grade elements. In addition, ramp slabs should be constructed so that slopes sufficient for effective drainage of surface water are still provided after potential differential movements.

6.3 Ground Supported Floor Slabs & Exterior Flatwork

In conjunction with drilled shafts, interior slabs and/or exterior flatwork can be placed on a prepared subgrade. Ground-supported floor slab construction only should be considered if slab movement can be tolerated. The level of acceptable movement varies with the user, but methods are normally selected with the goal of limiting slab movements to about one inch or less. Reductions in anticipated movements can be achieved by using methods developed in this area to reduce on-grade slab movements. The more commonly used methods consist of placing non-expansive select fill beneath the slab and moisture conditioning the soils. The use of these methods will not eliminate the risk of unacceptable movements.

Based on the conditions encountered in the site the installation of a minimum of 1 foot of non-expansive select fill over a minimum of 4½ feet of moisture conditioned clays should reduce potential movements to on the order of 1 inch. Moisture conditioning is recommended to be achieved by mechanically reworking the clays as described below. This method also serves to rework a portion of the existing fills. Slabs not capable of tolerating this level of movement should be structurally suspended. These recommendations should be reviewed once a grading plan is finalized.

Consideration should be given to extending the moisture conditioning process beyond the building line to include entrances, sidewalks, flatwork, pavement, porticos or any other areas sensitive to movement. Outside the building, a single lift of select fill (6 to 8 inches) is recommended to minimize drying during construction.

Soil treatments presented in this section are referenced as an alternative to the use of a structurally suspended slab. The owner must fully understand that if the floor slab is placed on-grade, some movement and resultant cracking within the slab may occur. This upward slab movement and cracking is usually difficult and costly to repair, and may require continued maintenance expense.

These methods of treatment are presented as an option for the owner's consideration. The options may or may not be practical or economically feasible, depending on the expected performance of the proposed structure. The owner should be aware that this method will not prevent movement of soil-supported elements, and can only reduce the magnitude of the movement.

A properly engineered and constructed vapor barrier should be provided beneath slabs-on-grade which will be carpeted or receive moisture sensitive coverings or adhesives.

In general, the following procedure is recommended to be performed to provide a moisture-conditioned pad:

Mechanical Reworking of Near-Surface Clays with 1' Select Fill Cap

In general, the procedure is performed as follows:

1. Remove all existing pavements, surface vegetation, trees and associated root mats, organic topsoil and any other deleterious material.
2. Excavate clays a minimum of 5 feet below finished grade. Proof-roll the exposed clay subgrade using heavy pneumatic equipment (minimum 25 tons). Any soft or pumping areas should be excavated to firm ground and properly backfilled as described in the Earthwork Section. the exposed clay subgrade, if present, at the base of the excavation to a depth of 8 inches, adjust the moisture, and compact at a minimum of 3 percentage points above optimum moisture to between 93 and 98 percent of Standard Proctor density (ASTM D 698). Over-compaction should not be allowed.
3. Fill pad to 1 foot below final grade using site excavated or similar clay soils with no rock fragments greater than 4 inches in maximum dimension. Compact in maximum 9-inch loose lifts at a

minimum of 3 percentage points above optimum moisture to between 93 and 98 percent of Standard Proctor density (ASTM D 698). Over-compaction should not be allowed.

4. Complete pad fill using a minimum of 1 foot of sandy clay/clayey sand non-expansive select fill with a Liquid Limit less than 35 and a Plasticity Index (PI) between 5 and 16. The select fill should be compacted in maximum 9-inch loose lifts at -2 to +3 percentage points of the soil's optimum moisture content at a minimum of 95 percent of Standard Proctor density (ASTM D 698). The select fill should be placed within 48 hours of completing the installation of the moisture conditioned soils.

7.0 EXPANSIVE SOIL CONSIDERATIONS

7.1 Site Drainage

An important feature of the project is to provide positive drainage away from the proposed building. If water is permitted to stand next to or below the structure, excessive soil movements (heave) can occur. This could result in differential floor slab or foundation movement.

A well-designed site drainage plan is of utmost importance and surface drainage should be provided during construction and maintained throughout the life of the structure. Consideration should be given to the design and location of gutter downspouts, planting areas, or other features which would produce moisture concentration adjacent to or beneath the structure or paving. Consideration should be given to the use of self-contained, watertight planters. Joints next to the structure should be sealed with a flexible joint sealer to prevent infiltration of surface water. Proper maintenance should include periodic inspection for open joints and cracks and resealing as necessary.

Rainwater collected by the gutter system should be transported by pipe to a storm drain or to a paved area. If downspouts discharge next to the structure onto flatwork or paved areas, the area should be watertight in order to eliminate infiltration next to the building.

7.2 Additional Design Considerations

The following information has been assimilated after examination of numerous projects constructed in active soils throughout the area. It is presented here for your convenience. If these features are incorporated in the overall design of the project, the performance of the structure should be improved.

- Special consideration should be given to completion items outside the building area, such as stairs, sidewalks, signs, etc. They should be adequately designed to sustain the potential vertical movements mentioned in the report.

- Roof drainage should be collected by a system of gutters and downspouts and transmitted away from the structure where the water can drain away without entering the building subgrade.

- Sidewalks should not be structurally connected to the building. They should be sloped away from the building so that water will drain away from the structure.

- The paving and the general ground surface should be sloped away from the building on all sides so that water will always drain away from the structure. Water should not be allowed to pond near the building after the slab has been placed.

- Trees and deep rooted shrubs <u>should not</u> be used as landscaping around the structure perimeter as the root systems can lead to desiccation of the subgrade soils. Any existing trees or trees to be planted should be at a distance from the building such that the building will not fall within the drip line of the mature plants (usually one to one-and-one-half times the mature height of the tree). If existing tree removal is not an acceptable option, a vertical root barrier, extending to a minimum depth of 4 feet, should be constructed around the perimeter of the foundation in proximity to the area described above.

- Every attempt should be made to limit the extreme wetting or drying of the subsurface soils since swelling and shrinkage will result. Standard construction practices of providing good surface water drainage should be used. A positive slope of the ground away from the foundation should be provided to carry off the run-off water both during and after construction.

- Backfill for utility lines or along the perimeter beams should consist of on-site material so that they will be stable. If the backfill is too dense or too dry, swelling may form a mound along the ditch line. If the backfill is too loose or too wet, settlement may form a sink along the ditch line. Either case is undesirable since several inches of movement is possible and floor cracks are likely to result. The soils should be processed using the previously discussed compaction criteria.

- Provide irrigation systems away from the edge of the foundation such that any leakage of said systems will not cause undue localized moisture gain below the slab.

- Utility line details and fixtures must consider the potential for differential movement beneath any piping. In conjunction with a structural slab all underground utility lines should be isolated from expansive clays. A similar 10-inch void is recommended between the utility bottom and underlying clay soils. This prevents the utility lines from uplifting into the suspended slab.

8.0 EARTHWORK

8.1 Site Preparation

The project site should be stripped of vegetation, roots, old construction debris, and other organic material. It is estimated that the depth of stripping will be on the order of 4 to 6 inches. The actual stripping depth should be based on field observations with particular attention given to old drainage areas, uneven topography, and excessively wet soils. The stripped areas should be observed to determine if additional excavation is required to remove weak or otherwise objectionable materials that would adversely affect the fill placement or other construction activities.

The subgrade should be firm and able to support the construction equipment without displacement. Soft or yielding subgrade should be corrected and made stable before construction proceeds. The subgrade should be proof rolled to detect soft spots, which if exist, should be excavated to provide a firm and otherwise suitable subgrade. Proof rolling should be performed using a heavy pneumatic tired roller, loaded dump truck, or similar piece of equipment (minimum 25 tons). The proof rolling operations should be observed by the project geotechnical engineer or his/her representative.

The on-site soils are suitable for use in general site grading. Imported fill material should be clean soil with a Liquid Limit less than 50 and no rock greater than 4 inches in maximum dimension. The fill materials should be free of vegetation and debris.

8.2 Placement and Compaction

Fill material should be placed in loose lifts not exceeding 8 inches in uncompacted thickness. The uncompacted lift thickness should be reduced to 4 inches for structure backfill zones requiring hand-operated power compactors or small self-propelled compactors. The fill material should be uniform with respect to material type and moisture content. Clods and chunks of material should be broken down and the fill material mixed by disking, blading, or plowing, as necessary, so that a material of uniform moisture and density is obtained for each lift. Water required for sprinkling to bring the fill material to the proper moisture content should be applied evenly through each layer.

The fill material should be compacted to a density ranging from 95 to 100 percent of maximum dry density as determined by ASTM D 698, Standard Proctor. In conjunction with the compacting operation, the fill material should be brought to the proper moisture content. The moisture content

for general earth fill should range from 2 percentage points below optimum to 5 percentage points above optimum (-2 to +5). These ranges of moisture contents are given as maximum recommended ranges. For some soils and under some conditions, the contractor may have to maintain a more narrow range of moisture content (within the recommended range) in order to consistently achieve the recommended density.

Field density tests should be taken as each lift of fill material is placed. As a guide, one field density test per lift for each 5,000 square feet of compacted area is recommended. For small areas or critical areas the frequency of testing may need to be increased to one test per 2,500 square feet. A minimum of 2 tests per lift should be required. The earthwork operations should be observed and tested on a continuing basis by an experienced geotechnician working in conjunction with the project geotechnical engineer.

Each lift should be compacted, tested, and approved before another lift is added. The purpose of the field density tests is to provide some indication that uniform and adequate compaction is being obtained. The actual quality of the fill, as compacted, should be the responsibility of the contractor and satisfactory results from the tests should not be considered as a guarantee of the quality of the contractor's filling operations.

8.3 Trench Backfill

Trench backfill for pipelines or other utilities should be properly placed and compacted. Overly dense or dry backfill can swell and create a mound along the completed trench line. Loose or wet backfill can settle and form a depression along the completed trench line. Distress to overlying structures, pavements, etc. is likely if heaving or settlement occurs. On-site soil fill material is recommended for trench backfill. Care should be taken not to use free draining granular material, to prevent the backfilled trench from becoming a french drain and piping surface or subsurface water beneath structures, pipelines, or pavements. If a higher class bedding material is required for the pipelines, a lean concrete bedding will limit water intrusion into the trench and will not require compaction after placement. The soil backfill should be placed in approximately 4- to 6-inch loose lifts. The density and moisture content should be as recommended for fill in Section 8.2, Placement and Compaction, of this report. A minimum of one field density test should be taken per lift for each 150 linear feet of trench, with a minimum of 2 tests per lift.

8.4 Excavation

The side slopes of excavations through the overburden soils should be made in such a manner to provide for their stability during construction. Existing structures, pipelines or other facilities, which are constructed prior to or during the currently proposed construction and which require excavation, should be protected from loss of end bearing or lateral support.

Temporary construction slopes and/or permanent embankment slopes should be protected from surface runoff water. Site grading should be designed to allow drainage at planned areas where erosion protection is provided, instead of allowing surface water to flow down unprotected slopes.

Trench safety recommendations are beyond the scope of this report. The contractor must comply with all applicable safety regulations concerning trench safety and excavations including, but not limited to, OSHA regulations.

8.5 Acceptance of Imported Fill

Any soil imported from off-site sources should be tested for compliance with the recommendations for the particular application and approved by the project geotechnical engineer prior to the materials being used. The owner should also require the contractor to obtain a written, notarized certification from the landowner of each proposed off-site soil borrow source stating that to the best of the landowner's knowledge and belief there has never been contamination of the borrow source site with hazardous or toxic materials. The certification should be furnished to the owner prior to proceeding to furnish soils to the site. Soil materials derived from the excavation of underground petroleum storage tanks should not be used as fill on this project.

8.6 Soil Corrosion Potential

Specific testing for soil corrosion potential was not included in the scope of this study. However, based upon past experience on other projects in the vicinity, the soils at this site may be corrosive. Standard construction practices for protecting metal pipe and similar facilities in contact with these soils should be used.

8.7 Erosion and Sediment Control

All disturbed areas should be protected from erosion and sedimentation during construction, and all permanent slopes and other areas subject to erosion or sedimentation should be provided with permanent erosion and sediment control facilities. All applicable ordinances and codes regarding erosion and sediment control should be followed.

9.0 CONSTRUCTION OBSERVATIONS

In any geotechnical investigation, the design recommendations are based on a limited amount of information about the subsurface conditions. In the analysis, the geotechnical engineer must assume the subsurface conditions are similar to the conditions encountered in the borings. However, quite often during construction anomalies in the subsurface conditions are revealed. Therefore, it is recommended that CMJ Engineering, Inc. be retained to observe earthwork and foundation installation and perform materials evaluation during the construction phase of the project. This enables the geotechnical engineer to stay abreast of the project and to be readily available to evaluate unanticipated conditions, to conduct additional tests if required and, when necessary, to recommend alternative solutions to unanticipated conditions. Until these construction phase services are performed by the project geotechnical engineer, the recommendations contained in this report on such items as final foundation bearing elevations, proper soil moisture condition, and other such subsurface related recommendations should be considered as preliminary.

It is proposed that construction phase observation and materials testing commence by the project geotechnical engineer at the outset of the project. Experience has shown that the most suitable method for procuring these services is for the owner or the owner's design engineers to contract directly with the project geotechnical engineer. This results in a clear, direct line of communication between the owner and the owner's design engineers and the geotechnical engineer.

10.0 REPORT CLOSURE

The boring logs shown in this report contain information related to the types of soil encountered at specific locations and times and show lines delineating the interface between these materials. The logs also contain our field representative's interpretation of conditions that are believed to exist in those depth intervals between the actual samples taken. Therefore, these boring logs contain both

factual and interpretive information. Laboratory soil classification tests were also performed on samples from selected depths in the borings. The results of these tests, along with visual-manual procedures were used to generally classify each stratum. Therefore, it should be understood that the classification data on the logs of borings represent visual estimates of classifications for those portions of each stratum on which the full range of laboratory soil classification tests were not performed. It is not implied that these logs are representative of subsurface conditions at other locations and times.

With regard to ground-water conditions, this report presents data on ground-water levels as they were observed during the course of the field work. In particular, water level readings have been made in the borings at the times and under conditions stated in the text of the report and on the boring logs. It should be noted that fluctuations in the level of the ground-water table can occur with passage of time due to variations in rainfall, temperature and other factors. Also, this report does not include quantitative information on rates of flow of ground water into excavations, on pumping capacities necessary to dewater the excavations, or on methods of dewatering excavations. Unanticipated soil conditions at a construction site are commonly encountered and cannot be fully predicted by mere soil samples, test borings or test pits. Such unexpected conditions frequently require that additional expenditures be made by the owner to attain a properly designed and constructed project. Therefore, provision for some contingency fund is recommended to accommodate such potential extra cost.

The analyses, conclusions and recommendations contained in this report are based on site conditions as they existed at the time of our field investigation and further on the assumption that the exploratory borings are representative of the subsurface conditions throughout the site; that is, the subsurface conditions everywhere are not significantly different from those disclosed by the borings at the time they were completed. If, during construction, different subsurface conditions from those encountered in our borings are observed, or appear to be present in excavations, we must be advised promptly so that we can review these conditions and reconsider our recommendations where necessary. If there is a substantial lapse of time between submission of this report and the start of the work at the site, if conditions have changed due either to natural causes or to construction operations at or adjacent to the site, or if structure locations, structural loads or finish grades are changed, we urge that we be promptly informed and retained to review our report to determine the

applicability of the conclusions and recommendations, considering the changed conditions and/or time lapse.

Further, it is urged that CMJ Engineering, Inc. be retained to review those portions of the plans and specifications for this particular project that pertain to earthwork and foundations as a means to determine whether the plans and specifications are consistent with the recommendations contained in this report. In addition, we are available to observe construction, particularly the compaction of structural fill, or backfill and the construction of foundations as recommended in the report, and such other field observations as might be necessary.

The scope of our services did not include any environmental assessment or investigation for the presence or absence of wetlands or hazardous or toxic materials in the soil, surface water, ground water or air, on or below or around the site.

This report has been prepared for use in developing an overall design concept. Paragraphs, statements, test results, boring logs, diagrams, etc. should not be taken out of context, nor utilized without a knowledge and awareness of their intent within the overall concept of this report. The reproduction of this report, or any part thereof, supplied to persons other than the owner, should indicate that this study was made for design purposes only and that verification of the subsurface conditions for purposes of determining difficulty of excavation, trafficability, etc. are responsibilities of the contractor.

This report has been prepared for the exclusive use of City of Lake Worth and their consultants for specific application to design of this project only, and not for additions or modifications to the project. The only warranty made by us in connection with the services provided is that we have used that degree of care and skill ordinarily exercised under similar conditions by reputable members of our profession practicing in the same or similar locality. No other warranty, expressed or implied, is made or intended.

* * * *

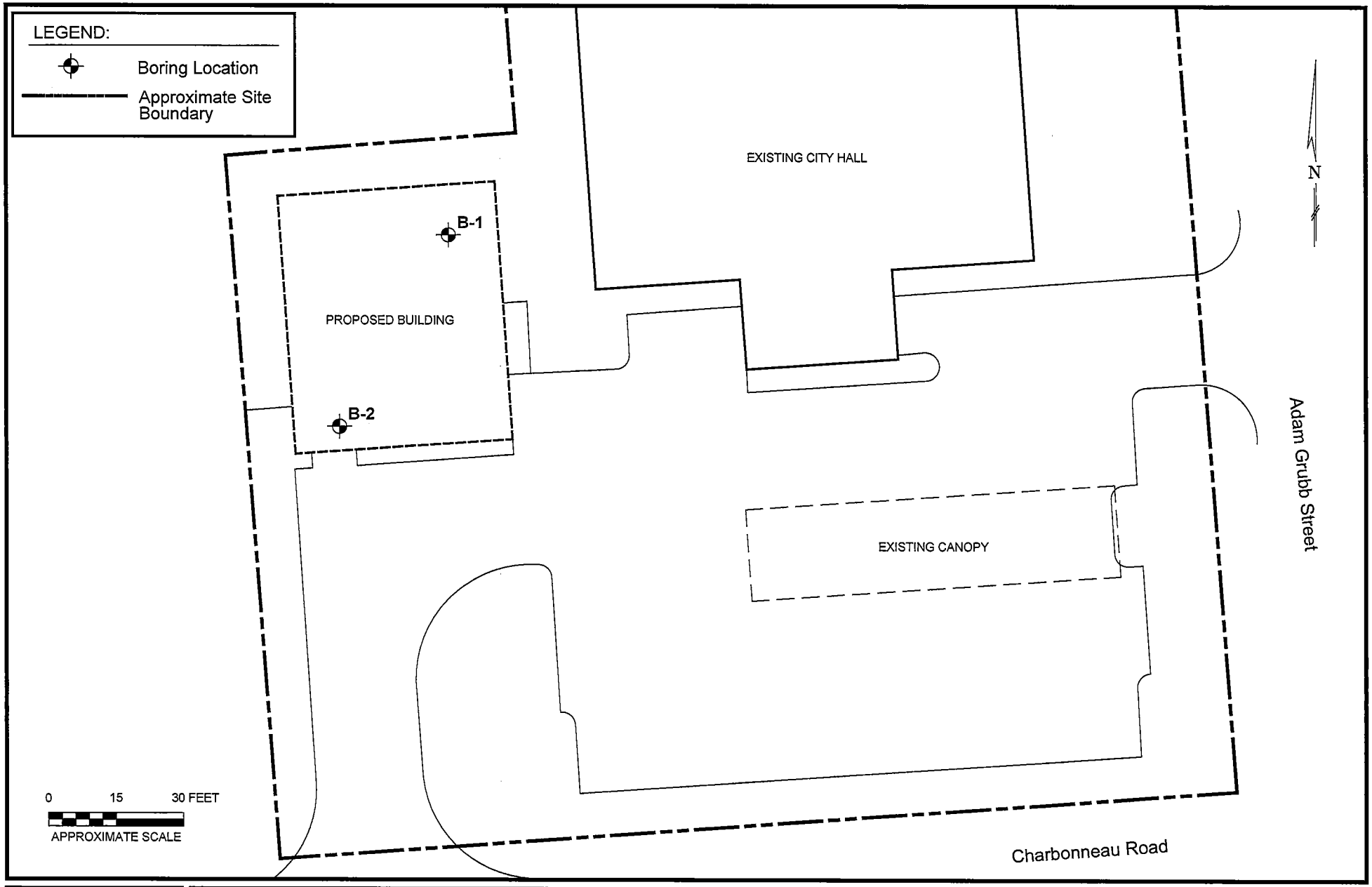


Plate A.1

PLAN OF BORINGS

Record Storage Building
Lake Worth, Texas

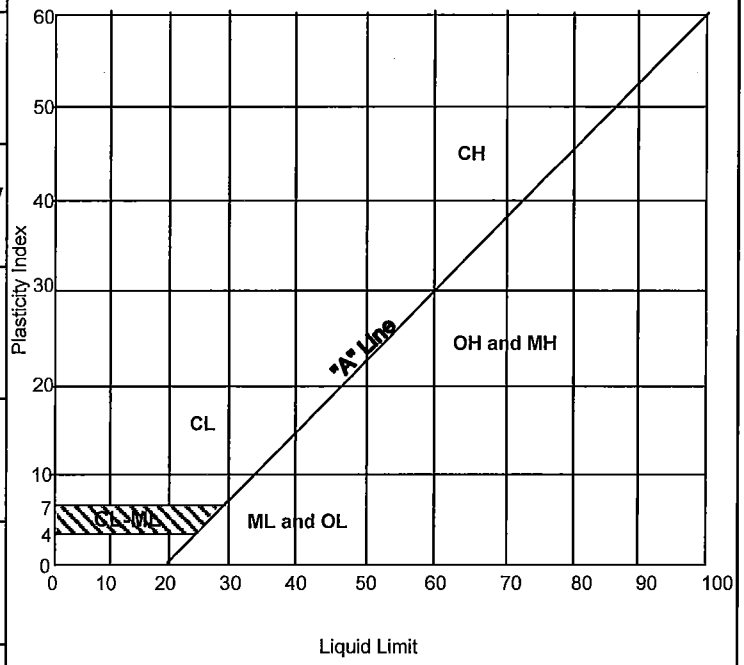
CMJ ENGINEERING, INC.

CMJ Project No. 419-18-04

Major Divisions			Grp. Sym.	Typical Names	Laboratory Classification Criteria	
Coarse-grained soils (more than half of the material is larger than No. 200 sieve size)	Gravels (More than half of coarse fraction is larger than No. 4 sieve size)	Clean gravels (Little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4: $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	
			GP	Poorly graded gravels, gravel sand mixtures, little or no fines	Not meeting all gradation requirements for GW	
		Gravels with fines (Appreciable amount of fines)	GM	Silty gravels, gravel-sand-silt mixtures	Liquid and Plastic limits below "A" line or P.I. greater than 4	Liquid and plastic limits plotting in hatched zone between 4 and 7 are borderline cases requiring use of dual symbols
			GC	Clayey gravels, gravel-sand-clay mixtures	Liquid and Plastic limits above "A" line with P.I. greater than 7	
	Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (Little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 6: $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	
			SP	Poorly graded sands; gravelly sands, little or no fines	Not meeting all gradation requirements for SW	
		Sands with fines (Appreciable amount of fines)	SM	Silty sands, sand-silt mixtures	Liquid and Plastic limits below "A" line or P.I. less than 4	Liquid and plastic limits plotting between 4 and 7 are borderline cases requiring use of dual symbols
			SC	Clayey sands, sand-clay mixtures	Liquid and Plastic limits above "A" line with P.I. greater than 7	
Fine-grained soils (More than half of material is smaller than No. 200 sieve)	Silts and clays (Liquid limit less than 50)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity		
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, and lean clays		
			OL	Organic silts and organic silty clays of low plasticity		
	Silts and clays (Liquid limit greater than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts		
			CH	Inorganic clays of high plasticity, fat clays		
			OH	Organic clays of medium to high plasticity, organic silts		
	Highly Organic soils		Pt	Peat and other highly organic soils		

Determine percentages of sand and gravel from grain size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 percent.....GW, GP, SW, SP
More than 12 percent.....GM, GC, SM, SC
5 to 12 percent.....*Borderline* cases requiring dual symbols



Plasticity Chart

UNIFIED SOIL CLASSIFICATION SYSTEM **PLATE A.2**

SOIL OR ROCK TYPES

GRAVEL	LEAN CLAY	LIMESTONE	Shelby Tube	Auger	Split Spoon
SAND	SANDY	SHALE	Rock Core	Cone Pen	No Recovery
SILT	SILTY	SANDSTONE			
HIGHLY PLASTIC CLAY	CLAYEY	CONGLOMERATE			

TERMS DESCRIBING CONSISTENCY, CONDITION, AND STRUCTURE OF SOIL

Fine Grained Soils (More than 50% Passing No. 200 Sieve)

Descriptive Item	Penetrometer Reading, (tsf)
Soft	0.0 to 1.0
Firm	1.0 to 1.5
Stiff	1.5 to 3.0
Very Stiff	3.0 to 4.5
Hard	4.5+

Coarse Grained Soils (More than 50% Retained on No. 200 Sieve)

Penetration Resistance (blows/foot)	Descriptive Item	Relative Density
0 to 4	Very Loose	0 to 20%
4 to 10	Loose	20 to 40%
10 to 30	Medium Dense	40 to 70%
30 to 50	Dense	70 to 90%
Over 50	Very Dense	90 to 100%

Soil Structure

Calcareous	Contains appreciable deposits of calcium carbonate; generally nodular
Slickensided	Having inclined planes of weakness that are slick and glossy in appearance
Laminated	Composed of thin layers of varying color or texture
Fissured	Containing cracks, sometimes filled with fine sand or silt
Interbedded	Composed of alternate layers of different soil types, usually in approximately equal proportions

TERMS DESCRIBING PHYSICAL PROPERTIES OF ROCK

Hardness and Degree of Cementation

Very Soft or Plastic	Can be remolded in hand; corresponds in consistency up to very stiff in soils
Soft	Can be scratched with fingernail
Moderately Hard	Can be scratched easily with knife; cannot be scratched with fingernail
Hard	Difficult to scratch with knife
Very Hard	Cannot be scratched with knife
Poorly Cemented or Friable	Easily crumbled
Cemented	Bound together by chemically precipitated material; Quartz, calcite, dolomite, siderite, and iron oxide are common cementing materials.

Degree of Weathering

Unweathered	Rock in its natural state before being exposed to atmospheric agents
Slightly Weathered	Noted predominantly by color change with no disintegrated zones
Weathered	Complete color change with zones of slightly decomposed rock
Extremely Weathered	Complete color change with consistency, texture, and general appearance approaching soil

KEY TO CLASSIFICATION AND SYMBOLS **PLATE A.3**

CMJ ENGINEERING INC.

Project No.	Boring No.	Project
419-18-04	B-1	Record Storage Building Lake Worth, Texas

Location	Water Observations
See Plate A.1	Dry during drilling; dry at completion

Completion Depth	Completion Date	Surface Elevation	Type
25.0'	10-12-18		B-47, w/ CFA

Depth, Ft.	Symbol	Samples	Stratum Description	REC %	RQD %	Blows/Ft. or Pen Reading, T.S.F.	Passing No 200 Sieve, %	Liquid Limit, %	Plastic Limit, %	Plasticity Index	Moisture Content, %	Unit Dry Wt. Lbs./Cu. Ft.	Unconfined Compression Pounds/Sq. Ft.
			CRUSHED ASPHALT, 5 inches thick			2.5		35	13	22	19		
			SILTY CLAY, dark brown and dark reddish brown, w/ occasional calcareous nodules, stiff (FILL)			2.0					23	97	1950
						3.0					22		
			SILTY CLAY, brown and reddish brown, w/ occasional calcareous nodules, calcareous deposits and gravel, very stiff to hard (FILL)			4.0					13		
						4.5+					9		
5			-w/ abundant limestone fragments and pebbles below 4'										
			-w/ light reddish brown below 7'			4.5+		36	12	24	13		
			LIMESTONE, tan, w/ clay seams, hard to very hard										
						100/1.25"							
10													
						100/0.875"							
15													
			-w/ light gray limestone seams below 17.5'										
						100/0.375"							
20			LIMESTONE, gray, very hard										
						100/0.375"							
25													

LOG OF BORING NO. B-1

PLATE A.4

LOG OF BORING 419-18-04.GPJ CMJ.GDT 10/31/18

CMJ ENGINEERING INC.

Project No.	Boring No.	Project
419-18-04	B-2	Record Storage Building Lake Worth, Texas

Location	Water Observations
See Plate A.1	Dry during drilling; dry at completion

Completion Depth	Completion Date
25.0'	10-12-18

Surface Elevation

Type: B-47, w/ CFA

Depth, Ft.	Symbol	Samples	Stratum Description	REC %	RQD %	Blows/Ft. or Pen Reading, T.S.F.	Passing No 200 Sieve, %	Liquid Limit, %	Plastic Limit, %	Plasticity Index	Moisture Content, %	Unit Dry Wt. Lbs./Cu. Ft.	Unconfined Compression Pounds/Sq. Ft.
			SILTY CLAY, dark brown and dark reddish brown, w/ gravel, very stiff (FILL)			4.25					14		
						3.0					22		
			CLAY, dark brown, dark reddish brown and reddish brown, w/ occasional calcareous nodules and deposits, stiff to very stiff (FILL)			2.25					22	104	4150
						2.5		56	16	40	22	104	
			-w/ ironstone nodules above 2'			4.5+					15		
5			-w/ iron stains 3' to 4'										
			-w/ abundant gravel below 4'										
			LIMESTONE, tan, w/ clay seams, hard										
						100/1.75"							
10													
						100/1.125"							
15													
			LIMESTONE, gray, very hard										
						100/0.375"							
20													
						100/0.375"							
25													

LOG OF BORING NO. B-2

PLATE A.5

LOG OF BORING 419-18-04.GPJ CMJ.GDT 10/31/18

FREE SWELL TEST RESULTS

Project: Record Storage Building
Lake Worth, Texas

Project No.: 419-18-04

Boring No.	Depth Interval (ft.)	Sample Description	Liquid Limit	Plastic Limit	Plasticity Index	Moisture Content %		Percent Swell (%)
			LL	PL	PI	Initial	Final	
B – 2	3 – 4	Clay	56	16	40	22.2	22.3	0.0

Free swell tests performed at approximate overburden pressure

SECTION 01 1000
SUMMARY

PART 1 GENERAL

1.01 PROJECT

A. Project Name: Lake Worth Record Storage

B. Architect's Name: Oxley Williams Tharp Architects, PLLC..

C. The Project consists of the construction of a new Storage Building and parking area modifications.

1.02 CONTRACT DESCRIPTION

A. Contract Type: A single prime contract based on Guaranteed Maximum Price as described in Document 00 5200 - Agreement Form.

1.03 OWNER OCCUPANCY

A. Owner intends to continue to occupy the adjacent existing building during the entire construction period.

B. Owner intends to occupy the Project upon Substantial Completion.

C. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.

D. Schedule the Work to accommodate Owner occupancy.

1.04 CONTRACTOR USE OF SITE AND PREMISES

A. Arrange use of site and premises to allow:
   1. Owner occupancy.
   2. Work by Others.

B. Provide access to and from site as required by law and by Owner:
   1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
   2. Do not obstruct roadways, sidewalks, or other public ways without permit.

C. Time Restrictions:
   1. Limit conduct of especially noisy exterior work to the hours of 9 am to 3 pm on weekdays or as otherwise mandated by the City of Lake Worth and/or neighboring residential areas.
   2. Limit conduct of the hours of construction to those mandated by the City of lake Worth.

D. Utility Outages and Shutdown:
   1. Limit disruption of utility services to hours the building is unoccupied.
   2. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days notice to Owner and authorities having jurisdiction.
   3. Prevent accidental disruption of utility services to other facilities.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 2000
PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedures for preparation and submittal of applications for progress payments.

B. Documentation of changes in Contract Sum and Contract Time.

C. Change procedures.

D. Procedures for preparation and submittal of application for final payment.

1.02 RELATED REQUIREMENTS

A. Section 00 5000 - Contracting Forms and Supplements: Forms to be used.

B. Section 01 2200 - Unit Prices: Monetary values of unit prices; Payment and modification procedures relating to unit prices.

1.03 SCHEDULE OF VALUES

A. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Architect for approval.

B. Forms filled out by hand will not be accepted.

C. Submit Schedule of Values in duplicate within 15 days after date of Owner-Contractor Agreement.

D. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification section. Identify site mobilization.

E. Revise schedule to list approved Change Orders, with each Application For Payment.

1.04 APPLICATIONS FOR PROGRESS PAYMENTS

A. Payment Period: Submit at intervals stipulated in the Agreement.

B. Use Form AIA G702 and Form AIA G703, edition stipulated in the Agreement.

C. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.

D. Forms filled out by hand will not be accepted.

E. For each item, provide a column for listing each of the following:
   1. Item Number.
   2. Description of work.
   3. Scheduled Values.
   4. Previous Applications.
   5. Work in Place and Stored Materials under this Application.
   6. Authorized Change Orders.
   7. Total Completed and Stored to Date of Application.
   8. Percentage of Completion.
   9. Balance to Finish.
   10. Retainage.

F. Execute certification by signature of authorized officer.

G. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of work.

H. Submit one electronic and three hard-copies of each Application for Payment.

I. Include the following with the application:
   1. Transmittal letter as specified for submittals in Section 01 3000.
   2. Construction progress schedule, revised and current as specified in Section 01 3000.
   3. Current construction photographs specified in Section 01 3000.

4. Partial release of liens from major subcontractors and vendors.
5. Affidavits attesting to off-site stored products.

J. When Architect requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.

1.05 MODIFICATION PROCEDURES

A. For minor changes not involving an adjustment to the Contract Sum or Contract Time, Architect will issue instructions directly to Contractor.

B. For other required changes, Architect will issue a document signed by Owner instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
   1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
   2. Promptly execute the change.

C. For changes for which advance pricing is desired, Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within 3 days.

D. Contractor may propose a change by submitting a request for change to Architect, describing the proposed change and its full effect on the work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation. Document any requested substitutions in accordance with Section 01 6000.

E. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
   1. For pre-determined unit prices and quantities, the amount will based on the fixed unit prices.

F. Substantiation of Costs: Provide full information required for evaluation.
   1. On request, provide the following data:
      a. Quantities of products, labor, and equipment.
      b. Taxes, insurance, and bonds.
      c. Overhead and profit.
      d. Justification for any change in Contract Time.
      e. Credit for deletions from Contract, similarly documented.
   2. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.

1.06 APPLICATION FOR FINAL PAYMENT

A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.

B. Application for Final Payment will not be considered until the following have been accomplished:
   1. All closeout procedures specified in Section 01 7000.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 2100
ALLOWANCES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cash allowances.

B. Contingency allowance.

C. Payment and modification procedures relating to allowances.

1.02 RELATED REQUIREMENTS

A. Section 01 2000 - Price and Payment Procedures: Additional payment and modification procedures.

1.03 CASH ALLOWANCES

A. Architect Responsibilities:
   1. Consult with Contractor for consideration and selection of products, suppliers, and installers.
   2. Select products in consultation with Owner and transmit decision to Contractor.

B. Contractor Responsibilities:
   1. Assist Architect in selection of products, suppliers, and installers.
   2. Obtain proposals from suppliers and installers and offer recommendations.
   3. On notification of which products have been selected, execute purchase agreement with designated supplier and installer.
   4. Arrange for and process shop drawings, product data, and samples. Arrange for delivery.
   5. Promptly inspect products upon delivery for completeness, damage, and defects. Submit claims for transportation damage.

C. Differences in costs will be adjusted by Change Order.

1.04 CONTINGENCY ALLOWANCE

A. Contractor's costs for products, delivery, installation, labor, insurance, payroll, taxes, bonding, equipment rental, overhead and profit will be included in Change Orders authorizing expenditure of funds from this Contingency Allowance.

B. Funds will be drawn from the Contingency Allowance only by Change Order.

C. At closeout of Contract, funds remaining in Contingency Allowance will be credited to Owner by Change Order.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 2500
SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedural requirements for proposed substitutions.

1.02 RELATED REQUIREMENTS

A. Section 00 2113 - Instructions to Bidders: Restrictions on timing of substitution requests.

B. Section 00 4325 - Substitution Request Form - During Procurement: Required form for substitution requests made prior to award of contract (During procurement).

C. Section 00 6325 - Substitution Request Form - During Construction: Required form for substitution requests made after award of contract (During construction).

1.03 DEFINITIONS

A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
   2. Agrees to provide the same warranty for the substitution as for the specified product.
   3. Agrees to provide same or equivalent maintenance service and source of replacement parts, as applicable.
   4. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
   5. Waives claims for additional costs or time extension that may subsequently become apparent.
   6. Agrees to reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.

B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.

C. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.

D. Limit each request to a single proposed substitution item.

3.02 RESOLUTION

A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.

B. Architect will notify Contractor in writing of decision to accept or reject request.
   1. Architect's decision following review of proposed substitution will be noted on the submitted form.

3.03 ACCEPTANCE

A. Accepted substitutions change the work of the Project. They will be documented and incorporated into work of the project by Change Order, Construction Change Directive, Architectural Supplementary Instructions, or similar instruments provided for in the Conditions of the Contract.

3.04 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. Include completed Substitution Request Forms as part of the Project record. Include both approved and rejected Requests.

END OF SECTION

SECTION 01 3000
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General administrative requirements.

B. Electronic document submittal service.

C. Preconstruction meeting.

D. Site mobilization meeting.

E. Progress meetings.

F. Construction progress schedule.

G. Contractor's daily reports.

H. Progress photographs.

I. Submittals for review, information, and project closeout.

J. Number of copies of submittals.

K. Requests for Interpretation (RFI) procedures.

L. Submittal procedures.

1.02 RELATED REQUIREMENTS

A. Section 00 7200 - General Conditions: Dates for applications for payment.

B. Section 00 7200 - General Conditions: Duties of the Construction Manager.

C. Section 01 7000 - Execution and Closeout Requirements: Additional coordination requirements.

D. Section 01 7800 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.

1.03 REFERENCE STANDARDS

A. AIA G716 - Request for Information; 2004.

B. AIA G810 - Transmittal Letter; 2001.

1.04 GENERAL ADMINISTRATIVE REQUIREMENTS

A. Conform to requirements of Section 01 7000 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.

B. Make the following types of submittals to Architect:
   1. Requests for Interpretation (RFI).
   2. Requests for substitution.
   3. Shop drawings, product data, and samples.
   4. Test and inspection reports.
   5. Design data.
   6. Manufacturer's instructions and field reports.
   7. Applications for payment and change order requests.
   8. Progress schedules.
   9. Coordination drawings.
   10. Correction Punch List and Final Correction Punch List for Substantial Completion.
   11. Closeout submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 ELECTRONIC DOCUMENT SUBMITTAL SERVICE

A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF, MS Word, or MS Excel) format, as appropriate to the document, and transmitted via an

Internet-based submittal service that receives, logs and stores documents, provides electronic stamping and signatures, and notifies addressees via email.

1. Besides submittals for review, information, and closeout, this procedure applies to Requests for Interpretation (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.
2. Contractor and Architect are required to use this service.
3. It is Contractor's responsibility to submit documents in allowable format.
4. Subcontractors, suppliers, and Architect's consultants are to be permitted to use the service at no extra charge.
5. Users of the service need an email address, internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat, www.adobe.com, or Bluebeam PDF Revu, www.bluebeam.com), unless such software capability is provided by the service provider.
6. Paper document transmittals will not be reviewed; emailed electronic documents will not be reviewed.
7. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.

B. Cost: The cost of the service is to be paid by Contractor; include the cost of the service in the Contract Sum.

C. Submittal Service: The selected service is:
   1. Submittal Exchange (tel: 1-800-714-0024): www.submittalexchange.com/#sle.
   2. Newforma Project Cloud: www.newformaprojectcloud.com/#sle.

D. Training: One, one-hour, web-based training session will be arranged for all participants, with representatives of Architect and Contractor participating; further training is the responsibility of the user of the service.

E. Project Closeout: Architect will determine when to terminate the service for the project and is responsible for obtaining archive copies of files for Owner.

3.02 PRECONSTRUCTION MEETING

A. Schedule meeting after Notice of Award.

B. Attendance Required:
   1. Owner.
   2. Architect.
   3. Contractor.

C. Agenda:
   1. Execution of Owner-Contractor Agreement.
   2. Submission of executed bonds and insurance certificates.
   3. Distribution of Contract Documents.
   4. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
   5. Designation of personnel representing the parties to Contract, _____ and Architect.
   6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
   7. Scheduling.

D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.03 SITE MOBILIZATION MEETING

A. Schedule meeting at the Project site prior to Contractor occupancy.

B. Attendance Required:

1. Contractor.
2. Owner.
3. Architect.
4. Contractor's superintendent.
5. Major subcontractors.

C. Agenda:
1. Use of premises by Owner and Contractor.
2. Owner's requirements.
3. Construction facilities and controls provided by Owner.
4. Temporary utilities provided by Owner.
5. Survey and building layout.
6. Security and housekeeping procedures.
7. Schedules.
8. Application for payment procedures.
9. Procedures for testing.
10. Procedures for maintaining record documents.
11. Requirements for start-up of equipment.
12. Inspection and acceptance of equipment put into service during construction period.

D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.04 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the Work at maximum bi-monthly intervals.

B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

C. Attendance Required:
1. Contractor.
2. Owner.
3. Architect.
4. Contractor's superintendent.
5. Major subcontractors.

D. Agenda:
1. Review minutes of previous meetings.
2. Review of work progress.
3. Field observations, problems, and decisions.
4. Identification of problems that impede, or will impede, planned progress.
5. Review of submittals schedule and status of submittals.
6. Review of RFIs log and status of responses.
7. Maintenance of progress schedule.
8. Corrective measures to regain projected schedules.
9. Planned progress during succeeding work period.
10. Maintenance of quality and work standards.
11. Effect of proposed changes on progress schedule and coordination.
12. Other business relating to work.

E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.05 CONSTRUCTION PROGRESS SCHEDULE

A. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of Work, with a general outline for remainder of Work.

B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
   1. Include written certification that major contractors have reviewed and accepted proposed schedule.

D. Within 10 days after joint review, submit complete schedule.

E. Submit updated schedule with each Application for Payment.

3.06 PROGRESS PHOTOGRAPHS

A. Submit photographs with each application for payment, taken not more than 3 days prior to submission of application for payment.

B. Maintain one set of all photographs at project site for reference; same copies as submitted, identified as such.

C. Photography Type: Digital; electronic files.

D. Provide photographs of site and construction throughout progress of work produced by an experienced photographer, acceptable to Architect.

E. In addition to periodic, recurring views, take photographs of each of the following events:
   1. Completion of site clearing.
   2. Excavations in progress.
   3. Foundations in progress and upon completion.
   4. Structural framing in progress and upon completion.
   5. Enclosure of building, upon completion.
   6. Final completion, minimum of ten (10) photos.

F. Views:
   1. Provide non-aerial photographs from four cardinal views at each specified time, until date of Substantial Completion.
   2. Consult with Architect for instructions on views required.
   3. Provide factual presentation.
   4. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.

G. Digital Photographs: 24 bit color, minimum resolution of 1024 by 768, in JPG format; provide files unaltered by photo editing software.
   1. Delivery Medium: Via email.
   2. File Naming: Include project identification, date and time of view, and view identification.
   3. PDF File: Assemble all photos into printable pages in PDF format, with 2 to 3 photos per page, each photo labeled with file name; one PDF file per submittal.

3.07 SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:
   1. Product data.
   2. Shop drawings.
   3. Samples for selection.
   4. Samples for verification.

B. Submit to Architect for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.

C. Samples will be reviewed for aesthetic, color, or finish selection.

D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 7800 - Closeout Submittals.

3.08 SUBMITTALS FOR INFORMATION

A. When the following are specified in individual sections, submit them for information:
   1. Design data.

2. Certificates.
3. Test reports.
4. Inspection reports.
5. Manufacturer's instructions.
6. Manufacturer's field reports.
7. Other types indicated.

B. Submit for Architect's knowledge as contract administrator or for Owner.

3.09 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit Correction Punch List for Substantial Completion.

B. Submit Final Correction Punch List for Substantial Completion.

C. When the following are specified in individual sections, submit them at project closeout in conformance to requirements of Section 01 7800 - Closeout Submittals:
1. Project record documents.
2. Operation and maintenance data.
3. Warranties.
4. Bonds.
5. Other types as indicated.

D. Submit for Owner's benefit during and after project completion.

3.10 NUMBER OF COPIES OF SUBMITTALS

A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.

B. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
1. After review, produce duplicates.
2. Retained samples will not be returned to Contractor unless specifically so stated.

3.11 SUBMITTAL PROCEDURES

A. General Requirements:
1. Use a separate transmittal for each item.
2. Submit separate packages of submittals for review and submittals for information, when included in the same specification section.
3. Sequentially identify each item. For revised submittals use original number and a sequential numerical suffix.
4. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
5. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
   a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.
6. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
7. Schedule submittals to expedite the Project, and coordinate submission of related items.
   a. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.
   b. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional 7 days.
8. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
9. Provide space for Contractor and Architect review stamps.
10. When revised for resubmission, identify all changes made since previous submission.

11. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
12. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.

B. Product Data Procedures:
1. Submit only information required by individual specification sections.
2. Collect required information into a single submittal.
3. Submit concurrently with related shop drawing submittal.
4. Do not submit (Material) Safety Data Sheets for materials or products.

C. Shop Drawing Procedures:
1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting the Contract Documents and coordinating related work.
2. Do not reproduce the Contract Documents to create shop drawings.
3. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.

D. Samples Procedures:
1. Transmit related items together as single package.
2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.

E. Shop Drawing Procedures:
1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting the Contract Documents and coordinating related Work.
2. Do not reproduce the Contract Documents to create shop drawings.
3. Generic, non-project specific information submitted as shop drawings do not meet the requirements for shop drawings.

F. Transmit each submittal with a copy of approved submittal form.

G. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetic suffix.

H. Identify Project, Contractor, Subcontractor or supplier; pertinent drawing and detail number, and specification section number, as appropriate on each copy.

I. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents.

J. Schedule submittals to expedite the Project, and coordinate submission of related items.

K. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.

L. Identify variations from Contract Documents and Product or system limitations that may be detrimental to successful performance of the completed Work.

M. Provide space for Contractor and Architect review stamps.

N. When revised for resubmission, identify all changes made since previous submission.

O. Distribute reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.

P. Submittals not requested will not be recognized or processed.

3.12 SUBMITTAL REVIEW

A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.

B. Submittals for Information: Architect will acknowledge receipt and review. See below for actions to be taken.

C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.

D. Architect's and consultants' actions on items submitted for review:
   1. Authorizing purchasing, fabrication, delivery, and installation:
      a. "Approved", or language with same legal meaning.
      b. "Approved as Noted, Resubmission not required", or language with same legal meaning.
         1) At Contractor's option, submit corrected item, with review notations acknowledged and incorporated.
      c. "Approved as Noted, Resubmit for Record", or language with same legal meaning.
   2. Not Authorizing fabrication, delivery, and installation:
      a. "Revise and Resubmit".
         1) Resubmit revised item, with review notations acknowledged and incorporated.
         2) Non-responsive resubmittals may be rejected.
      b. "Rejected".
         1) Submit item complying with requirements of Contract Documents.

E. Architect's and consultants' actions on items submitted for information:
   1. Items for which no action was taken:
      a. "Received" - to notify the Contractor that the submittal has been received for record only.
   2. Items for which action was taken:
      a. "Reviewed" - no further action is required from Contractor.

END OF SECTION

SECTION 01 3216
CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preliminary schedule.

B. Construction progress schedule, bar chart type.

1.02 REFERENCE STANDARDS

A. AGC (CPSM) - Construction Planning and Scheduling Manual; 2004.

1.03 SUBMITTALS

A. Within 10 days after date of Agreement, submit preliminary schedule.

B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.

1. Include written certification that major contractors have reviewed and accepted proposed schedule.

D. Within 10 days after joint review, submit complete schedule.

E. Submit updated schedule with each Application for Payment.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRELIMINARY SCHEDULE

A. Prepare preliminary schedule in the form of a horizontal bar chart.

3.02 BAR CHARTS

A. Include a separate bar for each major portion of Work or operation.

B. Identify the first work day of each week.

3.03 UPDATING SCHEDULE

A. Maintain schedules to record actual start and finish dates of completed activities.

B. Indicate progress of each activity to date of revision, with projected completion date of each activity.

C. Annotate diagrams to graphically depict current status of Work.

D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.

E. Indicate changes required to maintain Date of Substantial Completion.

F. Submit reports required to support recommended changes.

3.04 DISTRIBUTION OF SCHEDULE

A. Distribute copies of updated schedules to Contractor's project site file, to subcontractors, suppliers, Architect, Owner, and other concerned parties.

B. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

END OF SECTION

SECTION 01 3553
SECURITY PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Security measures including entry control, personnel identification, and miscellaneous restrictions.

1.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: use of premises and occupancy.

B. Section 01 5000 - Temporary Facilities and Controls: Temporary lighting.

1.03 SECURITY PROGRAM

A. Protect Work, existing premises and Owner's operations from theft, vandalism, and unauthorized entry.

B. Initiate program in coordination with Owner's existing security system at project mobilization.

C. Maintain program throughout construction period until Owner occupancy.

1.04 ENTRY CONTROL

A. Restrict entrance of persons and vehicles into Project site and existing facilities.

B. Allow entrance only to authorized persons with proper identification.

C. Maintain log of workers and visitors, make available to Owner on request.

1.05 PERSONNEL IDENTIFICATION

A. Provide identification badge to each person authorized to enter premises.

B. Badge To Include: Personal photograph, name, assigned number, expiration date and employer.

C. Maintain a list of accredited persons, submit copy to Owner on request.

D. Require return of badges at expiration of their employment on the Work.

1.06 RESTRICTIONS

A. Do no work on Sundays.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 4000
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittals.

B. Quality assurance.

C. References and standards.

D. Testing and inspection agencies and services.

E. Control of installation.

F. Tolerances.

G. Defect Assessment.

1.02 RELATED REQUIREMENTS

A. Document 00 7200 - General Conditions: Inspections and approvals required by public authorities.

B. Section 01 3000 - Administrative Requirements: Submittal procedures.

C. Section 01 4216 - Definitions.

D. Section 01 6000 - Product Requirements: Requirements for material and product quality.

1.03 REFERENCE STANDARDS

A. IAS AC89 - Accreditation Criteria for Testing Laboratories; 2010.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents, or for Owner's information.

C. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.

1. Include:
   a. Date issued.
   b. Project title and number.
   c. Name of inspector.
   d. Date and time of sampling or inspection.
   e. Identification of product and specifications section.
   f. Location in the Project.
   g. Type of test/inspection.
   h. Date of test/inspection.
   i. Results of test/inspection.
   j. Conformance with Contract Documents.
   k. When requested by Architect, provide interpretation of results.
2. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents, or for Owner's information.

D. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.

1. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.

E. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

F. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.
   1. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the Contract Documents.

1.05 QUALITY ASSURANCE

A. Testing Agency Qualifications:
   1. Prior to start of work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
   2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
   3. Qualification Statement: Provide documentation showing testing laboratory is accredited under IAS AC89.

1.06 REFERENCES AND STANDARDS

A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.

C. Obtain copies of standards where required by product specification sections.

D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.

F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.07 TESTING AND INSPECTION AGENCIES AND SERVICES

A. Owner will employ and pay for services of an independent testing agency to perform other specified testing.

B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Have Work performed by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

3.03 TESTING AND INSPECTION

A. See individual specification sections for testing and inspection required.

B. Testing Agency Duties:
   1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
   2. Perform specified sampling and testing of products in accordance with specified standards.
   3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   4. Promptly notify Architect and Contractor of observed irregularities or non-conformance of Work or products.
   5. Perform additional tests and inspections required by Architect.
   6. Submit reports of all tests/inspections specified.

C. Limits on Testing/Inspection Agency Authority:
   1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Agency may not approve or accept any portion of the Work.
   3. Agency may not assume any duties of Contractor.
   4. Agency has no authority to stop the Work.

D. Contractor Responsibilities:
   1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
   2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
   3. Provide incidental labor and facilities:
      a. To provide access to Work to be tested/inspected.
      b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
      c. To facilitate tests/inspections.
      d. To provide storage and curing of test samples.
   4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
   5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
   6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

E. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Architect.

F. Re-testing required because of non-conformance to specified requirements shall be paid for by Contractor.

3.04 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not conforming to specified requirements.

END OF SECTION

SECTION 01 4216
DEFINITIONS

PART 1 GENERAL

1.01 SUMMARY

A. Other definitions are included in individual specification sections.

1.02 DEFINITIONS

A. Furnish: To supply, deliver, unload, and inspect for damage.

B. Install: To unpack, assemble, erect, apply, place, finish, cure, protect, clean, start up, and make ready for use.

C. Product: Material, machinery, components, equipment, fixtures, and systems forming the work result. Not materials or equipment used for preparation, fabrication, conveying, or erection and not incorporated into the work result. Products may be new, never before used, or re-used materials or equipment.

D. Provide: To furnish and install.

E. Supply: Same as Furnish.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 5000
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary utilities.

B. Temporary telecommunications services.

C. Temporary sanitary facilities.

D. Temporary Controls: Barriers, enclosures, and fencing.

E. Vehicular access and parking.

F. Waste removal facilities and services.

G. Project identification sign.

H. Field offices.

1.02 RELATED REQUIREMENTS

A. Section 01 5100 - Temporary Utilities.

B. Section 01 5213 - Field Offices and Sheds.

C. Section 01 5500 - Vehicular Access and Parking.

D. Section 01 5813 - Temporary Project Signage.

1.03 TEMPORARY UTILITIES - SEE SECTION 01 5100

A. Provide all electrical power, lighting, water, heating and cooling, and ventilation required for construction purposes.

B. Existing facilities may not be used.

C. New permanent facilities may be used.

1.04 TELECOMMUNICATIONS SERVICES

A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.

B. Telecommunications services shall include:
   1. Windows-based personal computer dedicated to project telecommunications, with necessary software and laser printer.
   2. Internet Connections: Minimum of one; DSL modem or faster.

1.05 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.

B. Maintain daily in clean and sanitary condition.

1.06 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.

C. Provide protection for plants designated to remain. Replace damaged plants.

D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.07 FENCING

A. Provide 6 foot (1.8 m) high fence around construction site; equip with vehicular and pedestrian gates with locks. Or as otherwise mandated by the Town of Groton.

1.08 SECURITY - SEE SECTION 01 3553

A. Provide security and facilities to protect Work, and Owner's operations from unauthorized entry, vandalism, or theft.

1.09 VEHICULAR ACCESS AND PARKING - SEE SECTION 01 5500

A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.

B. Coordinate access and haul routes with governing authorities and Owner.

C. Provide and maintain access to fire hydrants, free of obstructions.

D. Provide means of removing mud from vehicle wheels before entering streets.

E. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

1.10 WASTE REMOVAL

A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.

B. Provide containers with lids. Remove trash from site periodically.

C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.11 PROJECT SIGNS - SEE SECTION 01 5813

1.12 PROJECT IDENTIFICATION

A. Provide project identification sign of design, construction, and location approved by Owner.

B. No other signs are allowed without Owner permission except those required by law.

1.13 FIELD OFFICES - SEE SECTION 01 5213

A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack, and drawing display table.

B. Provide space for Project meetings, with table and chairs to accommodate 6 persons.

C. Locate offices a minimum distance of 30 feet (10 m) from existing and new structures.

1.14 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.

B. Remove underground installations to a minimum depth of 2 feet (600 mm). Grade site as indicated.

C. Clean and repair damage caused by installation or use of temporary work.

D. Restore new permanent facilities used during construction to specified condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 5100
TEMPORARY UTILITIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary Utilities: Provision of electricity, lighting, heat, ventilation, and water.

1.02 RELATED REQUIREMENTS

A. Section 01 5000 - Temporary Facilities and Controls:
   1. Temporary telecommunications services for administrative purposes.
   2. Temporary sanitary facilities required by law.

1.03 REFERENCE STANDARDS

A. 29 CFR 1926 - U.S. Occupational Safety and Health Standards; current edition.

1.04 TEMPORARY ELECTRICITY

A. Cost: By Owner.

B. Provide power service required from utility source.

C. Connect to Owner's existing power service.
   1. Exercise measures to conserve energy.

D. Provide temporary electric feeder from existing building electrical service at location as directed.

E. Complement existing power service capacity and characteristics as required.

F. Provide power outlets for construction operations, with branch wiring and distribution boxes located at each floor. Provide flexible power cords as required.

G. Provide main service disconnect and over-current protection at convenient location and meter.

H. Permanent convenience receptacles may be utilized during construction.

I. Provide adequate distribution equipment, wiring, and outlets to provide single phase branch circuits for power and lighting.

1.05 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

A. Provide and maintain incandescent lighting for construction operations to achieve a minimum lighting level of 2 watt/sq ft (to achieve a minimum lighting level of 21 watt/sq m).

B. Provide and maintain 1 watt/sq ft (10.8 watt/sq m) lighting to exterior staging and storage areas after dark for security purposes.

C. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.

D. Maintain lighting and provide routine repairs.

E. Permanent building lighting may be utilized during construction.

1.06 TEMPORARY HEATING

A. Cost of Energy: By Owner.

B. Provide heating devices and heat as needed to maintain specified conditions for construction operations.

C. Maintain minimum ambient temperature of 50 degrees F (10 degrees C) in areas where construction is in progress, unless indicated otherwise in specifications.

D. Existing facilities shall not be used.

1.07 TEMPORARY COOLING

A. Cost of Energy: By Owner.

B. Provide cooling devices and cooling as needed to maintain specified conditions for construction operations.

C. Maintain maximum ambient temperature of 80 degrees F (26 degrees C) in areas where construction is in progress, unless indicated otherwise in specifications.

D. Existing facilities shall not be used.

E. Prior to operation of permanent equipment for temporary cooling purposes, verify that installation is approved for operation, equipment is lubricated and filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.

1.08 TEMPORARY WATER SERVICE

A. Cost of Water Used: By Owner.

B. Provide and maintain suitable quality water service for construction operations at time of project mobilization.

C. Connect to existing water source.
   1. Exercise measures to conserve water.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 5213
FIELD OFFICES AND SHEDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary field offices for use of Contractor.

1.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: use of premises and responsibility for providing field offices.

B. Section 01 5000 - Temporary Facilities and Controls:
   1. Temporary telecommunications services for administrative purposes.
   2. Temporary sanitary facilities required by law.

1.03 USE OF EXISTING FACILITIES

A. Existing facilities shall not be used for field offices.

1.04 USE OF PERMANENT FACILITIES

A. When permanent facilities are enclosed with operable utilities, relocate offices into building, with written agreement of Owner, and remove temporary buildings.

PART 2 PRODUCTS

2.01 CONSTRUCTION

A. Construction: Structurally sound, secure, weather tight enclosures for office. Maintain during progress of Work; remove when no longer needed.

B. Lighting for Offices: 50 fc (538 lx) at desk top height, exterior lighting at entrance doors.

C. Fire Extinguishers: Appropriate type fire extinguisher at each office.

2.02 ENVIRONMENTAL CONTROL

A. Heating, Cooling, and Ventilating: Automatic equipment to maintain comfort conditions.

2.03 CONTRACTOR OFFICE AND FACILITIES

A. Size: For Contractor's needs and to provide space for project meetings.

B. Furnishings in Meeting Area: Conference table and chairs to seat at least eight persons; racks and files for Contract Documents, submittals, and project record documents.

C. Equipment: Two adjustable band protective helmets for visitors, one 10 inch (250 mm) outdoor weather thermometer and protective eyewear and safety vests.

PART 3 EXECUTION

3.01 PREPARATION

A. Fill and grade sites for temporary structures to provide drainage away from buildings.

3.02 INSTALLATION

A. Install office spaces ready for occupancy 15 days after date fixed in Notice to Proceed.

3.03 MAINTENANCE AND CLEANING

A. Maintain approach walks free of mud, water, and snow.

3.04 REMOVAL

A. At completion of Work remove buildings, foundations, utility services, and debris. Restore areas.

END OF SECTION

SECTION 01 5500
VEHICULAR ACCESS AND PARKING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Access roads.

B. Parking.

C. Permanent pavements and parking facilities.

D. Construction parking controls.

E. Traffic signs and signals.

F. Maintenance.

G. Removal, repair.

H. Mud from site vehicles.

1.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: For access to site, work sequence, and occupancy.

B. Section 01 5813 - Temporary Project Signage: Post Mounted and Wall Mounted Traffic Control and Informational Signs.

C. Section 31 2200 - Grading: Specifications for earthwork and paving bases.

PART 2 PRODUCTS

2.01 MATERIALS

A. Temporary Construction: Contractor's option.

B. Materials for Permanent Construction: As specified in product specification sections, including earthwork, paving base, and topping.

2.02 SIGNS, SIGNALS, AND DEVICES

A. Post Mounted and Wall Mounted Traffic Control and Informational Signs: Specified in Section 01 5813 - Temporary Project Signage.

B. Automatic Traffic Control Signals: As approved by local jurisdictions.

C. Traffic Cones and Drums, Flares and Lights: As approved by local jurisdictions.

PART 3 EXECUTION

3.01 PREPARATION

A. Clear areas, provide surface and storm drainage of road, parking, area premises, and adjacent areas.

3.02 ACCESS ROADS

A. Use of existing on-site streets and driveways for construction traffic is permitted.

B. Tracked vehicles not allowed on paved areas.

C. Construct new temporary all-weather access roads from public thoroughfares to serve construction area, of a width and load bearing capacity to provide unimpeded traffic for construction purposes.

D. Extend and relocate as work progress requires, provide detours as necessary for unimpeded traffic flow.

E. Provide unimpeded access for emergency vehicles. Maintain 20 foot (6 m) width driveways with turning space between and around combustible materials.

F. Provide and maintain access to fire hydrants free of obstructions.

3.03 PARKING

A. Arrange for temporary parking areas to accommodate use of construction personnel.

B. When site space is not adequate, provide additional off-site parking.

C. Locate as approved by Architect.

3.04 PERMANENT PAVEMENTS AND PARKING FACILITIES

A. Avoid traffic loading beyond paving design capacity. Tracked vehicles not allowed.

3.05 CONSTRUCTION PARKING CONTROL

A. Control vehicular parking to prevent interference with public traffic and parking, access by emergency vehicles, and Owner's operations.

B. Monitor parking of construction personnel's vehicles in existing facilities. Maintain vehicular access to and through parking areas.

C. Prevent parking on or adjacent to access roads or in non-designated areas.

3.06 TRAFFIC SIGNS AND SIGNALS

A. At approaches to site and on site, install at crossroads, detours, parking areas, and elsewhere as needed to direct construction and affected public traffic.

B. Relocate as work progresses, to maintain effective traffic control.

3.07 MAINTENANCE

A. Maintain traffic and parking areas in a sound condition free of excavated material, construction equipment, products, mud, snow, and ice.

B. Maintain existing paved areas used for construction; promptly repair breaks, potholes, low areas, standing water, and other deficiencies, to maintain paving and drainage in original, or specified, condition.

3.08 REMOVAL, REPAIR

A. Repair existing facilities damaged by use, to original condition.

B. Remove equipment and devices when no longer required.

C. Repair damage caused by installation.

3.09 MUD FROM SITE VEHICLES

A. Provide means of removing mud from vehicle wheels before entering streets.

END OF SECTION

SECTION 01 5713

TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Prevention of erosion due to construction activities.

B. Prevention of sedimentation of waterways, open drainage ways, and storm and sanitary sewers due to construction activities.

C. Restoration of areas eroded due to insufficient preventive measures.

D. Performance bond.

E. Compensation of Owner for fines levied by authorities having jurisdiction due to non-compliance by Contractor.

1.02 RELATED REQUIREMENTS

A. Section 31 2200 - Grading: Temporary and permanent grade changes for erosion control.

B. Section 32 1123 - Aggregate Base Courses: Temporary and permanent roadways.

C. Section 32 9219 - Seeding: Permanent turf for erosion control.

D. Section 32 9223 - Sodding: Permanent turf for erosion control.

E. Section 32 9300 - Plants: Permanent plantings for erosion control.

F. Section 03 3000 - Cast-in-Place Concrete: Concrete for temporary and permanent erosion control structures indicated on drawings.

1.03 REFERENCE STANDARDS

A. ASTM D4355/D4355M - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus; 2014.

B. ASTM D4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity; 1999a (Reapproved 2014).

C. ASTM D4533 - Standard Test Method for Trapezoid Tearing Strength of Geotextiles; 2011.

D. ASTM D4632/D4632M - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles; 2015a.

E. ASTM D4751 - Standard Test Method for Determining Apparent Opening Size of a Geotextile; 2012.

F. ASTM D4873 - Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples; 2002 (Reapproved 2009).

G. EPA (NPDES) - National Pollutant Discharge Elimination System (NPDES), Construction General Permit; Current Edition.

1.04 PERFORMANCE REQUIREMENTS

A. Comply with requirements of EPA (NPDES) for erosion and sedimentation control, as specified by the NPDES, for Phases I and II, and in compliance with requirements of Construction General Permit (CGP), whether the project is required by law to comply or not.

B. Also comply with all more stringent requirements of State of Connecticut Erosion and Sedimentation Control Manual.

C. Develop and follow an Erosion and Sedimentation Prevention Plan and submit periodic inspection reports.

D. Do not begin clearing, grading, or other work involving disturbance of ground surface cover until applicable permits have been obtained; furnish all documentation required to obtain applicable permits.

E. Provide to Owner a Performance Bond covering erosion and sedimentation preventive measures only, in an amount equal to 100 percent of the cost of erosion and sedimentation control work.

F. Timing: Put preventive measures in place as soon as possible after disturbance of surface cover and before precipitation occurs.

G. Storm Water Runoff: Control increased storm water runoff due to disturbance of surface cover due to construction activities for this project.
   1. Prevent runoff into storm and sanitary sewer systems, including open drainage channels, in excess of actual capacity or amount allowed by authorities having jurisdiction, whichever is less.
   2. Anticipate runoff volume due to the most extreme short term and 24-hour rainfall events that might occur in 25 years.

H. Erosion On Site: Minimize wind, water, and vehicular erosion of soil on project site due to construction activities for this project.
   1. Control movement of sediment and soil from temporary stockpiles of soil.
   2. Prevent development of ruts due to equipment and vehicular traffic.
   3. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.

I. Erosion Off Site: Prevent erosion of soil and deposition of sediment on other properties caused by water leaving the project site due to construction activities for this project.
   1. Prevent windblown soil from leaving the project site.
   2. Prevent tracking of mud onto public roads outside site.
   3. Prevent mud and sediment from flowing onto sidewalks and pavements.
   4. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.

J. Sedimentation of Waterways On Site: Prevent sedimentation of waterways on the project site, including wetlands, rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
   1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.
   2. If sediment basins are used as temporary preventive measures, pump dry and remove deposited sediment after each storm.

K. Sedimentation of Waterways Off Site: Prevent sedimentation of waterways off the project site, including wetlands, rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
   1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.

L. Open Water: Prevent standing water that could become stagnant.

M. Maintenance: Maintain temporary preventive measures until permanent measures have been established.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Erosion and Sedimentation Control Plan:
   1. Submit within 2 weeks after Notice to Proceed.
   2. Include:
      a. Site plan identifying soils and vegetation, existing erosion problems, and areas vulnerable to erosion due to topography, soils, vegetation, or drainage.
      b. Site plan showing grading; new improvements; temporary roads, traffic accesses, and other temporary construction; and proposed preventive measures.

c. Where extensive areas of soil will be disturbed, include storm water flow and volume calculations, soil loss predictions, and proposed preventive measures.
d. Schedule of temporary preventive measures, in relation to ground disturbing activities.
e. Other information required by law.
f. Format required by law is acceptable, provided any additional information specified is also included.

3. Obtain the approval of the Plan by authorities having jurisdiction.
4. Obtain the approval of the Plan by Owner.

C. Certificate: Mill certificate for silt fence fabric attesting that fabric and factory seams comply with specified requirements, signed by legally authorized official of manufacturer; indicate actual minimum average roll values; identify fabric by roll identification numbers.

D. Inspection Reports: Submit report of each inspection; identify each preventive measure, indicate condition, and specify maintenance or repair required and accomplished.

E. Maintenance Instructions: Provide instructions covering inspection and maintenance for temporary measures that must remain after Substantial Completion.

PART 2 PRODUCTS

2.01 MATERIALS

A. Grass Seed For Temporary Cover: Select a species appropriate to climate, planting season, and intended purpose. If same area will later be planted with permanent vegetation, do not use species known to be excessively competitive or prone to volunteer in subsequent seasons.

B. Bales: Air dry, rectangular straw bales.
1. Cross Section: 14 by 18 inches (350 by 450 mm), minimum.
2. Bindings: Wire or string, around long dimension.

C. Bale Stakes: One of the following, minimum 3 feet (1 m) long:
1. Steel U- or T-section, with minimum mass of 1.33 lb per linear foot (1.98 kg per linear m).
2. Wood, 2 by 2 inches (50 by 50 mm) in cross section.

D. Silt Fence Fabric: Polypropylene geotextile resistant to common soil chemicals, mildew, and insects; non-biodegradable; in longest lengths possible; fabric including seams with the following minimum average roll lengths:
1. Average Opening Size: 30 U.S. Std. Sieve (0.600 mm), maximum, when tested in accordance with ASTM D4751.
2. Permittivity: 0.05 sec^-1, minimum, when tested in accordance with ASTM D4491.
3. Ultraviolet Resistance: Retaining at least 70 percent of tensile strength, when tested in accordance with ASTM D4355/D4355M after 500 hours exposure.
4. Tensile Strength: 100 lb-f (450 N), minimum, in cross-machine direction; 124 lb-f (550 N), minimum, in machine direction; when tested in accordance with ASTM D4632/D4632M.
5. Elongation: 15 to 30 percent, when tested in accordance with ASTM D4632/D4632M.
6. Tear Strength: 55 lb-f (245 N), minimum, when tested in accordance with ASTM D4533.
7. Color: Manufacturer's standard, with embedment and fastener lines preprinted.

E. Silt Fence Posts: One of the following, minimum 5 feet (1500 mm) long:
1. Steel U- or T-section, with minimum mass of 1.33 lb per linear foot (1.98 kg per linear m).

F. Gravel: See Section 32 1123 for aggregate.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine site and identify existing features that contribute to erosion resistance; maintain such existing features to greatest extent possible.

3.02 PREPARATION

A. Schedule work so that soil surfaces are left exposed for the minimum amount of time.

3.03 SCOPE OF PREVENTIVE MEASURES

A. In all cases, if permanent erosion resistant measures have been installed temporary preventive measures are not required.

B. Construction Entrances: Traffic-bearing aggregate surface.
   1. Width: As required; 12 feet (___ m), minimum.
   2. Length: 50 feet (16 m), minimum.
   3. Provide at each construction entrance from public right-of-way.
   4. Where necessary to prevent tracking of mud onto right-of-way, provide wheel washing area out of direct traffic lane, with drain into sediment trap or basin.

C. Linear Sediment Barriers: Made of silt fences.
   1. Provide linear sediment barriers:
      a. Along downhill perimeter edge of disturbed areas, including soil stockpiles.
   2. Space sediment barriers with the following maximum slope length upslope from barrier:
      a. Slope of Less Than 2 Percent: 100 feet (30 m)..
      b. Slope Between 2 and 5 Percent: 75 feet (23 m).
      c. Slope Between 5 and 10 Percent: 50 feet (15 m).
      d. Slope Between 10 and 20 Percent: 25 feet (7.5 m).
      e. Slope Over 20 Percent: 15 feet (4.5 m).

D. Storm Drain Curb Inlet Sediment Trap: Protect each curb inlet using one of the following measures:
   1. Filter fabric wrapped around hollow concrete blocks blocking entire inlet face area; use one piece of fabric wrapped at least 1-1/2 times around concrete blocks and secured to prevent dislodging; orient cores of blocks so runoff passes into inlet.

E. Storm Drain Drop Inlet Sediment Traps: As detailed on drawings.

F. Temporary Splash Pads: Stone aggregate over filter fabric; size to suit application; provide at downspout outlets and storm water outlets.

G. Soil Stockpiles: Protect using one of the following measures:
   1. Cover with polyethylene film, secured by placing soil on outer edges.
   2. Cover with mulch at least 4 inches (100 mm) thickness of pine needles, sawdust, bark, wood chips, or shredded leaves, or 6 inches (150 mm) of straw or hay.

H. Mulching: Use only for areas that may be subjected to erosion for less than 6 months.

I. Temporary Seeding: Use where temporary vegetated cover is required.

3.04 INSTALLATION

A. Traffic-Bearing Aggregate Surface:
   1. Excavate minimum of 6 inches (150 mm).
   2. Place geotextile fabric full width and length, with minimum 12 inch (300 mm) overlap at joints.
   3. Place and compact at least 6 inches (150 mm) of 1.5 to 3.5 inch (40 to 90 mm) diameter stone.

B. Silt Fences:
   1. Store and handle fabric in accordance with ASTM D4873.
   2. Reference Civil Drawings.

C. Straw Bale Rows:
   1. Reference Civil Drawings.

D. Temporary Seeding:
   1. When hydraulic seeder is used, seedbed preparation is not required.
   2. When surface soil has been sealed by rainfall or consists of smooth undisturbed cut slopes, and conventional or manual seeding is to be used, prepare seedbed by scarifying sufficiently to allow seed to lodge and germinate.

3. If temporary mulching was used on planting area but not removed, apply nitrogen fertilizer at 1 pound per 1000 sq ft (0.5 kg per 100 sq m).
4. On soils of very low fertility, apply 10-10-10 fertilizer at rate of 12 to 16 pounds per 1000 sq ft (6 to 8 kg per 100 sq m).
5. Incorporate fertilizer into soil before seeding.
6. Apply seed uniformly; if using drill or cultipacker seeders place seed 1/2 to 1 inch (12 to 25 mm) deep.
7. Irrigate as required to thoroughly wet soil to depth that will ensure germination, without causing runoff or erosion.
8. Repeat irrigation as required until grass is established.

3.05 MAINTENANCE

A. Inspect preventive measures weekly, within 24 hours after the end of any storm that produces 0.5 inches (13 mm) or more rainfall at the project site, and daily during prolonged rainfall.

B. Repair deficiencies immediately.

C. Silt Fences:
1. Promptly replace fabric that deteriorates unless need for fence has passed.
2. Remove silt deposits that exceed one-third of the height of the fence.
3. Repair fences that are undercut by runoff or otherwise damaged, whether by runoff or other causes.

D. Straw Bale Rows:
1. Promptly replace bales that fall apart or otherwise deteriorate unless need has passed.
2. Remove silt deposits that exceed one-half of the height of the bales.
3. Repair bale rows that are undercut by runoff or otherwise damaged, whether by runoff or other causes.

E. Clean out temporary sediment control structures weekly and relocate soil on site.

F. Place sediment in appropriate locations on site; do not remove from site.

3.06 CLEAN UP

A. Remove temporary measures after permanent measures have been installed, unless permitted to remain by Architect.

B. Clean out temporary sediment control structures that are to remain as permanent measures.

C. Where removal of temporary measures would leave exposed soil, shape surface to an acceptable grade and finish to match adjacent ground surfaces.

END OF SECTION

SECTION 01 5813
TEMPORARY PROJECT SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project identification sign.

1.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Responsibility to provide signs.

1.03 REFERENCE STANDARDS

A. FHWA (SHS) - Standard Highway Signs; Federal Highway Administration; 2004.

1.04 QUALITY ASSURANCE

A. Finishes, Painting: Adequate to withstand weathering, fading, and chipping for duration of construction.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Shop Drawing: Show content, layout, lettering, color, foundation, structure, sizes and grades of members.

PART 2 PRODUCTS

2.01 SIGN MATERIALS

A. Structure and Framing: New, wood, structurally adequate.

B. Sign Surfaces: Exterior grade plywood with medium density overlay, minimum 3/4 inch (19 mm) thick, standard large sizes to minimize joints.

C. Rough Hardware: Galvanized.

2.02 PROJECT IDENTIFICATION SIGN

A. One painted sign, 48 sq ft (4.5 sq m) area, bottom 6 feet (2 m) above ground.

B. Content:
   1. Project number, title, logo and name of Owner as indicated on Contract Documents.
   2. Names and titles of Architect.
   3. Name of Contractor .

PART 3 EXECUTION

3.01 INSTALLATION

A. Install project identification sign within 30 days after date fixed by Notice to Proceed.

B. Erect supports and framing on secure foundation, rigidly braced and framed to resist wind loadings.

C. Install sign surface plumb and level, with butt joints. Anchor securely.

D. Paint exposed surfaces of sign, supports, and framing.

3.02 MAINTENANCE

A. Maintain signs and supports clean, repair deterioration and damage.

3.03 REMOVAL

A. Remove signs, framing, supports, and foundations at completion of Project and restore the area.

END OF SECTION

SECTION 01 6000
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General product requirements.

B. Re-use of existing products.

C. Transportation, handling, storage and protection.

D. Product option requirements.

E. Substitution limitations.

F. Procedures for Owner-supplied products.

G. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

A. Section 01 2500 - Substitution Procedures: Substitutions made during and after the Bidding/Negotiation Phase.

B. Section 01 4000 - Quality Requirements: Product quality monitoring.

C. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions: Requirements for VOC-restricted product categories.

1.03 REFERENCE STANDARDS

A. 16 CFR 260.13 - Guides for the Use of Environmental Marketing Claims; Federal Trade Commission; Recycled Content; Current Edition.

B. ASTM D6866 - Standard Test Methods for Determining the Biobased Content of Solid, Liquid, and Gaseous Samples Using Radiocarbon Analysis; 2012.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
   1. Submit within 15 days after date of Agreement.
   2. For products specified only by reference standards, list applicable reference standards.

B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

C. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

D. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
   1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by the Contract Documents.

B. Unforeseen historic items encountered remain the property of the Owner; notify Owner promptly upon discovery; protect, remove, handle, and store as directed by Owner.

2.02 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by the Contract Documents.

B. DO NOT USE products having any of the following characteristics:
   1. Made using or containing CFC's or HCFC's.
   2. Containing lead, cadmium, asbestos.

C. Where all other criteria are met, Contractor shall give preference to products that:
   1. If used on interior, have lower emissions, as defined in Section 01 6116.
   2. If wet-applied, have lower VOC content, as defined in Section 01 6116.
   3. Are extracted, harvested, and/or manufactured closer to the location of the project.
   4. Have longer documented life span under normal use.
   5. Result in less construction waste.
   6. Are made of recycled materials.
   7. If made of wood, are made of sustainably harvested wood, wood chips, or wood fiber.
   8. Have a published GreenScreen Chemical Hazard Analysis.

2.03 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.04 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

A. See Section 01 2500 - Substitution Procedures.

B. Architect will consider requests for substitutions only within 15 days after date of Agreement.

C. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.

D. A request for substitution constitutes a representation that the submitter:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
   2. Agrees to provide the same warranty for the substitution as for the specified product.
   3. Agrees to coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
   4. Waives claims for additional costs or time extension that may subsequently become apparent.

E. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

F. Substitution Submittal Procedure (after contract award):
   1. Submit three copies of request for substitution for consideration. Limit each request to one proposed substitution.
   2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.
   3. Architect will notify Contractor in writing of decision to accept or reject request.

3.02 OWNER-SUPPLIED PRODUCTS

A. Owner's Responsibilities:
   1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
   2. Arrange and pay for product delivery to site.
   3. On delivery, inspect products jointly with Contractor.
   4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
   5. Arrange for manufacturers' warranties, inspections, and service.

B. Contractor's Responsibilities:
   1. Review Owner reviewed shop drawings, product data, and samples.
   2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
   3. Handle, store, install and finish products.
   4. Repair or replace items damaged after receipt.

3.03 TRANSPORTATION AND HANDLING

A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.

B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.

C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

D. Transport and handle products in accordance with manufacturer's instructions.

E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.

H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.04 STORAGE AND PROTECTION

A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.

B. Store and protect products in accordance with manufacturers' instructions.

C. Store with seals and labels intact and legible.

D. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.

E. For exterior storage of fabricated products, place on sloped supports above ground.

F. Provide off-site storage and protection when site does not permit on-site storage or protection.

G. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

H. Comply with manufacturer's warranty conditions, if any.

I. Do not store products directly on the ground.

J. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

K. Prevent contact with material that may cause corrosion, discoloration, or staining.

L. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

M. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

SECTION 01 7000
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Requirements for alterations work, including selective demolition, _____.

C. Pre-installation meetings.

D. Cutting and patching.

E. Surveying for laying out the work.

F. Cleaning and protection.

G. Starting of systems and equipment.

H. Demonstration and instruction of Owner personnel.

I. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.

J. General requirements for maintenance service.

1.02 RELATED REQUIREMENTS

A. Section 01 3000 - Administrative Requirements: Submittals procedures, Electronic document submittal service.

B. Section 01 4000 - Quality Requirements: Testing and inspection procedures.

C. Section 01 5100 - Temporary Utilities: Temporary heating, cooling, and ventilating facilities.

D. Section 01 5713 - Temporary Erosion and Sediment Control: Additional erosion and sedimentation control requirements.

E. Section 01 7800 - Closeout Submittals: Project record documents, operation and maintenance data, warranties and bonds.

F. Section 01 7900 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
   1. On request, submit documentation verifying accuracy of survey work.
   2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in conformance with Contract Documents.
   3. Submit surveys and survey logs for the project record.

C. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
   1. Structural integrity of any element of Project.
   2. Integrity of weather exposed or moisture resistant element.
   3. Efficiency, maintenance, or safety of any operational element.
   4. Visual qualities of sight exposed elements.
   5. Work of Owner or separate Contractor.

D. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.04 QUALIFICATIONS

A. For survey work, employ a land surveyor registered in the State in which the Project is located and acceptable to Architect. Submit evidence of Surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate.

B. For field engineering, employ a professional engineer of the discipline required for specific service on Project, licensed in the State in which the Project is located. Employ only

individual(s) trained and experienced in establishing and maintaining horizontal and vertical control points necessary for laying out construction work on project of similar size, scope and/or complexity.

C. For design of temporary shoring and bracing, employ a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

1.05 PROJECT CONDITIONS

A. Use of explosives is not permitted.

B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

C. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

D. Perform dewatering activities, as required, for the duration of the project.

E. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

F. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.

G. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
   1. Minimize amount of bare soil exposed at one time.
   2. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
   3. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

H. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.

I. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.

J. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.06 COORDINATION

A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Notify affected utility companies and comply with their requirements.

C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

F. Coordinate completion and clean-up of work of separate sections.

G. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 PREINSTALLATION MEETINGS

A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.

B. Require attendance of parties directly affecting, or affected by, work of the specific section.

C. Notify Architect four days in advance of meeting date.

D. Prepare agenda and preside at meeting:
   1. Review conditions of examination, preparation and installation procedures.
   2. Review coordination with related work.

E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.04 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.

B. Promptly notify Architect of any discrepancies discovered.

C. Contractor shall locate and protect survey control and reference points.

D. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

E. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

F. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.

G. Utilize recognized engineering survey practices.

H. Establish a minimum of two permanent bench marks on site, referenced to established control points. Record locations, with horizontal and vertical data, on project record documents.

I. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
   1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
   2. Grid or axis for structures.
   3. Building foundation, column locations, ground floor elevations.

J. Periodically verify layouts by same means.

K. Maintain a complete and accurate log of control and survey work as it progresses.

3.05 GENERAL INSTALLATION REQUIREMENTS

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.06 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 indicated.
   2. Report discrepancies to Architect before disturbing existing installation.
   3. Beginning of alterations work constitutes acceptance of existing conditions.

B. Remove existing work as indicated and as required to accomplish new work.
   1. Remove items indicated on drawings.
   2. Relocate items indicated on drawings.
   3. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
   4. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.

C. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
   2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
   3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
      a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
      b. Provide temporary connections as required to maintain existing systems in service.

4. Verify that abandoned services serve only abandoned facilities.
5. 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; patch holes left by removal using materials specified for new construction.

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.

E. Adapt existing work to fit new work: Make as neat and smooth transition as possible.

F. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.

G. Refinish existing surfaces as indicated:
1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.

H. Clean existing systems and equipment.

I. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.

J. Do not begin new construction in alterations areas before demolition is complete.

K. Comply with all other applicable requirements of this section.

3.07 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. See Alterations article above for additional requirements.

C. Perform whatever cutting and patching is necessary to:
1. Complete the work.
2. Fit products together to integrate with other work.
3. Provide openings for penetration of mechanical, electrical, and other services.
4. Match work that has been cut to adjacent work.
5. Repair areas adjacent to cuts to required condition.
6. Repair new work damaged by subsequent work.
7. Remove samples of installed work for testing when requested.
8. Remove and replace defective and non-conforming work.

D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

E. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

G. Restore work with new products in accordance with requirements of Contract Documents.

H. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 8400, to full thickness of the penetrated element.

J. Patching:

1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
2. Match color, texture, and appearance.
3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.08 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.09 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual specification sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

G. Prohibit traffic from landscaped areas.

H. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.10 SYSTEM STARTUP

A. Coordinate schedule for start-up of various equipment and systems.

B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.

C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

D. Verify that wiring and support components for equipment are complete and tested.

E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.

F. 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.

G. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.11 DEMONSTRATION AND INSTRUCTION

A. See Section 01 7900 - Demonstration and Training.

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. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

3.12 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.13 FINAL CLEANING

A. Use cleaning materials that are nonhazardous.

B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

C. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.

D. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

E. Clean filters of operating equipment.

F. Clean debris from roofs, gutters, downspouts, area drains, and drainage systems.

G. Clean site; sweep paved areas, rake clean landscaped surfaces.

H. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.14 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.
   1. Provide copies to Architect.

B. Accompany Owner and Architect on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.

C. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.

D. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.

E. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.

F. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.

G. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.

H. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

3.15 MAINTENANCE

A. Provide service and maintenance of components indicated in specification sections.

B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.

C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.

E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

END OF SECTION

SECTION 01 7800
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project Record Documents.

B. Operation and Maintenance Data.

C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

A. Section 00 7200 - General Conditions and 00 7300 - Supplementary Conditions: Performance bond and labor and material payment bonds, warranty, and correction of work.

B. Section 01 3000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

C. Section 01 7000 - Execution and Closeout Requirements: Contract closeout procedures.

D. Individual Product Sections: Specific requirements for operation and maintenance data.

E. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.

B. Operation and Maintenance Data:
   1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
   2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
   3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
   4. Submit two sets of revised final documents in final form within 10 days after final inspection.

C. Warranties and Bonds:
   1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
   2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
   3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed shop drawings, product data, and samples.
   6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions or alternates utilized.
   3. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
   1. Field changes of dimension and detail.
   2. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA

A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:
   1. Product data, with catalog number, size, composition, and color and texture designations.
   2. Information for re-ordering custom manufactured products.

B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

C. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:
   1. Description of unit or system, and component parts.
   2. Identify function, normal operating characteristics, and limiting conditions.
   3. Include performance curves, with engineering data and tests.
   4. Complete nomenclature and model number of replaceable parts.

B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

C. Include color coded wiring diagrams as installed.

D. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

E. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

F. Provide servicing and lubrication schedule, and list of lubricants required.

G. Include manufacturer's printed operation and maintenance instructions.

H. Include sequence of operation by controls manufacturer.

I. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

J. Additional Requirements: As specified in individual product specification sections.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.

B. Where systems involve more than one specification section, provide separate tabbed divider for each system.

C. Binders: Commercial quality, 8-1/2 by 11 inch (216 by 280 mm) three D side ring binders with durable plastic covers; 2 inch (50 mm) maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants,Contractorand subcontractors, with names of responsible parties.

F. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.

G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.

H. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.

I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

J. Arrangement of Contents: Organize each volume in parts as follows:
   1. Project Directory.
   2. Table of Contents, of all volumes, and of this volume.
   3. Operation and Maintenance Data: Arranged by system, then by product category.
      a. Source data.
      b. Product data, shop drawings, and other submittals.
      c. Operation and maintenance data.
      d. Field quality control data.
      e. Photocopies of warranties and bonds.

3.06 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

E. Manual: Bind in commercial quality 8-1/2 by 11 inch (216 by 279 mm) three D side ring binders with durable plastic covers.

F. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.

G. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.

H. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

END OF SECTION

SECTION 01 7900
DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 SUMMARY

A. Demonstration of products and systems to be commissioned and where indicated in specific specification sections.

B. Training of Owner personnel in operation and maintenance is required for:
   1. All software-operated systems.
   2. HVAC systems and equipment.
   3. Electrical systems and equipment.
   4. Landscape irrigation.

C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:
   1. Roofing, waterproofing, and other weather-exposed or moisture protection products.
   2. Finishes, including flooring, wall finishes, ceiling finishes.

1.02 RELATED REQUIREMENTS

A. Section 01 7800 - Closeout Submittals: Operation and maintenance manuals.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures; except:
   1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Authority.
   2. Submit one copy to the Commissioning Authority, not to be returned.
   3. Make commissioning submittals on time schedule specified by Commissioning Authority.
   4. Submittals indicated as "Draft" are intended for the use of the Commissioning Authority in preparation of overall Training Plan; submit in editable electronic format, Microsoft Word 2003 preferred.

B. Draft Training Plans: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
   1. Submit to Commissioning Authority for review and inclusion in overall training plan.
   2. Submit not less than four weeks prior to start of training.
   3. Revise and resubmit until acceptable.
   4. Provide an overall schedule showing all training sessions.
   5. Include at least the following for each training session:
      a. Identification, date, time, and duration.
      b. Description of products and/or systems to be covered.
      c. Name of firm and person conducting training; include qualifications.
      d. Intended audience, such as job description.
      e. Objectives of training and suggested methods of ensuring adequate training.
      f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
      g. Media to be used, such a slides, hand-outs, etc.
      h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.

C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
   1. Include applicable portion of O&M manuals.
   2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
   3. Provide one extra copy of each training manual to be included with operation and maintenance data.

1.04 QUALITY ASSURANCE

A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
   1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
   2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.

B. Demonstrations conducted during Functional Testing need not be repeated unless Owner personnel training is specified.

C. Demonstration may be combined with Owner personnel training if applicable.

D. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.
   2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

E. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

A. Commissioning Authority will prepare the Training Plan based on draft plans submitted.

B. Conduct training on-site unless otherwise indicated.

C. Owner will provide classroom and seating at no cost to Contractor.

D. Do not start training until Functional Testing is complete, unless otherwise specified or approved by the Commissioning Authority.

E. Provide training in minimum two hour segments.

F. The Commissioning Authority is responsible for determining that the training was satisfactorily completed and will provide approval forms.

G. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.

H. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
   1. The location of the O&M manuals and procedures for use and preservation; backup copies.
   2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
   3. Typical uses of the O&M manuals.

I. Product- and System-Specific Training:
   1. Review the applicable O&M manuals.
   2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.

3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
4. Provide hands-on training on all operational modes possible and preventive maintenance.
5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
6. Discuss common troubleshooting problems and solutions.
7. Discuss any peculiarities of equipment installation or operation.
8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
9. Review recommended tools and spare parts inventory suggestions of manufacturers.
10. Review spare parts and tools required to be furnished by Contractor.
11. Review spare parts suppliers and sources and procurement procedures.

J. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION

SECTION DC 998

GEOTECHNICAL REPORT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Energy compliance reports appended to this section.

END OF SECTION

SECTION 04 2001

MASONRY VENEER

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Clay Facing Brick.

B. Mortar and Grout.

C. Reinforcement and Anchorage.

D. Flashings.

E. Installation of Lintels.

F. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 05 5000 - Metal Fabrications: Loose steel lintels.

B. Section 07 9200 - Joint Sealants: Sealing 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 A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2015.

D. ASTM C91/C91M - Standard Specification for Masonry Cement; 2012.

E. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made From Clay or Shale); 2014.

F. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2014a.

G. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing; 2005.

H. BIA Techical Notes No. 28B - Brick Veneer/Steel Stud Walls; 2005.

I. BIA Technical Notes No. 46 - Maintenance of Brick Masonry; 2005.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for masonry units, fabricated wire reinforcement, and mortar.

C. Samples: Submit four samples of decorative block and 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.

1.06 MOCK-UP

A. Construct a masonry wall as a mock-up panel sized 6 feet (___ m) long by 4 feet (___ m) high; include mortar and accessories and structural backup in mock-up.

B. Locate where directed.

C. Mock-up may remain as part of the Work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

1.08 FIELD CONDITIONS

A. Cold and Hot Weather Requirements: Comply with requirements of ACI 530/530.1/ERTA or applicable building code, whichever is more stringent.

PART 2 PRODUCTS

2.01 BRICK UNITS

A. Manufacturers:
   1. Acme Brick.
   2. Substitutions: See Section 01 6000 - Product Requirements.

B. Facing Brick: ASTM C216, Type FBS, Grade MW.
   1. Color and Texture: Match Existing City Hall.
   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.

2.02 MORTAR AND GROUT MATERIALS

A. Masonry Cement: ASTM C91/C91M Type N.
   1. Colored Mortar: Premixed cement as required to match Architect's color sample.

B. Water: Clean and potable.

2.03 REINFORCEMENT AND ANCHORAGE

A. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.

B. Joint Reinforcement: Truss type; ASTM A1064/A1064M steel wire, hot dip galvanized after fabrication to ASTM A153/A153M, Class B; 0.1483 inch (3.8 mm) side rods with 0.1483 inch (3.8 mm) cross rods; width as required to provide not more than 1 inch (25 mm) and not less than 1/2 inch (13 mm) of mortar coverage on each exposure.
   1. Manufacturers:
      a. Blok-Lok Limited; _____: www.blok-lok.com/#sle.
      b. Hohmann & Barnard, Inc; HB 213 Veneer Anchor: www.h-b.com/#sle.
      c. WIRE-BOND; _____: www.wirebond.com/#sle.

C. 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. Manufacturers:
      a. BLOK-LOK BL-607.
      b. Heckmann Building Products Pos-I-Tie.
      c. Substitutions: See Section 01 6000 - Product Requirements.

2.04 FLASHINGS

A. Plastic Flashings: Sheet polyolefin laminated to polypropylene; 40 mil (1mm) thick.
   1. Manufacturers:
      a. Hohmann & Barnard, Inc; _____: www.h-b.com/#sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.

B. Flexible Flashing with Elvaloy KEE: Solid-phase flexibilizer added to membrane flashing.
   1. Manufacturers:
      a. Hohmann & Barnard, Inc; _____: www.h-b.com/#sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.05 ACCESSORIES

A. Weeps: Molded PVC grilles, insect resistant.
   1. Manufacturers:
      a. Hohmann & Barnard, Inc; QuadroVent: www.h-b.com.

B. 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: Panels installed at flashing locations.
      a. Manufacturers:
         1) Mortar Net USA, Ltd; Mortar Net with Insect Barrier: www.mortarnet.com..
         2) Substitutions: See Section 01 6000 - Product Requirements.

C. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.06 MORTAR AND GROUT MIXES

A. Mortar for Unit Masonry: ASTM C270, Proportion Specification.

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 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. Brick Units:
   1. Bond: Running.
   2. Coursing: Three units and three mortar joints to equal 8 inches (200 mm).
   3. Mortar Joints: Concave.

3.03 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. Remove excess mortar as work progresses.

D. Interlock intersections and external corners, except for units laid in stack bond.

E. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

F. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

G. Isolate top joint of masonry veneer from horizontal structural framing members or support angles with compressible joint filler.

3.04 WEEPS/CAVITY VENTS

A. Install weeps in veneer walls at 24 inches (600 mm) on center horizontally above through-wall flashing, above shelf angles and lintels, and at bottom of walls.

3.05 CAVITY MORTAR CONTROL

A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.

B. For cavity walls, build inner wythe ahead of outer wythe to accommodate accessories.

C. Install cavity mortar control panels continuously throughout full height of exterior masonry cavities during construction of exterior wythe, complying with manufacturer's installation instructions. Verify that airspace width is no more than 3/8 inch (9 mm) greater than panel thickness. Install horizontally between joint reinforcement. Stagger end joints in adjacent rows. Fit to perimeter construction and penetrations without voids.

D. 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.

3.06 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

A. Install horizontal joint reinforcement 16 inches (400 mm) on center.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches (400 mm) 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 (150 mm).

E. Stud Back-Up: Secure veneer anchors to stud framed back-up and embed into masonry veneer at maximum 16 inches (400 mm) on center vertically and 24 inches (600 mm) on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches (200 mm) on center.

3.07 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 (152 mm), minimum, into adjacent masonry or turn up at least 8 inches (203 mm), minimum, 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 plastic and Elvaloy Kee flashings to within 1/4 inch (6 mm) of exterior face of masonry.

C. Lap end joints of flashings at least 6 inches (152 mm), minimum, and seal watertight with flashing sealant/adhesive.

3.08 LINTELS

A. Install loose steel lintels over openings.

3.09 CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control or expansion joints.

B. Size control joints as indicated on drawings; if not indicated, 3/4 inch (19 mm) wide and deep.

3.10 TOLERANCES

A. Maximum Variation From Unit to Adjacent Unit: 1/16 inch (1.6 mm).

B. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft (6 mm in 3 m) and 1/2 inch in 20 ft (13 mm in 6 m) or more.

C. Maximum Variation from Plumb: 1/4 inch (6 mm) per story non-cumulative; 1/2 inch (13 mm) in two stories or more.

D. Maximum Variation from Level Coursing: 1/8 inch in 3 ft (3 mm in 1 m) and 1/4 inch in 10 ft (6 mm in 3 m); 1/2 inch in 30 ft (13 mm in 9 m).

E. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch (minus 6.4 mm, plus 9.5 mm).

3.11 CUTTING AND FITTING

A. Cut and fit for pipes and conduit. 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.

3.12 CLEANING

A. Remove excess mortar and mortar smears as work progresses.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

D. Use non-metallic tools in cleaning operations.

3.13 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

B. Seal all exposed masonry with suitable sealer.

END OF SECTION

SECTION 05 4000
COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Formed steel stud exterior wall and interior wall framing.

1.02 REFERENCE STANDARDS

A. AISI S100-12 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2012.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

C. ASTM C955 - Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases; 2011c.

D. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2011a.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with work of other sections that is to be installed in or adjacent to the metal framing system, including but not limited to structural anchors, cladding anchors, utilities, insulation, and firestopping.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on standard framing members; describe materials and finish, product criteria, limitations and _____.

C. Product Data: Provide manufacturer's data on factory-made framing connectors, showing compliance with requirements.

D. Shop Drawings: Indicate component details, framed openings, bearing, anchorage, loading, welds, and type and location of fasteners, and accessories or items required of related work.
   1. Indicate stud layout.
   2. Describe method for securing studs to tracks and for bolted framing connections.
   3. Provide design engineer's stamp on shop drawings.

E. Manufacturer's Installation Instructions: Indicate special procedures, conditions requiring special attention .

1.05 QUALITY ASSURANCE

A. Delegated Design: Engage a qualified professional engineer to design cold-formed steel framing.

B. Designer Qualifications: Design framing system under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State in which the Project is located.

C. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, and with minimum three years of documented experience.

D. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience and approved by manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Framing:
   1. Marino; ____: www.marinoware.com/#sle.
   2. The Steel Network, Inc; _____: www.SteelNetwork.com/#sle.

3. Substitutions: See Section 01 6000 - Product Requirements.

B. Framing Connectors and Accessories:
1. Same manufacturer as metal framing.
2. Simpson Strong Tie; ____: www.strongtie.com/#sle.
3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FRAMING SYSTEM

A. Provide primary and secondary framing members, bridging, bracing, plates, gussets, clips, fittings, reinforcement, and fastenings as required to provide a complete framing system.

B. Design Criteria: Provide completed framing system having the following characteristics:
1. Design: Calculate structural characteristics of cold-formed steel framing members according to AISI S100-12.
2. Structural Performance: Design, engineer, fabricate, and erect to withstand specified design loads for project conditions within required limits.
3. Design Loads: In accordance with applicable codes.
4. Live load deflection meeting the following, unless otherwise indicated:
a. Exterior Walls: Maximum horizontal deflection under wind load of 1/600 of span.
b. Design non-axial loadbearing framing to accommodate not less than 1/2 in (13 mm) vertical deflection.
5. Able to tolerate movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.
6. Able to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

2.03 FRAMING MATERIALS

A. Studs and Track: ASTM C955; studs formed to channel, "C", or "Sigma" shape with punched web; U-shaped track in matching nominal width and compatible height.

2.04 FASTENERS

A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot dip galvanized per ASTM A153/A153M.

B. Anchorage Devices: Powder actuated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Verify field measurements and adjust installation as required.

3.02 INSTALLATION OF STUDS

A. Install components in accordance with manufacturers' instructions and ASTM C1007 requirements.

B. Align floor and ceiling tracks; locate to wall layout. Secure in place with fasteners at maximum 24 inches (600 mm) on center. Coordinate installation of sealant with floor and ceiling tracks.

C. Place studs at 16 inches (400 mm) on center; not more than 2 inches (50 mm) from abutting walls and at each side of openings. Connect studs to tracks using clip and tie method.

D. Construct corners using minimum of three studs. Install double studs at wall openings, door and window jambs.

E. Install load bearing studs full length in one piece. Splicing of studs is not permitted.

F. Install load bearing studs, brace, and reinforce to develop full strength and achieve design requirements.

G. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.

H. Install intermediate studs above and below openings to align with wall stud spacing.

I. Provide deflection allowance in stud track, directly below horizontal building framing at non-load bearing framing.

J. Attach cross studs to studs for attachment of fixtures anchored to walls.

K. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.

L. Touch-up field welds and damaged galvanized surfaces with primer.

END OF SECTION

SECTION 05 5000
METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop fabricated steel items.

1.02 RELATED REQUIREMENTS

A. Section 09 9113 - Exterior Painting: Paint finish.

B. Section 09 9123 - Interior Painting: Paint finish.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

C. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2013.

D. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2014.

E. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.

F. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel; International Accreditation Service, Inc; 2011.

G. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).

H. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

1.04 SUBMITTALS

A. See Section 01 3000 - 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.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified steel fabricator that is accredited by IAS AC172.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.

C. Plates: ASTM A283/A283M.

D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.

E. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

F. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

G. 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. 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.

D. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

E. 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. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; galvanized finish.

B. Lintels: As detailed; prime paint finish.

2.04 FINISHES - STEEL

A. Prime paint steel items.
   1. Exceptions: Galvanize items to be embedded in concrete and items to be imbedded in masonry.
   2. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.

B. Prime Painting: One coat.

2.05 FABRICATION TOLERANCES

A. Squareness: 1/8 inch (3 mm) maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch (1.5 mm).

C. Maximum Misalignment of Adjacent Members: 1/16 inch (1.5 mm).

D. Maximum Bow: 1/8 inch (3 mm) in 48 inches (1.2 m).

E. Maximum Deviation From Plane: 1/16 inch (1.5 mm) in 48 inches (1.2 m).

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.

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. Obtain approval prior to site cutting or making adjustments not scheduled.

END OF SECTION

SECTION 05 5213
PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall mounted handrails.

B. Stair railings and guardrails.

1.02 RELATED REQUIREMENTS

A. Section 09 2116 - Gypsum Board Assemblies: Placement of backing plates in stud wall construction.

B. Section 09 9123 - 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 E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings; 2013.

D. ASTM E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings; 2000 (Reapproved 2006).

E. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).

1.04 SUBMITTALS

A. See Section 01 3000 - 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 (1095 N/m) applied to the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E935.

C. Allow for expansion and contraction of members and building movement without damage to connections or members.

D. Dimensions: See drawings for configurations and heights.
   1. Top Rails and Wall Rails: 1-1/2 inches (38 mm) diameter, round.
   2. Intermediate Rails: 1-1/2 inches (38 mm) diameter, round.
   3. Posts: 1-1/2 inches (38 mm) diameter, round.
   4. Balusters: 1/2 inch (12 mm) square solid bar.

E. 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 stud walls, provide backing plates, for bolting anchors.

F. Provide slip-on non-weld mechanical 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 RAILING SYSTEM

A. Steel Pipe: ASTM A53/A53M, Grade B Schedule 80, black finish.

B. Non-Weld Mechanical Fittings: Slip-on, galvanized malleable iron castings, for Schedule 40 pipe, with flush setscrews for tightening by standard hex wrench, no bolts or screw fasteners.

C. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.

D. Exposed Fasteners: No exposed bolts or screws.

E. 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.

D. Welded Joints:

1. Exterior Components: Continuously seal joined pieces by intermittent welds and plastic filler. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
2. Interior Components: Continuously seal joined pieces by intermittent welds and plastic filler.
3. 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.

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. 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 (6 mm) per floor level, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch (6 mm).

C. Maximum Out-of-Position: 1/4 inch (6 mm).

END OF SECTION

SECTION 06 1000
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preservative treated wood materials.

B. Communications and electrical room mounting boards.

C. Concealed wood blocking, nailers, and supports.

1.02 RELATED REQUIREMENTS

A. Section 07 6200 - Sheet Metal Flashing and Trim: Sill flashings.

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

B. AWPA U1 - Use Category System: User Specification for Treated Wood; 2012.

C. PS 1 - Structural Plywood; 2009.

D. PS 20 - American Softwood Lumber Standard; 2010.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.

1.05 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. Species: Douglas Fir-Larch, unless otherwise indicated.
   2. 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.
   3. 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. Sizes: Nominal sizes as indicated on drawings, S4S.

B. Moisture Content: S-dry or MC19.

C. Stud Framing (2 by 2 through 2 by 6 (50 by 50 mm through 50 by 150 mm)):
   1. Species: Douglas Fir-Larch.
   2. Grade: No. 2.

D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
   1. Lumber: S4S, No. 2 or Standard Grade.
   2. Boards: Standard or No. 3.

2.03 CONSTRUCTION PANELS

A. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch (19 mm) thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

2.04 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. Preservative Treatment:
   1. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative.
      a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
      b. Treat lumber in contact with roofing, flashing, or waterproofing.
      c. 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 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 framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.

C. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.

D. 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.

E. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

F. 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.
10. Wall-Hung Television Mounting Brackets.

3.04 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 (610 mm) 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.

3.05 CLEANING

A. Waste Disposal: Comply with the requirements of Section 01 7419 - Construction Waste Management and Disposal.
   1. Comply with applicable regulations.
   2. Do not burn scrap on project site.
   3. Do not burn scraps that have been pressure treated.
   4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

SECTION 07 9005
JOINT SEALERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sealants and joint backing.

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 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with other sections referencing this section.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating sealant chemical characteristics.

C. Samples: Submit two samples, 8 x 10 inch (____x____ mm) in size illustrating sealant colors for selection.

D. Manufacturer's Installation Instructions: Indicate special procedures.

1.05 QUALITY ASSURANCE

A. Maintain one copy of each referenced document covering installation requirements on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

C. Applicator Qualifications: Company specializing in performing the work of this section with minimum three years documented experience and approved by manufacturer.

1.06 MOCK-UP

A. Provide mock-up of sealant joints in conjunction with window under provisions of Section 01 4000.

B. Construct mock-up with specified sealant types and with other components noted.

C. Locate where directed.

1.07 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, 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. Gunnable and Pourable Sealants:
   1. Sika Corporation: www.usa-sika.com/#sle.
   2. W.R. Meadows, Inc: www.wrmeadows.com/#sle.

3. Substitutions: See Section 01 6000 - Product Requirements.

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: Match adjacent finished surfaces.
   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.
   3. Polyurethane Products:
      a. Pecora Corporation; DynaTrol I-XL General Purpose One Part Polyurethane Sealant: www.pecora.com/#sle.
      b. Sika Corporation; Sikaflex-1a: www.usa-sika.com/#sle.
      c. Sika Corporation; Sikaflex-15 LM: www.usa-sika.com/#sle.
      d. Substitutions: See Section 01 6000 - Product Requirements.

B. Exterior Metal Lap Joint Sealant: Butyl or polyisobutylene, nondrying, nonskinning, noncuring.
   1. Applications: Use for:
      a. Concealed sealant bead in sheet metal work.

C. General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C834, Type OP, Grade NF single component, paintable.
   1. Color: Match adjacent finished surfaces.
   2. Applications: Use for:
      a. Joints between door and window frames and wall surfaces.
      b. Other interior joints for which no other type of sealant is indicated.
   3. Products:
      a. Pecora Corporation; AC-20 + Silicone Acrylic Latex Caulking Compound: www.pecora.com/#sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.

D. 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.
   2. Products:
      a. Pecora Corporation; 898NST Sanitary Silicone Sealant - Class 50: www.pecora.com/#sle.
      b. Sika Corporation; Sikasil GP: www.usa-sika.com/#sle.
      c. Substitutions: See Section 01 6000 - Product Requirements.

E. Acoustical Sealant for Concealed Locations:
   1. Composition: Acrylic latex emulsion sealant.
   2. Applications: Use for concealed locations only:
      a. Sealant bead between top stud runner and structure and between bottom stud track and floor.
   3. Products:
      a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant: www.pecora.com/#sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.

F. 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. Color: Concrete gray.

3. Joint Width: 1/8 inch (3 mm).
4. Applications: Use for:
   a. Control joints in concrete slabs and floors not filled with filler placed in form.
   b. joints in concrete slabs and floors.
5. Products:
   a. W.R. Meadows, Inc; Rezi-Weld Flex: www.wrmeadows.com/#sle.
   b. Substitutions: See Section 01 6000 - Product Requirements.

G. Concrete Paving Joint Sealant: Polyurethane, self-leveling; ASTM C920, Class 25, Uses T, I, M and A; single component.
   1. Color: Gray.
   2. Applications: Use for:
      a. Joints in sidewalks and vehicular paving.
   3. Products:
      a. Pecora Corporation; NR-201 Self-Leveling Traffic and Loop Sealant: www.pecora.com/#sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.

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. Install bond breaker where joint backing is not used.

E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

F. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

G. Tool joints concave.

H. 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 08 1113

HOLLOW METAL DOORS AND FRAMES

.01 SELECT TYPE OF SPECIFICATION TO BE PREPARED: A SHORT FORM 3-PART SPEC, WITH MANUFACTURER NAMES LISTED.

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated hollow metal doors and frames.

B. Thermally insulated hollow metal doors with frames.

1.02 RELATED REQUIREMENTS

A. Section 08 7100 - Door Hardware.

B. Section 09 9113 - Exterior Painting: Field painting.

C. Section 09 9123 - Interior Painting: Field painting.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2011.

C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2014.

D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2011.

E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

F. ASTM A1008/A1008M - 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; 2015.

G. 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.

H. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.

I. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames; 2007.

1.04 SUBMITTALS

A. See Section 01 3000 - 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 standards/guidelines.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years documented experience.
   1. Provide hollow metal frames from SDI Certified manufacturer.

B. Maintain at project site copies of reference standards relating to installation of products specified.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hollow Metal Doors and Frames:
   1. Ceco Door, an Assa Abloy Group company; _____: www.assaabloydss.com/#sle.
   2. De La Fontaine Inc; Hollow Metal Door Model _____: www.delafontaine.com/#sle.
   3. De La Fontaine Inc; Windstorm-Resistant Steel Door and Frame; door style ____: www.delafontaine.com.
   4. De La Fontaine Inc; Hollow Metal Frame ____ Profile: www.delafontaine.com.
   5. Republic Doors; ____: www.republicdoor.com.
   6. Steelcraft, an Allegion brand; ____: www.allegion.com/#sle.
   7. Technical Glass Products; SteelBuilt Window & Door Systems: www.tgpamerica.com/#sle.
   8. Substitutions: See Section 01 6000 - Product Requirements.

2.02 DESIGN CRITERIA

A. Requirements for Hollow Metal Doors and Frames:
   1. Steel used for fabrication of doors and frames shall comply with one or more of the following requirements; Galvannealed steel conforming to ASTM A653/A653M, cold-rolled steel conforming to ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel conforming to ASTM A1011/A1011M, Commercial Steel (CS) Type B for each.
   2. Accessibility: Comply with ICC A117.1 and ADA Standards.

B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with 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.

2.03 HOLLOW METAL DOORS

A. Exterior Doors: Thermally insulated.
   1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
      a. Level 1 - Standard-duty.
      b. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
      c. Model 1 - Full Flush.
      d. Door Face Metal Thickness: 20 gage, 0.032 inch (0.8 mm), minimum.
   2. Core: Polystyrene.
   3. Door Thickness: 1-3/4 inch (44.5 mm), nominal.
   4. Weatherstripping: Refer to Section 08 7100.

B. Interior Doors, Non-Fire Rated:
   1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
      a. Level 1 - Standard-duty.
      b. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
      c. Model 1 - Full Flush.
      d. Door Face Metal Thickness: 20 gage, 0.032 inch (0.8 mm), minimum.
   2. Door Thickness: 1-3/4 inch (44.5 mm), nominal.

2.04 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

B. Exterior Door Frames: Full profile/continuously welded type.
   1. Weatherstripping: Separate, see Section 08 7100.

C. Interior Door Frames, Non-Fire Rated: Knock-down type.

2.05 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

2.06 ACCESSORIES

A. Silencers: Resilient rubber, fitted into drilled hole; 3 on strike side of single door, 3 on center mullion of pairs, and 2 on head of pairs without center mullions.

B. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

2.07 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

B. 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.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 PREPARATION

A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.03 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.

B. Coordinate frame anchor placement with wall construction.

C. Install door hardware as specified in Section 08 7100.

3.04 TOLERANCES

A. Maximum Diagonal Distortion: 1/16 in (1.5 mm) 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.

3.06 SCHEDULE

A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION

SECTION 08 3323
OVERHEAD COILING DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Overhead coiling doors and shutters, operating hardware, non-fire-rated and exterior; manually operated.

1.02 RELATED REQUIREMENTS

A. Section 07 9200 - Joint Sealants: Sealing joints between frames and adjacent construction.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide general construction and component connections and details.

C. Shop Drawings: Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Overhead Coiling Doors:
   1. Alpine Overhead Doors, Inc; _____: www.alpinedoors.com/#sle.
   2. C.H.I. Overhead Doors; Model 6180: www.chiohd.com/#sle.
   3. Clopay Building Products; Model CERD20: www.clopaydoor.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 COILING DOORS

A. Exterior Coiling Doors: Steel slat curtain.
   1. Capable of withstanding positive and negative wind loads of 20 psf (940 Pa), without undue deflection or damage to components.
   2. Sandwich slat construction with insulated core of foamed-in-place polyurethane insulation; minimum R-value of 8.1 (RSI-value of 1.43).
   3. Finish: Galvanized.
   4. Finish: Factory painted, TBD color.
   5. Guide, Angles: Galvanized steel.
   6. Hood Enclosure: Manufacturer's standard; primed steel.
   7. Manual hand chain lift operation.
   8. Mounting: Within framed opening.
   9. Locking Devices: Lock and latch handle on outside.

2.03 MATERIALS AND COMPONENTS

A. Curtain Construction: Interlocking slats.

1. Slat Ends: Alternate slats fitted with end locks to act as wearing surface in guides and to prevent lateral movement.
2. Curtain Bottom: Fitted with angles to provide reinforcement and positive contact in closed position.
3. Weatherstripping: Moisture and rot proof, resilient type, located at jamb edges, bottom of curtain, and where curtain enters hood enclosure of exterior doors.

B. Steel Slats: Minimum thickness, ___ gage, ___ inch (___ mm); ASTM A653/A653M galvanized steel sheet.
   1. Galvanizing: Minimum G90 (Z275) coating.

C. Guide Construction: Continuous, of profile to retain door in place with snap-on trim, mounting brackets of same metal.

D. Guides - Angle: ASTM A36/A36M metal angles, size as indicated.
   1. Hot-dip galvanized in compliance with ASTM A123/A123M.

E. Hood Enclosure and Trim: Internally reinforced to maintain rigidity and shape.

F. Lock Hardware:
   1. Latchset Lock Cylinders: Standard mortise cylinder.
      a. Keying: Differently.
   2. Latch Handle: Manufacturer's standard.
   3. Manual Chain Lift: Provide padlockable chain keeper on guide.

G. Roller Shaft Counterbalance: Steel pipe and helical steel spring system, capable of producing torque sufficient to ensure smooth operation of curtain from any position and capable of holding position at mid-travel; with adjustable spring tension; requiring 25 lb (10 kg) nominal force to operate.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that opening sizes, tolerances and conditions are acceptable.

3.02 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.

C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.

D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

E. Install enclosure and perimeter trim.

3.03 TOLERANCES

A. Maintain dimensional tolerances and alignment with adjacent work.

B. Maximum Variation From Plumb: 1/16 inch (1.6 mm).

C. Maximum Variation From Level: 1/16 inch (1.6 mm).

D. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch per 10 ft (3.2 mm per 3 m) straight edge.

3.04 ADJUSTING

A. Adjust operating assemblies for smooth and noiseless operation.

3.05 CLEANING

A. Clean installed components.

B. Remove labels and visible markings.

END OF SECTION

SECTION 08 7100
DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hardware for hollow metal doors.

B. Thresholds.

C. Weatherstripping, seals and door gaskets.

1.02 RELATED REQUIREMENTS

A. Section 08 1113 - Hollow Metal Doors and Frames.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. BHMA A156.2 - American National Standard for Bored and Preassembled Locks & Latches; 2011.

C. BHMA A156.3 - American National Standard for Exit Devices; 2014.

D. BHMA A156.4 - American National Standard for Door Controls - Closers; 2013.

E. BHMA A156.8 - American National Standard for Door Controls - Overhead Stops and Holders; 2010.

F. BHMA A156.18 - American National Standard for Materials and Finishes; 2012.

G. BHMA A156.21 - American National Standard for Thresholds; 2014.

H. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames; 2004.

I. DHI WDHS.3 - Recommended Locations for Architectural Hardware for Flush Wood Doors; 1993; also in WDHS-1/WDHS-5 Series, 1996.

J. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.

K. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.

L. NFPA 101 - Life Safety Code; 2015.

M. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.04 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 Owner'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.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project.

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 Owner.

E. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

F. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.
   1. Submit manufacturer's parts lists and templates.
   2. Bitting List: List of combinations as furnished.

G. Keys: Deliver with identifying tags to Owner by security shipment direct from hardware supplier.

H. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

I. Maintenance Materials and Tools: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

B. Hardware Supplier Qualifications: Company specializing in supplying the type of products specified in this section with at least three years documented experience.

C. Hardware Supplier Personnel: Employ an Architectural Hardware Consultant (AHC) to assist in the work of this section.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Package hardware items individually; label and identify each package with door opening code to match hardware schedule.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year warranty for door closers and _____.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Allegion Brands, Ives, LCN, Schlage, Steelcraft, or Von Duprin; _____: www.allegion.com/us/#sle.Allegion Brands, Ives, LCN, Schlage, Steelcraft, or Von Duprin; _____: www.allegion.com/us/#sle.Allegion Brands, Ives, LCN, Schlage, Steelcraft, or Von Duprin; _____: www.allegion.com/us/#sle.Allegion Brands, Ives, LCN, Schlage, Steelcraft, or Von Duprin; _____: www.allegion.com/us/#sle.

B. Assa Abloy Brands, Corbin Russwin, Curries, McKinney, Norton, Sargent, or Yale; _____: www.assaabloydss.com/#sle.

C. C. R. Laurence Company, Inc; _____: www.crl-arch.com/#sle.

D. Hager Companies; _____: www.hagerco.com/#sle.

E. Substitutions: See Section 01 6000 - Product Requirements.

2.02 GENERAL REQUIREMENTS

A. Provide door hardware specified, or as 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. Accessibility: ADA Standards and ICC A117.1.
   3. Applicable provisions of NFPA 101, Life Safety Code.

4. Hardware for Smoke and Draft Control Doors (Indicated as "S" on Drawings): Provide hardware that enables door assembly to comply with air leakage requirements of the applicable code.

D. Finishes: Provide door hardware of the same finish unless otherwise indicated.
1. Finish: Satin chrome plated over nickel on brass or bronze, 626 (approx US26D).
2. Finish Definitions: BHMA A156.18.

2.03 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".

2.04 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.

B. Manufacturers - Hinges:
1. Assa Abloy Brands; McKinney: www.assaabloydss.com/#sle.
2. C. R. Laurence Company, Inc; _____: www.crl-arch.com/#sle.
3. Hager Companies; _____: www.hagerco.com/#sle.
4. Stanley Black & Decker; _____: www.stanleyblackanddecker.com/#sle.

2.05 CYLINDRICAL LOCKSETS

A. Locking Functions: As defined in BHMA A156.2, and as follows.
1. Passage: No locking, always free entry and exit.
2. Privacy: F76, emergency tool unlocks.
3. Office: F82 Grade 1, key required to lock, unlocks upon exit.
4. Classroom: F84, key required to lock.

B. Manufacturers - Cylindrical Locksets:
1. Assa Abloy Brands, Corbin Russwin, Sargent, or Yale; _____: www.assaabloydss.com/#sle.
2. Hager Companies; _____: www.hagerco.com/#sle.
3. Schlage, an Allegion brand; _____: www.allegion.com/us/#sle.Schlage, an Allegion brand; _____: www.allegion.com/us/#sle.Schlage, an Allegion brand; _____: www.allegion.com/us/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

2.06 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.

2.07 EXIT DEVICES

A. Locking Functions: Functions as defined in BHMA A156.3, and as follows:
   1. Entry/Exit, Free Swing: Key outside retracts latch, latch holdback (dogging) for free swing during occupied hours, not fire-rated; outside trim must be lever or pull.

B. Manufacturers - Exit Devices:
   1. Von Duprin, an Allegion brand; _____: www.allegion.com/us/#sle.Von Duprin, an Allegion brand; _____: www.allegion.com/us/#sle.Von Duprin, an Allegion brand; _____: www.allegion.com/us/#sle.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.08 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. On doors scheduled to receive magnetic holds, provide closers from same manufacturer as magnetic holds. Provide closers that are acceptable by the manufacturer as compatible with magnetic holds.

B. Manufacturers - Surface Mounted Closers:
   1. Assa Abloy Brands, Corbin Russwin, Sargent, or Yale; _____: www.assaabloydss.com.
   2. C. R. Laurence Company, Inc; _____: www.crl-arch.com/#sle.
   3. DORMA USA, Inc; 7400 Series, 8600 Series, 8900 Series, and TS93: www.dorma.com/#sle.
   4. LCN, an Allegion brand; _____: www.allegion.com/us/#sle.LCN, an Allegion brand; _____: www.allegion.com/us/#sle.LCN, an Allegion brand; _____: www.allegion.com/us/#sle.
   5. Substitutions: See Section 01 6000 - Product Requirements.

2.09 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.

B. Manufacturers - Wall and Floor Stops/Holders:
   1. Assa Abloy Brands, McKinney; _____: www.assaabloydss.com/#sle.
   2. C. R. Laurence Company, Inc; _____: www.crl-arch.com/#sle.
   3. Hager Companies; _____: www.hagerco.com/#sle.
   4. Trimco., Inc: www.trimcohardware.com/#sle.
   5. Substitutions: See Section 01 6000 - Product Requirements.

C. Manufacturers - Magnetic Holder/Releases:
   1. DORMA USA, Inc; EM-508: www.dorma.com.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.10 GASKETING AND THRESHOLDS

A. Thresholds: Complying with BHMA A156.21.
   1. At each exterior door, provide a threshold unless otherwise indicated.
   2. Field cut threshold to frame for tight fit.

B. Fasteners At Exterior Locations: Non-corroding.

C. Manufacturers - Gasketing and Thresholds:
   1. Assa Abloy Brands, McKinney; _____: www.assaabloydss.com/#sle.
   2. Hager Companies; _____: www.hagerco.com/#sle.
   3. National Guard Products, Inc; _____: www.ngpinc.com/#sle.
   4. Pemko Manufacturing Co; _____: www.pemko.com/#sle.
   5. Zero International, Inc; _____: www.zerointernational.com/#sle.
   6. Substitutions: See Section 01 6000 - Product Requirements.

2.11 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.

B. Drip Guard: Provide projecting drip guard over all exterior doors unless they are under a projecting roof or canopy.

C. Manufacturers - Protection Plates and Architectural Trim:
   1. Rockwood Manufacturing Company, an Assa Abloy brand: www.rockwoodmfg.com/#sle.
   2. C. R. Laurence Company, Inc; _____: www.crl-arch.com/#sle.
   3. Hager Companies; _____: www.hagerco.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.12 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. Provide Lock Box per City of Lake Worth Fire Department requirements.

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.

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. As indicated in the following list; unless noted otherwise in Door Hardware Sets Schedule or on the drawings.
   1. For steel doors and frames: Comply with DHI (LOCS) "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames".
   2. For Wood Doors: Comply with DHI WDHS.3 "Recommended Locations for Architectural Hardware for Flush Wood 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 ADJUSTING

A. Adjust work under provisions of Section 01 7000 - Execution and Closeout Requirements.

B. Adjust hardware for smooth operation.

C. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

3.04 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.

3.05 PROTECTION

A. Protect finished Work under provisions of Section 01 7000 - Execution and Closeout Requirements.

B. Do not permit adjacent work to damage hardware or finish.

3.06 SCHEDULE - ATTACHED

END OF SECTION

HARDWARE SCHEDULE

HW 01:

(3) HINGES
(1) PANIC DEVICE WITH LEVER
(1) MORTISE LOCK
(1) SURFACE CLOSER
(1) STAINLESS STEEL KICK PLATE
(1) SEALS
(1) THRESHOLD
(1) DRIP CAP
(1) DOOR SWEEP

HW 02:

(3) HINGES
(1) STOREROOM LOCK
(1) MORTISE LOCK
(1) SEALS
(1) THRESHOLD
(1) DRIP CAP
(1) DOOR SWEEP

HW 03:

(6) HINGES
(2) STOREROOM LOCK
(2) MORTISE LOCK
(2) SEALS
(1) THRESHOLD
(1) DRIP CAP
(2) DOOR SWEEP
(1) FLUSH BOLTS
(2) KICK DOWN HOLDS

HW 04:
(3) HINGES
(1) STOREROOM LOCK
(1) WALL STOP
(3) SILENCERS

HW 05:
(6) HINGES
(2) STOREROOM LOCK
(2) WALL STOP
(6) SILENCERS
(1) FLUSH BOLTS

END OF SCHEDULE

SECTION 09 2116
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.

I. Textured finish system.

1.02 RELATED REQUIREMENTS

A. Section 05 4000 - Cold-Formed Metal Framing: Exterior wind-load-bearing metal stud framing.

B. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.

C. Section 07 2500 - Weather Barriers: Water-resistive barrier over sheathing.

1.03 REFERENCE STANDARDS

A. ANSI A108.11-SystemDeleted - American National Standard for Interior Installation of Cementitious Backer Units; 2010 (Revised).

B. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2015.

C. ASTM C514 - Standard Specification for Nails for the Application of Gypsum Board; 2004 (Reapproved 2014).

D. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2014.

E. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2012.

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 C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base; 2014a.

K. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2013.

L. ASTM C1278/C1278M - Standard Specification for Fiber-Reinforced Gypsum Panel; 2007a (Reapproved 2011).

M. ASTM C1280 - Standard Specification for Application of Gypsum Sheathing Board; 2013.

N. ASTM C1288 - Standard Specification for Discrete Non-Asbestos Fiber-Cement Interior Substrate Sheets; 2014.

O. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2014.

P. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels; 2015.

Q. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels; 2013.

R. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2012.

S. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009.

T. ASTM E413 - Classification for Rating Sound Insulation; 2010.

U. GA-216 - Application and Finishing of Gypsum Board; 2013.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.

C. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.

D. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

E. 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.

F. Samples: Submit two samples of gypsum board finished with proposed texture application, 12 by 12 inches (300 by 300 mm) in size, illustrating finish color and texture.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing gypsum board application and finishing, with minimum five 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, Indicated as Acoustic: 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.

2.02 METAL FRAMING MATERIALS

A. Manufacturers - Metal Framing, Connectors, and Accessories:
   1. Clarkwestern Dietrich Building Systems LLC; ____: www.clarkdietrich.com/#sle.
   2. Marino; ____: www.marinoware.com/#sle.
   3. Phillips Manufacturing Company; _____: www.phillipsmfg.com.

B. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/120 at 5 psf (L/120 at 240 Pa).
   1. Studs: "C" shaped with flat or formed webs with knurled faces.
   2. Runners: U shaped, sized to match studs.
   3. Ceiling Channels: C-shaped.
   4. Furring: Hat-shaped sections, minimum depth of 7/8 inch (22 mm).

C. Exterior Non-Loadbearing Studs and Furring for Application of Gypsum Board: As specified in Section 09 2216.

D. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.

E. Partition Head To Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short and fastened as indicated on drawings.

2.03 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
   1. American Gypsum Company; ____: www.americangypsum.com/#sle.
   2. CertainTeed Corporation; ____: www.certainteed.com/#sle.
   3. Georgia-Pacific Gypsum; ____: www.gpgypsum.com/#sle.
   4. National Gypsum Company; ____: www.nationalgypsum.com/#sle.
   5. USG Corporation; ____: www.usg.com/#sle.

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. Thickness:
      a. Vertical Surfaces: 1/2 inch (13 mm).
      b. Ceilings: 5/8 inch (16 mm).
   4. Mold Resistant Paper Faced Products:
      a. American Gypsum Company; M-Bloc.
      b. American Gypsum Company; M-Bloc Type X.
      c. Georgia-Pacific Gypsum; ToughRock Mold-Guard.
   5. Glass Mat Faced Products:
      a. Georgia-Pacific Gypsum; DensArmor Plus.
      b. National Gypsum Company; Gold Bond eXP Fire-Shield Interior Extreme Gypsum Panel.
   6. Unfaced Products:

C. Impact Resistant Wallboard:
   1. Application: Provide to 8'-0" a.f.f. in south area of Commons, Children's Worship, Corridor west of Children's Worship and Corridor of Nursery Classroom area.
   2. Type: Fire resistance rated Type X, UL or WH listed.
   3. Thickness: 5/8 inch (16 mm).
   4. Edges: Tapered.
   5. Products:

D. Backing Board For Wet Areas: One of the following products:
   1. Application: Surfaces behind tile in wet areas_____.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   3. ASTM Cement-Based Board: Non-gypsum-based, cementitious board complying with ASTM C1288.
      a. Thickness: 1/2 inch (12.7 mm).
      b. Products:
         1) James Hardie Building Products, Inc; _____: www.jameshardie.com/#sle.

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 at wet areas, around windows and doors in exterior walls..
   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 (16 mm).
   6. Type C Thickness: 5/8 inch (19 mm).

7. Regular Board Thickness: 5/8 inch (16 mm).
8. Edges: Tapered.
9. Products:
    a. American Gypsum Company; M-Bloc.

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: 5/8 inch (___ mm).
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. Glass Mat Faced Sheathing: Glass mat faced gypsum substrate as defined in ASTM C1177/C1177M.
3. Core Type: Regular.
4. Regular Board Thickness: 1/2 inch (13 mm).
5. Edges: Square.
6. Glass Mat Faced Products:
    a. Georgia-Pacific Gypsum; DensGlass Sheathing.
    b. National Gypsum Company; Gold Bond eXP Sheathing.

2.04 ACCESSORIES

A. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced. Thickness: _____ inch (_____ mm).

B. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced. Thickness: 3-1/2 inch (_____ mm).

C. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.

D. Water-Resistive Barrier:

E. Finishing Accessories: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.
1. Types: As detailed or required for finished appearance.
2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead at exposed panel edges.
3. Products:
    a. Same manufacturer as framing materials.
    b. Phillips Manufacturing Co: www.phillipsmfg.com.

F. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.

G. 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.

H. Textured Finish Materials: Latex-based compound; plain.

I. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inch (0.84 mm) in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion resistant.

J. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch (0.84 to 2.84 mm) in Thickness: ASTM C954; steel drill screws, corrosion resistant.

K. Nails for Attachment to Wood Members: ASTM C514.

L. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 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 (at 406 mm on center).
   1. Extend partition framing to structure where indicated and to ceiling in other locations.
   2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
   3. Partitions Terminating at Structure: Attach extended leg top runner to structure, maintain clearance between top of studs and structure, and brace both flanges of studs with continuous bridging.

D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

E. Blocking: Install wood blocking for support of:
   1. Framed openings.
   2. Wall mounted cabinets.
   3. Plumbing fixtures.
   4. Toilet partitions.
   5. Toilet accessories.
   6. Wall mounted door hardware.
   7. Television Mounts

3.03 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.

3.04 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Non-Rated: Install gypsum board perpendicular to framing, with ends and edges occurring over firm bearing.
   1. Exception: Tapered edges to receive joint treatment at right angles to framing.

C. Fire-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

D. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.

E. Exterior Sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.
   1. Seal joints, cut edges, and holes with water-resistant sealant.

F. Cementitious Backing Board: Install over steel framing members where indicated, in accordance with ANSI A108.11-SystemDeleted and manufacturer's instructions.

G. 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.

3.05 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
   1. Not more than 30 feet (10 meters) apart on walls and ceilings over 50 feet (16 meters) long.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.06 JOINT TREATMENT

A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, bedded and finished with chemical hardening type joint compound.

B. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 1: Fire rated wall areas above finished ceilings, whether or not accessible in the completed construction.

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 (0.8 mm).

3.07 TEXTURE FINISH

A. Apply finish texture coating by means of spraying apparatus in accordance with manufacturer's instructions and to match approved sample.

B. Texture Required: Orange Peel.

3.08 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet (3 mm in 3 m) in any direction.

END OF SECTION

SECTION 09 2216
NON-STRUCTURAL METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal partition, ceiling, and soffit framing.

B. Framing accessories.

1.02 RELATED REQUIREMENTS

A. Section 09 2116 - Gypsum Board Assemblies: Metal studs for gypsum board partition framing.

1.03 REFERENCE STANDARDS

A. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2014.

B. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2015.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:
   1. Indicate prefabricated work, component details, stud layout, framed openings, anchorage to structure, acoustic details, type and location of fasteners, accessories, and items of other related work.
   2. Describe method for securing studs to tracks, splicing, and for blocking and reinforcement of framing connections.

C. Product Data: Provide data describing framing member materials and finish, product criteria, load charts, and limitations.

D. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience and approved by manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Framing, Connectors, and Accessories:
   1. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FRAMING MATERIALS

A. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf (L/240 at 240 Pa).
   1. Studs: C shaped with flat or formed webs with knurled faces.
   2. Runners: U shaped, sized to match studs.

B. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.

C. Partition Head to Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short and braced with continuous bridging on both sides.

2.03 FABRICATION

A. Fabricate assemblies of framed sections to sizes and profiles required.

B. Fit, reinforce, and brace framing members to suit design requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that rough-in utilities are in proper location.

3.02 INSTALLATION OF STUD FRAMING

A. Comply with requirements of ASTM C754.

B. Extend partition framing to structure where indicated and to ceiling in other locations.

C. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.

D. Partitions Terminating at Structure: Attach extended leg top runner to structure, maintain clearance between top of studs and structure, and brace both flanges of studs as indicated.

E. Align and secure top and bottom runners at 24 inches (600 mm) on center.

F. At partitions indicated with an acoustic rating:

G. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.

H. Align stud web openings horizontally.

I. Secure studs to tracks using crimping method. Do not weld.

J. Fabricate corners using a minimum of three studs.

K. Double stud at wall openings, door and window jambs, not more than 2 inches (50 mm) from each side of openings.

L. Coordinate installation of bucks, anchors, and blocking with electrical, mechanical, and other work to be placed within or behind stud framing.

3.03 CEILING AND SOFFIT FRAMING

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 (1 800 mm) on center, and not more than 6 inches (150 mm) 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. Place furring channels perpendicular to carrying channels, not more than 2 inches (50 mm) from perimeter walls, and rigidly secure. Lap splices securely.

3.04 TOLERANCES

A. Maximum Variation From True Position: 1/8 inch in 10 feet (3 mm in 3 m).

B. Maximum Variation From Plumb: 1/8 inch in 10 feet (3 mm in 3 m).

END OF SECTION

SECTION 09 5100
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

1.02 RELATED REQUIREMENTS

A. Section 21 1300 - Fire-Suppression Sprinkler Systems: Sprinkler heads in ceiling system.

B. Section 28 4600 - Fire Detection and Alarm: Fire alarm components in ceiling system.

1.03 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 C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2013.

C. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2014.

D. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2014.

1.04 ADMINISTRATIVE REQUIREMENTS

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. Do not install acoustical units until after interior wet work is dry.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on suspension system components.

C. Samples: Submit two samples 4 x 4 inch (_____ mm) in size illustrating material and finish of acoustical units.

D. Samples: Submit two samples each, 12 inches (__ mm) long, of suspension system main runner.

E. Manufacturer's Installation Instructions: Indicate special procedures.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Acoustical Units: Quantity equal to 5 percent of total installed.

1.06 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.

1.07 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F (16 degrees C), and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.01 ACOUSTICAL UNITS

A. Manufacturers:

2.02 SUSPENSION SYSTEM(S)

2.03 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. Perimeter Moldings: Same material and finish as grid.
   1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.

C. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.02 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, 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 (150 mm) of each corner, or support components independently.

H. Do not eccentrically load system or induce rotation of runners.

I. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Use longest practical lengths.
   2. Overlap and rivet corners.

3.03 INSTALLATION - ACOUSTICAL UNITS

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. Make field cut edges of same profile as factory edges.
   2. Double cut and field paint exposed reveal edges.

G. Where round obstructions occur, provide preformed closures to match perimeter molding.

H. Lay acoustical insulation for a distance of 48 inches (1200 mm) either side of acoustical partitions as indicated.

I. Install hold-down clips on panels within 20 ft (6 m) of an exterior door.

3.04 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

SECTION 09 9000
PAINTING AND COATING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints and other coatings.

C. Scope: Finish all interior and exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
   1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
   2. Exposed surfaces of steel lintels and ledge angles.
   3. Mechanical and Electrical:
      a. In finished areas, paint all insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.

D. Do Not Paint or Finish the Following Items:
   1. Items fully factory-finished unless specifically so 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, and lead items.
   7. Marble, granite, slate, and other natural stones.
   8. Floors, unless specifically so indicated.
   9. Ceramic and other tiles.
   10. Brick, architectural concrete, cast stone, integrally colored plaster and stucco.
   11. Glass.
   12. Acoustical materials, unless specifically so indicated.
   13. Concealed pipes, ducts, and conduits.
   14. Exposed Spiral Duct and associated grilles in Commons Area.

1.02 DEFINITIONS

A. Conform to ASTM D16 for interpretation of terms used in this section.

1.03 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; 2014.

C. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials; 2007.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of all 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 all substitutions proposed.

C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches (216 by 279 mm) 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 Architect 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, have been approved.

D. Manufacturer's Instructions: Indicate special surface preparation procedures.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Paint and Coatings: 1 gallon (4 L) of each color; store where directed.
3. Label each container with color in addition to the manufacturer's label.

1.05 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 three years experience.

1.06 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 (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.07 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 coatings 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: 45 degrees F (7 degrees C) for interiors; 50 degrees F (10 degrees C) for exterior; unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.

B. Provide all paint and coating products from the same manufacturer to the greatest extent possible.
1. In the event that a single manufacturer cannot provide all specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.

C. Paints:
   1. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
D. Transparent Finishes:
   1. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
E. Stains:
   1. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
F. Primer Sealers: Same manufacturer as top coats.
G. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PAINTS AND COATINGS - GENERAL

A. Paints and Coatings: Ready mixed, unless intended to be a field-catalyzed coating.
   1. Provide paints and coatings 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. Supply each coating material in quantity required to complete entire project's work from a single production run.
   3. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.
B. Colors: As indicated on drawings
   1. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under.

2.03 PAINT SYSTEMS - EXTERIOR

A. Paint ME-OP-3A - Ferrous Metals, Unprimed, Alkyd, 3 Coat:
   1. One coat of alkyd primer.
   2. Semi-gloss: Two coats of alkyd enamel.
B. Paint ME-OP-2A - Ferrous Metals, Primed, Alkyd, 2 Coat:
   1. Touch-up with rust-inhibitive primer recommended by top coat manufacturer.
   2. Semi-gloss: Two coats of alkyd enamel.
C. Paint MgE-OP-3A - Galvanized Metals, Alkyd, 3 Coat:
   1. One coat galvanize primer.
   2. Semi-gloss: Two coats of alkyd enamel.
D. Paint E-Pav - Pavement Marking Paint:
   1. White: One coat, with reflective particles .

2.04 PAINT SYSTEMS - INTERIOR

A. Paint I-OP-MD-DT - Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals, wood, and _____:
   1. Medium duty applications include doors, door frames, railings, handrails, guardrails, balustrades, and _____.
   2. Two top coats and one coat primer.
   3. Top Coat(s): Interior Alkyd; MPI #47, 48.
   4. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.
   5. Top Coat Product(s):
      a. Sherwin-Williams ProMar 200 Waterbased Acrylic-Alkyd.
   6. Primer(s): As recommended by manufacturer of top coats.
B. Paint I-OP-MD-WC - Medium Duty Vertical/Overhead: Including gypsum board, plaster, concrete, concrete masonry, uncoated steel, shop primed steel, galvanized steel, aluminum, and _____.
   1. Two top coats and one coat primer.
   2. Flat: MPI gloss level 1; use this sheen for ceilings and other overhead surfaces.
   3. Top Coat Product(s):
      a. Sherwin-Williams ProMar 200 Zero VOC Latex. (MPI #144)

4. Primer(s): As recommended by manufacturer of top coats.

C. Paint I-TR -W - Transparent Finish on Wood, Unless Otherwise Indicated:
1. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.
2. Top Coat Product(s):
a. Sherwin-Williams MinWax High Build Polyurethane.
3. Stain Product(s):
a. Sherwin-Williams Wood Classics Interior Oil Stain. (MPI #90)
4. Sanding Sealer Product(s):
a. Sherwin-Williams Wood Classics FastDry Sanding Sealer. (MPI #102)

2.05 ACCESSORY MATERIALS

A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required to achieve the finishes specified whether specifically indicated or not; commercial quality.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of coatings 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 affect proper application.

D. If substrate preparation is the responsibility of another installer, notify Architect 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 Unit Masonry: 12 percent.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to coating 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 mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

F. Concrete and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

G. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.

H. Plaster Surfaces to be Painted: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

I. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

J. Uncorroded Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand or power tool wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.

K. Shop-Primed Steel Surfaces to be Finish Painted: 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.

L. Interior 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.

M. Interior 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.

N. 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 instructions.

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.

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 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

A. Protect finished coatings until completion of project.

B. Touch-up damaged coatings after Substantial Completion.

END OF SECTION

SECTION 09 9600
HIGH-PERFORMANCE COATINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. High performance coatings.

B. Surface preparation.

1.02 RELATED REQUIREMENTS

A. Section 09 9123 - Interior Painting: Requirements for mechanical and electrical equipment surfaces.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Samples: Submit two samples 8 by 8 inch (203 by 203 mm) in size illustrating colors available for selection.

C. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

D. Maintenance Data: Include cleaning procedures and repair and patching techniques.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Coating Materials: 1 gallon (4 liters) of each type and color.
   2. Label each container with manufacturer's name, product number, color number, and room names and numbers where used.

1.04 QUALITY ASSURANCE

A. Maintain one copy of each referenced document that applies to application on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

C. Applicator Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

1.05 FIELD CONDITIONS

A. Do not install materials when temperature is below 55 degrees F (13 degrees C) or above 90 degrees F (32 degrees C).

B. Maintain this temperature range, 24 hours before, during, and 72 hours after installation of coating.

C. Restrict traffic from area where coating is being applied or is curing.

1.06 WARRANTY

A. Correct defective Work within a five year period after Date of Substantial Completion.

B. Warranty: Include coverage for bond to substrate.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. High-Performance Coatings:
   1. Sherwin-Williams Company; Sher-Cryl Performance Acrylic, semi-gloss; Pro-Cryl Primer: www.protective.sherwin-williams.com/industries/#sle.
   2. Peacock Laboratories; Permalac Original, Black Tint.
   3. Substitutions: Section 01 6000 - Product Requirements.

2.02 ACCESSORY MATERIALS

A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of coated surfaces.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Do not begin application of coatings until substrates have been properly prepared.

C. Verify that substrate surfaces are ready to receive work as instructed by the coating manufacturer. Obtain and follow manufacturer's instructions for examination and testing of substrates.

D. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

E. Proceed with coating application only after unacceptable conditions have been corrected.
   1. Commencing coating application constitutes Contractor's acceptance of substrates and conditions.

3.02 PREPARATION

A. Clean surfaces of loose foreign matter.

B. Remove substances that would bleed through finished coatings.

C. Remove finish hardware, fixture covers, and accessories and store.

D. Galvanized Surfaces:

E. Ferrous Metal:
   1. Prepare surfaces per High-Performance Coating Manufacturer's requirements.
   2. 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", and protect from corrosion until coated.

F. Protect adjacent surfaces and materials not receiving coating from spatter and overspray; mask if necessary to provide adequate protection. Repair damage.

3.03 PRIMING

A. Apply primer to all surfaces, unless specifically not required by coating manufacturer. Apply in accordance with coating manufacturer's instructions.

3.04 COATING APPLICATION

A. Apply coatings in accordance with manufacturer's written instructions, to thicknesses specified and recommendations in "MPI Architectural Painting and Specification Manual".

B. Apply in uniform thickness coats, without runs, drips, pinholes, brush marks, or variations in color, texture, or finish. Finish edges, crevices, corners, and other changes in dimension with full coating thickness.

3.05 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

B. Clean surfaces immediately of overspray, splatter, and excess material.

C. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

3.06 PROTECTION

A. Protect finished work from damage.

END OF SECTION

SECTION 21 05 00

COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Mechanical sleeve seals.
3. Sleeves.
4. Escutcheons.
5. Grout.
6. Equipment installation requirements common to equipment sections.
7. Painting and finishing.
8. Concrete bases.
9. Supports and anchorages.

1.03 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.04 SUBMITTALS

A. Product Data: For the following:

1. Mechanical sleeve seals.
2. Escutcheons.

B. Welding certificates.

1.05 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Fire-Suppression Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.06 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 to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight and physical damage. Support to prevent sagging and bending.

1.07 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for fire-suppression installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for fire-suppression items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 8.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.02 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 21 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.03 JOINING MATERIALS

A. Refer to individual Division 21 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. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.04 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Manufacturers:

    a. Advance Products & Systems, Inc.
    b. Calpico, Inc.
    c. Metraflex Co.
    d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Stainless steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.05 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

    1. Underdeck Clamp: Clamping ring with set screws.

2.06 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.

    1. Finish: Polished chrome-plated.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

    1. Finish: Polished chrome-plated.

E. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.

F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw or spring clips, and chrome-plated finish.

G. One-Piece, Floor-Plate Type: Cast-iron floor plate.

H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.07 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.01 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 21 Sections specifying piping systems.

B. 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 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 to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
c. Insulated Piping: One-piece, stamped-steel type with spring clips.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.

e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece or split-casting, cast-brass type with polished chrome-plated finish.
g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type and set screw.
h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
i. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
j. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

M. Sleeves are not required for core-drilled holes.

N. Permanent sleeves are not required for holes formed by removable PE sleeves.

O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

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. Install sleeves in new walls and slabs as new walls and slabs are constructed.
3. Install sleeves that are 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 NPS 6.
b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.

1) Seal space outside of sleeve fittings with grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

Q. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow 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 and larger in diameter.
3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten

bolts against pressure plates that cause sealing elements to expand and make watertight seal.

R. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

S. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 7 for materials.

T. Verify final equipment locations for roughing-in.

U. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.02 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 21 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. 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 unless dry seal threading is specified.
2. 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.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.03 PAINTING

A. Painting of fire-suppression systems, equipment, and components is specified in Division 9.

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.04 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.
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-psig, 28-day compressive-strength concrete and reinforcement as specified in Division 3.

3.05 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 5 for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor fire-suppression materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.06 GROUTING

A. Mix and install grout for fire-suppression equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

3.07 TRAINING

A. “Training of the Owner’s operation and maintenance personnel is required in cooperation with the Owner's Representative. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and troubleshooting of the installed systems. The instruction shall be scheduled in coordination with the Owner's Representative after submission and approval of formal training plans. Refer to Section 01770, Execution Requirements, for contractor training requirements.

3.08 TESTING

A. Contractors' tests shall be scheduled and documented.

END OF SECTION 210500

SECTION 21 10 00

WATER-BASED AND DRY FIRE-SUPPRESSION SYSTEMS

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.

1.02 SUMMARY

A. This Section includes the following fire-suppression piping inside the building:

1. Wet-pipe and dry pipe sprinkler systems.

1.03 DEFINITIONS

A. CPVC: Chlorinated polyvinyl chloride plastic.

B. CR: Chlorosulfonated polyethylene synthetic rubber.

C. High-Pressure Piping System: Fire-suppression piping system designed to operate at working pressure higher than standard 175 psig.

D. PE: Polyethylene plastic.

E. Underground Service-Entrance Piping: Underground service piping below the building.

1.04 SYSTEM DESCRIPTIONS

A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

B. Dry-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing compressed air. Opening of sprinklers releases compressed air and permits water pressure to open dry-pipe valve. Water then flows into piping and discharges from sprinklers that are open.

C. Combined Dry-Pipe and Preaction Sprinkler System: Automatic sprinklers are attached to piping containing compressed air. Fire-detection system in same area as sprinklers actuates tripping devices that open dry-pipe valve without loss of air pressure and actuates fire alarm. Water discharges from sprinklers that have opened.

D. Single-Interlock Preaction Sprinkler System: Automatic sprinklers are attached to piping containing low-pressure air. Actuation of fire-detection system in same area as sprinklers opens deluge valve, permitting water to flow into piping and to discharge from sprinklers that have opened.

E. Double-Interlock Preaction Sprinkler System: Automatic sprinklers are attached to piping containing low-pressure air. Actuation of a fire-detection system in the same area as sprinklers

opens the deluge valve permitting water to flow into the sprinkler piping; a closed solenoid valve in the sprinkler piping is opened by another fire-detection device; then water will discharge from sprinklers that have opened.

1.05 PERFORMANCE REQUIREMENTS

A. Standard Piping System Component Working Pressure: Listed for at least 175 psig.

B. Fire-suppression sprinkler system design shall be approved by authorities having jurisdiction.

1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.

2. Sprinkler Occupancy Hazard Classifications:

   a. Building Service Areas: Ordinary Hazard, Group 1.
   b. Electrical Equipment Rooms: Ordinary Hazard, Group 1.
   c. General Storage Areas: Ordinary Hazard, Group 1.
   d. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
   e. Office and Public Areas: Light Hazard.

3. Minimum Density for Automatic-Sprinkler Piping Design:

   a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. area.
   b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. area.
   c. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over 1500-sq. ft. area.
   d. Extra-Hazard, Group 1 Occupancy: 0.30 gpm over 2500-sq. ft. area.
   e. Extra-Hazard, Group 2 Occupancy: 0.40 gpm over 2500-sq. ft. area.
   f. Special Occupancy Hazard: As determined by authorities having jurisdiction.

4. Maximum Protection Area per Sprinkler: Per UL listing.
5. Maximum Protection Area per Sprinkler:

   a. Office Spaces: 120 sq. ft.
   b. Storage Areas: 130 sq. ft.
   c. Mechanical Equipment Rooms: 130 sq. ft.
   d. Electrical Equipment Rooms: 130 sq. ft.
   e. Other Areas: According to NFPA 13 recommendations, unless otherwise indicated.

6. Total Combined Hose-Stream Demand Requirement: According to NFPA 13, unless otherwise indicated:

   a. Light-Hazard Occupancies: 100 gpm for 30 minutes.
   b. Ordinary-Hazard Occupancies: 250 gpm for 60 to 90 minutes.
   c. Extra-Hazard Occupancies: 500 gpm for 90 to 120 minutes.

1.06 SUBMITTALS

A. Product Data: For the following:

1. Piping materials, including dielectric fittings, flexible connections, and sprinkler specialty fittings.
2. Pipe hangers and supports.

3. Valves, including listed fire-protection valves, unlisted general-duty valves, and specialty valves and trim.
4. Air compressors, including electrical data.
5. Excess-pressure pumps, including electrical data.
6. Sprinklers, escutcheons, and guards. Include sprinkler flow characteristics, mounting, finish, and other pertinent data.
7. Hose connections, including size, type, and finish.
8. Monitors.
9. Fire department connections, including type; number, size, and arrangement of inlets; caps and chains; size and direction of outlet; escutcheon and marking; and finish.
10. Alarm devices, including electrical data.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Fire-hydrant flow test report.

D. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations, if applicable.

E. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13 and NFPA 14. Include "Contractor's Material and Test Certificate for Aboveground Piping" and "Contractor's Material and Test Certificate for Underground Piping."

F. Welding certificates.

G. Field quality-control test reports.

H. Operation and Maintenance Data: For standpipe and sprinkler specialties to include in emergency, operation, and maintenance manuals.

1.07 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing fire-suppression systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

   a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

B. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

C. NFPA Standards: Fire-suppression-system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13, "Installation of Sprinkler Systems."
2. NFPA 13R, "Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height."
3. NFPA 14, "Installation of Standpipe, Private Hydrant, and Hose Systems."
4. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."

1.08 COORDINATION

A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

1.09 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Provide and install spare sprinkler head cabinet(s) in accordance with NFPA-13.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell end and plain end.

   1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
   2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron gland, rubber gasket, and steel bolts and nuts.

B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell end and plain end.

   1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
   2. Gaskets: AWWA C111, rubber.

C. Grooved-End, Ductile-Iron Pipe: AWWA C151, with factory- or field-formed, radius-cut-grooved ends according to AWWA C606.

   1. Grooved-Joint Piping Systems:

      a. Manufacturers:

         1) Tyco Fire Products ‘Grinnell’ couplings and fittings.
         2) Victaulic Co. of America.

      b. Grooved-End Fittings: ASTM A 536, ductile-iron casting with OD matching ductile-iron-pipe OD and cement lining.
      c. Grooved-End-Pipe Couplings: AWWA C606, gasketed fitting matching ductile-iron-pipe OD. Include ductile-iron housing with keys matching ductile-iron-pipe and fitting grooves, prelubricated rubber gasket with center leg, and steel bolts and nuts.
      d. Grooved-End-Pipe Transition Coupling: UL 213 and AWWA C606, gasketed fitting with end matching ductile-iron-pipe OD and end matching steel-pipe OD. Include

ductile-iron housing with key matching ductile-iron-pipe groove and key matching steel-pipe groove, prelubricated rubber gasket listed for use with housing, and steel bolts and nuts.

2.03 STEEL PIPE AND FITTINGS

A. Threaded-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, hot-dip galvanized where indicated and with factory- or field-formed threaded ends.

1. Cast-Iron Threaded Flanges: ASME B16.1.
2. Malleable-Iron Threaded Fittings: ASME B16.3.
3. Gray-Iron Threaded Fittings: ASME B16.4.
4. Steel Threaded Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, seamless steel pipe hot-dip galvanized where indicated. Include ends matching joining method.
5. Steel Threaded Couplings: ASTM A 865 hot-dip galvanized-steel pipe where indicated.

B. Plain-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795 hot-dip galvanized-steel pipe where indicated.

1. Locking-Lug Fittings: UL 213, ductile-iron body with retainer lugs that require one-quarter turn to secure pipe in fitting.

a. Manufacturers:

1) Anvil International, Inc.
2) Victaulic Co. of America.
3) Ward Manufacturing.

C. Plain-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795 hot-dip galvanized-steel pipe where indicated.

1. Steel Welding Fittings: ASTM A 234/A 234M, and ASME B16.9 or ASME B16.11.
2. Steel Flanges and Flanged Fittings: ASME B16.5.

D. Grooved-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, hot-dip galvanized where indicated and with factory- or field-formed, square-cut- or roll-grooved ends.

1. Grooved-Joint Piping Systems:

a. Manufacturers:

1) Tyco Fire Products ‘Grinnell’ grooved couplings and fittings.
2) Anvil International, Inc.
3) Shurjoint Piping Products, Inc.
4) Victaulic Co. of America.
5) Ward Manufacturing.

b. Grooved-End Fittings: UL-listed, ASTM A 536, ductile-iron casting with OD matching steel-pipe OD.
c. 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 and fitting grooves, prelubricated rubber gasket listed for use with housing, and steel bolts and nuts.

E. Threaded-End, Schedule 30 Steel Pipe: ASTM A 135 or ASTM A 795, with wall thickness less than Schedule 40 and equal to or greater than Schedule 30; or ASTM A 795 and ASME B36.10M, Schedule 30 wrought-steel pipe; hot-dip galvanized where indicated and with factory- or field-threaded ends.

1. Cast-Iron Threaded Flanges: ASME B16.1.
2. Malleable-Iron Threaded Fittings: ASME B16.3.
3. Gray-Iron Threaded Fittings: ASME B16.4.
4. Steel Threaded Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, seamless steel pipe hot-dip galvanized where indicated. Include ends matching joining method.
5. Steel Threaded Couplings: ASTM A 865 hot-dip galvanized-steel pipe where indicated.

F. Plain-End, Schedule 30 Steel Pipe: ASTM A 135 or ASTM A 795, with wall thickness less than Schedule 40 and equal to or greater than Schedule 30; or ASTM A 795 and ASME B36.10M, Schedule 30 wrought-steel pipe hot-dip galvanized where indicated.

1. Locking-Lug Fittings: UL 213, ductile-iron body with retainer lugs that require one-quarter turn to secure pipe in fitting.

a. Manufacturers:

1) Anvil International, Inc.
2) Victaulic Co. of America.
3) Ward Manufacturing.

G. Plain-End, Schedule 30 Steel Pipe: ASTM A 135 or ASTM A 795, with wall thickness less than Schedule 40 and equal to or greater than Schedule 30; or ASTM A 795 and ASME B36.10M, Schedule 30 wrought-steel pipe hot-dip galvanized where indicated.

1. Steel Welding Fittings: ASTM A 234/A 234M, and ASME B16.9 or ASME B16.11.
2. Steel Flanges and Flanged Fittings: ASME B16.5.

H. Grooved-End, Schedule 30 Steel Pipe: ASTM A 135 or ASTM A 795, with wall thickness less than Schedule 40 and equal to or greater than Schedule 30; or ASTM A 795 and ASME B36.10M, Schedule 30 wrought-steel pipe hot-dip galvanized where indicated; with factory- or field-formed, roll-grooved ends.

1. Grooved-Joint Piping Systems:

a. Manufacturers:

1) Tyco Fire Products ‘Grinnell’ grooved couplings and fittings.
2) Anvil International, Inc.
3) Shurjoint Piping Products, Inc.
4) Victaulic Co. of America.
5) Ward Manufacturing.

b. Grooved-End Fittings: UL-listed, ASTM A 536, ductile-iron casting with OD matching steel-pipe OD.
c. 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 and fitting grooves,[prelubricated] rubber gasket listed for use with housing, and steel bolts and nuts.

I. Threaded-End, Threadable, Thinwall Steel Pipe: ASTM A 135 or ASTM A 795, with wall thickness less than Schedule 40 and greater than Schedule 10, and with factory- or field-formed threaded ends.

1. Cast-Iron Threaded Flanges: ASME B16.1.
2. Malleable-Iron Threaded Fittings: ASME B16.3.
3. Gray-Iron Threaded Fittings: ASME B16.4.
4. Steel Threaded Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, seamless steel pipe.
5. Steel Threaded Couplings: ASTM A 865.

J. Plain-End, Threadable, Thinwall Steel Pipe: ASTM A 135 or ASTM A 795, with wall thickness less than Schedule 40 and greater than Schedule 10.

1. Locking-Lug Fittings: UL 213, ductile-iron body with retainer lugs that require one-quarter turn to secure pipe in fitting.

a. Manufacturers:

1) Anvil International, Inc.
2) Victaulic Co. of America.
3) Ward Manufacturing.

K. Plain-End, Schedule 10 Steel Pipe: ASTM A 135 or ASTM A 795, Schedule 10 in NPS 5 and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10.

1. Locking-Lug Fittings: UL 213, ductile-iron body with retainer lugs that require one-quarter turn to secure pipe in fitting.

a. Manufacturers:

1) Anvil International, Inc.
2) Victaulic Co. of America.
3) Ward Manufacturing.

L. Plain-End, Schedule 10 Steel Pipe: ASTM A 135 or ASTM A 795, Schedule 10 in NPS 5 and smaller; and NFPA 13 specified wall thickness in NPS 6 to NPS 10.

1. Steel Welding Fittings: ASTM A 234/A 234M, and ASME B16.9 or ASME B16.11.
2. Steel Flanges and Flanged Fittings: ASME B16.5.

M. Grooved-End, Schedule 10 Steel Pipe: ASTM A 135 or ASTM A 795, Schedule 10 in NPS 5 and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10; with factory- or field-formed, roll-grooved ends.

N. Standard Weight, Galvanized-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.

O. Schedule 30, Galvanized-Steel Pipe: ASTM A 135; ASTM A 795/A 795M, Type E or ASME B36.10M, wrought steel; with wall thickness not less than Schedule 30 and not more than Schedule 40. Pipe ends may be factory or field formed to match joining method.

2.04 DIELECTRIC FITTINGS

A. Assembly shall be copper alloy, ferrous, and insulating materials with ends matching piping system.

B. Dielectric Unions: Factory-fabricated assembly, designed for 250-psig minimum working pressure at 180 deg F. Include insulating material that isolates dissimilar materials and ends with inside threads according to ASME B1.20.1.

1. Manufacturers:

a. Capitol Manufacturing Co.
b. Epco Sales, Inc.
c. Hart Industries International, Inc.
d. Watts Industries, Inc.; Water Products Div.
e. Zurn Industries, Inc.; Wilkins Div.

C. Dielectric Flanges: Factory-fabricated companion-flange assembly, for 175-psig minimum working-pressure rating as required for piping system.

1. Manufacturers:

a. Capitol Manufacturing Co.
b. Epco Sales, Inc.
c. Watts Industries, Inc.; Water Products Div.

D. Dielectric Flange Insulation Kits: Components for field assembly shall include CR or phenolic gasket, PE or phenolic bolt sleeves, phenolic washers, and steel backing washers.

1. Manufacturers:

a. Advance Products and Systems, Inc.
b. Calpico, Inc.
c. Pipeline Seal and Insulator, Inc.

E. Dielectric Couplings: Galvanized steel with inert and noncorrosive thermoplastic lining and threaded ends and 300-psig working-pressure rating at 225 deg F.

1. Manufacturers:

a. Calpico, Inc.
b. Lochinvar Corp.

F. Dielectric Nipples: Electroplated steel with inert and noncorrosive thermoplastic lining, with combination of plain, threaded, or grooved ends and 300-psig working-pressure rating at 225 deg F.

1. Manufacturers:

a. Perfection Corporation.
b. Precision Plumbing Products, Inc.
c. Victaulic Co. of America.

2.05 FLEXIBLE CONNECTORS

A. Flexible connectors shall have materials suitable for system fluid. Include 250-psig working-pressure rating and ends according to the following:

1. NPS 2 and Smaller: Threaded.
2. NPS 2-1/2 and Larger: Flanged.
3. Option for NPS 2-1/2 and Larger: Grooved for use with grooved-end-pipe couplings.

B. Manufacturers:

1. Flex-Head Co., Inc.
2. Metraflex, Inc.

C. 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.

D. 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.

E. Stainless-Steel-Hose/Stainless-Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include stainless-steel nipples or flanges, welded to hose.

2.06 CORROSION-PROTECTIVE ENCASEMENT FOR PIPING

A. Encasement for Underground Metal Piping: ASTM A 674 or AWWA C105, PE film, 0.008-inch minimum thickness, tube or sheet.

2.07 SPRINKLER SPECIALTY FITTINGS

A. Sprinkler specialty fittings shall be UL listed or FMG approved, with 250-psig minimum working-pressure rating, and made of materials compatible with piping. Sprinkler specialty fittings shall have 250-psig working-pressure rating if fittings are components of high-pressure piping system.

B. Outlet Specialty Fittings:

1. Manufacturers:

    1) Tyco Fire Products ‘Grinnell’ grooved couplings and fittings.
    2) Anvil International, Inc.
    3) Shurjoint Piping Products, Inc.
    4) Victaulic Co. of America.
    5) Ward Manufacturing.

2. Mechanical-T and -Cross Fittings: UL 213, ductile-iron housing with gaskets, bolts and nuts, and threaded, locking-lug, or grooved outlets.
3. Snap-On and Strapless Outlet Fittings: UL 213, ductile-iron housing or casting with gasket and threaded outlet.

C. Sprinkler Drain and Alarm Test Fittings: Cast- or ductile-iron body; with threaded or locking-lug inlet and outlet, test valve, and orifice and sight glass.

1. Manufacturers:

a. Tyco Fire Products
b. Fire-End and Croker Corp.
c. Viking Corp.
d. Victaulic Co. of America.

D. Sprinkler Branch-Line Test Fittings: Brass body with threaded inlet, capped drain outlet, and threaded outlet for sprinkler.

1. Manufacturers:

a. Elkhart Brass Mfg. Co., Inc.
b. Fire-End and Croker Corp.
c. Potter-Roemer; Fire-Protection Div.

E. Sprinkler Inspector's Test Fitting: Cast- or ductile-iron housing with threaded inlet and drain outlet and sight glass.

1. Manufacturers:

a. AGF Manufacturing Co.
b. Tyco Fire Products
c. G/J Innovations, Inc.
d. Triple R Specialty of Ajax, Inc.

F. Drop-Nipple Fittings: UL 1474, adjustable with threaded inlet and outlet, and seals.

1. Manufacturers:

a. CECA, LLC.
b. Merit.

2.08 LISTED FIRE-PROTECTION VALVES

A. Valves shall be UL listed or FMG approved, with 250-psig minimum pressure rating. Valves shall have 250-psig pressure rating if valves are components of high-pressure piping system.

B. Gate Valves with Wall Indicator Posts:

1. Gate Valves: UL 262, cast-iron body, bronze mounted, with solid disc, nonrising stem, operating nut, and flanged ends.
2. Indicator Posts: UL 789, horizontal-wall type, cast-iron body, with operating wrench, extension rod, locking device, and cast-iron barrel.
3. Manufacturers:

a. McWane, Inc.; Kennedy Valve Div.
b. NIBCO.
c. Stockham.

C. Ball Valves: Comply with UL 1091, except with ball instead of disc.

1. NPS 1-1/2 and Smaller: Bronze body with threaded ends.
2. NPS 2 and NPS 2-1/2: Bronze body with threaded ends or ductile-iron body with grooved ends.
3. NPS 3: Ductile-iron body with grooved ends.
4. Manufacturers:

a. NIBCO.
b. Victaulic Co. of America.

D. Butterfly Valves: UL 1091.

1. NPS 2 and Smaller: Bronze body with threaded ends.

a. Manufacturers:

1) Global Safety Products, Inc.
2) Milwaukee Valve Company.

2. NPS 2-1/2 and Larger: Bronze, cast-iron, or ductile-iron body; wafer type or with flanged or grooved ends.

a. Manufacturers:

1) Global Safety Products, Inc.
2) McWane, Inc.; Kennedy Valve Div.
3) Mueller Company.
4) NIBCO.
5) Pratt, Henry Company.
6) Tyco Fire Products
7) Victaulic Co. of America.

E. Check Valves NPS 2 and Larger: UL 312, swing type, cast-iron body with flanged or grooved ends.

1. Manufacturers:

a. AFAC Inc.
b. American Cast Iron Pipe Co.; Waterous Co.
c. Clow Valve Co.
d. Crane Co.; Crane Valve Group; Crane Valves.
e. Crane Co.; Crane Valve Group; Jenkins Valves.
f. Hammond Valve.
g. McWane, Inc.; Kennedy Valve Div.
h. Mueller Company.
i. NIBCO.
j. Potter-Roemer; Fire Protection Div.
k. Stockham.
l. Tyco Fire Products
m. United Brass Works, Inc.
n. Victaulic Co. of America.

F. Gate Valves: UL 262, OS&Y type.

1. NPS 2 and Smaller: Bronze body with threaded ends.

a. Manufacturers:

1) McWane Co., Kennedy Valve Division
2) Crane Co.; Crane Valve Group; Crane Valves.
3) Hammond Valve.
4) NIBCO.

5) United Brass Works, Inc.

2. NPS 2-1/2 and Larger: Cast-iron body with flanged ends.

a. Manufacturers:

1) McWane Co., Kennedy Valve Division
2) Clow Valve Co.
3) Crane Co.; Crane Valve Group; Crane Valves.
4) Crane Co.; Crane Valve Group; Jenkins Valves.
5) Hammond Valve.
6) Milwaukee Valve Company.
7) Mueller Company.
8) NIBCO.
9) Red-White Valve Corp.
10) United Brass Works, Inc.

G. Indicating Valves: UL 1091, with integral indicating device and ends matching connecting piping.

1. Indicator: Electrical, 115-V ac, prewired, 2-circuit, supervisory switch.
2. NPS 2 and Smaller: Ball or butterfly valve with bronze body and threaded ends.

a. Manufacturers:

1) Milwaukee Valve Company.
2) NIBCO.
3) Victaulic Co. of America.

3. NPS 2-1/2 and Larger: Butterfly valve with cast- or ductile-iron body; wafer type or with flanged or grooved ends.

a. Manufacturers:

1) McWane, Inc.; Kennedy Valve Div.
2) Milwaukee Valve Company.
3) NIBCO.
4) Tyco Fire Products
5) Victaulic Co. of America.

2.09 UNLISTED GENERAL-DUTY VALVES

A. Ball Valves NPS 2 and Smaller: MSS SP-110, 2-piece copper-alloy body with chrome-plated brass ball, 600-psig minimum CWP rating, blowout-proof stem, and threaded ends.

B. Check Valves NPS 2 and Smaller: MSS SP-80, Type 4, Class 125 minimum, swing type with bronze body, nonmetallic disc, and threaded ends.

C. Gate Valves NPS 2 and Smaller: MSS SP-80, Type 2, Class 125 minimum, with bronze body, solid wedge, and threaded ends.

D. Globe Valves NPS 2 and Smaller: MSS SP-80, Type 2, Class 125 minimum, with bronze body, nonmetallic disc, and threaded ends.

2.10 SPECIALTY VALVES

A. Sprinkler System Control Valves: UL listed or FMG approved, cast- or ductile-iron body with flanged or grooved ends, and 250-psig minimum pressure rating. Control valves shall have 250-psig pressure rating if valves are components of high-pressure piping system.

1. Manufacturers:

   a. AFAC Inc.
   b. Tyco Fire Products
   c. Victaulic Co. of America.

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.
   b. Drip Cup Assembly: Pipe drain with check valve to main drain piping.

B. Pressure-Regulating Valves: UL 1468, brass or bronze, NPS 2-1/2, 400-psig minimum rating. Include female NPS inlet and outlet, adjustable setting feature, and straight or 90-degree-angle pattern design as indicated.

1. Finish: Rough chrome-plated.
2. Manufacturers:

   a. AFAC Inc.
   b. Elkhart Brass Mfg. Co., Inc.
   c. Fire-End and Croker Corp.
   d. GMR International Equipment Corporation.
   e. Potter-Roemer; Fire Protection Div.
   f. Zurn Industries, Inc.; Wilkins Div.

C. Automatic Drain Valves: UL 1726, NPS 3/4, ball-check device with threaded ends.

1. Manufacturers:

   a. AFAC Inc.

D. Dry-Pipe Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Globe Fire Sprinkler Corporation.
   b. Reliable Automatic Sprinkler Co., Inc.
   c. Tyco Fire & Building Products LP.
   d. Venus Fire Protection Ltd.
   e. Victaulic Company.
   f. Viking Corporation.

2. Standard: UL 260
3. Design: Differential-pressure type.

4. Include UL 1486, quick-opening devices, trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
5. Air-Pressure Maintenance Device:

    a. Manufacturers: Subject to compliance with requirements, [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
    b. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

        1) AFAC Inc.
        2) Globe Fire Sprinkler Corporation.
        3) Reliable Automatic Sprinkler Co., Inc.
        4) Tyco Fire & Building Products LP.
        5) Venus Fire Protection Ltd.
        6) Victaulic Company.
        7) Viking Corporation.
        8) <**Insert manufacturer's name**>.

    c. Standard: UL 260.
    d. Type: Automatic device to maintain minimum air pressure in piping.
    e. Include shutoff valves to permit servicing without shutting down sprinkler piping, bypass valve for quick filling, pressure regulator or switch to maintain pressure, strainer, pressure ratings with 14- to 60-psig (95- to 410-kPa) adjustable range, and [**175-psig (1200-kPa)**] [**300-psig (2070-kPa)**] outlet pressure.

6. Air Compressor:

    a. Manufacturers: Subject to compliance with requirements, provide product by one of the following:
        1) General Air Products, Inc,
        2) Viking Corporation.

    b. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
    c. Motor Horsepower: Fractional.
    d. Power: 120-V ac, 60 Hz, single phase.

E. Deluge Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following
    a. Globe Fire Sprinkler Corporation.
    b. Reliable Automatic Sprinkler Co., Inc.
    c. Tyco Fire & Building Products LP.
    d. Victaulic Company.
    e. Viking Corporation.

2. Standard: UL 260.
3. Design: Hydraulically operated, differential-pressure type.
4. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, drip cup assembly piped without valves and separate from main drain line, fill-line attachment with strainer, and push-rod chamber supply connection.

5. Dry, Pilot-Line Trim Set: Include dry, pilot-line actuator; air- and water-pressure gages; low-air-pressure warning switch; air relief valve; and actuation device. Dry, pilot-line actuator includes cast-iron, operated, diaphragm-type valve with resilient facing plate, resilient diaphragm, and replaceable bronze seat. Valve includes threaded water and air inlets and water outlet. Loss of air pressure on dry, pilot-line side allows pilot-line actuator to open and causes deluge valve to open immediately.
6. Air-Pressure Maintenance Device:

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following
        1) Globe Fire Sprinkler Corporation.
        2) Reliable Automatic Sprinkler Co., Inc.
        3) Tyco Fire & Building Products LP.
        4) Victaulic Company.
        5) Viking Corporation.

    b. Standard: UL 260.
    c. Type: Automatic device to maintain minimum air pressure in piping.
    d. Include shutoff valves to permit servicing without shutting down sprinkler piping, bypass valve for quick filling, pressure regulator or switch to maintain pressure, strainer, pressure ratings with 14- to 60-psigadjustable range, and 175-psig outlet pressure.

7. Air Compressor:

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following
        1) General Air Products, Inc,
        2) Viking Corporation.

    b. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
    c. Motor Horsepower: Fractional.
    d. Power: 120-V ac, 60 Hz, single phase.

2.11 MANUAL CONTROL STATIONS

A. Manual Control Stations: UL listed or FMG approved, hydraulic operation, with union, NPS 1/2 pipe nipple, and bronze ball valve. Include metal enclosure labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut to prevent accidental opening.

2.12 SPRINKLERS

A. Sprinklers shall be UL listed or FMG approved, with 175-psig minimum pressure rating. Sprinklers shall have 250-psig minimum pressure rating if sprinklers are components of high-pressure piping system.

B. Manufacturers:
    1. Firematic Sprinkler Devices, Inc.
    2. Globe Fire Sprinkler Corporation.
    3. Reliable Automatic Sprinkler Co., Inc.
    4. Tyco Fire Products

5. Victaulic Co. of America.
6. Viking Corp.

C. Automatic Sprinklers: With heat-responsive element complying with the following:

1. UL 199, for nonresidential applications.
2. UL 1767, for early-suppression, fast-response applications.

D. Sprinkler Types and Categories: Nominal 1/2-inch orifice for "Ordinary" temperature classification rating, unless otherwise indicated or required by application.

1. Open Sprinklers: UL 199, without heat-responsive element.

a. Orifice: 1/2 inch, with discharge coefficient K between 5.3 and 5.8.
b. Orifice: 17/32 inch, with discharge coefficient K between 7.4 and 8.2.

E. Sprinkler types, features, and options as follows:

1. Concealed ceiling sprinklers, including bright white cover plate.
2. Extended-coverage sprinklers.
3. Flush ceiling sprinklers, including escutcheon.
4. Pendent sprinklers, including escutcheon if applicable.
5. Pendent , dry-type sprinklers.
6. Quick-response sprinklers.
7. Recessed sprinklers, including escutcheon.
8. Sidewall sprinklers.
9. Sidewall, dry-type sprinklers.
10. Upright sprinklers.

F. Sprinkler Finishes: Chrome plated, bronze, and painted.

G. Special Coatings: Wax, lead, and corrosion-resistant paint.

H. 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.

I. Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler with which it is listed.

2.13 HOSE CONNECTIONS

A. Manufacturers:

1. Elkhart Brass Mfg. Co., Inc.
2. Fire-End and Croker Corp.
3. Fire Protection Products, Inc.
4. GMR International Equipment Corporation.
5. Guardian Fire Equipment Incorporated.
6. McWane, Inc.; Kennedy Valve Div.
7. Mueller Company.
8. Potter-Roemer; Fire-Protection Div.

9. United Brass Works, Inc.

B. Description: UL 668, brass or bronze, 300-psig minimum pressure rating, hose valve for connecting fire hose. Include angle or gate pattern design; female NPS inlet and male hose outlet; and lugged cap, gasket, and chain. Include NPS 1-1/2 or NPS 2-1/2 as indicated, and hose valve threads according to NFPA 1963 and matching local fire department threads.

1. Valve Operation: Nonadjustable type, unless pressure-regulating type is indicated.
2. Finish: Rough metal or chrome-plated.

2.14 WALL-TYPE FIRE HYDRANTS

A. Manufacturers:

1. AFAC Inc.
2. Elkhart Brass Mfg. Co., Inc.
3. Guardian Fire Equipment Incorporated.
4. Potter-Roemer; Fire-Protection Div.

B. Description: Cast-brass-body fire hydrant with brass wall escutcheon plates, brass lugged caps with gaskets and brass chains, and brass lugged swivel connections. Include outlets with threads according to NFPA 1963 and matching local fire department sizes and threads, inlet with pipe threads, extension pipe nipple, and valve control.

1. Type: Flush with two hose-connection outlets and square or rectangular escutcheon plate.
2. Type: Exposed, projecting, with two hose-connection outlets and round escutcheon plate.
3. Finish: Rough chrome-plated.
4. Hydrant Escutcheon-Plate Marking: "HYDRANT."
5. Hydrant Valve Control: Wall-mounting assembly with extension rod for manual control of valve inside building.
6. Hydrant Valve-Control Escutcheon-Plate Marking: "HYDRANT VALVE CONTROL."

2.15 FIRE DEPARTMENT CONNECTIONS

A. Manufacturers:

1. Elkhart Brass Mfg. Co., Inc.
2. Fire-End and Croker Corp.
3. Fire Protection Products, Inc.
4. GMR International Equipment Corporation.
5. Guardian Fire Equipment Incorporated.
6. Potter-Roemer; Fire-Protection Div.
7. United Brass Works, Inc.

B. Wall-Type, Fire Department Connection: UL 405, 250-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, extension pipe nipples, check devices or clappers for inlets, and escutcheon plate with marking similar to "AUTO SPKR & STANDPIPE."

1. Type: Flush, with two inlets and square or rectangular escutcheon plate.
2. Finish: Rough chrome-plated.

C. Exposed, Freestanding-Type, Fire Department Connection: UL 405, 250-psig minimum pressure rating; with corrosion-resistant-metal body, brass inlets with threads according to NFPA 1963 and matching local fire department sizes and threads, and bottom outlet with pipe threads. Include brass lugged caps, gaskets, and brass chains; brass lugged swivel connection and drop clapper for each hose-connection inlet; 18-inch high, brass sleeve; and round, floor, brass escutcheon plate with marking "AUTO SPKR & STANDPIPE."

1. Finish Including Sleeve: Rough chrome-plated.

2.16 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Water-Motor-Operated Alarm: UL 753, mechanical-operation type with pelton-wheel operator with shaft length, bearings, and sleeve to suit wall construction and 10-inch- diameter, cast-aluminum alarm gong with red-enamel factory finish. Include NPS 3/4 inlet and NPS 1 drain connections.

1. Manufacturers:

a. Firematic Sprinkler Devices, Inc.
b. Globe Fire Sprinkler Corporation.
c. Reliable Automatic Sprinkler Co., Inc.
d. Tyco Fire Products
e. Viking Corp.

C. Electrically Operated Alarm: UL 464, with 10-inch- diameter, vibrating-type, metal alarm bell with red-enamel factory finish and suitable for outdoor use.

1. Manufacturers:

a. Potter Electric Signal Company.
b. System Sensor.

D. Water-Flow Indicator: UL 346, electrical-supervision, paddle-operated-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.

1. Manufacturers:

a. Potter Electric Signal Company.
b. System Sensor.

E. Pressure Switch: 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.

1. Manufacturers:

a. Potter Electric Signal Company.
b. System Sensor.

F. Valve Supervisory Switch: UL 753, electrical, single-pole, double-throw switch with normally closed contacts. Include design that signals controlled valve is in other than fully open position.

1. Manufacturers:

a. Potter Electric Signal Company.
b. System Sensor.

G. Indicator-Post Supervisory Switch: UL 753, electrical, single-pole, double-throw switch with normally closed contacts. Include design that signals controlled indicator-post valve is in other than fully open position.

1. Manufacturers:

a. Potter Electric Signal Company.
b. System Sensor.

2.17 PRESSURE GAGES

A. Manufacturers:

1. AGF Manufacturing Co.
2. AMETEK, Inc.; U.S. Gauge.
3. Brecco Corporation.
4. Dresser Equipment Group; Instrument Div.
5. Marsh Bellofram.
6. WIKA Instrument Corporation.

B. Description: UL 393, 3-1/2- to 4-1/2-inch diameter, dial pressure gage with range of 0 to 250 psig minimum.

1. Water System Piping: Include caption "WATER" or "AIR/WATER" on dial face.
2. Air System Piping: Include retard feature and caption "AIR" or "AIR/WATER" on dial face.

2.18 CONTROL PANELS

A. Description: Single-area, two-area, or single-area cross-zoned type control panel as indicated, including NEMA ICS 6, Type 1 enclosure, detector, alarm, and solenoid-valve circuitry for operation of deluge valves. Panels contain power supply; battery charger; standby batteries; field-wiring terminal strip; electrically supervised solenoid valves and polarized fire-alarm bell; lamp test facility; single-pole, double-throw auxiliary alarm contacts; and rectifier.

1. Panels: UL listed and FM Global approved when used with thermal detectors and Class A detector circuit wiring. Electrical characteristics are 120-V ac, 60 Hz, with 24-V dc rechargeable batteries.
2. Manual Control Stations: Electric operation, metal enclosure, labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut to prevent accidental opening.
3. Manual Control Stations: Hydraulic operation, with union, NPS 1/2 pipe nipple, and bronze ball valve. Include metal enclosure labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut to prevent accidental opening.

PART 3 - EXECUTION

3.01 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 14 and NFPA 291. Use results for system design calculations required in Part 1 "Quality Assurance" Article.

B. Report test results promptly and in writing.

3.02 EARTHWORK

A. Refer to Division 31 for excavating, trenching, and backfilling.

3.03 EXAMINATION

A. Examine roughing-in for hose connections and stations to verify actual locations of piping connections before installation.

B. Examine walls and partitions for suitable thicknesses, fire- and smoke-rated construction, framing for hose-station cabinets, and other conditions where hose connections and stations are to be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.04 PIPING APPLICATIONS, GENERAL

A. Shop weld pipe joints where welded piping is indicated.

B. Do not use welded joints for galvanized-steel pipe.

C. Flanges, flanged fittings, unions, nipples, and transition and special fittings with finish and pressure ratings same as or higher than system's pressure rating may be used in aboveground applications, unless otherwise indicated.

D. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with threaded ends; cast- or malleable-iron threaded fittings; and threaded joints.

E. Underground Service-Entrance Piping: Ductile-iron, mechanical-joint pipe and fittings and restrained joints. Include corrosion-protective encasement.

3.05 SPRINKLER SYSTEM PIPING APPLICATIONS

A. Standard-Pressure, Wet-Pipe Sprinkler System, 175-psig Maximum Working Pressure:
   1. NPS 1-1/2 and Smaller: Threaded-end, black, standard-weight steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.
   2. NPS 1-1/2 and Smaller: Threaded-end, black, Schedule 30 steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.
   3. NPS 2: Plain-end, black, standard-weight steel pipe; steel welding fittings; and welded joints.
   4. NPS 2: Plain-end, black, Schedule 30 steel pipe; steel welding fittings; and welded joints.
   5. NPS 2: Grooved-end, black, Schedule 30 steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
   6. NPS 2-1/2 to NPS 3-1/2: Plain-end, black, standard-weight steel pipe; steel welding fittings; and welded joints.

7. NPS 2-1/2 to NPS 3-1/2: Grooved-end, black, standard-weight steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
8. NPS 2-1/2 to NPS 3-1/2: Plain-end, black, Schedule 30 steel pipe; steel welding fittings; and welded joints.
9. NPS 2-1/2 to NPS 3-1/2: Grooved-end, black, Schedule 30 steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
10. NPS 4 to NPS 6: Plain-end, black, standard-weight steel pipe; steel welding fittings; and welded joints.
11. NPS 4 to NPS 6: Grooved-end, black, standard-weight steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
12. NPS 4 to NPS 6: Plain-end, black, Schedule 30 steel pipe; steel welding fittings; and welded joints.
13. NPS 4 to NPS 6: Grooved-end, black, Schedule 30 steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.

3.06 PIPING SCHEDULE

A. Piping between Fire-Department Connections and Check Valves

B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings

C. Standard-pressure, dry-pipe sprinkler system, NPS 2 and smaller shall be one of The following:

1. Standard-weight or Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
2. Standard-weight, Schedule 30, galvanized-steel pipe with plain ends; plain-end-pipe fittings; and twist-locked joints.
3. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

D. Standard-pressure, dry-pipe sprinkler system, NPS 2-1/2 to NPS 4 shall be one of the following:

1. Standard-weight or Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
2. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

E. Standard-pressure, dry-pipe sprinkler system, NPS 5 and NPS 6 shall be one of the following:

1. Standard-weight or Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
2. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

3.07 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Listed Fire-Protection Valves: UL listed or FMG approved for applications where required by NFPA 13 and NFPA 14.

    a. Shutoff Duty: Use ball, butterfly, or gate valves.

2. Unlisted General-Duty Valves: For applications where UL-listed and FMG-approved valves are not required by NFPA 13 and NFPA 14.

    a. Shutoff Duty: Use ball, butterfly, or gate valves.
    b. Throttling Duty: Use ball or globe valves.

3.08 JOINT CONSTRUCTION

A. Refer to Division 21 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. Grooved Joints: Assemble joints with listed coupling and gasket, lubricant, and bolts.

    1. Ductile-Iron Pipe: Radius-cut-groove ends of piping. Use grooved-end fittings and grooved-end-pipe couplings.
    2. Steel Pipe: Square-cut or roll-groove piping as indicated. Use grooved-end fittings and rigid, grooved-end-pipe couplings, unless otherwise indicated.
    3. Copper Tube: Roll-groove tubing. Use grooved-end fittings and grooved-end-tube couplings.
    4. Dry-Pipe Systems: Use fittings and gaskets listed for dry-pipe service.

D. Dissimilar-Metal Piping Joints: Construct joints using dielectric fittings compatible with both piping materials.

    1. NPS 2 and Smaller: Use dielectric unions, couplings, or nipples.
    2. NPS 2-1/2 to NPS 4: Use dielectric flanges.
    3. NPS 5 and Larger: Use dielectric flange insulation kits.

3.09 SERVICE-ENTRANCE PIPING

A. Connect fire-suppression piping to water-service piping of size and in location indicated for service entrance to building.

B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping. Refer to Division 22 for backflow preventers.

C. Install shutoff valve, check valve, pressure gage, and drain at connection to water service.

3.10 WATER-SUPPLY CONNECTION

A. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water distribution piping. Refer to Division 22 for backflow preventers.

B. Install shutoff valve, check valve, pressure gage, and drain at connection to water supply.

3.11 PIPING INSTALLATION

A. Refer to Division 21 for basic piping installation.

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. Install underground ductile-iron service-entrance piping according to NFPA 24 and with restrained joints. Encase piping in corrosion-protective encasement.

D. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Install unions adjacent to each valve in pipes NPS 2 and smaller. Unions are not required on flanged devices or in piping installations using grooved joints.

F. Install flanges or flange adapters on valves, apparatus, and equipment having NPS 2-1/2 and larger connections.

G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, sized and located according to NFPA 13.

H. Install sprinkler piping with drains for complete system drainage.

I. Install sprinkler zone control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

J. Install drain valves on standpipes.

K. Install ball drip valves to drain piping between fire department connections and check valves. Drain to floor drain or outside building.

L. Connect compressed-air supply to dry-pipe sprinkler piping.

M. Install alarm devices in piping systems.

N. Hangers and Supports: Comply with NFPA 13 for hanger materials.

   1. Install standpipe system piping according to NFPA 14.
   2. Install sprinkler system piping according to NFPA 13.

O. Install 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.

P. Drain dry-pipe sprinkler piping.

Q. Pressurize and check dry-pipe sprinkler system piping and air compressors.

R. Fill wet-standpipe system piping with water.

S. Fill wet-pipe sprinkler system piping with water.

T. Install flexible connectors on fire-pump and pressure-maintenance-pump supply and discharge connections and in fire-suppression piping where indicated.

3.12 VALVE INSTALLATION

A. Install listed fire-protection valves, unlisted general-duty valves, specialty valves and trim, controls, and specialties according to NFPA 13 and NFPA 14 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. Valves for Wall-Type Fire Hydrants: Install nonrising-stem gate valve in water-supply pipe.

D. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water supply sources.

E. Specialty Valves:

1. Alarm Check Valves: Install in vertical or horizontal (if specifically listed for orientation) position for proper direction of flow, including bypass check valve and retarding chamber drain-line connection.
2. Dry-Pipe Valves: Install trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.

    a. Air-Pressure Maintenance Devices for Dry-Pipe Systems: Install shutoff valves to permit servicing without shutting down sprinkler system; bypass valve for quick system filling; pressure regulator or switch to maintain system pressure; strainer; pressure ratings with 14- to 60-psig adjustable range; and 175-psig maximum inlet pressure.
    b. Install air compressor and compressed-air supply piping.

3.13 SPRINKLER APPLICATIONS

A. Drawings indicate sprinkler types to be used. Where specific types are not indicated, use the following sprinkler types:

1. Rooms without Ceilings: Upright sprinklers.
2. Rooms with Suspended Ceilings: Recessed sprinklers.
3. Wall Mounting: Sidewall sprinklers.
4. Spaces Subject to Freezing: Upright, pendent, dry sprinklers; and dry sidewall sprinklers as indicated.
5. Special Applications: Extended-coverage, and quick-response sprinklers where indicated.
6. Sprinkler Finishes:

    a. Upright, Pendent, and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.
    b. Concealed Sprinklers: Rough brass, with factory-painted bright white cover plate.
    c. Flush Sprinklers: Bright chrome, with painted white escutcheon.
    d. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.

3.14 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of narrow dimension of acoustical ceiling panels and tiles.

B. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing. Use dry-type sprinklers with water supply from heated space.

3.15 FIRE HYDRANT INSTALLATION

A. Install fire hydrants mounted in vertical wall with shutoff valve inside building in heated space.

3.16 FIRE DEPARTMENT CONNECTION INSTALLATION

A. Install wall-type, fire department connections in vertical wall.

B. Install freestanding-type, fire department connections in level surface.

1. Install protective pipe bollards on two sides of each fire department connection. Refer to Division 05 Section "Metal Fabrications" for pipe bollards.

C. Install ball drip valve at each check valve for fire department connection.

3.17 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 Division 22 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. Connect excess-pressure pumps to the following piping and wiring:

1. Sprinkler system, hydraulically.
2. Pressure gages and controls, hydraulically.
3. Electrical power system.
4. Alarm device accessories for pump.
5. Fire alarm.

G. Connect compressed-air supply to dry-pipe sprinkler piping.

H. Connect air compressor to the following piping and wiring:

1. Pressure gages and controls.
2. Electrical power system.
3. Fire alarm devices, including low-pressure alarm.

I. Electrical Connections: Power wiring is specified in Division 26.

J. Connect alarm devices to fire alarm.

K. Ground equipment according to Division 26.

L. Connect wiring according to Division 26.

M. 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.

3.18 LABELING AND IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13 and NFPA 14.

3.19 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Energize circuits to electrical equipment and devices.
4. Start and run excess-pressure pumps.
5. Start and run air compressors.
6. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
7. Flush, test, and inspect standpipe systems according to NFPA 14, "System Acceptance" Chapter.
8. Coordinate with fire alarm tests. Operate as required.
9. Coordinate with fire-pump tests. Operate as required.
10. Verify that equipment hose threads are same as local fire department equipment.

B. Report test results promptly and in writing to Architect and authorities having jurisdiction.

3.20 CLEANING AND PROTECTION

A. Clean dirt and debris from sprinklers.

B. Remove and replace sprinklers with paint other than factory finish.

C. Protect sprinklers from damage until Substantial Completion. Use factory-supplied protective ceiling caps (concealed sprinklers) or optional available protective covers (recessed sprinklers).

3.21 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specialty valves. Refer to Division 1.

3.22 TRAINING

A. “Training of the Owner’s operation and maintenance personnel is required in cooperation with the Owner's Representative. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and

troubleshooting of the installed systems. The instruction shall be scheduled in coordination with the Owner's Representative after submission and approval of formal training plans. Refer to Section 01770, Execution Requirements, for contractor training requirements.

END OF SECTION 211000

SECTION 23 05 00

COMMON WORK RESULTS 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. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Mechanical sleeve seals.
5. Sleeves.
6. Escutcheons.
7. Grout.
8. HVAC demolition.
9. Equipment installation requirements common to equipment sections.
10. Painting and finishing.
11. Concrete bases.
12. Supports and anchorages.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. CPVC: Chlorinated polyvinyl chloride plastic.

2. PE: Polyethylene plastic.
3. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. GENERAL MECHANICAL AND PLUMBING SUBMITTAL REQUIREMENTS
1. In addition to submittal procedures indicated in other sections of this specification, all Division 22 and 23 items shall be submitted as **one complete set**, in PDF format for equipment and systems properly and clearly identified per project document designations (**partial submittals will not be accepted** without the written permission of the Engineer). All capacities, standard accessories, options and characteristics shall be clearly and individually identified. Any deviations from the specified systems and equipment shall be clearly identified and accompanied by descriptions, explanations, drawings and calculations, etc. to support their use, indicating specifically how the submitted items will meet requirements of the original design specifications. The Engineer shall have sole discretion, without recourse, as to the determination of what items are deemed suitable for approval. Alternative submittals/substitutions: If re-design of the building and/or systems is required to accommodate the proposed alternative equipment/systems, such re-design shall be performed by the A/E of record, and paid for (on an hourly basis, plus expenses) by the contractor requesting the substitution. <u>Submittals not meeting these requirements are subject to return without notice or review.</u>

B. Product Data: For the following:

1. Transition fittings.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Escutcheons.

C. Welding certificates.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

D. ALL CONTROL WIRING SHALL BE INSTALLED IN EMT CONDUIT (OR OTHER APPROVED RACEWAY) AS PER DIVISION 26, AND NEC REQUIREMENTS, UNLESS OTHERWISE APPROVED. EXCEPTION: PROPERLY RATED CABLE (CEILING PLENUM, ETC.) MAY BE INSTALLED IN ACCESSIBLE, CONCEALED SPACES, AS DIRECTED IN OTHER SECTIONS OF THIS SPECIFICATION.

E. Work shall be performed in accordance with quality, commercial practices. The appearance of finished work shall be of equal importance with its operation. Materials and equipment shall be installed based upon the actual dimensions and conditions at the project site. Locations for materials or equipment requiring an exact fit shall be field measured. Rotating equipment, piping and duct system shall be isolated to avoid unacceptable noise levels from objectionable vibrations from all systems without cost to the Owner.

F. Some mechanical equipment sizes indicated on the Drawings are based on a particular manufacturer. It is the responsibility of the Contractor to verify that the equipment he/she proposes to furnish will fit in the space indicated on the Drawings. Refer to Architectural and Structural Drawings for building dimensions. Equipment furnished by the Owner shall be coordinated with equipment furnished and installed under this section and other sections

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 to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces.

D. Where the mechanical drawings indicate (diagrammatically or otherwise) the work intended and the functions to be performed, even though some minor details are not shown, the Contractor shall furnish all equipment, material (other than Owner furnished items), and labor to complete the installation, and accomplish all indicated functions of the mechanical installation. Further, the Contractor shall be responsible for taking the necessary actions to ensure that all mechanical work is coordinated and compatible with architectural, plumbing, electrical and structural plans. In the event of conflict between the plans and the enforcing code authority, the latter shall rule. Any modification resulting there from shall be made without additional cost to the Owner or Engineer. The contractor shall report such modifications to the Architect in writing and secure approval before proceeding. Where a conflict between the construction drawings and specifications occur the greater quantity and/or greater quality shall be used.

E. Maintain "As-Built" Drawing to be included with the O & M Manuals. Maintain a set of "Blue-Line Prints and indicate changes and diagrams of those portions of work in which actual construction is significantly at variance with the Contract Drawings. Mark the Drawings with a

colored pencil. Prepare, as the work progresses and upon completion of work, drawings clearly indicating locations of all devices, equipment and other pertinent items, as installed. Include invert elevation or buried depth of piping. Upon completion of the project, submit all materials to the Owner, after verifying all the above data is shown correctly.

F. Perform work to meet or exceed the requirements of the International Building Code, International Mechanical Code, International Plumbing Code and other applicable statutes, ordinances, codes and regulations of governmental authorities having jurisdiction. Resolve any code violation discovered in the Contract Documents with the Engineer prior to award of the Contract. After award of the Contract, make any corrections or additions necessary for compliance with applicable codes at no additional cost to the Owner.

G. Obtain and pay for all permits, licenses and inspections as required by law for the completion of the work. Comply with the requirements of the applicable utility companies serving this project. Make all arrangements with the utility companies for proper coordination of the work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 23 piping Sections for pipe, tube, 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 22 and 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. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.4 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

1. Manufacturers:

a. Capitol Manufacturing Co.
b. Watts Industries, Inc.; Water Products Div.
c. Zurn Industries, Inc.; Wilkins Div.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

1. Manufacturers:

a. Capitol Manufacturing Co.
b. Epco Sales, Inc.
c. Watts Industries, Inc.; Water Products Div.

E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Manufacturers:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Central Plastics Company.

2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where 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 deg F.

1. Manufacturers:

a. Calpico, Inc.
b. Lochinvar Corp.

G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

1. Manufacturers:

a. Perfection Corp.
b. Precision Plumbing Products, Inc.
c. Sioux Chief Manufacturing Co., Inc.
d. Victaulic Co. of America.

2.5 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Manufacturers:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Metraflex Co.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Stainless steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.6 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

2.7 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.

1. Finish: Polished chrome-plated.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated.

E. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.

F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw or spring clips, and chrome-plated finish.

G. One-Piece, Floor-Plate Type: Cast-iron floor plate.

H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.8 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.10 DRAIN PANS

A. Description: Stainless steel formed or welded construction, sized to accommodate the equipment the pan is intended to protect. All equipment (i.e. water heaters, air handlers, pumps, etc.) that are required by code or as indicated on the construction documents shall be provided with a drain pan with the associated copper drain pipe routed to a code compliant receptor.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 22 & 23 Sections specifying piping systems.

B. 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 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 and lighting fixture removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
c. Insulated Piping: One-piece, stamped-steel type with spring clips.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge and set screw.
g. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type with [concealed and [set screw or spring clips].
h. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
i. Bare Piping in Equipment Rooms: One-piece, stamped-steel type with set screw or spring clips.
j. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

M. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

N. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

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. Install sleeves in new walls and slabs as new walls and slabs are constructed.
3. Install sleeves that are 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 NPS 6.
b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Installation shall comply with roofing system warranty requirements.

1) Seal space outside of sleeve fittings with grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint.

O. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow 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 and larger in diameter.
3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

P. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

Q. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials.

R. Verify final equipment locations for roughing-in.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 22& 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. 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 unless dry seal threading is specified.
2. 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.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Plastic 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. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
3. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
4. PVC Nonpressure Piping: Join according to ASTM D 2855.

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

L. 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.

M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.3 PIPING CONNECTIONS

A. 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. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. 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.

D. Install equipment to allow right of way for piping installed at required slope.

E. Install drain pans under equipment in such a manner that there is sufficient fall for the water to drain if an overflow/leak condition occurs. The contractor is responsible for coordinating the size and equipment installation for a drain pan and piping system that meets code and functionality requirements.

3.5 PAINTING

A. Painting of mechanical systems, equipment, and components is specified in Division 09 Sections.

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

C. Unless otherwise indicated, where “bright” ductwork, or other piping, etc. systems are visible to the occupied space through grilles, etc., they shall be painted with “flat” black paint.

D. Refer to specification section 230553 – Mechanical Identification for other painting requirements.

3.6 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
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.

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

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.

3.8 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor HVAC materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.9 GROUTING

A. Mix and install grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

3.10 TRAINING

A. Training of the Owner’s operation and maintenance personnel is required in cooperation with the Owner's Representative. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and

troubleshooting of the installed systems. The instruction shall be scheduled in coordination with the Owner's Representative after submission and approval of formal training plans.

END OF SECTION 230500

SECTION 23 05 13

COMMON MOTOR REQUIREMENTS FOR HVAC 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 general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

B. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

C. Source Limitations: Obtain field-installed motors through one source from a single manufacturer.

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.

E. Comply with NFPA 70.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when stricter requirements are specified in mechanical equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

C. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 MOTOR CHARACTERISTICS

A. Motors 3/4 HP and Larger: Three phase.

B. Motors Smaller Than 1/2HP: Single phase.

C. Frequency Rating: 60 Hz.

D. Voltage Rating: NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected.

E. Service Factor: 1.15 for open dripproof motors; 1.0 for totally enclosed motors.

F. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.4 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Premium efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Double-shielded, prelubricated ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Insulation: Class F.

2.5 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

D. Rugged-Duty Motors: Totally enclosed, with 1.25 minimum service factor, greased bearings, integral condensate drains, and capped relief vents. Windings insulated with non-hygroscopic material.

1. Finish: Chemical-resistant paint over corrosion-resistant primer.

E. Source Quality Control for Field-Installed Motors: Perform the following tests on each motor according to NEMA MG 1:

1. Measure winding resistance.
2. Read no-load current and speed at rated voltage and frequency.
3. Measure locked rotor current at rated frequency.
4. Perform high-potential test.

2.6 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

C. Motors 1/20 HP and Smaller: Shaded-pole type.

D. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

E. Source Quality Control for Field-Installed Motors: Perform the following tests on each motor according to NEMA MG 1:

1. Measure winding resistance.
2. Read no-load current and speed at rated voltage and frequency.
3. Measure locked rotor current at rated frequency.
4. Perform high-potential test.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230513

SECTION 23 05 29

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

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 hangers and supports for HVAC system piping and equipment:

1. Steel pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Fiberglass strut systems.
5. Thermal-hanger shield inserts.
6. Fastener systems.
7. Pipe stands.
8. Equipment supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Steel pipe hangers and supports.
2. Fiberglass pipe hangers.
3. Thermal-hanger shield inserts.
4. Powder-actuated fastener systems.

For all items listed above, if sending a copy of a page out of a product data book, clearly indicate which items are not going to be used

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers. Include Product Data for components.
2. Metal framing systems. Include Product Data for components.
3. Fiberglass strut systems. Include Product Data for components.
4. Pipe stands. Include Product Data for components.
5. Equipment supports.

C. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel.", ASME Boiler and Pressure Vessel Code: Section IX.

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.3, "Structural Welding Code--Sheet Steel."
4. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
5. ASME Boiler and Pressure Vessel Code: Section IX.

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. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. Grinnell Corp.
3. National Pipe Hanger Corporation.
4. Piping Technology & Products, Inc.

C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. Thomas & Betts Corporation.
3. Tolco Inc.
4. Unistrut Corp.; Tyco International, Ltd.

C. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.5 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig-minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Manufacturers:

1. PHS Industries, Inc.
2. Pipe Shields, Inc.
3. Rilco Manufacturing Company, Inc.
4. Value Engineered Products, Inc.

C. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.

D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.

E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

G. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.6 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:

a. Hilti, Inc.
b. ITW Ramset/Red Head.
c. Masterset Fastening Systems, Inc.
d. Powers Fasteners.

B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:

a. B-Line Systems, Inc.; a division of Cooper Industries.
b. Hilti, Inc.
c. ITW Ramset/Red Head.
d. Powers Fasteners.

2.7 PIPE STAND FABRICATION

A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod-roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

1. Manufacturers:

a. ERICO/Michigan Hanger Co.
b. MIRO Industries.
c. Portable Pipe Hangers

C. Low-Type, Single-Pipe Stand: One-piece plastic base unit with plastic roller, for roof installation without membrane penetration.

1. Manufacturers:

a. MIRO Industries.
b. Portable Pipe Hangers

D. High-Type, Single-Pipe Stand: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.

1. Manufacturers:

a. ERICO/Michigan Hanger Co.
b. MIRO Industries.

c. Portable Pipe Hangers.

2. Base: Plastic.
3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.

1. Manufacturers:

a. Portable Pipe Hangers.

2. Bases: One or more plastic.
3. Vertical Members: Two or more protective-coated-steel channels.
4. Horizontal Member: Protective-coated-steel channel.
5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

F. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe support made from structural-steel shape, continuous-thread rods, and rollers for mounting on permanent stationary roof curb.

2.8 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.9 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use padded hangers for piping that is subject to scratching.

F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8.
7. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
8. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
9. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
10. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
11. Adjustable, Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36, if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
12. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
13. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20, from single rod if horizontal movement caused by expansion and contraction might occur.
14. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
15. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24, if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
16. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30, if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
4. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.

3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

N. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

3.2 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Fiberglass Pipe Hanger Installation: Comply with applicable portions of MSS SP-69 and MSS SP-89. Install hangers and attachments as required to properly support piping from building structure.

D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

E. Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled fiberglass struts.

F. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

G. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

H. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. Refer to Division 07 Section "Roof Accessories" for curbs.

I. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

J. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

K. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

L. Install lateral bracing with pipe hangers and supports to prevent swaying.

M. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

N. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

O. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.

P. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.

a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
c. Do not exceed pipe stress limits according to ASME B31.1 for power piping and ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

    a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
    b. NPS 4: 12 inches long and 0.06 inch thick.
    c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
    d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.

5. Insert Material: Length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers 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.

3.5 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.

3.6 PAINTING

A. Touch 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 minimum dry film thickness of 2.0 mils.

B.

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SECTION 23 05 48

VIBRATION CONTROLS FOR HVAC PIPING AND 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 DEFINITIONS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.3 SUBMITTALS

A. Product Data: For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
   a. Annotate to indicate application of each product submitted and compliance with requirements.

3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

B. Delegated-Design Submittal: For vibration isolation details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, and spring deflection changes. Include certification that riser system has been examined for excessive stress and that none will exist.
2. Vibration Isolation Base Details: Detail overall dimensions, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.

C. Welding certificates.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For air-mounting systems to include in operation and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ace Mountings Co., Inc.
2. Isolation Technology, Inc.
3. Kinetics Noise Control.
4. Mason Industries.
5. Vibration Eliminator Co., Inc.
6. Vibration Isolation.
7. Vibration Mountings & Controls, Inc.

B. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

1. Resilient Material: Oil- and water-resistant neoprene.

C. Mounts: Double-deflection type, with molded, oil-resistant rubber, hermetically sealed compressed fiberglass, or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

D. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch- thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
2. Restraint: Seismic or limit stop as required for equipment and authorities having jurisdiction.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.

5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

E. Housed Spring Mounts: Housed spring isolator with integral seismic snubbers.

1. Housing: Ductile-iron or steel housing to provide all-directional seismic restraint.
2. Base: Factory drilled for bolting to structure.
3. Snubbers: Vertically adjustable to allow a maximum of 1/4-inch travel up or down before contacting a resilient collar.

F. Elastomeric Hangers: Single or double-deflection type, fitted with molded, oil-resistant elastomeric isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.

G. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
7. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

2.2 RESTRAINED VIBRATION ISOLATION ROOF-CURB RAILS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Isolation Technology, Inc.
2. Kinetics Noise Control.
3. Mason Industries.
4. Vibration Eliminator Co., Inc.
5. Vibration Mountings & Controls, Inc.

B. General Requirements for Restrained Vibration Isolation Roof-Curb Rails: Factory-assembled, fully enclosed, insulated, air- and watertight curb rail designed to resiliently support equipment and to withstand wind forces.

C. Lower Support Assembly: Formed sheet-metal section containing adjustable and removable steel springs that support upper frame. Upper frame shall provide continuous support for equipment and shall be captive to resiliently resist wind forces. Lower support assembly shall have a means for attaching to building structure and a wood nailer for attaching roof materials, and shall be insulated with a minimum of 2 inches of rigid, glass-fiber insulation on inside of assembly.

D. Spring Isolators: Adjustable, restrained spring isolators shall be mounted on 1/4-inch- thick, elastomeric vibration isolation pads and shall have access ports, for level adjustment, with removable waterproof covers at all isolator locations. Isolators shall be located so they are accessible for adjustment at any time during the life of the installation without interfering with the integrity of the roof.

1. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with wind restraint.

   a. Housing: Steel with resilient vertical-limit stops and adjustable equipment mounting and leveling bolt.
   b. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
   c. Minimum Additional Travel: 50 percent of the required deflection at rated load.
   d. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
   e. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

E. Snubber Bushings: All-directional, elastomeric snubber bushings at least 1/4 inch thick.

F. Water Seal: Galvanized sheet metal with EPDM seals at corners, attached to upper support frame, extending down past wood nailer of lower support assembly, and counterflashed over roof materials.

2.3 FACTORY FINISHES

A. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.
2. All hardware shall be galvanized. Hot-dip galvanized metal components for exterior use.
3. Baked enamel or powder coat for metal components on isolators for interior use.
4. Color-code or otherwise mark vibration isolation and wind-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and wind-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by manufacturer.

B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 VIBRATION-CONTROL DEVICE INSTALLATION

A. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members. Coordinate this Article with Drawings.

3.4 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION 230548

SECTION 23 05 53

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

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 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. Stencils.
8. Valve tags.
9. Valve schedules.
10. Warning tags.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For color, letter style, and graphic representation required for each identification material and device. Provide a color board with piping name, color sample and stencil/identifier label to be used on pipe. This board, after approval, shall be mounted in the maintenance office for future reference. Specify on color chart for each color pipe service and locations intended to be used.

C. Valve numbering scheme.

D. Valve Schedules: For each piping system. Furnish extra copies (in addition to mounted copies) to include in maintenance manuals.

1.4 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 and paint before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 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 Markers: Engraved, color-coded laminated plastic. Include contact-type, permanent adhesive.

1. Terminology: Match schedules as closely as possible.
2. Data:

a. Name and plan number.
b. Equipment service.
c. Design capacity.
d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.

3. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.

C. 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: 1/16 inch for units up to 20 sq. in. or 8 inches in length, and 1/8 inch for larger units.
4. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

D. Access Panel and Door Markers: 1/16-inch-thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification (i.e. FD = fire damper, MAINT = maintenance access). Provide 1/8-inch center hole for attachment.

1. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

2.2 PIPING IDENTIFICATION DEVICES

A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.

1. Pipe Labels:
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 strip-type 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. Self-Adhesive Pipe Markers: Plastic with pressure-sensitive, permanent-type, self-adhesive back.

E. Plastic Tape: Continuously printed, vinyl tape at least 3 mils thick with pressure-sensitive, permanent-type, 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.

2.3 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers, with numbering scheme approved by Architect. Provide 5/32-inch hole for fastener.

1. Material: 0.032-inch-thick brass.
2. Valve-Tag Fasteners: Brass wire-link or beaded chain; or S-hook.

2.4 VALVE SCHEDULES

A. Valve Schedules: For each piping system, on standard-size bond paper. Tabulate valve tag numbers, piping systems, system abbreviation (as shown on pipe labels – section 2.3A), 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.

2.5 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.

PART 3 - EXECUTION

3.1 APPLICATIONS, GENERAL

3.2 EQUIPMENT IDENTIFICATION

A. Install and permanently fasten equipment nameplates on each item of mechanical equipment. Locate nameplates where accessible and visible. Include nameplates for the following general categories of equipment:

1. Fuel-burning units, including boilers, furnaces, water, etc.
2. Pumps, compressors, chillers, condensers, booster pump, fire pump and similar motor-driven units.
3. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
4. Fans, blowers, primary balancing dampers, and terminal units (VAV boxes).
5. HVAC central-station and zone-type units.

B. Install equipment markers with permanent adhesive on or near each major item of mechanical equipment. Data required for markers may be included on signs, and markers may be omitted if both are indicated.

1. 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.
2. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
3. Locate markers where accessible and visible. Include markers for the following general categories of equipment:

    a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
    b. Fire department hose valves and hose stations.
    c. Fuel-burning units, including boilers, furnaces, water heaters, etc.
    d. Pumps, compressors, chillers, condensers, booster pump, fire pump and similar motor-driven units.
    e. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
    f. Fans, blowers, primary balancing dampers, and terminal units (VAV boxes).
    g. HVAC central-station and zone-type units.
    h. Tanks and pressure vessels.
    i. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.

C. 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. All identifiers shall be white face with black letters.

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. Fuel-burning units, including boilers, furnaces, water heaters, etc.
    c. Pumps, compressors, chillers, condensers, booster pump, fire pump and similar motor-driven units.
    d. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
    e. Fans, blowers, primary balancing dampers, and terminal units (VAV boxes).
    f. HVAC central-station and zone-type units.
    g. Tanks and pressure vessels.
    h. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.

D. Install access panel markers with screws on equipment access panels.

3.3 PIPING IDENTIFICATION

A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow. Coordinate with section 2.3A for color schemes and legends to be used. Use abbreviations only when necessary.

1. Pipes with OD, Including Insulation, Less Than 6 Inches: Self-adhesive pipe markers. Use self-adhesive plastic tape, 1-1/2 inches wide, lapped at least 1-1/2 inches at both ends of pipe marker, and covering full circumference of pipe.
2. Pipes with OD, Including Insulation, 6 Inches and Larger: Self-adhesive pipe markers. Use self-adhesive plastic tape, at least 1-1/2 inches wide, lapped at least 3 inches at both ends of pipe marker, and covering full circumference of pipe.

B. Locate pipe markers where piping is not exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, access doors, above lay-in ceilings and plenums; and exterior nonconcealed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and nonaccessible enclosures.
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 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings.

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; 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.

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 ADJUSTING

A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

3.8 CLEANING

A. Clean faces of mechanical identification devices and glass frames of valve schedules.

END OF SECTION 230553

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING

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. Constant-volume air systems.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. TAB: Testing, adjusting, and balancing.

C. TABB: Testing, Adjusting, and Balancing Bureau.

D. TAB Specialist: An entity engaged to perform TAB Work.

E. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.

F. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to indicated quantities.

G. Barrier or Boundary: Construction, either vertical or horizontal, such as walls, floors, and ceilings that are designed and constructed to restrict the movement of airflow, smoke, odors, and other pollutants.

H. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.

I. NC: Noise criteria.

J. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.

K. RC: Room criteria.

L. Report Forms: Test data sheets for recording test data in logical order.

M. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.

N. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.

O. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

P. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.

Q. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.

R. Test: A procedure to determine quantitative performance of systems or equipment.

S. Testing, Adjusting, and Balancing (TAB) Firm: The entity responsible for performing and reporting TAB procedures.

1.4 SUBMITTALS

A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 45 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.

C. Strategies and Procedures Plan: Within 80 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

D. Certified TAB reports.

E. Sample report forms.

F. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

1.5 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC or NEBB. Contractor shall be an independent firm and not associated with any other installing contractor.

1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC or NEBB

2. TAB Technician: Employee of the TAB contractor and who is certified by AABC or NEBB as a TAB technician.

B. TAB Conference: Meet with Architect, Engineer, and Owner on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Require the participation of the TAB field supervisor and technicians. Provide seven days' advance notice of scheduled meeting time and location.

1. Agenda Items:

a. The Contract Documents examination report.
b. The TAB plan.
c. Coordination and cooperation of trades and subcontractors.
d. Coordination of documentation and communication flow.

C. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

D. TAB Report Forms: Use standard forms from AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems".

E. Instrumentation Type, Quantity, and Accuracy: As described in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems".

F. Instrumentation Calibration: Calibrate instruments at least every six months or more frequently if required by instrument manufacturer.

1. Keep an updated record of instrument calibration that indicates date of calibration and the name of party performing instrument calibration.

1.6 PROJECT CONDITIONS

A. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.7 COORDINATION

A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.

B. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

C. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.8 WARRANTY

A. National Project Performance Guarantee (AABC standards): Provide a guarantee on AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" forms stating that AABC will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents.

B. Guarantee shall include the following provisions:

1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
2. Systems are balanced to optimum performance capabilities within design and installation limits.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Division 23 Section "[Metal Ducts] [Nonmetal Ducts]" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

K. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.

L. Examine two and three-way valves for proper installation for their intended function of diverting or mixing fluid flows.

M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

N. Examine system pumps to ensure absence of entrained air in the suction piping.

O. Examine operating safety interlocks and controls on HVAC equipment.

P. Examine automatic temperature system components to verify the following:

1. Dampers, valves, and other controlled devices are operated by the intended controller.
2. Dampers and valves are in the position indicated by the controller.
3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
4. Automatic modulating and shutoff valves, including two-way valves and three-way mixing and diverting valves, are properly connected.
5. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
6. Sensors are located to sense only the intended conditions.
7. Sequence of operation for control modes is according to the Contract Documents.
8. Controller set points are set at indicated values.
9. Interlocked systems are operating.
10. Changeover from heating to cooling mode occurs according to indicated values.

Q. The testing, adjusting and balancing contractor shall thoroughly review the construction document control diagrams and the submitted data for the building DDC system. A complete understanding of each system's operation is required to ensure that the system is properly balanced. The testing, adjusting and balancing contractor shall work with the controls contractor to ensure that the systems perform correctly.

R. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system-readiness checks and prepare reports. Verify the following:

1. Permanent electrical-power wiring is complete.

2. Hydronic systems are filled, clean, and free of air.
3. Automatic temperature-control systems are operational.
4. Equipment and duct access doors are securely closed.
5. Balance, smoke, and fire dampers are open.
6. Isolating and balancing valves are open and control valves are operational.
7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" and in this Section.

1. Comply with requirements in ASHRAE 62.1-2004, Section 7.2.2, "Air Balancing."

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. After testing and balancing, install test ports and duct access doors that comply with requirements in Division 23 Section "Air Duct Accessories."
3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 23 Section "HVAC Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling-unit components.

L. Verify that air duct system is sealed as specified in Division 23 Section "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

   a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.

2. Measure fan static pressures as follows to determine actual static pressure:

   a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
   b. Measure static pressure directly at the fan outlet or through the flexible connection.
   c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
   d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

   a. Report the cleanliness status of filters and the time static pressures are measured.

4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
6. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Division 23 Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure airflow of submain and branch ducts.

a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure air outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Record compressor data.

3.7 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each electric heating coil:

1. Nameplate data.
2. Airflow.
3. Entering- and leaving-air temperature at full load.
4. Voltage and amperage input of each phase at full load and at each incremental stage.
5. Calculated kilowatt at full load.
6. Fuse or circuit-breaker rating for overload protection.

B. Measure, adjust, and record the following data for each refrigerant coil:

1. Dry-bulb temperature of entering and leaving air.
2. Wet-bulb temperature of entering and leaving air.
3. Airflow.
4. Air pressure drop.
5. Refrigerant suction pressure and temperature.

3.8 TEMPERATURE-CONTROL VERIFICATION

A. Verify that controllers are calibrated and commissioned.

B. Check transmitter and controller locations and note conditions that would adversely affect control functions.

C. Record controller settings and note variances between set points and actual measurements.

D. Check the operation of limiting controllers (i.e., high- and low-temperature controllers).

E. Check free travel and proper operation of control devices such as damper and valve operators.

F. Check the sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water flow measurements. Note the speed of response to input changes.

G. Check the interaction of electrically operated switch transducers.

H. Check the interaction of interlock and lockout systems.

I. Record voltages of power supply and controller output. Determine whether the system operates on a grounded or nongrounded power supply.

J. Note operation of electric actuators using spring return for proper fail-safe operations.

3.9 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus 5 to plus 10 percent.
2. Air Outlets and Inlets: 0 to minus 10 percent.

3.10 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: As work progresses, provide reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.11 FINAL REPORT

A. General: Prepare a certified typed-written or computer print-out in letter-quality font report; on standard bond paper, in three ring binder, tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB contractor.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

E. Rooftop unit/fan coil unit and Pool Units Test Reports: For rooftop units with coils, include the following:

1. Unit Data:

   a. Unit identification.
   b. Location.
   c. Make and type.
   d. Model number and unit size.
   e. Manufacturer's serial number.
   f. Unit arrangement and class.
   g. Discharge arrangement.
   h. Sheave make, size in inches, and bore.
   i. Center-to-center dimensions of sheave, and amount of adjustments in inches.
   j. Number, make, and size of belts.
   k. Number, type, and size of filters.

2. Motor Data:

   a. Motor make, and frame type and size.
   b. Horsepower and rpm.
   c. Volts, phase, and hertz.
   d. Full-load amperage and service factor.
   e. Sheave make, size in inches, and bore.
   f. Center-to-center dimensions of sheave, and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):

   a. Total air flow rate in cfm.
   b. Total system static pressure in inches wg.
   c. Fan rpm.
   d. Discharge static pressure in inches wg.
   e. Filter static-pressure differential in inches wg.
   f. Preheat-coil static-pressure differential in inches wg.
   g. Cooling-coil static-pressure differential in inches wg.
   h. Heating-coil static-pressure differential in inches wg.
   i. Outdoor airflow in cfm.
   j. Return airflow in cfm.
   k. Outdoor-air damper position.
   l. Return-air damper position.
   m. Vortex damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:

   a. System identification.
   b. Location.
   c. Coil type.
   d. Number of rows.
   e. Fin spacing in fins per inch o.c.
   f. Make and model number.
   g. Face area in sq. ft..
   h. Tube size in NPS.
   i. Tube and fin materials.

j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm.
b. Average face velocity in fpm.
c. Air pressure drop in inches wg.
d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
e. Return-air, wet- and dry-bulb temperatures in deg F.
f. Entering-air, wet- and dry-bulb temperatures in deg F.
g. Leaving-air, wet- and dry-bulb temperatures in deg F.
h. Water flow rate in gpm.
i. Water pressure differential in feet of head or psig.
j. Entering-water temperature in deg F.
k. Leaving-water temperature in deg F.
l. Refrigerant expansion valve and refrigerant types.
m. Refrigerant suction pressure in psig.
n. Refrigerant suction temperature in deg F.
o. Inlet steam pressure in psig.

G. Gas-fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:

1. Unit Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.
f. Fuel type in input data.
g. Output capacity in Btu/h.
h. Ignition type.
i. Burner-control types.
j. Motor horsepower and rpm.
k. Motor volts, phase, and hertz.
l. Motor full-load amperage and service factor.
m. Sheave make, size in inches, and bore.
n. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Test Data (Indicated and Actual Values):

a. Total air flow rate in cfm.
b. Entering-air temperature in deg F.
c. Leaving-air temperature in deg F.
d. Air temperature differential in deg F.
e. Entering-air static pressure in inches wg.
f. Leaving-air static pressure in inches wg.
g. Air static-pressure differential in inches wg.
h. Low-fire fuel input in Btu/h.
i. High-fire fuel input in Btu/h.
j. Manifold pressure in psig.
k. High-temperature-limit setting in deg F.
l. Operating set point in Btu/h.
m. Motor voltage at each connection.
n. Motor amperage for each phase.

o. Heating value of fuel in Btu/h.

H. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:

1. Unit Data:

a. System identification.
b. Location.
c. Coil identification.
d. Capacity in Btu/h.
e. Number of stages.
f. Connected volts, phase, and hertz.
g. Rated amperage.
h. Air flow rate in cfm.
i. Face area in sq. ft..
j. Minimum face velocity in fpm.

2. Test Data (Indicated and Actual Values):

a. Heat output in Btu/h.
b. Air flow rate in cfm.
c. Air velocity in fpm.
d. Entering-air temperature in deg F.
e. Leaving-air temperature in deg F.
f. Voltage at each connection.
g. Amperage for each phase.

I. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches, and bore.
h. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.

c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Suction static pressure in inches wg.

J. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

a. System and air-handling-unit number.
b. Location and zone.
c. Traverse air temperature in deg F.
d. Duct static pressure in inches wg.
e. Duct size in inches.
f. Duct area in sq. ft..
g. Indicated air flow rate in cfm.
h. Indicated velocity in fpm.
i. Actual air flow rate in cfm.
j. Actual average velocity in fpm.
k. Barometric pressure in psig.

K. Air-Terminal-Device Reports:

1. Unit Data:

a. System and air-handling unit identification.
b. Location and zone.
c. Apparatus used for test.
d. Area served.
e. Make.
f. Number from system diagram.
g. Type and model number.
h. Size.
i. Effective area in sq. ft..

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm.
b. Air velocity in fpm.
c. Preliminary air flow rate as needed in cfm.
d. Preliminary velocity as needed in fpm.
e. Final air flow rate in cfm.
f. Final velocity in fpm.
g. Space temperature in deg F.

L. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:

1. Unit Data:

a. System and air-handling-unit identification.
b. Location and zone.
c. Room or riser served.
d. Coil make and size.
e. Flowmeter type.

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm.
b. Entering-water temperature in deg F.
c. Leaving-water temperature in deg F.
d. Water pressure drop in feet of head or psig.
e. Entering-air temperature in deg F.
f. Leaving-air temperature in deg F.

M. Compressor and Condenser Reports: For refrigerant side of unitary systems, stand-alone refrigerant compressors, air-cooled condensing units, or water-cooled condensing units, include the following:

1. Unit Data: Include the following:

a. Unit identification.
b. Location.
c. Unit make and model number.
d. Manufacturer's compressor serial numbers.
e. Compressor make.
f. Compressor model and serial numbers.
g. Refrigerant weight in lb Low ambient temperature cutoff in deg F

2. Test Data: Include design and actual values for the following:

a. Inlet-duct static pressure in inches wg
b. Outlet-duct static pressure in inches wg Entering-air, dry-bulb temperature in deg F
c. Leaving-air, dry-bulb temperature in deg F Condenser entering-water temperature in deg F
d. Condenser leaving-water temperature in deg F (Condenser water temperature differential in deg F
e. Condenser entering-water pressure in feet of head or psig Condenser leaving-water pressure in feet of head or psig Condenser water pressure differential in feet of head or psig
f. Control settings.
g. Unloader set points.
h. Low-pressure-cutout set point in psig High-pressure-cutout set point in psig
i. Suction temperature in deg FCondenser refrigerant pressure in psig Condenser refrigerant temperature in deg F Oil pressure in psig Oil temperature in deg F Voltage at each connection.
j. Amperage for each phase.
k. The kW input.
l. Crankcase heater kW.
m. Number of fans.
n. Condenser fan rpm.
o. Condenser fan airflow rate in cfm Condenser fan motor make, frame size, rpm, and horsepower.
p. Condenser fan motor voltage at each connection.
q. Condenser fan motor amperage for each phase.

N. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.

b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.12 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
2. Check the following for each system:

   a. Measure airflow of at least 10 percent of air outlets.
   b. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
   c. Verify that balancing devices are marked with final balance position.
   d. Note deviations from the Contract Documents in the final report.

B. Final Inspection:

1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Architect.
2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Architect and Owner.
3. Architect and Owner shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.

D. Prepare test and inspection reports.

3.13 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 23 05 93

SECTION 23 07 00

DUCT INSULATION

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 semirigid and flexible duct, and plenum insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.

1.3 SUBMITTALS

A. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.

B. Shop Drawings: Show fabrication and installation details for the following:

C. Samples: For each type of insulation and field-applied jacket. Identify each Sample, describing product and intended use. Submit 12-inch- square sections of each sample material.
   1. Manufacturer's Color Charts: Show the full range of colors available for each type of field-applied finish material indicated.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the U.S. Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.
   1. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.
   2. Insulation Installed Outdoors: Flame-spread rating of 75 or less, and smoke-developed rating of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate clearance requirements with duct Installer for insulation application.

1.7 SCHEDULING

A. Schedule insulation application after testing duct systems. Insulation application may begin on segments of ducts that have satisfactory test results.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Mineral-Fiber Insulation:
      a. Johns-Manville, Inc.
      b. Or approved equal

2.2 INSULATION MATERIALS

A. Mineral-Fiber Acoustic Internal Liner Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 1071, Type I, ASTM G-21 and G-22 with factory applied edge finish. Air-side surface shall have a reinforced coating provides sound attenuation and will not support microbial growth. Material shall be rated for air velocity of 6,000 fpm. Material shall be rated for a maximum thermal conductivity of 0.24 btu*in/(hr.*ft2*F). Product shall be formaldehyde free. Material shall be Johns-Manville, Permacote Linacoustic Standard or equal.

B. Mineral-Fiber Blanket Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II, without facing and with all-service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film. Material shall be rated for a maximum thermal conductivity of 0.25 btu*in/(hr.*ft2*F). Product shall be formaldehyde free. Material shall be Johns-Manville, Microlite, Type 100 or approved equal.

2.3 FIELD-APPLIED JACKETS

A. General: ASTM C 921, Type 1, unless otherwise indicated.

B. Foil and Paper Jacket: Laminated, glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil.

C. PVC Jacket: High-impact, ultraviolet-resistant PVC; 20 mils thick; roll stock ready for shop or field cutting and forming.
   1. Adhesive: As recommended by insulation material manufacturer.
   2. PVC Jacket Color: White.

D. Aluminum Jacket: Deep corrugated sheets manufactured from aluminum alloy complying with ASTM B 209, and having an integrally bonded moisture barrier over entire surface in contact with insulation. Metal thickness and corrugation dimensions are scheduled at the end of this Section.

1. Finish: Cross-crimp corrugated finish.
2. Moisture Barrier: 1-mil- thick, heat-bonded polyethylene and kraft paper.

E. Stainless-Steel Jacket: Deep corrugated sheets of stainless steel complying with ASTM A 666, Type 316; 0.10 inch thick; and roll stock ready for shop or field cutting and forming to indicated sizes.
1. Moisture Barrier: 1-mil- thick, heat-bonded polyethylene and kraft paper.
2. Jacket Bands: Stainless steel, Type 304, 3/4 inch wide.

2.4 ACCESSORIES AND ATTACHMENTS

A. Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, presized a minimum of 8 oz./sq. yd..
1. Tape Width: 4 inches.

B. Bands: 3/4 inch wide, in one of the following materials compatible with jacket:
1. Stainless Steel: ASTM A 666, Type 304; 0.020 inch thick.
2. Galvanized Steel: 0.005 inch thick.
3. Aluminum: 0.007 inch thick.
4. Brass: 0.010 inch thick.
5. Nickel-Copper Alloy: 0.005 inch thick.

C. Wire: 0.080-inch, nickel-copper alloy; 0.062-inch, soft-annealed, stainless steel; or 0.062-inch, soft-annealed, galvanized steel.

D. Adhesive-Attached Anchor Pins and Speed Washers: Galvanized steel plate, pin, and washer manufactured for attachment to duct and plenum with adhesive. Pin length sufficient for insulation thickness indicated.
1. Adhesive: Recommended by the anchor pin manufacturer as appropriate for surface temperatures of ducts, plenums, and breechings; and to achieve a holding capacity of 100 lb for direct pull perpendicular to the adhered surface.

2.5 VAPOR RETARDERS

A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL APPLICATION REQUIREMENTS

A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; and free of voids throughout the length of ducts and fittings.

B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each duct system.

C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Apply multiple layers of insulation with longitudinal and end seams staggered.

E. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.

F. Keep insulation materials dry during application and finishing.

G. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.

H. Apply insulation with the least number of joints practical.

I. Apply insulation over fittings and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated.

J. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic. Apply insulation continuously through hangers and around anchor attachments.

K. Insulation Terminations: For insulation application where vapor retarders are indicated, seal ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

L. Apply insulation with integral jackets as follows:
   1. Pull jacket tight and smooth.
   2. Joints and Seams: Cover with tape and vapor retarder as recommended by insulation material manufacturer to maintain vapor seal.
   3. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to duct flanges and fittings.

M. Cut insulation according to manufacturer's written instructions to prevent compressing insulation to less than 75 percent of its nominal thickness.

N. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and partitions, except fire-rated walls and partitions.

O. Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire/smoke damper sleeves for fire-rated wall and partition penetrations.

3.4 MINERAL-FIBER INSULATION APPLICATION

A. Blanket Applications for Ducts and Plenums: Secure blanket insulation with adhesive and anchor pins and speed washers.
   1. Apply adhesives according to manufacturer's recommended coverage rates per square foot, for 100 percent coverage of duct and plenum surfaces.
   2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
   3. Install anchor pins and speed washers on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
      a. On duct sides with dimensions 18 inches and smaller, along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
      b. On duct sides with dimensions larger than 18 inches. Space 16 inches o.c. each way, and 3 inches maximum from insulation joints. Apply additional pins and clips to hold insulation tightly against surface at cross bracing.
      c. Anchor pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
      d. Do not overcompress insulation during installation.
   4. Impale insulation over anchors and attach speed washers.
   5. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
   6. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation segment with 1/2-inch staples, 1 inch o.c., and cover with pressure-sensitive tape having same facing as insulation.
   7. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. Secure with steel band at end joints and spaced a maximum of 18 inches o.c.
   8. Apply insulation on rectangular duct elbows and transitions with a full insulation segment for each surface. Apply insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
   9. Insulate duct stiffeners, hangers, and flanges that protrude beyond the insulation surface with 6-inch- wide strips of the same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with anchor pins spaced 6 inches o.c.
   10. Apply vapor-retarder mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retarder.

B. Board Applications for Ducts and Plenums: Secure board insulation with adhesive and anchor pins and speed washers.
   1. Apply adhesives according to manufacturer's recommended coverage rates per square foot, for 100 percent coverage of duct and plenum surfaces.
   2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
   3. Space anchor pins as follows:
      a. On duct sides with dimensions 18 inches and smaller, along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
      b. On duct sides with dimensions larger than 18 inches. Space 16 inches o.c. each way, and 3 inches maximum from insulation joints. Apply additional pins and clips to hold insulation tightly against surface at cross bracing.
      c. Anchor pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
      d. Do not overcompress insulation during installation.
   4. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
   5. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation segment with 1/2-inch staples, 1 inch o.c., and cover with pressure-sensitive tape having same facing as insulation.

6. Apply insulation on rectangular duct elbows and transitions with a full insulation segment for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Apply insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond the insulation surface with 6-inch- wide strips of the same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with anchor pins spaced 6 inches o.c.
8. Apply vapor-retarder mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retarder.

3.5 FIELD-APPLIED JACKET APPLICATION

A. Apply glass-cloth jacket, where indicated, directly over bare insulation or insulation with factory-applied jackets.
   1. Apply jacket smooth and tight to surface with 2-inch overlap at seams and joints.
   2. Embed glass cloth between two 0.062-inch- thick coats of jacket manufacturer's recommended adhesive.
   3. Completely encapsulate insulation with jacket, leaving no exposed raw insulation.

3.6 FINISHES

A. Glass-Cloth Jacketed Insulation: Paint insulation finished with glass-cloth jacket as specified in Division 09 - Finishes

B. Color: Final color for ductwork exposed in mechanical room shall be per the master color chart and per the requirements of Section 230553 – Mechanical Identification. Vary first and second coats to allow visual inspection of the completed Work. Where ductwork is exposed in the public spaces it shall be painted according to the architect.

3.7 DUCT SYSTEM APPLICATIONS

A. Insulation materials and thicknesses are specified in schedules at the end of this Section.

B. Materials and thicknesses for systems listed below are specified in schedules at the end of this Section.

C. Insulate the following plenums and duct systems:
   1. Indoor concealed supply-, return-, and outside-air ductwork.
   2. Indoor exposed supply-, return-, and outside-air ductwork.
   3. Outdoor exposed supply and return ductwork.

D. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:
   1. Metal ducts with duct liner.
   2. Factory-insulated flexible ducts.
   3. Factory-insulated plenums, casings, terminal boxes, and filter boxes and sections.
   4. Flexible connectors.
   5. Vibration-control devices.
   6. Testing agency labels and stamps.
   7. Nameplates and data plates.
   8. Pre-insulated access panels and doors in air-distribution systems.

3.8 INDOOR DUCT AND PLENUM APPLICATION SCHEDULE

A. The following applies to ductwork applications requiring 2 inch duct wrap.
   1. Material: Mineral-fiber blanket.
   2. Thickness: 2 inches.
   3. Number of Layers: One.
   4. Vapor Retarder Required: Yes

B. The following applies to ductwork applications requiring 1 inch duct wrap.
   1. Material: Mineral-fiber blanket.
   2. Thickness: 1 inch.
   3. Number of Layers: One.
   4. Vapor Retarder Required: Yes

C. The following applies to ductwork applications requiring 1 1/2 inch duct liner.
   1. Material: Mineral-fiber Acoustic Internal Liner.
   2. Thickness: 1-1/2 inch.
   3. Number of Layers: One.

D. Duct insulation shall be as indicated below:

   1. Rectangular supply air and rectangular return air ducts:

      a. 1 1/2 inch thick acoustical duct liner

   2. Concealed round supply air and round return air and round outside air ducts:

      a. 2 inch thick mineral fiber blanket

   3. Exhaust ductwork round and rectangular ducts:

      a. 2 inch thick mineral fiber blanket

END OF SECTION 230700

SECTION 23 07 20

HVAC PIPE INSULATION

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 preformed, rigid and flexible pipe insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds. Paint per other Sections of these specifications. Not all listed systems may be utilized for this project. Use applicable systems, as required.

1.3 SUBMITTALS

A. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.

B. Shop Drawings: Show fabrication and installation details for the following:

1. Application of protective shields, saddles, and inserts at pipe hangers for each type of insulation and hanger.
2. Attachment and covering of heat trace inside insulation.
3. Insulation application at pipe expansion joints for each type of insulation.
4. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Removable insulation at piping specialties and equipment connections.
6. Application of field-applied jackets.

C. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets with requirements indicated. Include dates of tests.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.
2. Insulation Installed Outdoors: Flame-spread rating of 75 or less, and smoke-developed rating of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified.

B. Coordinate clearance requirements with piping Installer for insulation application.

C. Coordinate installation and testing of steam or electric heat tracing.

1.7 SCHEDULING

A. Schedule insulation application after testing piping systems and, where required, after installing and testing heat-trace tape. Insulation application may begin on segments of piping that have satisfactory test results.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Molded Mineral-Fiber Insulation:

   a. Johns-Manville Insulation, Inc.
   b. Knauf FiberGlass GmbH.
   c. Owens-Corning Fiberglas Corp.

2. Flexible Elastomeric Thermal Insulation:

   a. Armstrong World Industries, Inc.
   b. Rubatex Corp.
   c. Approved equal by engineer

2.2 INSULATION MATERIALS

A. Molded Mineral-Fiber Insulation: Glass fibers bonded with a thermosetting resin complying with the following:

1. Preformed Pipe Insulation: Comply with ASTM C 547, Type 1, with factory-applied, all-purpose, vapor-retarder jacket.
2. Fire-Resistant Adhesive: Comply with MIL-A-3316C in the following classes and grades:

   a. Class 1, Grade A for bonding glass cloth and tape to unfaced glass-fiber insulation, for sealing edges of glass-fiber insulation, and for bonding lagging cloth to unfaced glass-fiber insulation.
   b. Class 2, Grade A for bonding glass-fiber insulation to metal surfaces.

3. Vapor-Retarder Mastics: Fire- and water-resistant, vapor-retarder mastic for indoor applications. Comply with MIL-C-19565C, Type II.
4. Mineral-Fiber Insulating Cements: Comply with ASTM C 195.
5. Expanded or Exfoliated Vermiculite Insulating Cements: Comply with ASTM C 196.

6. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.
7. Thermal Conductivity of 0.23 Btu*in./(Hr*ft2*F)

B. Flexible Elastomeric Thermal Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

1. Adhesive: As recommended by insulation material manufacturer.
2. Ultraviolet-Protective Coating: As recommended by insulation manufacturer.
3. Thermal Conductivity of 0.27 Btu*in./(Hr*ft2*F)

C. Prefabricated Thermal Insulating Fitting Covers: Comply with ASTM C 450 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.

2.3 ACCESSORIES AND ATTACHMENTS

A. Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, presized a minimum of 8 oz./sq. yd..

1. Tape Width: 4 inches.

B. Bands: 3/4 inch wide, in one of the following materials compatible with jacket:

1. Stainless Steel: ASTM A 666, Type 304; 0.020 inch thick.

C. Wire: 0.062-inch, soft-annealed, stainless steel.

2.4 VAPOR RETARDERS

A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry pipe and fitting surfaces. Remove materials that will adversely affect insulation application.

3.3 GENERAL APPLICATION REQUIREMENTS

A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each piping system.

C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Apply insulation with longitudinal seams at top and bottom of horizontal pipe runs.

E. Apply multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.

H. Keep insulation materials dry during application and finishing.

I. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.

J. Apply insulation with the least number of joints practical.

K. Apply insulation over fittings, valves, and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated. Refer to special instructions for applying insulation over fittings, valves, and specialties.

L. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic.

1. Apply insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor retarders are indicated, extend insulation on anchor legs at least 12 inches from point of attachment to pipe and taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
3. Install insert materials and apply insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by the insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect the jacket from tear or puncture by the hanger, support, and shield.

M. Insulation Terminations: For insulation application where vapor retarders are indicated, taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

N. Apply adhesives and mastics at the manufacturer's recommended coverage rate.

O. Apply insulation with integral jackets as follows:

1. Pull jacket tight and smooth.
2. Circumferential Joints: Cover with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip and spaced 4 inches o.c.
3. Longitudinal Seams: Overlap jacket seams at least 1-1/2 inches. Apply insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.

    a. Exception: Do not staple longitudinal laps on insulation having a vapor retarder.

4. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to flanges, unions, valves, and fittings.
5. At penetrations in jackets for thermometers and pressure gages, fill and seal voids with vapor-retarder mastic.

P. Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.

1. Seal penetrations with vapor-retarder mastic.
2. Apply insulation for exterior applications tightly joined to interior insulation ends.
3. Extend metal jacket of exterior insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal metal jacket to roof flashing with vapor-retarder mastic.

Q. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and floors.

R. Fire-Rated Wall and Partition Penetrations: Apply insulation continuously through penetrations of fire-rated walls and partitions per UL requirements for the construction of the partition/wall.

3.4 MOLDED MINERAL-FIBER INSULATION APPLICATION

A. Apply insulation to straight pipes and tubes as follows:

1. Secure each layer of preformed pipe insulation to pipe with wire, tape, or bands without deforming insulation materials.
2. Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic. Apply vapor retarder to ends of insulation at intervals of 15 to 20 feet to form a vapor retarder between pipe insulation segments.
3. For insulation with factory-applied jackets, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.

B. Apply insulation to flanges as follows:

1. Apply preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch, and seal joints with vapor-retarder mastic.

C. Apply insulation to fittings and elbows as follows:

1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When premolded insulation elbows and fittings are not available, apply mitered sections of pipe insulation, or glass-fiber blanket insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire, tape, or bands.
3. Cover fittings with colored PVC fitting covers.

D. Apply insulation to valves and specialties as follows:

1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When premolded insulation sections are not available, apply glass-fiber blanket insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, arrange insulation for access to stainer basket without disturbing insulation.
3. Apply insulation to flanges as specified for flange insulation application.
4. Use preformed standard PVC fitting covers for valve sizes where available, fabricate custom covers of the same material and color if needed. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

3.5 FLEXIBLE ELASTOMERIC THERMAL INSULATION APPLICATION

A. Apply insulation to straight pipes and tubes as follows:

1. Follow manufacturer's written instructions for applying insulation.
2. Seal longitudinal seams and end joints with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

B. Apply insulation to flanges as follows:

1. Apply pipe insulation to outer diameter of pipe flange.
2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of the same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

C. Apply insulation to fittings and elbows as follows:

1. Apply mitered sections of pipe insulation.
2. 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.

D. Apply insulation to valves and specialties as follows:

1. Apply preformed valve covers manufactured of the same material as pipe insulation and attached according to the manufacturer's written instructions.
2. Apply cut segments of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, fabricate removable sections of insulation arranged to allow access to strainer basket.
3. Apply insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

3.6 FIELD-APPLIED JACKET APPLICATION

A. Apply PVC jacket where indicated, with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

B. Apply metal jacket where indicated, with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.7 FINISHES

A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of the insulation manufacturer's recommended protective coating.

3.8 PIPING SYSTEM APPLICATIONS

A. Insulation materials and thicknesses are specified in schedules at the end of this Section.

B. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:

1. Flexible connectors.
2. Vibration-control devices.
3. Fire-suppression piping.
4. Drainage piping located in crawl spaces, unless otherwise indicated.
5. Below-grade piping, unless otherwise indicated.
6. Chrome-plated pipes and fittings, unless potential for personnel injury.
7. Air chambers, unions, strainers, check valves, plug valves, and flow regulators.

3.9 INSULATION APPLICATION SCHEDULE, GENERAL

A. Refer to insulation application schedules for required insulation materials, vapor retarders, and field-applied jackets.

B. Application schedules identify piping system and indicate pipe size ranges and material, thickness, and jacket requirements. Refer to section 230553 – Mechanical Identification for jacket color requirements and pipe painting requirements.

3.10 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.11 INDOOR PIPING INSULATION SCHEDULE

A. Condensate Drains and associated drain piping – piping to be Type “L” copper:

1. Piping: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe, Type I: 1 inch thick.
2. Field-Applied Jacket: Yes
3. Vapor Retarder Required: No.

B. Refrigerant Suction, liquid, and Hot-Gas Piping:

1. All Pipe Sizes: Insulation shall be the following:
   a. Flexible Elastomeric: 1 1/2 inch thick

END OF SECTION 230720

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. This Section includes refrigerant piping used for air-conditioning applications.

1.3 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.

1.4 SUBMITTALS

A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop, based on manufacturer's test data, for the following:

1. Thermostatic expansion valves.
2. Solenoid valves.
3. Hot-gas bypass valves.
4. Filter dryers.
5. Strainers.
6. Pressure-regulating valves.

B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.

1. Shop Drawing Scale: 1/4 inch equals 1 foot.
2. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.

C. Welding certificates.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.6 PRODUCT STORAGE AND HANDLING

A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

1.7 COORDINATION

A. Coordinate size and location of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

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 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; Type, Grade, and wall thickness as selected in Part 3 piping applications articles.

B. Wrought-Steel Fittings: ASTM A 234/A 234M, for welded joints.

C. Steel Flanges and Flanged Fittings: ASME B16.5, steel, including bolts, nuts, and gaskets, bevel-welded end connection, and raised face.

D. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

E. Flanged Unions:

1. Body: Forged-steel flanges for NPS 1 to NPS 1-1/2 and ductile iron for NPS 2 to NPS 3. Apply rust-resistant finish at factory.
2. Gasket: Fiber asbestos free.
3. Fasteners: Four plated-steel bolts, with silicon bronze nuts. Apply rust-resistant finish at factory.
4. End Connections: Brass tailpiece adapters for solder-end connections to copper tubing.
5. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch- long assembly.
6. Pressure Rating: Factory test at minimum 400 psig.
7. Maximum Operating Temperature: 330 deg F.

F. Flexible Connectors:

1. Body: Stainless-steel bellows with woven, flexible, stainless-steel-wire-reinforced protective jacket
2. End Connections:

   a. NPS 2 and Smaller: With threaded-end connections.
   b. NPS 2-1/2 and Larger: With flanged-end connections.

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.

2.3 VALVES AND SPECIALTIES

A. Diaphragm Packless Valves:

1. Body and Bonnet: Forged brass or cast bronze; globe design with straight-through or angle pattern.
2. Diaphragm: Phosphor bronze and stainless steel with stainless-steel spring.
3. Operator: Rising stem and hand wheel.
4. Seat: Nylon.
5. End Connections: Socket, union, or flanged.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 275 deg F.

B. Packed-Angle Valves:

1. Body and Bonnet: Forged brass or cast bronze.
2. Packing: Molded stem, back seating, and replaceable under pressure.
3. Operator: Rising stem.
4. Seat: Nonrotating, self-aligning polytetrafluoroethylene.
5. Seal Cap: Forged-brass or valox hex cap.
6. End Connections: Socket, union, threaded, or flanged.
7. Working Pressure Rating: 500 psig.
8. Maximum Operating Temperature: 275 deg F.

C. Check Valves:

1. Body: Ductile iron, forged brass, or cast bronze; globe pattern.
2. Bonnet: Bolted ductile iron, forged brass, or cast bronze; or brass hex plug.
3. Piston: Removable polytetrafluoroethylene seat.
4. Closing Spring: Stainless steel.
5. Manual Opening Stem: Seal cap, plated-steel stem, and graphite seal.
6. End Connections: Socket, union, threaded, or flanged.
7. Maximum Opening Pressure: 0.50 psig.
8. Working Pressure Rating: 500 psig.
9. Maximum Operating Temperature: 275 deg F.

D. 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.

E. 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 conduit adapter, and [24] [115] [208]-V ac coil.
6. Working Pressure Rating: 400 psig.
7. Maximum Operating Temperature: 240 deg F.
8. Manual operator.

F. Safety Relief Valves: Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.

1. Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.
2. Piston, Closing Spring, and Seat Insert: Stainless steel.
3. Seat Disc: Polytetrafluoroethylene.
4. End Connections: Threaded.
5. Working Pressure Rating: 400 psig.
6. Maximum Operating Temperature: 240 deg F.

G. 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. Superheat: Adjustable
6. Reverse-flow option (for heat-pump applications).
7. End Connections: Socket, flare, or threaded union.
8. Working Pressure Rating: 700 psig.

H. Hot-Gas Bypass Valves: Comply with UL 429; listed and labeled by an NRTL.

1. Body, Bonnet, and Seal Cap: Ductile iron or steel.
2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
3. Packing and Gaskets: Non-asbestos.
4. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
5. Seat: Polytetrafluoroethylene.
6. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter, and coil.
7. End Connections: Socket.
8. Throttling Range: Maximum 5 psig.
9. Working Pressure Rating: 500 psig.
10. Maximum Operating Temperature: 240 deg F.

I. Straight-Type Strainers:

1. Body: Welded steel with corrosion-resistant coating.
2. Screen: 100-mesh stainless steel.
3. End Connections: Socket or flare.
4. Working Pressure Rating: 500 psig.
5. Maximum Operating Temperature: 275 deg F.

J. Angle-Type Strainers:

1. Body: Forged brass or cast bronze.
2. Drain Plug: Brass hex plug.
3. Screen: 100-mesh monel.
4. End Connections: Socket or flare.
5. Working Pressure Rating: 500 psig.
6. Maximum Operating Temperature: 275 deg F.

K. 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.

L. 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. Designed for reverse flow (for heat-pump applications).

4. End Connections: Socket.
5. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 240 deg F.

M. Mufflers:

1. Body: Welded steel with corrosion-resistant coating.
2. End Connections: Socket or flare.
3. Working Pressure Rating: 500 psig.
4. Maximum Operating Temperature: 275 deg F.

N. Receivers: Comply with ARI 495.

1. Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
2. Comply with UL 207; listed and labeled by an NRTL.
3. Body: Welded steel with corrosion-resistant coating.
4. Tappings: Inlet, outlet, liquid level indicator, and safety relief valve.
5. End Connections: Socket or threaded.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 275 deg F.

O. Liquid Accumulators: Comply with ARI 495.

1. Body: Welded steel with corrosion-resistant coating.
2. End Connections: Socket or threaded.
3. Working Pressure Rating: 500 psig.
4. Maximum Operating Temperature: 275 deg F.

2.4 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-134a

A. Suction Lines NPS 1-1/2 and Smaller: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed joints.

B. Suction Lines NPS 2 to NPS 4: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with brazed joints.

C. Hot-Gas and Liquid Lines Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed joints.

D. Safety-Relief-Valve Discharge Piping: Schedule 40, black-steel and wrought-steel fittings with welded joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

A. Install valves in suction and discharge lines of compressor.

B. Install service valves for gage taps at inlet and outlet of hot-gas bypass valves and strainers if they are not an integral part of valves and strainers.

C. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.

D. Except as otherwise indicated, install valves on inlet and outlet side of filter dryers.

E. Install a full-sized, three-valve bypass around filter dryers.

F. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at top.

G. 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.

H. Install safety relief valves where required by ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.

I. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

J. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for device being protected:

1. Solenoid valves.
2. Thermostatic expansion valves.
3. Hot-gas bypass valves.
4. Compressor.

K. Install filter dryers in liquid line between compressor and thermostatic expansion valve.

L. Install receivers sized to accommodate pump-down charge.

M. Install flexible connectors at compressors.

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 as specified in Division 08 Section "Access Doors and Frames" 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. Install traps and double risers to entrain oil in vertical runs.
4. 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. Before installation of steel refrigerant piping, clean pipe and fittings using the following procedures:

1. Shot blast the interior of piping.
2. Remove coarse particles of dirt and dust by drawing a clean, lintless cloth through tubing by means of a wire or electrician's tape.
3. Draw a clean, lintless cloth saturated with trichloroethylene through the tube or pipe. Continue this procedure until cloth is not discolored by dirt.
4. Draw a clean, lintless cloth, saturated with compressor oil, squeezed dry, through the tube or pipe to remove remaining lint. Inspect tube or pipe visually for remaining dirt and lint.
5. Finally, draw a clean, dry, lintless cloth through the tube or pipe.
6. Safety-relief-valve discharge piping is not required to be cleaned but is required to be open to allow unrestricted flow.

Q. Install pipe sleeves at penetrations in exterior walls and floor assemblies.

R. Seal penetrations through fire and smoke barriers according to Division 07 Section "Penetration Firestopping."

S. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

T. Install sleeves through floors, walls, or ceilings, sized to permit installation of full-thickness insulation.

U. Seal pipe penetrations through exterior walls according to Division 07 Section "Joint Sealants" for materials and methods.

V. Identify refrigerant piping and valves according to Division 23 Section "Identification for HVAC Piping and Equipment."

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 welding, 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.

F. Threaded Joints: Thread steel 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 unless dry-seal threading is specified.

2. 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.

G. Steel pipe can be threaded, but threaded joints must be seal brazed or seal welded.

H. Welded Joints: Construct joints according to AWS D10.12/D10.12M.

I. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.5 HANGERS AND SUPPORTS

A. Hanger, support, and anchor products are specified in Division 23 Section "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. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. 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.
8. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.
9. NPS 4: Maximum span, 12 feet; minimum rod size, 1/2 inch.

D. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
2. NPS 2-1/2: Maximum span, 11 feet; minimum rod size, 3/8 inch.
3. NPS 3: Maximum span, 12 feet; minimum rod size, 3/8 inch.
4. NPS 4: Maximum span, 14 feet; minimum rod size, 1/2 inch.

E. 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 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. Open shutoff valves in condenser water circuit.
2. Verify that compressor oil level is correct.
3. Open compressor suction and discharge valves.
4. Open refrigerant valves except bypass valves that are used for other purposes.
5. Check open compressor-motor alignment and verify lubrication for motors and bearings.

E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 232300

SECTION 23 31 13

METAL 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. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Double-wall rectangular ducts and fittings.
3. Single-wall round ducts and fittings.
4. Double-wall round ducts and fittings.
5. Sheet metal materials.
6. Duct liner.
7. Sealants and gaskets.
8. Hangers and supports.

B. Related Sections:

1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Division 23 Section "Nonmetal Ducts" for fibrous-glass ducts, thermoset fiber-reinforced plastic ducts, thermoplastic ducts, PVC ducts, and concrete ducts.
3. Division 23 Section "HVAC Casings" for factory- and field-fabricated casings for mechanical equipment.
4. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

1.4 SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.

B. Shop Drawings: CAD-generated and drawn to 1/4 inch equals 1 foot scale. Show fabrication and installation details for metal ducts. Drawings shall be submitted and approved prior to start of construction

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building and vibration isolation.

C. Welding certificates.

D. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) 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."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," 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. 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 2, "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."

2.2 SINGLE-WALL ROUND 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.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following

   a. Lindab Inc.
   b. McGill AirFlow LLC.
   c. SEMCO Incorporated.
   d. Sheet Metal Connectors, Inc.
   e. Spiral Manufacturing Co., Inc.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," 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."

1. Transverse Joints in Ducts Larger Than 60 inches in Diameter: Flanged.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," 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."

1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," 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."

2.3 SHEET METAL 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 Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

D. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

E. Aluminum Sheets: Comply with ASTM B 209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

F. Factory- or Shop-Applied Antimicrobial Coating:

1. Apply to the surface of sheet metal that will form the interior surface of the duct. An untreated clear coating shall be applied to the exterior surface.
2. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
3. Coating containing the antimicrobial compound shall have a hardness of 2H, minimum, when tested according to ASTM D 3363.
4. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
5. Antimicrobial coating on sheet metal is not required for duct containing liner treated with antimicrobial coating.

G. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

H. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.4 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. CertainTeed Corporation; Insulation Group.
    b. Johns Manville.
    c. Knauf Insulation.
    d. Owens Corning.
    e. Maximum Thermal Conductivity:

        1) Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
        2) Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

2. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
3. Water]-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

    a. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Flexible Elastomeric Duct Liner: Preformed, cellular, closed-cell, sheet materials complying with ASTM C 534, Type II, Grade 1; and with NFPA 90A or NFPA 90B.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Aeroflex USA Inc.
    b. Armacell LLC.
    c. Rubatex International, LLC

2. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
3. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.

    a. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Insulation Pins and Washers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

D. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-19, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
3. Butt transverse joints without gaps, and coat joint with adhesive.
4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.
7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

    a. Fan discharges.
    b. Intervals of lined duct preceding unlined duct.
    c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.

9. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.

    a. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.

10. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.5 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width6 inches
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
7. Service: Indoor and outdoor.

8. Service Temperature: Minus 40 to plus 200 deg F.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
10. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Solvent-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Base: Synthetic rubber resin.
3. Solvent: Toluene and heptane.
4. Solids Content: Minimum 60 percent.
5. Shore A Hardness: Minimum 60.
6. Water resistant.
7. Mold and mildew resistant.
8. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
9. VOC: Maximum 395 g/L.
10. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
11. Service: Indoor or outdoor.
12. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

E. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

F. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

G. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.6 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 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "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.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. 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.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. 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.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Ductwork located outdoors shall be sealed weather tight.

C. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
   1. For Pressure Class of 1” w.g., Seal Class C.
   2. For Pressure Class of 2” w.g., Seal Class B.
   3. For Pressure Class of 4” w.g., Seal Class A.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "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.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "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.

3.5 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 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. Paint materials and application requirements are specified in Division 09 painting Sections.

Coordinate painting of ducts that are exposed to view with Architect. For these cases provide metal ducts that are suitable to receive paint.

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.

2. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
3. Test for leaks before applying external insulation.
4. 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.
5. Give seven days' advance notice for testing.

C. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.
2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."

a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.8 START UP

A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

3.9 DUCT SCHEDULE

A. Static-Pressure Classes: Unless otherwise indicated, construct ducts according to the following:
1. FCU's Supply, Return, Outside Ducts: 2-inch w.g.

END OF SECTION 233113

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Manual-volume dampers.
   2. Fire and smoke dampers.
   3. Combination fire-smoke dampers.
   4. Duct silencers.
   5. Turning vanes.
   6. Duct-mounted access doors and panels.
   7. Flexible ducts.
   8. Flexible connectors.
   9. Duct accessory hardware.
   10. Isolation roof curb

1.3 SUBMITTALS

A. Product Data: For the following:
   1. Manual-volume dampers.
   2. Fire and smoke dampers.
   3. Duct silencers.
   4. Duct-mounted access doors and panels.
   5. Flexible ducts.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loadings, required clearances, method of field assembly, components, location, and size of each field connection. Detail the following:
   1. Special fittings and manual- and automatic-volume-damper installations.
   2. Fire- and smoke-damper installations, including sleeves and duct-mounted access doors and panels.

C. Product Certificates: Submit certified test data on dynamic insertion loss; self-noise power levels; and airflow performance data, static-pressure loss, dimensions, and weights.

1.4 QUALITY ASSURANCE

A. NFPA Compliance: Comply with the following NFPA standards:
   1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
   2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

1.5 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
   1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

A. Galvanized, Sheet Steel: Lock-forming quality; ASTM A 653/A 653M, G90 coating designation; mill-phosphatized finish for surfaces of ducts exposed to view.

B. Reinforcement Shapes and Plates: Galvanized steel reinforcement where installed on galvanized, sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

C. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for 36-inch length or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.2 MANUAL-VOLUME DAMPERS

A. General: Factory fabricated with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.
   1. Pressure Classifications of 3-Inch wg or Higher: End bearings or other seals for ducts with axles full length of damper blades and bearings at both ends of operating shaft.

B. Standard Volume Dampers: Multiple- or single-blade, opposed-blade design, standard leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.

C. Standard Volume Dampers: Multiple- or single-blade, opposed-blade design, standard leakage rating, and suitable for horizontal or vertical applications.
   1. Steel Frames: Hat-shaped, galvanized, sheet steel channels, minimum of 0.064 inch thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installing in ducts.
   2. Roll-Formed Steel Blades: 0.064-inch- thick, galvanized, sheet steel.
   3. Blade Axles: Galvanized steel.
   4. Tie Bars and Brackets: Galvanized steel.

D. Jackshaft: 1-inch- diameter, galvanized steel pipe rotating within a pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
   1. Length and Number of Mountings: Appropriate to connect linkage of each damper of a multiple-damper assembly.

E. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting.

2.3 FIRE DAMPERS

A. General: Labeled to UL 555 for appropriate fire rating and meets the requirements for fire dampers established by NFPA 90A, 92A, 92B, and 101.

B. Fire Rating: One, one-half hours, and three hour fire dampers. Coordinate firewall types and locations with architectural plans.

C. Frame: SMACNA Type A with blades in airstream; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.

D. Mounting Sleeve: Factory- or field-installed galvanized, sheet steel.
   1. Minimum Thickness: 0.052 inch or 0.138 inch thick as indicated, and length to suit application.
   2. Exceptions: Omit sleeve where damper frame width permits direct attachment of perimeter mounting angles on each side of wall or floor, and thickness of damper frame complies with sleeve requirements.

E. Mounting Orientation: Vertical or horizontal as indicated.

F. Blades: Roll-formed, interlocking, 0.034-inch- thick, galvanized, sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized steel blade connectors.

G. Horizontal Dampers: Include a blade lock and stainless-steel negator closure spring.

H. Fusible Link: Replaceable, 165 deg F rated.

2.4 CEILING FIRE DAMPERS

A. General: Labeled to UL 555C; comply with construction details for tested floor- and roof-ceiling assemblies as indicated in UL's "Fire Resistance Directory."

B. Frame: 0.040-inch- thick, galvanized, sheet steel; round or rectangular; style to suit ceiling construction.

C. Blades: 0.034-inch- thick, galvanized, sheet steel with nonasbestos refractory insulation.

D. Volume Adjustment: UL-labeled, fusible volume-control adjustment.

E. Fusible Link: Replaceable, 165 deg F rated.

2.5 SMOKE DAMPERS

A. General: Labeled to UL 555S. Combination fire and smoke dampers shall be labeled for one-and-one-half-hour rating to UL 555.

B. Fusible Link: Replaceable, 165deg F rated.

C. Frame and Blades: 0.064-inch- thick, galvanized, sheet steel.

D. Mounting Sleeve: Factory-installed, 0.052-inch- thick, galvanized, sheet steel; length to suit wall or floor application.

E. Damper Motors: Provide for two-position action.

1. Spring-Return Motors: Equip with an integral spiral-spring mechanism. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
2. Two position, Spring-Return Motor: 24 V, DC motor with power input from the fire alarm system. Coordinate all smoke damper actuator locations with the fire alarm contractor.

F. Accessories:
1. Auxiliary switches for signaling or position indication.

2.6 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Air Balance Inc.; a division of Mestek, Inc.
2. Greenheck Fan Corporation.
3. Pottorff Company
4. Ruskin Company.

B. Type: Static and dynamic; rated and labeled according to UL 555 and UL 555S by an NRTL.

C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 4000-fpm velocity.

D. Fire Rating: 1-1/2 and 3 hours, coordinate based on wall rating shown on architectural plans.

E. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.

F. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

G. Heat-Responsive Device: Electric resettable link and switch package, factory installed, rated.

H. Smoke Detector: Integral, factory wired for single-point connection. Coordinate with the fire alarm contractor to ensure that the smoke detector is compatible with the fire alarm system. If not, then install smoke detectors provided by the fire alarm contractor (i.e. purchase the detectors from the fire alarm contractor, they will not be part of the fire alarm scope of work).

I. Blades: Roll-formed, horizontal, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.

J. Leakage: Class I.

K. Rated pressure and velocity to exceed design airflow conditions.

L. Mounting Sleeve: Factory-installed, 0.052-inch- thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone calking.

M. Master control panel for use in dynamic smoke-management systems.

N. Damper Motors: Two position with spring return action.

O. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors.
1. Motor Sizes: Minimum size per the manufacturer based on the size of the smoke damper assembly without a service factor range above 1.0.

2. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
3. Two position, Spring-Return Motor: 24 V, DC motor with power input from the fire alarm system. Coordinate all smoke damper actuator locations with the fire alarm contractor.

P. Accessories:
1. Auxiliary switches for signaling or position indication.

2.7 TURNING VANES

A. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

B. Manufactured Turning Vanes: Fabricate of 1-1/2-inch- wide, curved blades set 3/4 inch o.c.; support with bars perpendicular to blades set 2 inches o.c.; and set into side strips suitable for mounting in ducts.

C. Acoustic Turning Vanes: Fabricate of airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

2.8 DUCT-MOUNTED ACCESS DOORS AND PANELS

A. General: Fabricate doors and panels airtight and suitable for duct pressure class.

B. Frame: Galvanized, sheet steel, with bend-over tabs and foam gaskets.

C. Door: Double-wall, galvanized, sheet metal construction with insulation fill and thickness, and number of hinges and locks as indicated for duct pressure class. Include vision panel where indicated. Include 1-by-1-inch butt or piano hinge and cam latches.

D. Seal around frame attachment to duct and door to frame with neoprene or foam rubber.

E. Insulation: 1-inch- thick, fibrous-glass or polystyrene-foam board.

2.9 FLEXIBLE CONNECTORS

A. General: Flame-retarded or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.

B. Standard Metal-Edged Connectors: Factory fabricated with a strip of fabric 3-1/2 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized, sheet steel or 0.032-inch aluminum sheets. Select metal compatible with connected ducts.

C. Extra-Wide Metal-Edged Connectors: Factory fabricated with a strip of fabric 5-3/4 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized, sheet steel or 0.032-inch aluminum sheets. Select metal compatible with connected ducts.

D. Transverse Metal-Edged Connectors: Factory fabricated with a strip of fabric 3-1/2 inches wide attached to two strips of 4-3/8-inch- wide, 0.028-inch- thick, galvanized, sheet steel or 0.032-inch aluminum sheets. Select metal compatible with connected ducts.

E. Conventional, Indoor System Flexible Connector Fabric: Glass fabric double coated with polychloroprene.
   1. Minimum Weight: 26 oz./sq. yd..
   2. Tensile Strength: 480 lbf/inch in the warp, and 360 lbf/inch in the filling.

F. Conventional, Outdoor System Flexible Connector Fabric: Glass fabric double coated with a synthetic-rubber, weatherproof coating resistant to the sun's ultraviolet rays and ozone environment.
   1. Minimum Weight: 26 oz./sq. yd..
   2. Tensile Strength: 530 lbf/inch in the warp, and 440 lbf/inch in the filling.

2.10 FLEXIBLE DUCTS

A. General: Comply with UL 181, Class 1.

B. Flexible Ducts, Insulated: Factory-fabricated, insulated, round duct, with an outer jacket enclosing 2-inch- thick, glass-fiber insulation around a continuous inner liner (R value of 6 minimu).
   1. Reinforcement: Steel-wire helix encapsulated in inner liner.
   2. Outer Jacket: Glass-reinforced, silver Mylar with a continuous hanging tab, integral fibrous-glass tape, and nylon hanging cord.
   3. Outer Jacket: Polyethylene film.
   4. Inner Liner: Polyethylene film.

C. Pressure Rating: minimum of 10-inch wg, positive, 1/2-inch wg, negative.

2.11 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 length to suit duct insulation thickness.

B. Splitter Damper Accessories: Zinc-plated damper blade bracket; 1/4-inch, zinc-plated operating rod; and a duct-mounted, ball-joint bracket with flat rubber gasket and square-head set screw.

C. Flexible Duct Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action, in sizes 3 to 18 inches to suit duct size.

D. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

2.12 VIBRATION ISOLATION CURBS

A. Curb mounted rooftop units shall be isolated on Vibro-Acoustics type VCR roof top spring isolation curb (or approved equal) consisting of galvanized curb sections with integral vertical and laterally restrained isolators formed to fit the contractor supplied rooftop equipment.

B. The curb shall bear directly on the roof structure and shall be flashed and waterproofed into the roof’s membrane waterproofing system by the installing contractor.

C. The curb shall be constructed from a minimum of 16 ga G90 galvanized perimeter steel with a factory attached wood nailer. The perimeter steel seams shall be continuously welded. The

galvanized perimeter curb steel shall be attached to a structural steel frame that incorporates a minimum of 4 restrained spring isolators that supports the rooftop unit,

D. Curb sides and ends shall be capable of accepting 51 mm (2”) external insulation furnished and installed by the roofing contractor or factory installed.

E. The isolation springs shall be of the vertical and laterally restrained type. The springs shall be designed to be laterally stable and properly selected to provide minimum specified deflection with 50% additional travel to solid. Isolation springs shall be powder coated for corrosion resistance and have a minimum static spring deflection of 51 mm (2”).

F. Overhung condensing unit sections shall be supported by a structural steel pedestal assembly with isolation springs that are vertically and laterally restrained and shall be installed as the main curb section.

G. A galvanized and insulated pan shall be provided under condensing sections that are located within the curb perimeter

H. The curb section shall be complete with factory installed duct supports.

I. The curb section shall be complete with factory installed supply air and return air neoprene flex connections.

J. The curb section shall be complete with factory installed supply air and return air neoprene flex connections.

K. The isolation shall allow 6 mm (¼”) movement before resisting wind loads in any lateral direction.

L. The perimeter of the curb shall have a flexible neoprene air and weather seal joining the upper and lower curb sections. There shall also be a continuous closed cell sponge material above the top of the spring isolation curb to provide a waterproof seal between the rooftop unit.

M. The spring isolation curb shall be shipped pre-assembled where possible. Where size prohibits one piece shipping, the isolation curb shall be split into a minimum number of sections and all connecting hardware shall be supplied by the manufacture.

N. This work shall be coordinated with specific RTU internal springs to avoid inference of both springs in operation at the same time and causing adverse affects on the systems.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details shown in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts.

B. Install volume dampers in lined duct; avoid damage to and erosion of duct liner.

C. Provide test holes at fan inlet and outlet and elsewhere as indicated.

D. Install fire and smoke dampers according to manufacturer's UL-approved written instructions.
   1. Install fusible links in fire dampers.

E. Install duct access panels for access to both sides of duct coils. Install duct access panels downstream from volume dampers, fire dampers, smoke dampers, turning vanes and equipment.
   1. Install duct access panels to allow access to interior of ducts for cleaning, inspecting, adjusting, and maintaining accessories and terminal units.
   2. Install access panels on side of duct where adequate clearance is available.

3.2 ADJUSTING

A. Adjust duct accessories for proper settings.

B. Adjust fire and smoke dampers for proper action.

END OF SECTION 233300

SECTION 23 33 11

DIFFUSERS, REGISTERS, AND GRILLES

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 ceiling- and wall-mounted diffusers, registers, and grilles.

B. Related Sections include the following:

1. Division 23 Section "Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.3 SUBMITTALS

A. Product Data: For each product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.

B. Schedule of diffusers, registers, and grilles indicating drawing designation, model number, size and accessories furnished.

C. Assembly Drawing: For each type of air outlet and inlet; indicate materials and methods of assembly of components.

D. NFPA Compliance: Install diffusers, registers, and grilles according to NFPA 90A, "Standard for the Installation of Air-Conditioning and Ventilating Systems."

E. Product Options: Drawings and schedules indicate specific requirements of diffusers, registers, and grilles and are based on the specific requirements of the systems indicated. Other manufacturers' products with equal performance characteristics may be considered.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Diffusers, registers, and grilles are scheduled on Drawings.

B. Manufacturers

1. Products: Subject to compliance with requirements, provide one of the following:

a. Titus
b. Carnes
c. Krueger
d. MetalAire
e. Price Industries

2.2 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practicable. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233311

SECTION 23 81 26

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes split-system air-conditioning consisting of separate evaporator-fan and compressor-condenser components. Units are designed for exposed or concealed mounting, and may be connected to ducts.

1.3 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

E. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of split-system units 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. ASHRAE/IESNA 90.1-2013 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2013, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.5 COORDINATION

A. Coordinate size and location of concrete bases for units. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork are specified in Division 3 Section "Cast-in-Place Concrete."

1.6 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: Five years from date of Substantial Completion.

2. Electric Heat Exchanger Warranty: Ten years from date of Substantial Completion.

3. Compressor Warranty: Ten years from date of Substantial Completion.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: One set of filters for each unit.
2. Fan Belts: One set of belts for each unit.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carrier Air Conditioning; Div. of Carrier Corporation.
2. Lennox Industries Inc.
3. Trane Company (The); Unitary Products Group.
4. York International Corp.

2.2 CONCEALED EVAPORATOR-FAN COMPONENTS

A. Chassis: Galvanized steel with flanged edges, removable panels for servicing, and insulation on back of panel.

1. Insulation: Faced, glass-fiber duct liner.
2. Drain Pans: Galvanized steel, with connection for drain; insulated and complying with ASHRAE 62.1-2010.
3. Auxilliary Drain Pan: Galvanized steel, with connection for drain; insulated. Contractor shall provide auxiliary drain pan under entire unit and sized per Code requirements.
4. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2010.

B. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with thermal-expansion valve. Refrigerant shall be R-410A and shall be provided in cased configuration.

C. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements with refractory ceramic support bushings; automatic-reset thermal cutout; built-in magnetic contactors; complete controls for staging; manual-reset thermal cutout; airflow proving device (P/E switch); and one-time fuses in terminal box for overcurrent protection.

D. Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.

E. Fan Motors: Comply with requirements in Division 15 Section "Motors."

1. Special Motor Features: Multitapped, multispeed with internal thermal protection and permanent lubrication.

F. Disposable Filters: 1 inch thick, in frames. Utilize same size for all units.

G. Wiring Terminations: Connect motor to chassis wiring with plug connection.

2.3 AIR-COOLED, HEAT PUMP COMPONENTS

A. Casing: Steel, finished with baked enamel in color selected by Architect, 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: Scroll.
2. Refrigerant: R-410A.

C. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid subcooler.

D. Fan: Aluminum-propeller type, directly connected to motor.

E. Motor: Permanently lubricated, with integral thermal-overload protection.

F. Low Ambient Kit: Provide with low ambient kit.

G. Mounting Base: Concrete pad.

H. Minimum Energy Efficiency: Comply with ASHRAE/IESNA 90.1, "Energy Standard for Buildings except Low-Rise Residential Buildings." And 2015 International Energy Conservation Code.

2.4 ACCESSORIES

A. Unless otherwise indicated, provide a seven-day programmable thermostat with auto. changeover from cooling to heating. The unit shall have a 5 degree F. deadband between the heating and cooling cycles, minimum 10 hour battery back up, 2 hour occupant (manual) override timer, automatic cooling set-up to 85 degrees, F, and heating set-back to 55 degrees. Include clear plastic, locking cover and insulated base unless otherwise indicated. Fan shall operate based on a thermostat call for heating or cooling. 24VAC outdoor air damper shall open when fan is on and be closed when fan is off.

B. Provide with hail guards.

C. Provide with all require low-ambient features and trim for those units scheduled for low ambient controls.

D. Provide piping for long-line refrigerant applications with required accessories.

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. Install on roof with equipment roof support stand.

D. Install and connect pre-charged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

E. Provide refrigerant as required to fill the system.

F. Provide flexible connections on all refrigerant piping to outdoor units.

3.2 CONNECTIONS

A. Install piping adjacent to unit to allow service and maintenance.

B. Duct Connections: Duct installation requirements are specified in "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 Division 15 Section "Duct Accessories."

C. Ground equipment according to electrical specifications.

D. Electrical Connections: Comply with requirements in electrical specifications for power wiring, switches, and motor controls.

E. Install condensate piping with P-trap as required per manufacturer installation instructions.

F. Refrigerant piping shall be installed in a neat organized manner and fully supported. Wall penetrations shall be sealed weather tight and protected with a wall mount galvanized hood painted black.

G. Coordinate location of outdoor units with exact location of electrical disconnects prior to pouring equipment bases. Location of disconnects with respect to equipment shall be installed to allow clearances as required per Code, National Electrical Code, and manufacturer data.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

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.

C. Remove and replace malfunctioning units and retest as specified above.

3.4 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.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units. Refer to Division 1 Section "Closeout Procedures Demonstration and Training."

END OF SECTION 238126

SECTION 26 0110

GENERAL PROVISIONS

PART 1 - GENERAL

1.1 SPECIAL NOTES

A. These general provisions to the electrical specifications shall be complimentary to General Conditions and Supplementary General Conditions of the contract, Division 1 – General Requirements and all supplements thereto, and to all other pertinent documents issued by the architect. All conditions imposed by those documents shall be applicable to the contractor, or contractors, and subcontractors for all portions of the work under this division.

B. Each bidder on any portion of the work under this division shall examine the architectural, structural, mechanical and electrical plans and specifications and all addenda issued. Failure to comply shall not relieve the bidder of responsibility. The omission of architectural, structural and mechanical details from the electrical drawings shall not be used as a basis for a request for additional compensation.

1.2 DEFINITIONS

A. Homerun – Conductors and associated raceways from a panel/switchboard's overcurrent protection device to the first device.

B. Raceway – Set of conduits, junction boxes, support hardware and accessories built with the intention of protecting conductors from damage.

1.3 EXTENT OF WORK

A. The work covered by this division of the specifications comprises the furnishing of all labor, materials, equipment, and services necessary for or incidental to the installation of the complete electrical systems in accordance with the applicable drawings and specifications contained herein, and subject to the terms and conditions of the contract.

B. It shall include modifications and extensions of existing systems, and the modifications of the existing structure as required to accommodate the installations of the electrical work.

1.4 MATERIAL DESCRIPTION

A. In describing the various items of equipment, in general each item will be described singularly, even though there may be a multiplicity of identical items. Also, where the description is only general in nature, exact sizes, duties, space arrangements, horsepower requirements and other data shall be determined by reference to plans, details and schedules.

B. Equipment called for on the plans and not listed herein shall be provided and installed as though it were fully described herein.

C. Equipment called for herein shall be completely provided and installed, whether fully detailed or not on the plans and/or scheduled.

1.5 CONSTRUCTION REQUIREMENTS

A. Review construction details of the existing portions of the building by inspection at the site and include work required to modify the existing electrical installations and install new materials, comprising a part of the electrical installation, within the present structure. Review all construction details of the new building and/or portions of the buildings as illustrated on the architectural and structural drawings and be guided thereby. Set sleeves in masonry while it is under construction. Run conduits and set all boxes as required by the schedule of the general construction.

B. The electrical plans diagrammatically show the sizes and locations of the various outlets, equipment, and sizes of the major interconnecting wires, without showing exact details as to elevations, offsets, control wiring and other installation details. Carefully lay out work at the site to conform to the architectural and structural conditions, to avoid obstructions, and exact location of outlets, apparatus, and connections thereto by reference to the general, detail, equipment, and rough-in drawings, etc., and by measurements at the building, in cooperation with other contractors; in all necessitated by the conditions at the site or directed by the architect, without additional cost to the owner.

C. Except for electrical conduits in various machinery and equipment rooms, unfinished spaces or where specifically noted to the contrary, run all conduits concealed in suspended ceiling, furring and/or chases where they occur, or install them buried under the construction. Wherever conditions existing which would cause any normally concealed materials to be exposed in finished spaces, immediately call the situation to the attention of the architect and stop work in those areas until the architect directs the resumption of the work and the procedures to be followed. Run all conduits parallel with the building surface planes.

D. These specifications and accompanying drawings are intended to describe and illustrate systems, which will not interfere with the architectural and structural design of the buildings, which will fit into the several available spaces, and which will insure complete and satisfactorily operating installations. Fit material and apparatus into the building and prepare installation drawings for all critical areas illustrating the installation of work in this division as related to the work of all other divisions and correct all interference's with the other trades or with the building structures before work proceeds.

1.6 FLASHINGS, SLEEVES, AND INSERTS

A. All penetrations through fire rated walls, ceilings or floors shall be provided with galvanized wrought iron pipe sleeves. The inside diameter of these sleeves shall be 1/2 inch greater than the outside diameters of the service pipes. After the conduits are installed in the sleeves, fill the annular space between conduits and sleeves with specified building sealant. The completed installation shall be watertight, fire resistive, as applicable.

B. Roof penetrations shall be provided with counter flashing to provide a weatherproof installation.

C. Penetrations through fire rated walls, floors and ceilings shall be done to maintain the integrity of the fire rating of the penetrated barrier.

1.7 APPLICABLE CODES AND STANDARDS

A. Perform work in accordance with the latest editions, revisions, amendments or supplements of applicable statutes, ordinances, codes and regulations of federal, state and local authorities having jurisdiction in effect on the date bids are received, including the National Electrical Code, National Electrical Safety Code, and NFPA 99.

B. Where approval standards have been established by OSHA, Underwriter's Laboratories, American codes, ASME, AGA, AMCA, ASA, ARI, NEC, NESC, State Fire insurance regulatory body and FM, these standards shall be followed whether or not indicated on the contract drawings or specifications. Include the cost of all work required to comply with the requirements of these authorities in the original proposal. Comply with ANSI, C2 where applicable.

C. Resolve any code violation discovered in contract documents with the architect prior to award of the contract.

D. The NECA "Standards of Installation" as published by the National Electrical Contractors Association, 7315 Wisconsin Ave., N.W., Washington, DC 20014 shall be considered a part of these specifications, except as modified by other provisions contained in these specifications.

E. In addition to the above, the latest edition of the applicable industry standards published by the following organizations shall apply:

ACI	-	American Concrete Institute
AIA	-	American Institute of Architects
ANSI	-	American National Standards Institute
ASTM	-	American Society for Testing & Materials
CBM	-	Certified Ballast Manufacturers Association
ETL	-	Electrical Testing Laboratories
FM	-	Factory Mutual
HLS	-	Texas Department of Health, Hospital Licensing Standard
IEEE	-	Institute of Electrical & Electronic Engineers
IES	-	Illuminating Engineers Society
IPCEA	-	Insulated Power Cable Engineers Association
IRI	-	Industrial Risk Insurers
NBS	-	National Bureau of Standards
NEC	-	National Electrical Code
NECA	-	National Electrical Contractors Association
NEMA	-	National Electrical Manufacturers Association
NESC	-	National Electrical Safety Code
NETA	-	National Electrical Testing Association
NFPA	-	National Fire Protection Association
UL	-	Underwriter's Laboratories

1.8 INSPECTION OF SITE

A. Visit the site and ascertain the conditions to be met and the work to be accomplished in removing and modifying the existing work, and in installing the new work. Field verify all dimensions and advise architect of discrepancies before performing work. Failure to comply with this shall not constitute grounds for any additional payment in connection with removing or modifying any part of the existing installations and/or installing any new or temporary work under this division.

1.9 SUBSTITUTIONS AND SPACE ALLOCATIONS

A. Comply with the pertinent requirements of Division 1 and the applicable following paragraphs of this specification.

B. The Architect reserves the right to request samples of any item of material offered in substitution, together with a sample of the specified materials when, in the architect's opinion, the quality of the material and/or the appearance is involved, and it is deemed that an evaluation of the two materials may be better made by visual inspection.

C. Space allocations have been made on the basis of equipment items named by the manufacturer and model number in the schedules or in the specifications. If any equipment is offered which differs substantially in dimension or configuration from the named equipment, provide as a part of the submission, scaled drawings showing that the substitute can be installed in the space available without interfering with other trades or with access for operation and maintenance in the completed project.

D. Where substitute equipment requiring different arrangement or connections from those shown on the drawings is accepted by the architect, install the equipment to operate properly and in harmony with the intent of the drawings and the specifications, making all incidental changes in piping, ductwork, or wiring resulting from the selection of equipment without increase in the contract amount. Pay all additional costs incurred by adjoining or connected trades.

1.10 SUBMITTALS

A. Comply with the pertinent requirements of Division 1 and the applicable following paragraphs of this specification. Submittals include: shop drawings, operating and maintenance manuals, installation drawings for special systems, and project record documents.

B. Provide complete submittals including all required information per section submitted. Incomplete submittals will be returned without review.

C. Substitution requests shall include a detailed comparison of proposed equipment showing compliance with all specifications requirements. Refer to specific sections for additional substitution requirements.

D. Provide manufacturer's specifications and product data needed to prove compliance with the specified requirements.

E. Manufacturer's recommended installation procedures which, when reviewed by the architect, will become the basis for accepting or rejecting actual installation procedures used on the work.

F. Shop drawings shall consist of manufacturer's catalog sheets, fabrication and installation drawings, schematic drawings and other data required to indicate the exact items offered. Exact items including manufacturer and model number shall be highlighted or marked.

G. Do not submit detailed quantitative lists of lighting fixtures, wiring devices and similar items. Provide proper sizes and quantities to conform with drawings and specifications.

H. Assemble submittals on related items procured from a single manufacturer in brochures or other suitable package form, rather than submitting a multiplicity of loose sheets.

I. The contractor shall sign the submittal as an indication of compliance with the contract documents. If there are any deviations from the contract documents, he shall so indicate on the submittal prior to signing. Any deviations not so indicated shall be cause for rejection and removal of the non-complying equipment at the contractor's expense.

1.11 PROTECTION OF APPARATUS

A. Take precaution to properly protect apparatus from damage. Include the erection of temporary shelters to adequately protect apparatus stored at the site, the cribbing of apparatus stored at the site, the cribbing of apparatus in the incomplete building with tarpaulins or other protective covering. Failure on the part of the contractor to comply with the above to the satisfaction of the architect will be sufficient cause for the rejection of the piece(s) of apparatus in question.

B. Responsibility for the protection of apparatus extends also to existing apparatus involved in this division of the work, whether such apparatus is designated to be used temporarily and later removed or is to be reused as a part of the permanent installation. Erect temporary shelter structures, provide temporary bracing and supports, or cover equipment as required or directed to afford proper protection for that equipment.

1.12 SCHEDULE OF WORK

A. Work schedules and completion dates established by the architect shall be adhered to insofar as possible. Cooperate in establishing these schedules and perform the work under this division to insure meeting scheduled dates and avoid delaying any other contractor.

B. Schedule all work which involves interruption of building services with the architect and the owner 14 calendar days in advance of the actual operation. Obtain written approval from the owner when interruption of services is unavoidable.

C. Should it become necessary to perform certain operations on an "overtime" basis in order not to interrupt the normal usage of the building, include the costs of such overtime without change to the contract amount.

1.13 CUTTING AND PATCHING

A. Perform cutting and patching associated with the work under this division, in accordance with the requirements of Division 1 and the requirements of the following paragraphs.

B. Perform work with trades specializing in cutting and patching.

C. Cut all openings required to install new work or to repair any defective work, using core drills or power driven saws. Impact-type equipment will not be used except where specifically acceptable to the architect. Include channeling walls as required for the installation of conduit, boxes, etc. Openings shall be cut or drilled to exact size.

D. Where openings are cut through masonry walls, provide and install lintels or other structural supports to protect the remaining masonry, and provide adequate support during the cutting operation to prevent damage to the masonry occasioned by the operation. Do not cut any structural member in a way to lessen its strength, unless the architect provides specific written permission.

1.14 CONCRETE WORK

A. All concrete work for concrete structures required for the work under this division shall be provided and installed under Division 3 - Concrete. Coordination of the concrete structures required for the work under this division shall be the responsibility of this division.

1.15 HOUSEKEEPING PADS

A. Steel reinforced concrete housekeeping pads shall be provided for all floor-mounted electrical equipment including, but not limited to switchboards, distribution boards, transformers, generators, transfer switches and similar equipment. Indoor pads shall be 4" thick and reinforced as required to support the equipment.

B. Pads shall be 6" larger in all dimensions than equipment supported, installed continuous to walls, etc., to prevent dirt traps where practical.

C. Install heavy-duty adjustable anchor bolts, set in the form and positioned using equipment templates, prior to pouring concrete when possible.

D. Pour as integral part of the floor slab when possible. Trowel finish and chamfer edges 1/2".

E. All concrete work for housekeeping pads required for the work under this division shall be provided and installed under the Concrete division of these specifications. Coordination of the housekeeping pads required for the work under this division shall be the responsibility of this division.

1.16 EXCAVATION AND BACKFILLING

A. Perform excavating and backfilling in accordance with the procedures and using the materials as described in the Earthwork division of these specifications.

B. Perform excavation required in connection with the installation of the work under this division. After the work has been installed, tested and approved, backfill all excavations with suitable material per the Earthwork division requirements. Include the cutting of all sidewalks, streets and other pavements and repair to original condition.

1.17 ACCESS PANELS

A. Furnish access panels for all locations where electrical equipment such as concealed pull boxes, electrically operated devices, etc. Are installed behind furring, chases, or non-removable suspended ceilings except such panels as are shown on the architectural drawings. These panels will be installed in the walls or ceilings by the trade involved under the applicable division of the general specifications.

B. Furnish access panels per Division 8. Minimum size shall be 24" x 24" unless field conditions dictate otherwise.

1.18 PAINTING

A. Perform painting in accordance with the procedures described in Division 9 of the specifications.

B. All equipment shall be delivered to the job site with suitable factory finish. Should the finish be damaged in transit or during the installation, it shall be finished to match appearance of original finish.

1.19 OPERATING INSTRUCTIONS AND TRAINING

A. Upon completion of work and testing, provide instruction on the operation, use and programming of all equipment to owner's representative, including, but not limited to panelboards, switchboards, lighting control panels, sensor calibration, fire alarm panels, automatic transfer switches, and generators and associated panels.

1.20 MANUALS AND WARRANTIES

A. Upon completion of the work, provide to the architect for delivery to the owner two copies of a bound manual or manuals containing all data and descriptions of all wiring devices, lighting fixtures, switchboards, panelboards, fire alarm and other signal systems; and all other special systems and equipment furnished and/or installed under this Division. Include in this data repair parts, lists, and operation and service instructions and manuals.

B. Provide warranty certificates for all equipment provided, including but not limited to, lighting fixtures, lighting control system, wiring devices, panelboards, switchboards, generators, transfer switches, motor control centers, lightning protection system, fire alarm system, and motors.

C. Bind data in loose leaf, hard back, ring binders sized for 8-1/2-inch by 11-inch sheets. Provide sufficient binders so that no binder will be over 3-1/2-inches thick.

1.21 INSPECTIONS AND TESTS

A. Obtain timely inspections of the installation by the constituted authorities. Remedy any deficiencies to the satisfaction of the inspection authority.

B. Make written notice to the architect adequately in advance of each of the following stages of construction:

1. When all rough in is complete, but not covered.

2. At completion of the work of this section.

3. Prior to placing floor slab, and when all associated electrical work is in place.

C. Perform tests required by the governing authorities and by NFPA 99 and the National Electrical Code, in addition to the tests specified in the individual specification sections.

D. In the architect's presence, test all parts of the electrical system and prove that the systems function electrically in the required manner.

E. When material or workmanship is found to not comply with the specified requirements, remove the non-complying items from the job site and replace them with items complying with the specified requirements at no additional cost to the owner. This shall be performed within 3 days after notice of noncompliance.

F. At the time of final inspection and tests of the power and lighting systems, all connections at panels, switches, circuit breakers, etc. And all splices shall be complete. All fuses shall be in place, and all circuits shall be continuous from point of service connection to all switches, receptacles, outlets, etc.

G. All circuits shall be free of shorts and grounds. Loads shall be balanced between phases.

H. Upon final completion of the work, obtain certificates of acceptance from the constituted authorities. Deliver the certificates to the architect for transmission to the owner.

1.22 CAD FILES

A. Contractor can request copies of the design CAD files for the purposes of preparing submittals. Engineer will only provide copies of floor plans. No details, schedules or borders will be provided.

B. Contractor shall pay a processing fee of $150 per sheet to engineer and sign the electronic files release prior to receiving files.

C. Engineer will release cad files no later than (5) days after receiving payment and release.

1.23 RECORD DRAWINGS

A. The purpose of final project record documents is to provide factual information regarding all aspects of the work, both concealed and visible, to enable future modification of the work to proceed without lengthy and expensive site measurement, investigation, and examination.

B. During the installation of the work, the contractor shall keep detailed records of any and all changes made from the contract drawings. On or before final completion of his work he shall revise a set of contract drawings to illustrate the work as actually installed. An electronic copy of the revised contract drawings shall be provided the architect; all revisions to the drawings shall be the contractor's responsibility and the work shall be neat, legible and accurate. These record drawings shall be stamped "as-built", dated, and submitted to the architect for review.

C. Show on the record drawings, by dimensions accurate to within one inch both horizontally and by vertical elevation, the centerline of each run of items such as sleeves and conduit below grade, in walls, or in concrete slab. Surface mounted devices and equipment are to reflect their exact location.

D. Clearly identify items by symbol or note such as "rigid conduit" and the like. Additionally, identify by symbol or note, the location of the item "under slab", "in ceiling plenum", "exposed", and the like.

E. Make identification sufficiently descriptive that it may be reliably related to the specifications.

F. Upon completion of the work the revised drawings shall be delivered to the architect.

1.24 WARRANTY CERTIFICATES

A. Upon completion of work, provide original warranty certificates for all equipment installed.

1.25 PROJECT COMPLETION

A. Upon completion of the work of this section, thoroughly clean all exposed portions of the electrical installation, removing all traces of soil, labels, grease, oil, and other foreign material, and using only the type cleaner recommended by the manufacturer of the item being cleaned.

B. Thoroughly indoctrinate the owner's operation and maintenance personnel in the contents of the operation and service manual required to be submitted as part of this section of these specifications.

END OF SECTION

SECTION 26 0519

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED CONDITIONS

A. Provisions established within the General Conditions and Supplementary General Conditions of the Contract, Division 1 - General Requirements, and the Drawings are collectively applicable to this Section.

1.2 SECTION INCLUDES

A. Building wire (600 volts & under).

B. Plenum cable.

1.3 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service.

B. Comply with the following applicable standards and codes: ICEA, IEEE, ASTM, UL, ANSI, NEMA and National Electrical Code.

C. All wire and cable shall be UL approved for application.

1.4 SUBMITTALS

A. General: Submit in accordance with Division 1.

B. Product Data: Submit manufacturer's catalog cut sheets, data sheets and installation instructions.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Building Wire (600 Volts & Under): AFC, Belden, Carol, Southwire, Triangle.

B. Splice & Termination Kits: Elastimold, Raychem, Sigmaform, 3M.

2.2 BUILDING WIRE (600-VOLTS AND UNDER)

A. Building wire in raceway: Provide conductors of soft drawn, annealed copper, 98% conductivity, insulation type "THHN/THWN" rated 600 volts. Wire size #10 AWG and smaller shall be solid conductor; #8 AWG and larger shall be stranded conductor. Temperature rating of conductors and conductor terminals shall be comparably rated for 75 degrees C (i.e. higher rated ampacities for conductors of 90 degrees cannot be utilized unless the terminals at which the conductors terminate have comparable ratings). Temperature applications shall be in accordance with the NEC.

B. Ungrounded Circuits from Isolating Transformers: 600-volt, cross-linked polyethylene insulated, single copper conductor cable having a dielectric constant less than 3.5; Okonite X-Olene Type XHHW.HS.

C. Metal-clad (MC) cable: UL listed with color coded copper conductors, type MC 600 volt, 90 degrees C dry, THHN insulation, minimum #12 with integral insulated ground, aluminum outer sheath. Utilize UL labeled MC cable fittings at all cable terminations. Cable shall be manufactured by AFC, Type MC

PART 3 - EXECUTION

3.1 WIRE PULLING

A. Completely and thoroughly swab raceway system before installing wires.

B. Pulling Devices in Empty Raceways: Provide in every empty raceway system a suitable pull line to facilitate future installation of wiring. This requirement does not apply to conduit stub-ups.

C. Attach pulling lines to conductors by means of insulated woven basket grips or by pulling eyes attached directly to conductors. Do not use rope hitches, or bare steel basket grips. All conductors to be installed in a single conduit shall be pulled together. Do not exceed manufacturer's recommended pulling tension or sidewall pressure.

D. All cable lubricants shall be UL listed, of non-conducting type, and shall be certified by their manufacturer to be no-injurious to the insulation on which they are used.

E. Do not use cable lubricants on conductors of isolated power systems, which are electrically monitored by ground detector systems, since lubricant may increase the capacitance to ground of these conductors.

3.2 INSTALLATION OF BUILDING WIRE (600-VOLTS AND UNDER)

A. Included hereunder is all wiring 600 volts and less, except for communication wiring. All wiring shall be installed in raceways unless specifically noted to the contrary.

B. Use no wire smaller than #12 AWG for power and lighting circuits and no smaller than #14 AWG for signal and control wiring. Provide minimum of #12 AWG for all switch legs. Provide neutral conductor of the same size as the phase conductors to which it is associated. Provide a separate, insulated equipment grounding conductor for all power circuits.

C. Use #10 AWG conductor minimum for 20 ampere, 120 volt branch circuits longer than 100 feet, and for 20 ampere, 277 volt branch circuits longer than 200 feet.

D. Do not install conductors operating at more than 300 volts between phases in the same compartment of a switch box.

E. Pull no conductors into conduit until all work of a nature, which may cause injury to conductors is completed.

F. Run all feeders their entire length in continuous pieces without joints or splices. If installation of feeder conductors without splices is impractical due to feeder length or installation conditions, submit “Request for Information” form to Architect for approval requesting permission to allow splice. Make joints in branch circuits only where circuits divide as shown on Drawings.

G. Control wiring for a motor branch circuit may be installed in the same conduit as that motor's power circuit. Increase the conduit size as required by NEC for conduit fill.

H. The control wiring serving a motor controller may be installed in the same conduit with the branch circuit serving the controller. Increase the conduit size as required by NEC for conduit fill.

I. The discrete branches of the emergency electrical system and equipment shall be completely independent of all other wiring and equipment, and shall not enter the same raceways, boxes or cabinets with each other or other wiring, except as follows:

1. In transfer switches;

2. In exit or emergency lighting fixtures supplied from two sources, or;

3. In a common junction box attached to exit or emergency lighting fixtures supplied from two sources.

J. Power and lighting circuits of different system voltages shall not occupy the same conduit, except as allowed by the NEC.

K. Neatly train and lace wiring inside boxes, panelboards, switchgear, motor control centers, wireways and other equipment using Thomas & Betts "Ty-Wraps".

L. Identification Tags: Refer to Specification Section 26 05 33 for wire identification requirements.

M. Bundling Conductors: Bundle conductors in panelboards, cabinets, switchboards, motor control centers, and the like, using nylon traps, made for the purpose. Bundle conductors larger than No. 10 in individual circuits. Smaller conductors may be bundled in larger groups.

N. Provide cable supports for wire installed in vertical conduit per Section 26 05 33 - Raceway and Cable Tray.

O. Make all joints or splices as follows:

1. In Wet Locations: In accordance with conductor manufacturer's recommendations.

2. Stranded Conductors: UL approved solderless bolted pressure connectors or Thomas & Betts Series 54000 compression connectors. All connectors shall be of proper sizes to match conductor sizes. All compression connectors shall be applied with properly sized dies and tools. Split-bolt connectors are not acceptable except for wire terminations to motors for wire sizes #8 AWG and larger.

3. Solid Conductors: UL approved solderless bolted pressure connectors or UL approved electrical spring connectors of "Scotchlok", Ideal or T&B "Piggy" make. All connectors shall be of proper sizes to match conductor sizes. Split-bolt connectors are not acceptable except for wire terminations to motors for wire sizes and 8 AWG and larger.

4. Lighting Fixture Taps: Electrical spring connectors as specified for solid conductors.

5. Wire nuts and crimped pressure connectors, except as specified above, are prohibited.

P. Color Coding:

1. Use standardized color coding of conductors throughout.

2. Neutral Conductors: White or natural gray. Where conductors of two different systems may be installed within the same enclosure, one neutral shall be white or natural gray; the other neutral shall be white with a colored stripe other than green.

3. Grounding Conductors: Green, or green with one or more yellow stripes.

4. Phase Conductors in 208-Volt System: Black, red and blue for phases A, B, and C, respectively.

5. Phase Conductors in 460- or 480-Volt System: Brown, Orange and Yellow for Phases A, B, and C, respectively.

6. Conductors in Isolated (Underground) System: Orange for conductor No. 1, Brown for Conductor No. 2, Yellow for Conductor No. 3, and Green for grounding.

7. Use other colors as necessary to identify other special circuits.

8. All color coding shall be continuous for the entire length of the conductors, and shall be permanent and readily distinguished after installation.

9. In cases where the specified colors of insulated wire and cable are unavailable, such conductors shall be color coded, as specified above, by means of Brady, or equivalent, slip-on plastic sleeves or wrapped with the appropriately colored tape a minimum of 3" of conductor length (after terminated) at all pull boxes, support boxes, outlet boxes, panelboards, switchboards, and other terminal and splicing points. Sleeves shall be of proper sizes to fit conductor insulation snugly.

3.3 INSTALLATION OF METAL-CLAD (MC) CABLE (600-VOLTS AND UNDER)

A. MC type cable may be used inside accessible ceilings and only for final connection to lighting fixtures where a direct connection to rigid conduit is not possible.

B. MC type cable runs longer than 6' are not allowed, unless authorized in writing by the engineer.

C. Support cable every 4-1/2 feet and 12 inches from each junction/outlet box in accordance with the National Electrical Code.

D. Arrange cable to maintain headroom and present a neat appearance.

E. Conceal cable in ceiling of all finished areas and in walls of all areas of the building. In unfinished areas without ceilings, cable may be run exposed overhead. Install exposed cable parallel or perpendicular to walls and adjacent piping. Use corridors as the main route for circuit distribution. Neatly route cable in a common rack in corridors. Do not mount cable to floor under any circumstances.

F. Maintain minimum 6 inch clearance between cable and piping. Maintain 12 inch clearance between cable and heat sources such as flues, steam pipes, and heating appliances. Wherever possible, avoid installing cable directly above or in close proximity to boilers and other like objects operating at high temperatures.

G. Do not use MC type cable in penetrations through floors or walls.

H. Locate cable so as not to hinder access to mechanical equipment or ceiling access hatches.

I. Utilize UL labeled MC cable fittings at all cable terminations.

3.4 FIELD QUALITY CONTROL

A. Inspect wire and cable for physical damage and proper connection.

B. Torque test conductor connections and termination to manufacturers recommended values.

C. Perform continuity test on all conductors to verify proper phasing connections.

END OF SECTION

SECTION 26 0523

CONTROL-VOLTAGE ELECTRICAL POWER CABLES

PART 1 - GENERAL

1.1 RELATED CONDITIONS

A. Provisions established within the General Conditions and Supplementary General Conditions of the Contract, Division 1 - General Requirements, and the Drawings are collectively applicable to this Section.

1.2 SECTION INCLUDES

A. Motor and equipment control and wiring.

1.3 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service.

B. Comply with the following applicable standards and codes: UL, ANSI, NEMA and National Electrical Code.

C. Motor and equipment control and wiring shall be UL approved for the application.

1.4 SUBMITTALS

A. General: Submit in accordance with Division 1.

B. Product Data: Submit manufacturer's catalog cut sheets, data sheets and installation instructions.

PART 2 - PRODUCTS

2.1 BASIC MATERIALS

A. Conduits, boxes, conductors, hangers and supports, and similar basic materials shall be as specified in other sections of the specifications.

2.2 GENERAL

A. All electric wiring of every character, both for power supply and for the control, will be done under Division 26, except for each such equipment items as are prewired at their point of manufacture and so delivered to the project and except for temperature control wiring as specified in Division 23 and unless specified otherwise hereinafter.

2.3 MOTOR, EQUIPMENT WIRING AND CONTROLS

A. Connect complete for operation of all items of heating, air conditioning, plumbing, kitchen, laboratory equipment, incinerator controls, and all other electrical equipment and devices furnished by the Owner or under other Divisions of the Specifications. Outlets of various types have been indicated at approximate equipment locations. Exact locations and work

scope are not shown on the drawings. Coordinate exact locations, work scope including wiring and connection requirements with the Owner or with other Divisions furnishing the equipment. Request of the Owner and the aforementioned Suppliers and Contractors all rough-in drawings required for proper installation of the electrical work in ample time to permit preparation of the drawings and thus avoid delays on the job.

B. Refer to Section 26 05 33 for conduit connections to motors. Where motors have no integral conduit boxes provide condulets at motors.

C. Where disconnect switches or circuit breakers are not provided integral with control equipment for motors and other electrical appurtenances, provide disconnect switches required by the National Electrical Code or as indicated on the drawings.

D. Temperature Regulating Equipment:

1. Division 23 will furnish items of freeze protection, temperature regulating and other control equipment including wiring for temperature regulating controls.

2. Connect and make operational all freeze protection having electrical components, and other electrical devices provided by others. Outlets of various types have been indicated at certain equipment locations, but indications of exact locations or work scope are not shown on the drawings, nor are the indications of the fire and freeze protection equipment electrical requirements shown.

3. Refer to Division 23 of these specifications for the scope of connections to be made for freeze protection. Wiring diagrams for the connection of devices provided by Division 23 will be furnished to Division 26 by Division 23. Request those diagrams, in writing, in ample time to permit preparation of the drawings and the proper installation of all wiring.

E. Elevator Wiring:

1. Provide electric feeders and branch circuits for elevator power as scheduled. Provide in each individual elevator feeder a fused disconnect switch or branch circuit in panelboard located in the elevator machine room where shown. Terminate each such branch circuit at the elevator controls as directed by the elevator manufacturer.

2. Provide all circuits required for elevator control power.

3. Provide circuits for elevator cab lights, terminated in junction boxes in elevator shafts at midpoints of elevator cab travel or in the elevator equipment room as directed by the elevator contractor.

F. Sump Pumps and Sewage Ejector Pumps:

1. Sump pumps and sewage ejector pumps with all necessary switches, monitoring equipment, etc., will be furnished and installed under Division 23. Provide all interwiring in conduit to accomplish the monitoring described in Division 23, and provide the branch circuit wiring in conduit to the pumps.

G. Pneumatic Tube Wiring:

1. The Pneumatic Tube Contractor or Subcontractor will furnish items of pneumatic tube control equipment.

2. Connect and make operational all pneumatic control equipment having electrical components. Outlets of various types have been indicated at certain equipment

locations, but indications of exact locations or work scope are not shown on the Drawings, nor are the indications of the pneumatic tube equipment electrical requirements shown.

3. Refer to the Conveying Systems Division of these Specifications for the scope of connections to be made for pneumatic tube electrical requirements. The Pneumatic Tube Contractor will provide wiring diagrams for the connection of devices he furnishes. Request those diagrams, in writing, in ample time to permit preparation of the Drawings and the proper installation of all wiring.

H. Control of the Air Handling System by the Fire Alarm System:

1. Provide all interwiring to accomplish the control of the Air Handling System by the Fire Alarm System as described in Section 28 31 00, and Division 23.

PART 3 - EXECUTION

3.1 INSTALLATION OF BASIC MATERIALS

A. All wiring shall be run in conduit with conductors, boxes, hangers and supports, and similar basic materials.

3.2 INSTALLATION OF MOTORS & EQUIPMENT CONTROLS

A. Unless otherwise specified, all motors and their controls will be furnished and delivered by the Owner or under other Divisions of the specifications. Where motors are mounted integrally with items of equipment, they will be erected in place with such equipment ready for electrical connection under Division 26, such erection is not a part of the work under this Division. Where motors are to be installed as separate items, their foundations, anchor bolts and other provisions necessary to their erection will be provided as a part of the work of the Division under which they are furnished, with final electrical connection under Division 26.

B. Unless otherwise specified, all motor starters and control equipment will be furnished and delivered by the Owner or under other Divisions of the specifications. Install under this Division, including supporting structures, all motor starters and control equipment which are not shipped integrally mounted with the controlled equipment. Provide and install all wiring of every character, for both power and control, except that which is factory installed and shipped as an integral part of assembled equipment.

END OF SECTION

SECTION 26 0526

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED CONDITIONS

A. Provisions established within the General Conditions and Supplementary General Conditions of the Contract, Division 1 - General Requirements, and the Drawings are collectively applicable to this Section.

1.2 SECTION INCLUDES

A. Grounding system.

1.3 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service.

B. Comply with the following applicable standards and codes: UL, ANSI, NEMA, NFPA including the National Electrical Code.

C. Grounding system material and components shall be UL approved for the application.

1.4 SUBMITTALS

A. General: Submit in accordance with Division 1.

B. Product Data: Submit manufacturer's catalog cut sheets, data sheets and installation instructions.

PART 2 - PRODUCTS

2.1 GROUNDING CONDUCTORS AND MATERIALS

A. Bonding jumpers shall be flexible tinned copper braid or copper conductor, sized per National Electrical Code Article 250.

B. Ground cable shall be bare rope lay type copper or copper conductor, sized per National Electrical Code Article 250.

C. Ground conductors shall be annealed copper and insulated to match the phase conductors, sized per National Electrical Code Article 250.

D. Grounding electrodes shall be copper ground rods ¾ inch diameter, 8 feet long, designed for driven installation.

E. Grounding connectors shall be mechanical clamp or exothermic weld type.

F. All ground conductors shall be sized in accordance with the National Electrical Code.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install electrical grounding systems in accordance with applicable portions of NEC, NFPA-99, NECA's "Standard of Installation," and in accordance with recognized industry practices to ensure that products comply with requirements and serve intended functions.

B. Provide a separate green-insulated grounding conductor, with insulation of the same rating as the phase conductors, for each feeder and for each branch circuit. Install the grounding conductors in the same raceway with related phase and neutral conductors. Where parallel conductors in separate raceways occur, provide grounding conductors in each raceway. Connect all grounding conductors to ground bars in panelboards, and to ground buses in switchboards, motor control centers, and like equipment so there will be no uninterrupted grounding circuit from the point of ground fault back to a point of connection of the equipment ground and system neutral. Provide required isolation for isolated ground circuits.

C. Assure the electrical continuity of all metallic raceway systems, pulling up all conduits and/or locknuts wrench-tight. Where expansion joints or telescoping joints occur, provide bonding jumpers. Wherever flexible metallic conduit is employed, provide a green insulated grounding jumper installed in the flexible conduit.

D. Provide grounding bushings on all feeder raceways terminating within the main switchboards, motor control centers, transformers, panelboards and like equipment, all junction and pull boxes or where required by the National Electrical Code. Install bonding jumper from these bushings to the equipment ground bus where one occurs or to ground lugs mounted to the frame of the enclosures, remove the paint around the raceway locknuts to assure good metal-to-metal contact.

E. Connect the secondary neutral point and the enclosure in each dry type transformer together and run a grounding electrode conductor from their common point of connection to the building's existing grounding electrode system.

F. Install mechanical clamp or exothermic type welded grounding connections. Exothermic weld type shall be used in inaccessible locations.

G. Use minimum #6 AWG copper conductor for communications service grounding conductor. Leave ten feet slack conductor at terminal board.

H. Provide equipotential grounding system as indicated and diagrammed on the drawings. Where equipotential grounding systems are used in conjunction with isolated power system, grounding shall be in accordance with NFPA 99 and the National Electrical Code.

3.2 FIELD QUALITY CONTROL

A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

B. Test the continuity of, and the proper connection of, each ground conductor and system, to assure that the grounding system is complete and uninterrupted.

C. Measure ground resistance from system neutral connection at service entrance to convenient ground reference point using suitable ground testing equipment. Resistance shall not exceed the lesser of 5 ohms or as required by code (NOTE: Resistance and leakage current values for isolated power systems shall adhere to the National Electrical Code and NFPA-99).

3.3 TESTING OF ISOLATED POWER AND EQUIPOTENTIAL GROUNDING SYSTEMS

A. The Contractor shall retain the services of an authorized manufacturer's representative to perform testing of equipotential grounding and isolated power systems to demonstrate conformance to NFPA 99 and National Electrical Code requirements. A written report for each system shall be prepared complete with a final certification of system conformance. The Architect shall be notified a minimum of four (4) weeks in advance of testing so a group of Owner and Architect representatives may be present to witness the testing.

END OF SECTION

SECTION 26 0533

RACEWAYS & BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED CONDITIONS

A. Provisions established within the General Conditions and Supplementary General Conditions of the Contract, Division 1 - General Requirements, and the Drawings are collectively applicable to this Section.

1.2 SECTION INCLUDES

A. Non-metallic conduit and fittings.

B. Metallic conduit and fittings.

C. Flexible metal conduit and fittings.

D. Surface metal raceways (wireways).

E. Outlet boxes and fittings.

F. Pull and junction boxes and fittings.

G. Floor boxes and fittings.

1.3 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service.

B. Comply with the following applicable standards and codes: UL, ANSI, NEMA and National Electrical Code.

C. Raceway and box systems shall be UL approved for the application.

1.4 SUBMITTALS

A. General: Submit in accordance with Division 1.

B. Product Data: Submit manufacturer's catalog cut sheets, data sheets and installation instructions.

C. Shop Drawings: Submit shop drawings for boxes over 864 square inches.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Non-metallic conduit: Carlon, Borg-Warner, Cantex, SEDCO.

B.	Metallic conduit:	Allied, NEPCO, Pittsburg, Republic Steel Triangle.
C.	Flexible metal conduit:	Flflex, AFC, Anaconda, Electri-Flex, O-Z Gedney.
D.	Couplings, Terminators/Fittings:	Appleton, Crouse Hinds, O-Z Gedney.
E.	Surface Metal Raceways:	Square D, Wireways Walker, Wiremold.
F.	Outlet Boxes:	Hoffman, Unity, Universal.
G.	Pull and Junction Boxes:	Hoffman, Unity, Universal.
H.	Floor Boxes:	Hubbell, Raceway Components, Incorporated, Steel City, Walker.

2.2 CONDUIT

A. Underground Plastic Conduit: Schedule 40, heavy wall, high impact rigid virgin polyvinyl chloride (PVC), Type II (designed for underground installation without concrete encasement), conforming to NEMA Publications TC2 and TC3, bearing UL label and UL listed for direct burial.

B. Rigid Galvanized Steel Conduit: Hot-dip galvanized inside and outside, with factory-cut threads galvanized after cutting; all conduit coated with outer coating of zinc dichromate inside and outside; couplings and elbows shall conform to UL Standard 6 and shall be UL listed and labeled; each conduit length equipped with coupling on one end and thread protectors on other end.

C. Intermediate Metal Conduit: Hot dip galvanized inside and outside, with factory-cut threaded galvanized after cutting; conduit and elbows shall conform to UL Standard 1242 and shall be UL listed and labeled; each conduit length equipped with coupling on one end and thread protectors on other end.

D. Electrical Metallic Tubing: Steel tubing, galvanized outside and provided with aluminum lacquer or enamel corrosion-resistant interior coating; conforming to UL Standard 797 and UL listed and labeled.

E. Flexible Metal Conduit: Spirally-wound with hot dip galvanized steel strips (commercial Greenfield) or aluminum armor; conforming to UL Standard 1 and UL listed and labeled.

F. Liquidtight Flexible Metal Conduit: Spirally wound with hot dipped galvanized steel strips or aluminum armor, polyvinyl chloride cover extruded over the exterior to make conduit liquidtight; UL listed and labeled; Anaconda "Sealtite" Type E.F.

2.3 COUPLINGS AND TERMINATORS

A. Couplings and Terminations for Rigid Steel or Intermediate Metal Conduit: Factory made threaded couplings of same material as conduit; O-Z Gedney Type "4" Series, molded nylon insulating (insulated on 1-1/4" and larger only) bushing at all boxes or cabinets, with locknuts inside and outside box or cabinet; O-Z Gedney Type IBC-L-BC nylon insulated grounding bushing on all conduits where grounding bushings are required, with locknuts inside and outside the enclosure involved.

B. Couplings and Terminations for Electrical Metallic Tubing: O-Z Gedney 5000 Series steel set-screw couplings; O-Z Gedney 4000 Series steel set-screw box connectors with nylon insulated throat (insulated on 1-1/4" and larger only) and locknuts at all box and cabinet terminations; and O-Z Gedney Type IBC-L-BC Series set-screw type nylon insulated grounding bushing on all tubing where grounding bushings are required.

C. Couplings and Terminations for Flexible Metal Conduit: O-Z Gedney Type C & 24 Series couplings at connections between flexible and rigid conduit; and O-Z Gedney Type C & 24 Series nylon insulated throat (insulated on 1-1/4" and larger only), steel grounding connectors at box or cabinet terminations.

D. Couplings and Terminations for Liquidtight Flexible Metal Conduit: O-Z Gedney Type 4Q-FM Series adapters at connections between flexible and rigid conduit; O-Z Gedney Type 4Q-L Series nylon insulated throat (insulated on 1-1/4" and larger only) steel grounding connectors at box or cabinet terminations.

2.4 EXPANSION FITTINGS

A. All expansion fittings shall be provided with O-Z Gedney Type "BJ" external bonding jumper.

B. Expansion fitting for rigid metal conduit: O-Z Gedney Type "AX", "AX8" for linear expansion, with bonding jumper.

C. Expansion fitting for rigid metal and intermediate metal conduit: O-Z Gedney Type "DX" for linear expansion with deflection, with bonding jumper.

D. Expansion fitting for electrical metallic tubing: O-Z Gedney Type "TX" for linear expansion, with bonding jumper..

2.5 SURFACE METAL RACEWAYS AND WIREWAYS

A. UL listed and labeled; surface metal raceways shall be used together with couplings, clips, bushings, straps, connectors, connection covers, elbows, boxes, extension boxes, fixture boxes, extension adapters, blank covers, knockouts, and all other required fittings; shall be of the proper size to accommodate the conductors to be installed therein in each case.

2.6 OUTLET BOXES

A. Provide standard, #14 gauge minimum galvanized or cadmium-plated pressed steel outlet boxes suitable for the conditions of each outlet. Provide multi-gang outlets of single box design.

B. Provide deep type cast metal outlet boxes located in damp locations exposed to weather or exposed areas subject to damage, complete with gasketed cover and threaded hubs.

C. Provide outlet boxes of sufficient volume to accommodate the number of conductors entering the box in accordance with the requirements of the National Electrical Code, and not less than 1-1/2 inch deep unless shallower boxes are required by field conditions and are approved by the Architect.

D. Provide 4-inch octagonal ceiling outlet boxes for light fixture installations.

2.7 PULL AND JUNCTION BOXES

A. Provide galvanized sheet metal boxes conforming to ANSI/NEMA OS 1. Provide hinged enclosures for any box larger than 12 inches in any dimension.

B. Boxes of volume not over 100 cubic inches shall be standard outlet.

C. Boxes over 864 square inches shall be sectionalized.

D. Provide separate pull boxes and junction boxes for electric power, control and communication systems.

E. Boxes shall be of the size indicated on the drawings or sized in accordance with the National Electrical Code.

F. Four (4) inch square ceiling junction boxes, where used, shall be provided with 2-hole eye hook type cover.

2.8 FLOOR BOXES

A. Floor boxes for installation in cast-in-place concrete floors shall be formed steel, fully adjustable and provided with required fittings including carpet flanges/plates for carpeted areas. Boxes shall be round or rectangular to match the area installed or as otherwise specified.

PART 3 - EXECUTION

3.1 CONDUIT SIZING, ARRANGEMENT AND SUPPORT

A. Minimum conduit size shall be 3/4 inch. Minimum conduits size for homeruns shall be 3/4 inch. Conduit sizes indicated on drawings are minimum based on THHN/THWN copper wire unless noted otherwise. Larger conduit sizes may be used for convenience of wire pulling.

B. Arrange conduit to maintain headroom and present a neat appearance. All home runs shall be routed through the corridor plenum, where possible.

C. Conceal conduit in ceiling of all finished areas and in walls of all areas of the building. In unfinished areas without ceilings, conduit may be run exposed overhead. Install all conduit, including conduit above accessible ceiling, parallel or perpendicular to walls and adjacent piping. Use corridors as the main route for circuit distribution. Neatly route conduit in a common rack in corridors above ceiling.

D. Maintain minimum 6 inch clearance between conduit and piping. Maintain 12 inch clearance between conduit and heat sources such as flues, steam pipes, and heating appliances. Wherever possible, avoid installing raceways directly above or in close proximity to boilers and other like objects operating at high temperatures.

E. Arrange conduit supports to prevent distortion of alignment by wire pulling operations. Fasten conduit securely to building structure using clamps, hangers and threaded rod.

F. Wherever raceways pass through floors, walls, penetrations, etc., carefully fill any space between the outside of the raceway and the building material to prevent passage of air, water, smoke and fumes. Filling material shall be fire resistive and, in general, similar to the basic building materials through which the raceway passes maintaining the fire rating of the penetrated barrier. Provide galvanized wrought iron sleeves for raceways penetrating exterior walls or fire rated walls, floors or ceilings.

G. Locate conduits so as not to hinder access to mechanical equipment or ceiling access hatches.

H. Install pull string in all conduits.

I. Install cable supports in vertical conduit risers for non-armored type cables in accordance with the N.E.C., O.Z. Gedney Type R.

3.2 INSTALLATION OF UNDERGROUND CONDUIT

A. Install underground conductors in plastic conduit, unless noted or specified otherwise. Underground installations shall meet the minimum cover requirements of the NEC and local ordinances. Cover raceways with 9 inches of sand before continuing backfill. Assemble and install raceways in accordance with manufacturer's instructions. Make joints with couplings and solvent welding cement. Fabricate long radius bends with proper heating equipment. Bends showing signs of overheating or flattening are unacceptable. Bends less than 10 feet radius shall be made with PVC coated rigid steel or rigid galvanized steel wrapped with 3M plastic tape as described herein. Ream ends of all conduit before joining.

B. Prior to conduit installation, dig a trench with a minimum of 12 inches width. Provide conduit separators to keep conduits parallel. Minimum conduit separation is 2 inches between conduits.

C. Electrical service entrances and installations requiring excavation of 12 inches width or greater shall be installed on a bed of sand not less than 3 inches deep. Cover raceway with 9 inches of sand before continuing backfill.

D. "Snake" plastic conduit in trench, from side to side, with a complete cycle every 40 feet, allowing for expansion and contraction. Maintain this configuration during backfilling.

E. Use rigid galvanized steel conduit in slab or where conduit enters into building, turns up out of earth, or turns up into concrete pads. Do not extend plastic conduit into building.

F. All rigid galvanized steel conduit in earth shall be PVC coated or wrapped with 3M 0.020-inch thick No. 52 "Scotchrap" vinyl plastic tape, half lapped to give a double thickness wrap. Remove all oil, grease and dirt from conduit with a suitable solvent, and clean and dry conduit before wrapping. If conduit is pre-wrapped in the shop and then cut and jointed on the job, wrap all joints on the job, overlapping pipe wrapping 3 inches on both sides of joints.

G. Provide plastic warning tape for underground conduit installations.

H. Provide concrete encased duct bank for installation of underground conduits containing fiber optical cable. Paint top surface of concrete orange. Refer to plans for construction requirements.

3.3 INSTALLATION OF BUILDING CONDUIT

A. Cut conduit square using a saw or pipe cutter; deburr cut ends before joining metal conduit.

B. Bring conduit to the shoulder of fittings and couplings and fasten securely. Make joints mechanically tight and all metal conduit electrically continuous.

C. Use conduit hubs for fastening conduit to sheet metal boxes in damp or wet locations. Use sealing locknuts and other approved techniques for moisture proofing raceway in wet areas.

D. Install no more than the equivalent of three 90 degree bends between boxes.

E. Use conduit bodies to make sharp changes in direction, such as around beams.

F. Use hydraulic one-shot conduit bender of factory elbows for bends in conduit 2 inch and larger in size.

G. Avoid moisture traps where possible; where unavoidable, provide junction box with drain fitting at conduit low point. Seal conduit which crosses a boundary between areas of extreme temperature difference.

H. Use suitable conduit caps to protect installed conduit against entrance of dirt and moisture.

I. Install conduit expansion fittings where conduit crosses building expansion joints and at 150 foot intervals in straight runs.

J. Drawings indicate intended circuiting and are not intended to be scaled for exact conduit location.

K. Provide fire-stop compound at all penetrations of floor slabs or fire walls to maintain fire rating integrity of barrier.

L. Use lengths of flexible metal conduit, not less than 12 inches long at final connections to all motors, generators, boiler controls and other devices subject to movement because of vibration or mechanical adjustment. Use flexible metal conduit also at connections to recessed lighting fixtures, and elsewhere as required. In damp or wet locations, at motor or equipment connections on or near pumps, and when installed outdoors, use liquidtight flexible metal conduit.

M. Join rigid galvanized steel conduit and intermediate metal conduit with threaded couplings. Ream out all conduit ends after threading. Secure rigid conduits at panel boxes, junction boxes, pull boxes, switchboards, support boxes, or sheet metal outlet boxes by galvanized locknuts, inside or outside, with insulating bushing inside. Unthreaded set screw type couplings or connectors are not acceptable in rigid conduit systems.

N. Join electrical metallic tubing with compression type couplings. At EMT terminations, provide insulated throat (insulated on 1-1/4" and larger only) steel box connectors and locknuts.

O. Seal ends of all raceways with blank discs (pennies), push pennies or other approved closers during construction.

P. Provide raceway with identification in accordance with Section 26 05 53 - Electrical Identification.

Q. Do not install conduit on roof.

R. Do not penetrate roof with conduit. Provide connections to roof equipment by routing conduit inside equipment curb. Any roof penetrations require written authorization by owner's representative.

S. Do not run interior conduit within 3" of roof.

3.4 CONDUIT INSTALLATION SCHEDULE

A. Rigid galvanized steel conduit: Damp or wet locations, hazardous locations, within concrete slab, under building, below grade bends with bend radius of less than 10 foot diameter and slab penetrations.

B. Intermediate metal conduit or electrical metallic conduit: Interior dry locations above slab.

C. Flexible metal conduit: Interior dry locations for final connections to motors, light transformers fixtures and other equipment subject to vibration. No lengths longer than 6 feet will accepted without written approval by engineer. Include a separate grounding conductor bonded at both ends to approved fittings for all lengths greater than 6 foot.

D. Liquidtight flexible metal conduit: Outdoor locations for final connections to motors and transformers; final connections to motors, transformers, and other equipment in kitchens equipment rooms and central plan subject to vibration.

E. PVC: Below grade.

3.5 INSTALLATION OF SURFACE METAL RACEWAYS

A. Firmly secure raceways components to building surfaces using plastic expansion shields and flathead sheet metal screws for plaster, plaster expansion shields and flathead wood screws for drywall, or masonry rail for brick, cinderblock and concrete construction.

B. Raceways shall be run in at right angles to building surfaces with boxes set plumb and square.

C. Install conductors as specified here in before under "Installation of Building Wire".

3.6 HANGERS AND SUPPORTS

A. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure using expansion anchors, preset inserts, or beam clamps.

B. Support conduits running vertically or horizontally along walls with galvanized malleable iron two-hole clamps. Carry individually supported horizontal conduits 1-1/4 inch and larger on Kindorf No. 150, Steel City No. C-149 hangers. Use no wire or perforated strap iron as hanger material.

C. Install hangers, supports, clamps, and attachments to support piping properly from building structure. Arrange for grouping of parallel runs of horizontal conduits to be supported together on trapeze type hangers where possible. Size trapeze members including the suspending rods for the number, size and loaded weight of the conduits they are to support. Install supports with spacing as required for the conduit supported.

D. Locate hangers and trapezes to support horizontal raceways without appreciable sagging. Hanger spacing shall not exceed NEC requirements. Space hangers more closely where required by conditions.

E. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or present inserts in solid masonry walls; self-drilling anchors or expansion anchor o concrete surfaces sheet metal screws in sheet metal studs; and wood screws in wood construction.

F. Do not fasten supports to piping, ductwork, mechanical equipment, or conduit.

G. Fabricate supports from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.

3.7 COORDINATION OF BOX LOCATIONS

A. Provide boxes as shown on drawings, and as required for splices, taps, wire pulling, equipment connections, and code compliance.

B. Box locations shown on drawings are approximate unless dimensioned. Verify with the Architect the location of floor boxes and outlets in offices and work areas prior to rough-in.

C. Locate and install boxes to allow access. Provide access doors where installation is inaccessible. Coordinate locations and sizes of required access doors with those specified in Division 25 - Mechanical. Do not mount boxes to HVAC duct.

D. Locate and install to maintain headroom and to present a neat appearance.

3.8 OUTLET BOX INSTALLATION

A. Do not install boxes back-to-back in walls. Provide minimum 4-inch separation.

B. Locate boxes in masonry walls to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat openings for boxes.

C. Provide knockout closures for unused openings. Provide blank plates for all junction boxes.

D. Securely fasten boxes to the building structure, independent of the conduit, except for splice boxes that are connected to two metal conduits, both supported within 12 inches of box.

E. Provide access to all boxes.

F. Use multiple-gang boxes where more than one device is mounted together; do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.

G. Install boxes in walls without damaging wall insulation.

H. Standard wall mounted outlets shall be mounted 18 inches above finished floor unless noted otherwise. Outlets above counters shall be mounted 8 inches above the counter surface and out of the backsplash area, unless noted otherwise. Exact locations and mounting heights shall be coordinated with the Architect and shall adhere to the 48 inch maximum mounting height requirement in accordance with Americans with Disabilities Act (A.D.A.).

I. Set boxes installed in concealed locations flush with the finish surfaces, and provide with the proper type extension rings and/or covers where required.

J. Position outlets to locate luminaries as shown on reflected ceiling plans.

K. In inaccessible ceiling areas, locate junction boxes serving equipment other than light fixtures, near ceiling hatches where provided, to achieve accessibility (i.e. do not locate junction boxes where removal of light fixture is required to access the box).

L. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioning to allow for surface finish thickness. Use adjustable steel channel fasteners for flush ceiling outlet boxes.

M. Align wall-mounted outlet boxes for switches, thermostats, and similar devices. Install all grouped device locations neat and symmetrical. Coordinate with Architect before rough-in and adhere to the 48 inch mounting height requirements in accordance with A.D.A.

3.9 PULL AND JUNCTION BOX INSTALLATION

A. Locate pull boxes and junction boxes above accessible ceilings or in unfinished areas.

B. Support pull and junction boxes independent of conduit.

C. Provide pull boxes in feeder circuits as required but at least every 150 feet in straight runs.

D. Identify all junction boxes by panelboard and circuit number on cover with legible permanent ink marker. Refer to Specification Section 26 05 53 for identification requirements.

3.10 FLOOR BOX INSTALLATION

A. Set and level floor boxes with plate to finish flush at floor lines.

END OF SECTION

SECTION 26 0553

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED CONDITIONS

A. Provisions established within the General Conditions and Supplementary General Conditions of the Contract, Division 1 - General Requirements, and the Drawings are collectively applicable to this Section.

1.2 SECTION INCLUDES

A. Junction box labeling.

B. Equipment nameplate labeling.

C. Wire and cable labeling.

D. Conductor color-coding (refer to Section 26 05 19 for requirements).

E. Panelboard circuit directories (refer to Section 26 24 16 for requirements).

1.3 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service.

1.4 SUBMITTALS

A. General: Submit in accordance with Division 1.

B. Product Data: Submit manufacturer's catalog cut sheets, data sheets and installation instructions.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Brady

B. Hermes

C. Ideal

D. Panduit

2.2 MATERIALS

A. Permanent marking pen for junction box circuit identification.

B. Engraved, beveled edge laminated plastic nameplate for equipment identification, black base with white core for “normal” system, red base with white core for “essential” system (i.e. white letters on black or red background). Plastic laminate shall be 1/8” thick. Letter and numerical engraving shall be ¼” high.

C. Nylon, split sleeve or tubing type wire and cable markers.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surfaces:

1. Degrease, clean and prepare surfaces to receive labels or nameplates in accordance with the manufacturers written instructions and recommendations.

3.2 APPLICATIONS

A. Labels and Nameplates:

1. Application of labels and nameplates shall be in accordance with the manufacturer's written instructions and recommendations.

2. Install labels and nameplates parallel to equipment lines.

3. Secure nameplates to equipment using stainless steel screws, rivets or double side adhesive tape. Screws or rivets shall be used exclusively for securing nameplates to vibrating equipment. Secure nameplates to equipment using double side adhesive tape for isolation type panelboards and where screws are not recommended by equipment manufacturer.

B. Wire Identification:

1. Power Wiring Identifications: Install nylon band identification tags having marking pad to each conductor within switchgear, distribution boards, switchboards and auto transfer switches identifying the cable or feeder number. Marking designations shall be field applied, utilizing a black pen having non-smearing, waterproof ink, and shall be written neatly and clearly. Securely fasten tags to cables and feeders at both the source and load locations.

2. Control Wiring Identifications: Install nylon band identification tags having marking pad to each control wire identifying the control wire number as indicated on equipment manufacturer's shop drawings or as specified by the Owner. Securely fasten tags to control wiring at both source and destination locations, and also at all intermediate terminal board locations.

C. Junction Boxes:

1. Provide circuit identification numbers on outside cover of junction boxes using permanent marking pen neatly handwritten. Note: Circuit number identification should match wire identification contained therein.

2. Paint fire alarm system junction boxes red.

D. Equipment Identification:

1. Switchgear, switchboards, motor control centers, panelboards, transformers, transfer switches, disconnect switches, motor starters, and like equipment shall have nameplates indicating the equipment name and voltage, and from where it is served. Note: Division 26 Labeling of Motor Starters shall be limited to starters provided by Division 26.

2. Each panelboard and transformer shall have nameplates indicating name of panel, voltage, phases, wires, and panel fed from.

3. Each feeder circuit breaker within switchgear, distribution boards and switchboards shall have nameplates indicating the device served and location of the device.

E. Receptacle Cover Plates

1. Engrave all receptacles with circuit and panel information. Stickers or painted labels are not allowed.

END OF SECTION

SECTION 26 09 23

LIGHTING CONTROL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following lighting control devices: [Adjust list below to suit Project.]

1. Lighting Control Panels.
2. Time Switches.
3. Indoor Occupancy Sensors.
4. Lighting Contactors.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field quality-control test reports.

C. Operation and maintenance data.

1.3 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.

PART 2 - PRODUCTS

2.1 LIGHTING CONTROL PANELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Leviton Mfg. Company Inc.
2. Lightolier Controls; a Genlyte Company.
3. Lithonia Lighting; Acuity Lighting Group, Inc.
4. Square D; Schneider Electric.
5. TORK.
6. Touch-Plate, Inc.
7. Watt Stopper (The).

B. Lighting control panels shall be UL listed and consist of the following:

1. Enclosure: NEMA 1.

2. Cover: Surface or flush as required, hinged, lockable and shall restrict access to line voltage section.

3. Interior: Barrier of separation of line voltage and low voltage wiring. It shall include all necessary elements to provide required features inside the cabinet.

C. Lighting Control Panel Features:

1. Panels shall accept single-pole relays up to the amount indicated in the lighting control schedules in the drawings. Relays shall be individual latching relays with 20 A load contacts for general purpose, magnetic or electronic loads. Relays shall use quick connectors and be individually replaceable

2. The lighting control panel shall provide a stagger up delay, override push button, pilot light outputs, and LED status light indicators for each relay.

3. The clock shall have a backlit display, user keypad and shall provide a minimum of 8 channels of time or astronomical control. Preprogrammed lighting control scenarios shall include scheduled on/off, manual on/schedule off, manual on/automatic switch sweep off, astronomic or photocell on/off and astronomic or photocell control with scheduled on/off. Time clock shall provide up to 42 holidays, automatic daylight savings adjustment, astronomic coordinates by major cities and help screens. Program memory shall be non-volatile and clock shall retain time keeping during power outages for at least 48 hours

4. Panel shall have at least 8 universal switch inputs that are low voltage, self-configuring and shall not require programming to accept momentary on/momentary off switch, push button, maintained switch or 24 VDC signal from other sensors or devices.

5. After-hour interior lighting shut-off control shall provide full duration override time of 1 to 240 minutes with a warning blink five minutes prior to shutting the lighting off. Lighting shut off event may be cancelled by pressing the automatic control switch push button.

6. Provide a minimum of (2) override control stations in addition to the ones indicated on plans. Coordinate with owner for exact locations of stations.

7. Provide a minimum of 20% spare relays for future use.

2.2 TIME SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Area Lighting research, Inc.; Tyco Electronics.

2. Grasslin Controls Corporation; a GE Industrial Systems Company.

3. Intermatic, Inc.

4. Leviton Mfg. Company, Inc.

5. Lightolier Controls; a Genlyte Company.

6. Lithnia Lighting; Acuity Lighting Group, Inc.

7. Paragon Electric Co.; Invensys Climate Controls.

8. Square D; Schneider Electric.

9. TORK.

10. Touch-Plate, Inc.

11. Watt Stopper (The).

B. Electronic Time Switches: Electronic, solid-state programmable units with alphanumeric display; complying with UL 917.

1. Contact Configuration: DPST

2. Contact Rating: 30-A inductive or resistive, 240-V ac.

3. Program: 2 on-off set points on a 24-hour schedule, allowing different set points for each day of the week and an annual holiday schedule that overrides the weekly operation on holidays.

4. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program on selected channels.

5. Astronomic Time: All channels.

6. Battery Backup: For schedules and time clock.

2.3 INDOOR OCCUPANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hubbell Lighting.

2. Leviton Mfg. Company Inc.

3. Lithonia Lighting; Acuity Lighting Group, Inc.

4. Novitas, Inc.

5. RAB Lighting, Inc.

6. Sensor Switch, Inc.

7. TORK.

8. Watt Stopper (The).

B. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit.

1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 30 minutes.

2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.

3. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.

4. Mounting:

   a. Sensor: Suitable for mounting in any position on a standard outlet box.

   b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.

   c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.

6. Bypass Switch: Override the on function in case of sensor failure.

C. PIR Type: Ceiling mounting; detect occupancy by sensing a combination of heat and movement in area of coverage.

1. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in.

2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.

3. Detection Coverage (Corridor): Detect occupancy within 90 feet when mounted on a 10-foot- high ceiling.

2.4 LIGHTING CONTACTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Allen-Bradley/Rockwell Automation

2. ASCO Power Technologies, LP; a division of Emerson Electric Co.

3. Eaton Electrical Inc.; Cutler-Hammer Products.

4. GE Industrial Systems; Total Lighting Control.

5. Grasslin Controls Corporation; a GE Industrial Systems Company.

6. Hubbell Lighting

7. Lithonia Lighting; Acuity Lighting Group, Inc.

8. MicroLite Lighting Control Systems.

9. Square D; Schneider Electric.

10. TORK.
11. Touch-Plate, Inc.

12. Watt Stopper (The).

B. Description: Electrically operated and electrically held, combination type with nonfused disconnect, complying with NEMA ICS 2 and UL 508.

1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).

2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.

3. Enclosure: Comply with NEMA 250.

4. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.

2.5 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 16 Section "Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 26 05 23 "Power Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Section 26 05 23 "Power Conductors and Cables."

PART 3 - EXECUTION

3.1 LIGHTING CONTROL PANEL INSTALLATION

A. Follow electrical panel installation requirements.

B. Provide override switch as shown on plans. If no switch is shown, provide override switch at a location as indicated by owner’s representative.

3.2 SENSOR INSTALLATION

A. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

B. When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions.

C.

3.3 CONTACTOR INSTALLATION

A. Mount electrically held lighting contactors with elastomeric isolator pads, to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.4 WIRING INSTALLATION

A. Wiring Method: Comply with Division 16 Section "Conductors and Cables." Minimum conduit size shall be 3/4 inch.

B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.5 IDENTIFICATION

A. Identify components and power and control wiring according to Division 16 Section "Electrical Identification."

1. Identify controlled circuits in lighting contactors.

2. Identify circuits or luminaries controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

3.6 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.

2. Operational Test: Verify operation of each lighting control device, and adjust time delays.

B. Lighting control devices that fail tests and inspections are defective work.

END OF SECTION

SECTION 26 2416

PANELBOARDS

PART 1 - GENERAL

1.1 RELATED CONDITIONS

A. Provisions established within the General Conditions and Supplementary General Conditions of the Contract, Division 1 - General Requirements, and the Drawings are collectively applicable to this Section.

1.2 SECTION INCLUDES

A. Lighting and branch circuit panelboards.

B. Distribution panelboards.

C. Individually mounted circuit breakers.

1.3 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service.

B. Comply with the following applicable standards and codes: UL, ANSI, IEEE, NEMA and National Electrical Code.

C. Panelboards shall be UL approved for the application.

1.4 SUBMITTALS

A. General: Submit in accordance with Division 1.

B. Product Data: Submit manufacturer's catalog cut sheets, data sheets and installation instructions.

C. Shop Drawings: Submit dimensioned drawings showing size, circuit breaker and equipment arrangement and ratings, including but not limited to: voltage, main bus ampacity, integrated short circuit ampere rating.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. General Electric

B. Square D Company

C. Siemens

D. Cuttler-Hammer

2.2 LIGHTING, BRANCH CIRCUIT & DISTRIBUTION PANELBOARDS

A. General

1. Panelboards shall be UL listed and labeled, and rated for the intended voltage and current as described herein and as shown in the drawings.

2. Panelboards shall be dead-front safety type, with switching and protective devices in quantities, ratings, types, and arrangements as shown on the drawings; with anti-burn solderless pressure type lug connectors approved for copper conductors.

3. Multi-section panels shall be same height and depth.

B. Cabinets

1. Cabinets shall be flush or surface mounted as shown on the Drawings; code gauge galvanized sheet steel for flush units; finished in ASA #61 gray baked enamel; provide a cabinet for each panelboard shown on the Drawings; entire unit dead front construction; barriers as required.

2. Cabinets shall have wiring space top, bottom and both sides in accordance with the National Electrical Code, but no less than 4-inches wide, with standard knockouts.

3. Doors and trim shall be code gauge sheet steel finished in ASA #61 gray baked enamel; doors shall have directory holder and clear plastic covered directory card; flush lock and latch for doors 48" and under; lockable handle with 3 point latch for doors larger than 48" all locks keyed alike; furnish 2 keys per lock to match existing locking system; trim for flush mounted cabinets shall overlap box by at least 3/4" all around; trim for surface mounted cabinets shall be the same size as the box.

C. Bussing and Interiors

1. Bus bars shall be 98% conductivity copper, mounted on insulator supports, sized in accordance with UL Standards, braced throughout to conform with industry standards governing short circuit stresses in panelboards, and arranged for sequence phasing throughout.

2. Phase bussing shall be full height without reductions, full size neutral, unless otherwise scheduled, with suitable lug for each outgoing circuit requiring a neutral connection. Provide bare uninsulated ground bar suitable for bolting to enclosure. Provide isolated ground bar in addition to uninsulated ground bar when specified on the drawings.

3. Bus bars shall terminate with lugs or circuit breakers as indicated; provide sub-feed or through-feed lugs as indicated.

4. On multi-section panels, the lugs and bus on each and every section shall be of the same current rating as the main overcurrent device protecting the feeder serving the panel and each section shall have a separate neutral, ground bar and conductors. Main lugs only, multi-section panels shall have double lugs to effect parallel feed of bus bars (rather than series). Feed-thru lugs are not acceptable for this application.

5. Terminals for feeder conductors, branch circuit devices and neutrals shall be UL listed as suitable for type of conductors specified.

6. Interiors shall be factory assembled with branch circuits arranged using double row construction designed such that circuit protective devices may be changed, replaced, or additional circuits added without disturbing adjacent units and without machining, drilling or tapping. In no case shall the width of panelboard enclosure be less than 20-inches.

D. Circuit Protective Devices

1. Circuit breaker shall be bolt-in type, heavy-duty, quick-make, quick-break thermal magnetic, single-pole or multi-pole common trip type, with toggle handles that indicate when tripped. Multi-pole shall not be individual single pole breakers with handle tie.

2. Circuit breaker interrupting rating shall be as indicated on the Drawings and shall be in excess of the available fault current at the panel in accordance with UL Listings for sizes involved. Minimum interrupting rating shall be 22,000 rms symmetrical amperes.

3. Circuit breakers shall be a minimum of 100 ampere frame size. Breakers 15 through 100 ampere trip size shall take up the same pole spacing.

4. "Spaces" shall be complete with studs, bus, and hardware for future devices without additional parts or changes in bus.

5. "Spares" shall be complete with circuit breakers installed ready to accept load side conductors.

6. Circuit breakers shall be of the same manufacturer as panelboards.

2.3 INDIVIDUALLY MOUNTED CIRCUIT BREAKERS

A. Individually mounted circuit breakers shall be molded case, capacity as indicated, in a NEMA Type 1 or 3R enclosure as indicated or required. Breakers shall be quick-make, quick-break thermal magnetic common trip type, ambient compensated with trip-free handle and have interrupting rating in accordance with UL listings for sizes required, but not less than 10,000 amperes rms symmetrical, and conform to requirements of NEMA Standard Publication No. AB1-2002. Each unit shall have insulated neutral and/or ground terminal of proper size, where indicated. Lugs shall be UL listed for copper cables.

1. Circuit switching/protective devices shall be housed in an enclosure suitable for the environment in which they are located. Provide lifting eyes or brackets.

B. Circuit breakers shall be of same manufacturer as panelboards.

PART 3 - EXECUTION

3.1 INSTALLATION OF PANELBOARDS

A. Install panelboards in accordance with manufacturer's written instructions, NEMA and NEC standards.

B. Except where otherwise indicated on the drawings or required to avoid conflicts, mount panelboards so the tops of the cabinets will be 6 feet above the finished floor. For panelboards which are too high to comply with the NEC for maximum device height, mount panelboards so bottom of cabinet will not be less than 6 inches above finished floor.

C. Locate cabinets so both present and future conduits can be connected conveniently. Coordinate the dimensions of the cabinet with the available space dimensions and wall thickness prior to fabrication to insure proper installation.

D. Stub above finished ceiling at each flush mounted lighting and branch circuit panelboard a minimum of one 3/4 inch empty conduit for each three spare circuit breakers or "space only" or part thereof.

E. Securely anchor panelboard to construction setting units plumb and square with a minimum of four anchors. Where panelboards are recessed, set for face of cabinet to finish flush with building surface.

F. Provide each panelboard with a neatly typewritten directory of circuits mounted in a cardholder on the inside of the panelboard cabinet. Cover directly with transparent sheet plastic. Label each panelboard.

G. Upon completion of the work, install new typewritten directories in each and every existing panelboard, update description of service for each circuit protective device whether or not altered by this phase of construction. Additionally, label each existing panelboard with a visible laminated, beveled edge, black base with white core nameplate with appropriate designations; secure with stainless steel screws or rivets. Existing emergency panels shall be labelled as above except red base with white core engraved nameplate.

H. Paint panelboard covers to match adjacent wall in accordance with the procedures described in Division 9. This shall not pertain to panelboards installed within electrical closets. Do not paint panelboard identification label.

3.2 FIELD QUALITY CONTROL

A. Inspect complete installation for physical damage, proper alignment, anchorage, and grounding.

B. Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads within 20% of each other. Maintain proper phasing for multi-wire branch circuits.

C. Check tightness of bolted connections, and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written specifications.

D. Touch up scratched or marred surfaces to match original finish.

END OF SECTION

SECTION 26 2726

WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED CONDITIONS

A. Provisions established within the General Conditions and Supplementary General Conditions of the Contract, Division 1 - General Requirements, and the Drawings are collectively applicable to this Section.

1.2 SECTION INCLUDES

A. Wall switches

B. Wall dimmers

C. Receptacles

D. Special systems outlets

E. Floor mounted devices

F. Multi-outlet assemblies

G. Device plates and covers

H. Occupancy sensors

1.3 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service.

B. Comply with the following applicable standards and codes: UL, ANSI, NEMA and National Electrical Code.

C. Wiring devices shall be UL approved for the application.

1.4 SUBMITTALS

A. General: Submit in accordance with Division 1.

B. Product Data: Submit manufacturer's catalog cut sheets, data sheets and installation instructions.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Wall switches: Hubbell, Leviton, Lutron, Pass & Seymour.

B. Wall dimmers: Hubbell, Leviton, Lutron, Pass & Seymour.

C. Receptacles: Hubbell, Leviton, Pass & Seymour.

D. Floor mounted devices: Hubbell, Leviton, Pass & Seymour, Wiremold.

E. Multi-outlet Assemblies: Wiremold.

2.2 WIRING DEVICES, COVER PLATES AND FITTINGS

A. Finishes:
   1. Wiring Devices on Normal Power: White
   2. Wiring Devices on Emergency Power: Red
   3. Cover Plates: Stainless Steel

B. General: Provide wiring devices of industrial grade as indicated on the drawings and/or specified and as required by the National Electrical Code.

C. Wall Switches: Provide industrial specification grade, horsepower rated, UL listed, side-wired, quiet operating type, 20 ampere, 120/277 volt AC rated.

D. General Purpose Receptacles: Provide industrial grade receptacles as indicated on the drawings and/or specified; 15 ampere, 125 volt, 2-pole, 3-wire, grounding and isolated ground type as indicated or required, side-wired, UL listed, NEMA configuration 5-15R (Note: 20 ampere equivalent devices shall be used on dedicated circuits containing one device) in administrative office areas only.

E. Floor mounted devices shall be flush, Wiremold #RC4 (poke-thru type) or #EFB6S (general type) unless otherwise noted on the Drawings.

F. Wall Clock Outlet: 15-amp, 2-pole, 3-wire, grounding regressed outlet with hook on stainless steel plate for use with non-system clock outlets.

2.3 MULTI-OUTLET ASSEMBLY

A. Wiremold brushed aluminum multi-outlet assembly with 3-wire grounding receptacles 12-inch on centers or as indicated on the drawings; complete with all fittings, adapters and accessories.

2.4 COVER PLATES

A. Provide cover plates for all wiring devices, unused telephone, unused data, and unused signal outlets and other similar devices.

B. Provide cover plates for single and combination wiring devices of types, sizes, and with ganging and cutouts as required. Construct with metal screws for securing plates to devices.

   Provide weatherproof while in-use cover plates possessing the following additional features for weatherproof applications, smooth satin stainless steel with stainless steel screws and gaskets.

C. Provide single common faceplate for all ganged installations.

PART 3 - EXECUTION

3.1 INSTALLATION OF WIRING DEVICES

A. Install wiring devices as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", and in accordance with recognized industry practices to fulfill project requirements.

B. Install GFCI type receptacles in bathrooms and on roofs in accordance with the N.E.C. whether or not shown on the drawings. Install GFCI type receptacles to serve countertop surfaces within six feet of sinks, and for exterior locations whether or not shown on the drawings.

C. Utilize side-wired connection points for wiring connection to all wiring devices. Do not use back-wired connection points.

D. Conductors shall be continuous between receptacles. The continuity of all conductors shall not be dependent upon device connections, where the removal of such device would interrupt the continuity (i.e. incoming and outgoing conductors must be pigtail connected before attachment to the wiring device).

E. Coordinate the mounting heights and arrangements prior to rough-in. Coordinate with cabinet work and interior furnishings for proper mounting heights and arrangements. Adhere to ADA/TAS mounting height requirements.

F. Install devices in electrical boxes, which are clean; free of excess building material, dirt and debris, and after conductors are pulled and painting is completed.

G. Coordinate the device/cover plate colors and finishes.

H. Provide devices of the type and at the locations indicated.

I. Install cover plates on all devices after painting is completed.

J. Mount devices vertically, unless noted otherwise.

K. Mount switches with UP being the ON position.

L. Mount receptacles occurring over countertops horizontally.

M. Where more than one device is indicated at a location, the devices shall be mounted in a multi-gang box and covered with a single multi-gang plate.

N. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for wiring devices. Where manufacturer's torque requirements are not indicted, tighten connectors and terminals to comply with tightening torque specified in UL Standards 486A and B. Use properly scaled torque indicating hand tool.

O. At time of Substantial Completion, replace those items, which have been damaged, including those burned and scored by faulty plugs.

P. Provide equipment-grounding connections for wiring devices, unless otherwise indicated. Tighten connections to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounds.

Q. Provide wiring device and associated junction box labeling in accordance with Section 26 05 53, Electrical Identification.

3.2 FIELD QUALITY CONTROL

A. Prior to energizing circuitry, test wiring for electrical continuity and for short-circuits. Ensure proper polarity of connections is maintained. Subsequent to energizing circuit, test wiring devices to demonstrate compliance with requirements.

END OF SECTION

SECTION 26 2813

FUSES

PART 1 - GENERAL

1.1 RELATED CONDITIONS

A. Provisions established within the General Conditions and Supplementary General Conditions of the Contract, Division 1 - General Requirements, and the Drawings are collectively applicable to this Section.

1.2 SECTION INCLUDES

A. Fuses (600 V and less)

1.3 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service.

B. Comply with the following applicable standards and codes: UL, ANSI, NEMA and National Electrical Code.

C. Fuse devices shall be UL approved for the application.

1.4 SUBMITTALS

A. General: Submit in accordance with Division 1.

B. Product Data: Submit manufacturer's catalog cut sheets, data sheets and installation instructions. Submit melting and clearing time-current curves for 5kV and 15kV fuses.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Bussmann

B. General Electric

C. Ferraz-Shawmut

D. Littlefuse

2.2 FUSES 600 VAC OR LESS

A. 600 amperes and less: current limiting, dual-element, time-delay, UL Class RKI, 200,000 RMS symmetrical amperes interrupting capacity, Bussmann Low-Peak LPS-RK-SP (600 VAC) or LPN-RK-SP (250 VAC) series.

B. 601 amperes and greater: current limiting, dual-element, time-delay, UL Class L, 200,000 RMS symmetrical amperes interrupting capacity, Bussmann Low-Peak KRP-C-SP Series.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fuses where indicated, in accordance with the manufacturer's written instructions.

B. Coordinate with equipment manufacturer to ensure each device is equipped with proper fuse clips installed.

C. Furnish a number of spare fuses equaling 10% of quantity installed but not less than three (3) fuses of each type and rating.

D. Install fuses with label oriented such that manufacturer, type and size are easily read.

END OF SECTION

SECTION 26 2816

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED CONDITIONS

A. Provisions established within the General Conditions and Supplementary General Conditions of the Contract, Division 1 - General Requirements, and the Drawings are collectively applicable to this Section.

1.2 SECTION INCLUDES

A. Circuit disconnects.
.
B. Motor disconnects.

1.3 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service.

B. Comply with the following applicable standards and codes: UL, ANSI, NEMA and National Electrical Code.

C. Disconnect switches shall be UL approved for the application.

1.4 SUBMITTALS

A. General: Submit in accordance with Division 1.

B. Product Data: Submit manufacturer's catalog cut sheets, data sheets and installation instructions. Product data to include equipment dimensions and ratings for voltage, amperage, horsepower and short circuit.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. General Electric

B. Square D Company

C. Cutter-Hammer

2.2 DISCONNECT SWITCHES

A. Disconnect switches shall be UL listed and labeled and shall meet NEMA Standard KS1-2001 for Type HD heavy duty switches. All motor circuit switches shall be horsepower rated.

B. Provide surface-mounted, heavy-duty type, sheet-steel enclosed safety switches, of types, sizes and electrical characteristics indicated; fusible or unfused type as indicated on drawings or as required, rated 600 volts, and incorporating quick-make, quick-break type switches;

constructed so that switch blades are visible in OFF position with door open. Equip with external operating handle which is pad-lockable in OFF position; constructed with current carrying parts of high-conductivity copper, with silver-tungsten type switch contacts, and positive pressure type reinforced "Rejection" type fuse clips designed to accommodate Type R fuses. Provide NEMA Type 1 or 3R enclosures as indicated on the drawings or as required.

C. Where unfused switches are employed, fusible switches with any type of jumper across fuse clips are not acceptable.

D. Single Phase Disconnect Switches: Single or two pole toggle switch, as required.

E. Three Phase Disconnect Switches: 3 pole heavy duty 600 volt NEMA Type 1 or 3 enclosures as indicated on drawings or as required.

F. Where disconnect switches are used to disconnect starters, provide auxiliary poles in switches as required to disconnect all auxiliary control circuits in starters

PART 3 - EXECUTION

3.1 INSTALLATION OF DISCONNECT SWITCHES

A. Provide motor and circuit disconnects at each location as indicated on the drawings, where required by National Electrical Code, and where required by equipment manufacturer, sized to match the equipment ratings and circuit characteristics.

B. Provide fuses or thermal overload protection to match actual installed equipment manufacturer's requirements.

C. Verify the characteristics and protective requirements for the actual equipment installed.

D. Keep disconnects used as the electrical power servicing disconnect within sight of the controller or equipment in accordance with the National Electrical Code.

E. Label switches in accordance with Section 26 05 53 - Electrical Identification

END OF SECTION

SECTION 26 5113

LIGHTING FIXTURES

PART 1 - GENERAL

1.1 RELATED CONDITIONS

A. Provisions established within the General Conditions and Supplementary General Conditions of the Contract, Division 1 – General Requirements, and the Drawings are collectively applicable to this Section.

1.2 SECTION INCLUDES

A. LED lighting fixtures

1.3 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service.

B. Comply with the following applicable standards and codes: UL, ANSI, NEMA, and National Electrical Code.

C. Lighting fixtures shall bear the U.L. label.

1.4 SUBMITTALS

A. General: Submit in accordance with Division 1 – Submittals

B. Product Data: Submit manufacturer's catalog cut sheets, data sheets and installation instructions for all light fixtures, lamps and ballasts. Incomplete submittals will be returned, un-reviewed.

C. For proposed substitutions: Contractor shall provide a photometric comparison showing performance of proposed fixture to be equal or better than specified fixture AND power consumption of proposed installation to be less than specified. Contractor shall provide .IES files for every substitution request for verification. Substitutions are at the discretion of the owner.

1.5 WARRANTY

A. Provide 5-year warranty for all LED fixtures and components.

B. Warranty period shall commence from date of installation (not date of manufacture).

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Light Fixtures: Provide light fixtures as specified on the Light Fixture Schedule located on the drawings or approved substitution.

2.2 FIXTURES

A. LED Luminaires

1. Provide same construction as required for fluorescent fixtures.

2. Provide minimum lumen maintenance of 90% for a minimum of 60,000 hours (L90/60,000).

3. Provide dimming option for all building fixtures. If option is not indicated in drawings, provide dimming option compatible with dimmers provided with lighting control system.

4. Provide fixtures with a minimum efficacy of the greater of 95 lumens/watt or as indicated in the lighting fixture schedule.

2.3 PARKING LOT AND AREA LIGHTING POLE ASSEMBLIES

A. Provide matching light pole assemblies engineered for each specified lighting fixture.

B. If no pole is specified with fixture, provide 25 foot, square poles.

C. Fixtures shall have symmetrical or asymmetrical light distribution as shown on the Light Fixture Schedule.

PART 3 - EXECUTION

3.1 INSTALLATION OF FIXTURES

A. Locate outlet boxes to coincide with chain and stem hangers where such occur. Outlet box locations, if shown on the drawings, are diagrammatic only.

B. Provide a suitable plaster ring or frame for each fixture recessed in a plaster or non-removable ceiling. Provide mountings for recessed fixtures in other types of ceiling suspension systems which are suitable for the system installed. All such accessories shall be manufactured by the light fixture manufacturer. Verify the ceiling type in every space before ordering fixtures.

C. Refer to ceiling installers layout for exact ceiling layout. Locate surface or suspended fixtures to conform to ceiling patterns; center all recessed fixtures in ceiling grids.

D. Wire lay-in type fixtures in ceilings using concealed outlet boxes accessible through ceiling panels; install conductors, including a grounding conductor, in flexible metallic conduit from box to fixture.

E. Fasten luminaries to ceiling suspension system.

F. Provide lens or louver, as indicated on the architectural drawings, for cove lighting applications.

G. Fit and adjust all fixtures and check and call to the Architect's attention any job conditions, which may cause conflicts between fixtures and the building structure or other trades.

H. Ensure all exit and emergency lighting fixtures are mounted so there are no obstructions in front of them and can be clearly seen from all points along the path of egress related to the

fixtures. Notify Architect at once if there are any architectural features or elements from any trade that obstruct visibility of exit or emergency lighting fixtures.

I. Prior to final acceptance, thoroughly clean all fixtures inside and out, including plastics and glassware. Adjust all trim to properly fit adjacent surface, replace broken or damaged parts and lamps. Test all fixtures for proper operation.

3.2 PARKING LOT AND AREA LIGHTING POLE ASSEMBLIES

A. Furnish and install ground rod at each pole base as indicated on the pole base detail shown on the drawings. Provide inspection well for grounding rod.

B. Concrete bases will be furnished and installed under another Division of the Specifications unless noted otherwise. Furnish the Contractor installing the concrete bases with mounting bolts and appropriate base dimensions for the poles to be installed.

C. Install poles on the base assembly using instruments to insure pole alignment.

END OF SECTION

SECTION 27 0528

CONDUITS AND BACK BOXES FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED CONDITIONS

A. Provisions established within the General Conditions and Supplementary General Conditions of the Contract, Division 1 - General Requirements, and the Drawings are collectively applicable to this Section.

1.2 SECTION INCLUDES

A. Raceway system for telephone and data systems including:

1. Metallic conduit and fittings, outlet boxes as specified in Section 26 05 33.

2. Backboard and cabinets as specified in Section 26 24 16.

1.3 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service.

B. Comply with the following applicable standards and codes: UL, ANSI, NEMA and National Electrical Code.

C. Conduit system shall be UL approved for the application.

1.4 SUBMITTALS

A. General: Submit in accordance with Division 1.

B. Product Data: Submit manufacturer's catalog cut sheets, data sheets and installation instructions.

PART 2 - PRODUCTS

2.1 BASIC MATERIALS

A. Conduits, boxes, fittings, hangers and supports, and similar materials shall be as specified under other appropriate sections of the specifications.

2.2 BACKBOARD AND CABINETS

A. Backboards shall be 3/4-inch thick, fire rated, Grade A-C plywood of the sizes indicated or required. Sand, fill and paint to match adjoining wall.

B. Cabinets shall be flush or surface mounted as shown; construction as required in Panelboard Cabinets.

PART 3 - EXECUTION

3.1 INSTALLATION SCHEDULE

A. For each telephone, data or combination telephone/data outlet shown on the drawings in a ventilated or heated only space or where the outlet is surface mounted, install a ¾" empty conduit with pull string from a single-gang back box to a location above an accessible ceiling plenum

B. For each telephone, data or combination telephone/data outlet shown on the drawings in gypboard wall construction in a conditioned space, provide a single gang ring in the gypboard with a string through the wall to the accessible ceiling space. Provide a bushing in the top track to protect future wiring. Route string vertically through wall in same stud cavity as outlet.

3.2 DISTRIBUTION

A. Where conduit systems are installed, provide pull boxes in the conduit run spaced not greater than 100 feet apart, and on the backboard side of runs with the equivalent of more than two 90 degree bends.

B. Install a pull line in each empty conduit.

C. Place "Telephone" label of pull and junction boxes.

3.3 COMPLETION

A. Upon completion of the project, provide a blank cover for each unused data outlet. Leave pull string inside box and label cover "Data". Provide cover that matches in material and color with used data outlets.

END OF SECTION

SECTION 28 3100

FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 RELATED CONDITIONS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. The work covered by this section is to be coordinated with related work as specified elsewhere in the specifications.

C. The system and all associated operations shall be in accordance with the latest editions of the following:

1. International Building Code
2. International Fire Code
3. International Mechanical Code
4. National Electrical Code
5. National Fire Alarm Code
6. Other applicable NFPA standards
7. State and Local Adopted Codes and Standards
8. ADA Accessibility Guidelines

1.2 SUMMARY

A. This Section covers the requirements for the design and installation of a complete fire alarm system, including initiating devices, notification appliances, controls, and supervisory devices.

B. Work covered by this section includes the furnishing of labor, equipment, and materials for installation of a complete and fully functional fire alarm system.

C. The Fire Alarm System shall consist of all necessary hardware equipment and software programming to perform the following functions:

1. Fire alarm system detection and notification operations.

1.3 DEFINITIONS

A. FACP: Fire alarm control panel.

B. LED: Light-emitting diode.

C. NICET: National Institute for Certification in Engineering Technologies.

D. Definitions in NFPA 72 apply to fire alarm terms used in this Section.

1.4 SCOPE OF WORK

A. General: Contractor shall design, furnish and install a new, addressable fire alarm system capable of detecting fire and notify users as well as required authorities through phone line or any other required media.

B. System shall work in conjunction with the fire protection system and provide necessary alarms and signals for to operation of the fire protection system.

1.5 ACCEPTABLE EQUIPMENT AND SERVICE PROVIDERS

A. Manufacturers:

1. Honeywell
2. Autocall
3. Simplex
4. Edwards (United Technologies)

1.6 SYSTEM DESCRIPTION

A. General: Provide a complete, non-coded addressable, microprocessor-based fire alarm system with initiating devices, notification appliances, and monitoring and control devices as indicated as specified herein.

B. Software: The fire alarm system shall allow for loading and editing instructions and operating sequences as necessary. The system shall be capable of on-site programming to accommodate system expansion and facilitate changes in operation. All software operations shall be stored in a non-volatile programmable memory within the fire alarm control unit. Loss of primary and secondary power shall not erase the instructions stored in memory. System shall be capable of storing dual configuration programs with one active and one in reserve. Panel shall be capable of full system operation during a new configuration download.

C. History Logs: The system shall provide a means to recall alarms and trouble conditions in chronological order for the purpose of recreating an event history. A separate alarm and trouble log shall be provided.

D. Recording of Events: Record all alarm, supervisory, and trouble events by means of system printer. The printout shall include the type of signal (alarm, supervisory, or trouble) the device identification, date and time of the occurrence. The printout differentiates alarm signals from all other printed indications.

E. Wiring/Signal Transmission:

1. Transmission shall be hard-wired using separate individual circuits for each zone of alarm operation, as required or addressable signal transmission, dedicated to fire alarm service only.

2. System connections for initiating device circuits shall be Class A, Style D, signaling line circuits shall be Class A, Style 6 and notification appliance circuits shall be Class B, Style Y.

3. Circuit Supervision: Circuit faults shall be indicated by a trouble signal at the FACP. Provide a distinctive indicating audible tone and alphanumeric annunciation.

F. Required Functions: The following are required system functions and operating features:

1. Priority of Signals: Fire alarm events have highest priority. Subsequent alarm events are queued in the order received and do not affect existing alarm conditions. Priority Two, Supervisory and Trouble events have second-, third-, and fourth-level priority, respectively. Signals of a higher-level priority take precedence over signals of lower priority even though the lower-priority condition occurred first. Annunciate all events regardless of priority or order received.

2. Noninterfering: An event on one zone does not prevent the receipt of signals from any other zone. All zones are manually resettable from the FACP after the initiating device or devices are restored to normal. The activation of an addressable device does not prevent the receipt of signals from subsequent addressable device activations.

3. Transmission to an approved Supervising Station: Automatically route alarm, supervisory, and trouble signals to an approved supervising station service provider, under another contract.

4. Annunciation: Operation of alarm and supervisory initiating devices shall be annunciated at the FACP, indicating the type of device, the operational state of the device (i.e. alarm, trouble or supervisory) and shall display the custom label associated with the device.

5. Selective Alarm: A system alarm shall include:

a. Indication of alarm condition at the FACP.

b. Identification of the device /zone that is the source of the alarm at the FACP.

c. Operation of audible and visible notification appliances until silenced at FACP.

d. Selectively closing doors normally held open by magnetic door holders on the fire floor, floor above and floor below.

e. Unlocking designated doors.

f. Shutting down supply and return fans serving zone where alarm is initiated.

g. Closing smoke dampers on system serving zone where alarm is initiated.

h. Transmission of signal to the supervising station.

i. Initiation of elevator Phase I functions (recall, shunt trip, illumination of indicator in cab, etc.) in accordance with ASME/ANSI A17.1, when elevator lobby, elevator machine room, or elevator shaftway sensors are activated.

6. Supervisory Operations: Upon activation of a supervisory device such as a tamper switch, the system shall operate as follows:

a. Activate the system supervisory service audible signal and illuminate the LED at the control unit.

b. Pressing the Supervisory Acknowledge Key will silence the supervisory audible signal while maintaining the Supervisory LED "on" indicating off-normal condition.

c. Record the event in the FACP historical log.

d. Transmission of supervisory signal to the supervising station.

e. Restoring the condition shall cause the Supervisory LED to clear and restore the system to normal.

7. Alarm Silencing: If the "Alarm Silence" button is pressed, all audible and visible alarm signals shall cease operation.

8. System Reset

a. The "System Reset" button shall be used to return the system to its normal state. Display messages shall provide operator assurance of the sequential steps ("IN PROGRESS", "RESET COMPLETED") as they occur. The system shall verify all circuits or devices are restored prior to resetting the system to avoid the potential for re-alarming the system. The display message shall indicate "ALARM PRESENT, SYSTEM RESET ABORTED."

b. Should an alarm condition continue, the system will remain in an alarmed state.

9. A manual evacuation (drill) switch shall be provided to operate the notification appliances without causing other control circuits to be activated.

10. WALKTEST: The system shall have the capacity of 8 programmable passcode protected one person testing groups, such that only a portion of the system need be disabled during testing. The actuation of the "enable one person test" program at the control unit shall activate the "One Person Testing" mode of the system as follows:

a. The city circuit connection and any suppression release circuits shall be bypassed for the testing group.

b. Control relay functions associated with one of the 8 testing groups shall be bypassed.

c. The control unit shall indicate a trouble condition.

d. The alarm activation of any initiating device in the testing group shall cause the audible notification appliances assigned only to that group to sound a code to identify the device or zone.

e. The unit shall automatically reset itself after signaling is complete.

f. Any opening of an initiating device or notification appliance circuit wiring shall cause the audible signals to sound for 4 seconds indicating the trouble condition.

G. Analog Smoke Sensors:

1. Monitoring: FACP shall individually monitor sensors for calibration, sensitivity, and alarm condition, and shall individually adjust for sensitivity. The control unit shall determine the condition of each sensor by comparing the sensor value to the stored values.

2. Environmental Compensation: The FACP shall maintain a moving average of the sensor's smoke chamber value to automatically compensate for dust, dirt, and other conditions that could affect detection operations.

3. Programmable Sensitivity: Photoelectric Smoke Sensors shall have 7 selectable sensitivity levels ranging from 0.2% to 3.7%, programmed and monitored from the FACP.

4. Sensitivity Testing Reports: The FACP shall provide sensor reports that meet NFPA 72 calibrated test method requirements. The reports shall be viewed on a CRT Display or printed for annual recording and logging of the calibration maintenance schedule.

5. The FACP shall automatically indicate when an individual sensor needs cleaning. The system shall provide a means to automatically indicate when a sensor requires cleaning. When a sensor's average value reaches a predetermined value, (3) progressive levels of reporting are provided. The first level shall indicate if a sensor is close to a trouble reporting condition and will be indicated on the FACP as "ALMOST DIRTY." This condition provides a means to alert maintenance staff of a sensor approaching dirty without creating a trouble in the system. If this indicator is ignored and the second level is reached, a "DIRTY SENSOR" condition shall be indicated at the FACP and subsequently a system trouble is reported to the Supervising Station. The sensor base LED shall glow steady giving a visible indication at the sensor location. The "DIRTY SENSOR" condition shall not affect the sensitivity level required to alarm the sensor. If a "DIRTY SENSOR" is left unattended, and its average value increases to a third predetermined value, an "EXCESSIVELY DIRTY SENSOR" trouble condition shall be indicated at the control unit.

6. The FACP shall continuously perform an automatic self-test on each sensor that will check sensor electronics and ensure the accuracy of the values being transmitted. Any sensor that fails this test shall indicate a "SELF TEST ABNORMAL" trouble condition.

7. Programmable bases. It shall be possible to program relay and sounder bases to operate independently of their associated sensor.

8. Magnet test activation of smoke sensors shall be distinguished by its label and history log entry as being activated by a magnet.

H. Power Requirements

1. The control unit shall receive AC power via a dedicated fused disconnect circuit.

2. The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal AC power in a normal supervisory mode for a period of 24 hours with 15 minutes of alarm operation at the end of this period. The system shall automatically transfer to battery standby upon power failure. All battery charging and recharging operations shall be automatic.

3. All circuits requiring system-operating power shall be 24 VDC and shall be individually fused at the control unit.

4. The incoming power to the system shall be supervised so that any power failure will be indicated at the control unit. A green "power on" LED shall be displayed continuously at the user interface while incoming power is present.

5. The system batteries shall be supervised so that a low battery or a depleted battery condition, or disconnection of the battery shall be indicated at the control unit and displayed for the specific fault type.

6. The system shall support NAC Lockout feature to prevent subsequent activation of Notification Appliance Circuits after a Depleted Battery condition occurs in order to make use of battery reserve for front panel annunciation and control.

7. The system shall support 100% of addressable devices in alarm or operated at the same time, under both primary (AC) and secondary (battery) power conditions.

8. Loss of primary power shall sound a trouble signal at the FACP. FACP shall indicate when the system is operating on an alternate power supply.

1.7 SUBMITTALS

A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.

1. Product data sheets for system components highlighted to indicate the specific products, features, or functions required to meet this specification. Wiring diagrams from manufacturer.

2. Shop drawings showing system details including location of FACP, all devices, and circuiting details.

3. System power and voltage drop calculations to assure that the system will operate in accordance with the prescribed backup time periods and under all voltage conditions per UL and NFPA standards.

4. Operating instructions for FACP.

5. Operation and maintenance data for inclusion in Operating and Maintenance Manual. Include data for each type product, including all features and operating sequences, both automatic and manual. Provide the names, addresses, and telephone numbers of service organizations.

B. Submission to Authority Having Jurisdiction: In addition to routine submission of the above material, make an identical submission to the authority having jurisdiction. Include copies of shop drawings as required to depict component locations to facilitate review. Upon receipt of comments from the Authority, make resubmissions, if required, to make clarifications or revisions to obtain approval.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: A factory authorized installer is to perform the work of this section.

B. Each and every item of the Fire Alarm System shall be listed under the appropriate category by Underwriters Laboratories, Inc. (UL), and shall bear the "UL" label.

1.9 **MAINTENANCE** SERVICE

A. Maintenance Service Contract: Provide maintenance of fire alarm systems and equipment for a period of 12 months, using factory-authorized service representatives.

PART 2 - PRODUCTS

2.1 FIRE ALARM CONTROL PANEL (FACP):

A. General: Comply with UL 864, "Control Units and Accessories for Fire Alarm Systems".

B. The following FACP hardware shall be provided:

1. Power Limited base panel with cabinet and door, 120 VAC input power.

2. From all battery charging circuits in the system provide battery voltage and ammeter readouts on the FACP LCD Display.

3. One Auxiliary electronically resettable fused 2A @24VDC Output, with programmable disconnect operation for 4-wire detector reset.

4. One Auxiliary Relay, SPDT 2A @32VDC, programmable as a trouble relay, either as normally energized or de-energized, or as an auxiliary control.

5. Where required provide Intelligent Remote Battery Charger for charging up to 110Ah batteries.

6. Power Supplies with integral intelligent Notification Appliance Circuit Class B for system expansion.

7. Four (4) form "C" Auxiliary Relay Circuits (Form C contacts rated 2A @ 24VDC, resistive), operation is programmable for trouble, alarm, supervisory of other fire response functions. Relays shall be capable of switching up to ½ A @ 120VAC, inductive.

8. The FACP shall support (6) RS-232-C ports and one service port.

9. Remote Unit Interface: supervised serial communication channel for control and monitoring of remotely located annunciators and I/O panels.

10. Programmable DACT for either Common Event Reporting or per Point Reporting.

11. Service Port Modem for dial in passcode access to all fire control panel information.

C. Cabinet: Lockable steel enclosure. Arrange unit so all operations required for testing or for normal care and maintenance of the system are performed from the front of the enclosure. If more than a single unit is required to form a complete control unit, provide exactly matching modular unit enclosures.

D. Alphanumeric Display and System Controls: Panel shall include an 80 character LCD display to indicate alarm, supervisory, and component status messages and shall include a keypad for use in entering and executing control commands.

2.2 EMERGENCY POWER SUPPLY

A. General: Components include battery, charger, and an automatic transfer switch.

B. Battery: Sealed lead-acid or nickel cadmium type. Provide sufficient capacity to operate the complete alarm system in normal or supervisory (non-alarm) mode for a period of 24 hours. Following this period of operation on battery power, the battery shall have sufficient capacity to operate all components of the system, including all alarm notification devices in alarm mode for a period of 15 minutes.

2.3 ADDRESSABLE MANUAL PULL STATIONS

A. Description: Addressable double-action type, red LEXAN, with molded, raised-letter operating instructions of contrasting color. Station will mechanically latch upon operation and remain so until manually reset by opening with a key common with the control units.

B. Protective Shield: Where required, as indicated on the drawings, provide a tamperproof, clear LEXAN shield and red frame that easily fits over manual pull stations. Warning horns which activate when shield is lifted to gain access to the station are prohibited.

2.4 SMOKE SENSORS

A. General: Comply with UL 268, "Smoke Detectors for Fire Protective Signaling Systems." Include the following features:

1. Factory Nameplate: Serial number and type identification.

2. Operating Voltage: 24 VDC, nominal.

3. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore normal operation.

4. Each sensor base shall contain an LED that will flash each time it is scanned by the Control Unit (once every 4 seconds). In alarm condition, the sensor base LED shall be on steady.

5. Each sensor base shall contain a magnetically actuated test switch to provide for easy alarm testing at the sensor location.

6. Each sensor shall be scanned by the Control Unit for its type identification to prevent inadvertent substitution of another sensor type. Upon detection of a "wrong device", the control unit shall operate with the installed device at the default alarm settings for that sensor; 2.5% obscuration for photoelectric sensor, 135-deg F and 15-deg F rate-of-rise for the heat sensor, but shall indicate a "Wrong Device" trouble condition.

7. The sensor's electronics shall be immune from nuisance alarms caused by EMI and RFI.

8. Sensors include a communication transmitter and receiver in the mounting base having a unique identification and capability for status reporting to the FACP. Sensor address shall be located in base to eliminate false addressing when replacing sensors.

9. Removal of the sensor head for cleaning shall not require the setting of addresses.

B. Type: Smoke sensors shall be of the photoelectric type.

C. Bases: Relay output, sounder and isolator bases shall be supported alternatives to the standard base.

D. Duct Smoke Sensor: Photoelectric type, with sampling tube of design and dimensions as recommended by the manufacturer for the specific duct size and installation conditions where applied. Sensor includes relay as required for fan shutdown.

1. Environmental compensation, programmable sensitivity settings, status testing, and monitoring of sensor dirt accumulation for the duct smoke sensor shall be provided by the FACP.

2. The Duct Housing shall provide a supervised relay driver circuit for driving up to 15 relays with a single "Form C" contact rated at 7A@ 28VDC or 10A@ 120VAC. This auxiliary relay output shall be fully programmable. Relay shall be mounted within 3 feet of HVAC control circuit.

3. Duct Housing shall provide a relay control trouble indicator Yellow LED.

4. Duct Housing shall have a transparent cover to monitor for the presence of smoke. Cover shall secure to housing by means of four (4) captive fastening screws.

5. Duct Housing shall provide two (2) Test Ports for measuring airflow and for testing. These ports will allow aerosol injection in order to test the activation of the duct smoke sensor.

6. Duct Housing shall provide a magnetic test area and Red sensor status LED.

7. For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housing front cover.

8. Each duct smoke sensor shall have a Remote Test Station with an alarm LED and test switch.

2.5 HEAT SENSORS

A. Thermal Sensor: Combination fixed-temperature and rate-of-rise unit with plug-in base and alarm indication lamp; 135-deg F fixed-temperature setting except as indicated.

B. Thermal sensor shall be of the epoxy encapsulated electronic design. It shall be thermistor-based, rate-compensated, self-restoring and shall not be affected by thermal lag.

C. Sensor fixed temperature sensing shall be independent of rate-of-rise sensing and] programmable to operate at 135-deg F or 155-deg F. Sensor rate-of-rise temperature detection shall be selectable at the FACP for either 15-deg F or 20-deg F per minute.

D. Sensor shall have the capability to be programmed as a utility monitoring device to monitor for temperature extremes in the range from 32-deg F to 155-deg F.

2.6 ADDRESSABLE CIRCUIT INTERFACE MODULES

A. Addressable Circuit Interface Modules: Arrange to monitor or control one or more system components that are not otherwise equipped for addressable communication. Modules shall be used for monitoring of non-addressable devices, and for control of AHU systems.

B. Addressable Circuit Interface Modules will be capable of mounting in a standard electric outlet box. Modules will include cover plates to allow surface or flush mounting. Modules will receive their operating power from the signaling line circuit or a separate two wire pair running from an appropriate power supply, as required.

C. All Circuit Interface Modules shall be supervised and uniquely identified by the control unit. Module identification shall be transmitted to the control unit for processing according to the program instructions. Modules shall have an on-board LED to provide an indication that the module is powered and communicating with the FACP. The LEDs shall provide a troubleshooting aid since the LED blinks on poll whenever the peripheral is powered and communicating.

2.7 MAGNETIC DOOR HOLDERS

A. Description: Units shall be listed to UL 228. Units are equipped for wall or floor mounting as indicated and are complete with matching door plate. Unit shall operate from a 120VAC, a 24VAC or a 24VDC source, and develop a minimum of 25 lbs. holding force.

B. Material and Finish: Match door hardware.

2.8 STANDARD ALARM NOTIFICATION APPLIANCES

A. Visible/Only: Strobe shall be listed to UL 1971. The V/O shall consist of a xenon flash tube and associated lens/reflector system. The V/O enclosure shall mount directly to standard single gang, double gang or 4" square electrical box, without the use of special adapters or trim rings. V/O appliances shall be provided with different minimum flash intensities of 15cd, 30cd, 75cd and 110cd. Provide a label inside the strobe lens to indicate the listed candela rating of the specific Visible/Only appliance.

B. Horn/Strobe: Combination Horn/Strobe(H/S) units combine the horn and visible functions into a common housing. The H/S shall be listed to UL 1971 and UL 464.

1. High intensity multi-candela xenon strobe with selectable levels: 15, 30, 75, or 110 cd.

2. Synchronized 1 Hz strobe flash rate.

3. ADA Compatible.

4. Rugged, high impact, flame retardant thermoplastic housing suitable for mounting ins single 4” electrical box.

5. Individually addressable.

C. Notification Appliance Circuit provides synchronization of strobes at a rate of 1Hz and operates horns with a Temporal Code Pattern operation. The capability to synchronize multiple notification appliance circuits shall be provided.

D. Accessories: The contractor shall furnish any necessary accessories.

E. Weatherproof (exterior rated) alarm notification appliances shall be provided where indicated on the drawings and where temperatures of 32-120□F are not maintained.

2.9 NAC Power Extender

A. The IDNet NAC Power Extender panel shall be a stand-alone panel capable of powering a minimum of 4 notification appliance circuits. Notification appliance circuits shall be Class B,

Style Y rated at 2 amps each. Panel shall provide capability to be expanded to 8 notification appliance circuits.

B. The internal power supply & battery charger shall be capable of charging up 12.7 Ah batteries internally mounted or 18Ah batteries mounted in an external cabinet.

C. The NAC extender panel may be mounted close to the host control panel or can be remotely located. The IDNET Addressable NAC Extender Panel when connected to an addressable panel shall connect to the host panel via an IDNet communications channel. Via the IDNET channel each output NAC can be individually controlled for general alarm or selective area notification.

D. For IDNet connected NAC extender panels up to five panels can be connected on a single Class A, Style 6 wired IDNet channel.

E. When connected to a conventional (non-addressable panel) one or two standard notification appliance circuits from the main control panel may be used to activate all the circuits on the NAC power extender panel.

F. Alarms from the host fire alarm control panel shall signal the NAC power extender panel to activate. The panel shall monitor itself and each of its NACs for trouble conditions and shall report trouble conditions to the host panel.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install system components and all associated devices in accordance with applicable NFPA Standards and manufacturer's recommendations.

B. Installation personnel shall be supervised by persons who are qualified and experienced in the installation, inspection, and testing of fire alarm systems. Examples of qualified personnel shall include, but not be limited to, the following:

1. Factory trained and certified personnel.

2. National Institute of Certification in Engineering Technologies (NICET) fire alarm level II certified personnel.

3. Personnel licensed or certified by the state or local authority.

3.2 EQUIPMENT INSTALLATION

A. Furnish and install a complete Fire Alarm System as described herein. Include sufficient control unit(s), manual stations, automatic fire detectors, smoke detectors, audible and visible notification appliances, wiring, terminations, electrical boxes, and all other necessary material for a complete operating system.

B. Duct Detector Device Location-Indicating Lights: Locate in the public space immediately adjacent to the device they monitor.

C. Install manual station with operating handle 48 inches (1.22 m) above floor. Install wall mounted audible and visual notification appliances not less than 80 inches (2.03 m) above floor to bottom of lens and not greater than 96 inches (2.44 m) above floor to bottom of lens.

D. Mount outlet box for electric door holder to withstand 80 pounds pulling force.

E. Make conduit and wiring connections to door release devices, sprinkler flow switches, sprinkler valve tamper switches, fire suppression system control panels, and duct smoke detectors.

3.3 PREPARATION

A. Coordinate work of this Section with other affected work.

3.4 WIRING INSTALLATION

A. System Wiring: Wire and cable shall be a type listed for its intended use by an approval agency acceptable to the Authority Having Jurisdiction and shall be installed in accordance with the referenced edition of NFPA 70: National Electric Code (NEC).

B. Contractor shall obtain from the Fire Alarm System Manufacturer written instruction regarding the appropriate wire/cable to be used for this installation. No deviation from the written instruction shall be made by the Contractor without the prior written approval of the Fire Alarm System Manufacturer.

C. Color Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color code for alarm initiating device circuits wiring and a different color code for supervisory circuits. Color-code notification appliance circuits differently from alarm-initiating circuits. Paint fire alarm system junction boxes and covers red.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and the pretesting, testing, and adjustment of the system.

B. Service personnel shall be qualified and experienced in the inspection, testing, and maintenance of fire alarm systems. Examples of qualified personnel shall be permitted to include, but shall not be limited to, individuals with the following qualifications:

1. Factory trained and certified.

2. National Institute for Certification in Engineering Technologies (NICET) fire alarm certified.

3. International Municipal Signal Association (IMSA) fire alarm certified.

4. Certified by a state or local authority.

5. Trained and qualified personnel employed by an organization listed by a national testing laboratory for the servicing of fire alarm systems.

C. Pretesting: Determine, through pretesting, the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new and retest until satisfactory performance and conditions are achieved.

D. Inspection:

1. Inspect equipment installation, interconnection with system devices, mounting locations, and mounting methods.

2. Verify that units and controls are properly installed, connected, and labeled and that interconnecting wires and terminals are identified.

E. Acceptance Operational Tests:

1. Perform operational system tests to verify conformance with specifications.

2. Provide minimum five days notice of acceptance test performance schedule to Owner, and local Authority Having Jurisdiction.

F. Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets the Specifications and complies with applicable standards.

G. Final Test, Record of Completion, and Certificate of Occupancy:

1. Test the system as required by the Authority Having Jurisdiction in order to obtain a certificate of occupancy. Provide completed NFPA 72 Record of Completion form to Owner and AHJ.

3.6 TRAINING

A. Provide the services of a factory-authorized service representative to demonstrate the system and train Owner's maintenance personnel as specified below.

1. Train Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventive maintaining of the system. Provide a minimum of four hours' training.

2. Schedule training with the Owner at least seven days in advance.

END OF SECTION

SHEET INDEX

#	SHEET NAME	ISSUED ON (DECEMBER 20, 2018)
GENERAL		
G0.0	COVER	X
G0.1	ACCESSIBILITY DETAILS	X
G0.2	RECORD STORAGE LIFE SAFETY PLAN	X
CIVIL		
C1.01	GRADING PLAN	X
C1.02	UTILITY PLAN	X
ARCHITECTURAL		
A1.1	SITE PLANS	X
A2.1	FLOOR PLANS	X
A2.2	REFLECTED CEILING PLANS/ FINISH PLANS	X
A3.1	EXTERIOR ELEVATIONS	X
A4.1	WALL SECTIONS	X
A5.1	EXTERIOR REPAIRS/ LOCATION KEY	X
A5.2	INTERIOR REPAIRS	X
A5.3	INTERIOR REPAIRS	X
A5.4	INTERIOR REPAIRS	X
STRUCTURAL		
S0.1	GENERAL NOTES, TYPICAL DETAILS	X
S0.2	SPECIAL INSPECTIONS	X
S1.1	FOUNDATION PLAN	X
S3.1	CONCRETE SECTIONS	X
MECHANICAL		
M0.1	MECHANICAL GENERAL NOTES AND SCHEDULES	X
M2.1	MECHANICAL FLOOR PLANS	X
M3.1	MECHANICAL DETAILS	X
FIRE PROTECTION		
FP0.1	FIRE PROTECTION GENERAL NOTES	X
FP2.1	FIRE PROTECTION FLOOR PLANS	X
ELECTRICAL		
E0.1	SYMBOLS AND GENERAL NOTES	X
E1.1	ELECTRICAL SITE PLAN	X
E2.1	LIGHTING	X
E3.1	POWER	X
E4.1	RISER DIAGRAM	X
E5.1	SCHEMATICS	X

19 DECEMBER 2018

LAKE WORTH - RECORD STORAGE/ ANIMAL SERVICES

100% CONSTRUCTION DOCUMENTS

2018.019.00

DECEMBER 19, 2018

MEP ENGINEER

MALTZ ENGINEERING LLC
2801 CARMEL STREET
DENTON, TX 76205
940-382-0949

STRUCTURAL ENGINEER

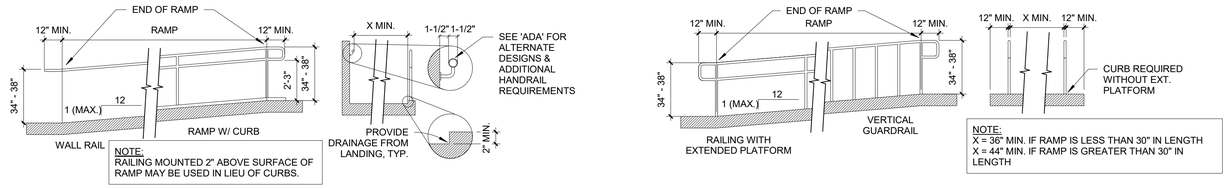
METRO STRUCTURAL CONSULTANTS
305 NE LOOP 820 #507, HURST TX 76053
817-284-8833

CIVIL ENGINEER

HAMILTON DUFFY, PC
8241 MID-CITIES BLVD.
SUITE 100
NORTH RICHLAND HILLS, TX 76182
817-268-0408

OWT ARCHITECTS

509 PECAN STREET
SUITE 100
FORT WORTH, TX 76102
817.993.9844



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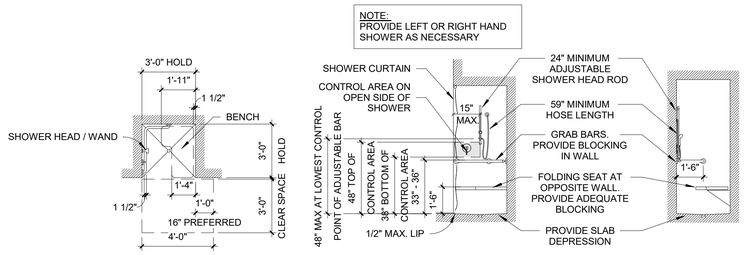

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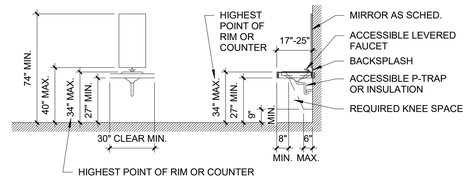

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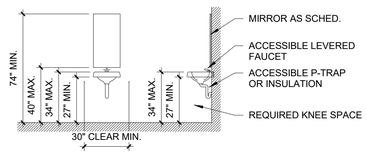
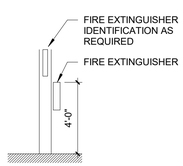
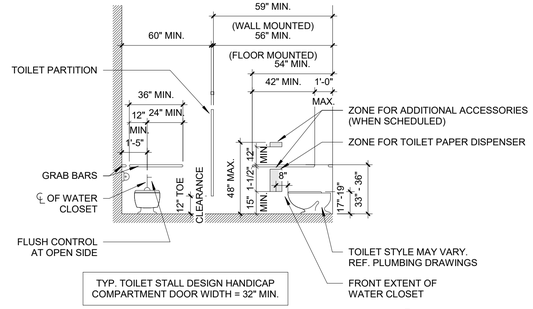


LAVATORY (WALL HUNG) 7



FIRE EXTINGUISHERS 6



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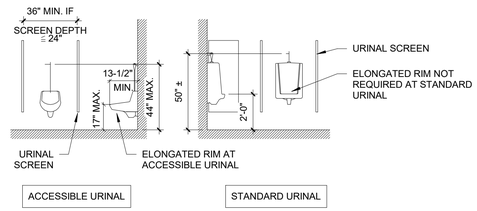

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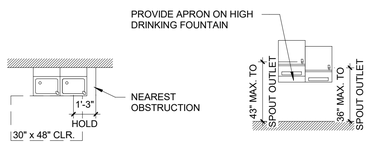
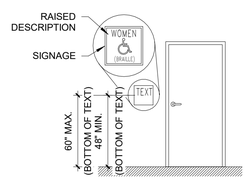
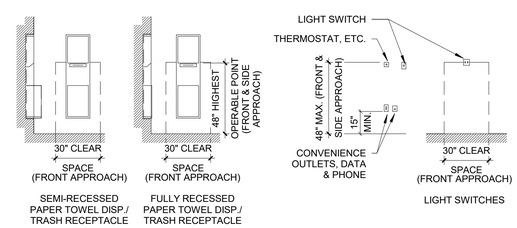


DRINKING FOUNTAINS 3



SIGNAGE 2



CONTROLS AND OPERATING MECHANISMS 1

NOTES:

1. REF. ENLARGED PLANS, DETAILS, AND PLUMBING DRAWINGS FOR EXACT FIXTURES AND ACCESSORIES USED.

2. IF USED, ALL ALARMS SHALL COMPLY WITH 'ADA'

3. CONTRACTOR SHALL BE RESPONSIBLE FOR COMPLIANCE WITH 'AMERICANS WITH DISABILITIES ACT'.

4. ALL DOOR OPENING FORCES SHALL COMPLY WITH 'ADA'. INTERIOR HINGED DOORS AND SLIDING OR FOLDING DOORS SHALL BE 5 LBF MAX.

5. NOTE: NOT ALL DETAILS ARE APPLICABLE TO THIS PROJECT.

TAS DETAILS
SCALE: 1/4" = 1'-0"

REGISTERED ARCHITECT ANDREW P. OXLEY 22705 STATE OF TEXAS

19 DECEMBER 2018

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LAKE WORTH - RECORD STORAGE/ ANIMAL SERVICES

3805 ADAM GRUBB ST.
LAKE WORTH, TX 76135

2018.019.00
DECEMBER 19, 2018

ACCESSIBILITY DETAILS

G0.1

CODE ANALYSIS

2012 INTERNATIONAL BUILDING CODE
OCCUPANCY S-1

ALLOWABLE HEIGHT & AREA FOR OCCUPANCY (A-3) CHAPTER 5, TABLE 503

TYPE IIB
ALLOWABLE HEIGHT = 2 STORIES
ALLOWABLE FLOOR AREA = 17,500 S.F.

AUTOMATIC SPRINKLER SYSTEM INCREASE PER 504.2 & 506.3
TYPE IIB
ALLOWABLE HEIGHT = 3 STORIES
ALLOWABLE FLOOR AREA = 28,500 S.F.

505.2 MEZZANINES.
- A MEZZANINE OR MEZZANINES IN COMPLIANCE WITH SECTION 505.2 SHALL BE CONSIDERED A PORTION OF THE STORY BELOW. SUCH MEZZANINES SHALL NOT CONTRIBUTE TO EITHER THE BUILDING AREA OR NUMBER OF STORIES AS REGULATED BY SECTION 503.1. THE AREA OF THE MEZZANINE SHALL BE INCLUDED IN DETERMINING THE FIRE AREA. THE CLEAR HEIGHT ABOVE AND BELOW THE MEZZANINE FLOOR CONSTRUCTION SHALL BE NOT LESS THAN 7 FEET.

ACTUAL HEIGHT = 1 STORY
ACTUAL FLOOR AREA = 2,760 S.F.

OCCUPANT LOAD CHAPTER 10, TABLE 1004.1.1

STORAGE: 300 GROSS. 2760 S.F. / 300 = 10 OCCUPANTS
MEZZANINE - STORAGE: 300 GROSS. 606 S.F. / 300 = 3 OCCUPANTS

TOTAL NUMBER OF OCCUPANTS: **13**

MEANS OF EGRESS CHAPTER 10

EGRESS WIDTH REQUIRED (SECTION 1005) = 13 x 0.2 = 2.6 INCHES
WIDTH PROVIDED = 255 INCHES

SECTION 1021 - NUMBER OF EXITS AND EXIT CONFIGURATION
1021.1 - GENERAL
ONE EXIT REQUIRED PER TABLE 1021.2(2)
- NUMBER OF OCCUPANTS IS LESS THAN 29
ONLY ONE EXIT REQUIRED FROM EACH ROOM UNDER EXCEPTION:
- 1. ROOMS, AREAS AND SPACES COMPLYING WITH SECTION 1015.1 WITH EXITS THAT DISCHARGE DIRECTLY TO THE EXTERIOR AT THE LEVEL OF DISCHARGE ARE PERMITTED TO HAVE ONE EXIT.

ALLOWED MAXIMUM EXIT ACCESS TRAVEL DISTANCE (TABLE 1016.1) = 250 FEET
PROVIDED MAXIMUM EXIT ACCESS TRAVEL DISTANCE = 94'-10"

PLUMBING FIXTURE FOR OCCUPANCY (A-3) CHAPTER 29, TABLE 2902.1

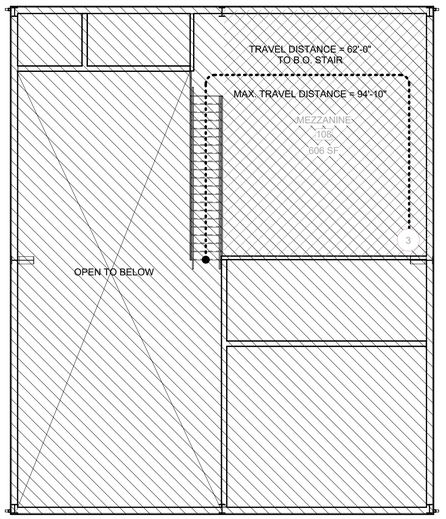
13 OCCUPANTS / 2 = 7 MEN, 7 WOMEN

WATER CLOSETS = MEN: 1 PER 125, WOMEN: 1 PER 65
W.C. REQUIRED: MEN = 5
W.C. PROVIDED: MEN = 10
W.C. REQUIRED: WOMEN = 9
W.C. PROVIDED: WOMEN = 10

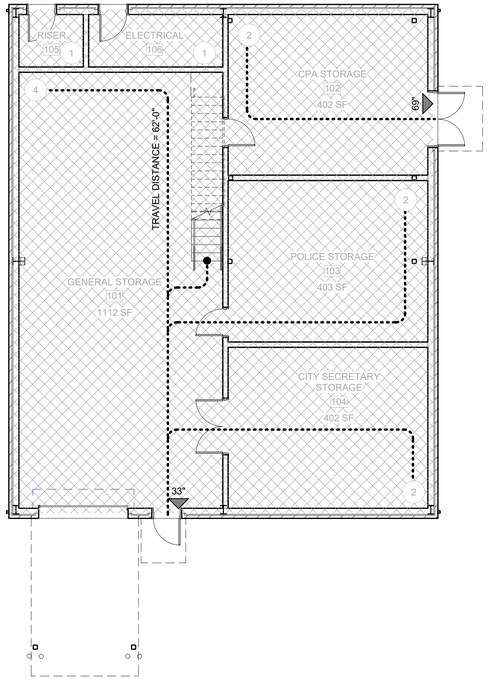
LAVATORIES = 1 PER 200
LAV. REQUIRED: MEN = 3
LAV. PROVIDED: MEN = 5
LAV. REQUIRED: WOMEN = 3
LAV. PROVIDED: WOMEN = 5

DRINKING FOUNTAIN = 1 PER 500
1149 OCCUPANTS = 3 D.F. REQUIRED
D.F. PROVIDED = 6

SERVICE SINK = 1 REQUIRED, 1 PROVIDED



MEZZANINE LIFE SAFETY PLAN 2
SCALE: 1/8" = 1'-0" G0.2



LIFE SAFETY PLAN 1
SCALE: 1/8" = 1'-0" G0.2

19 DECEMBER 2018

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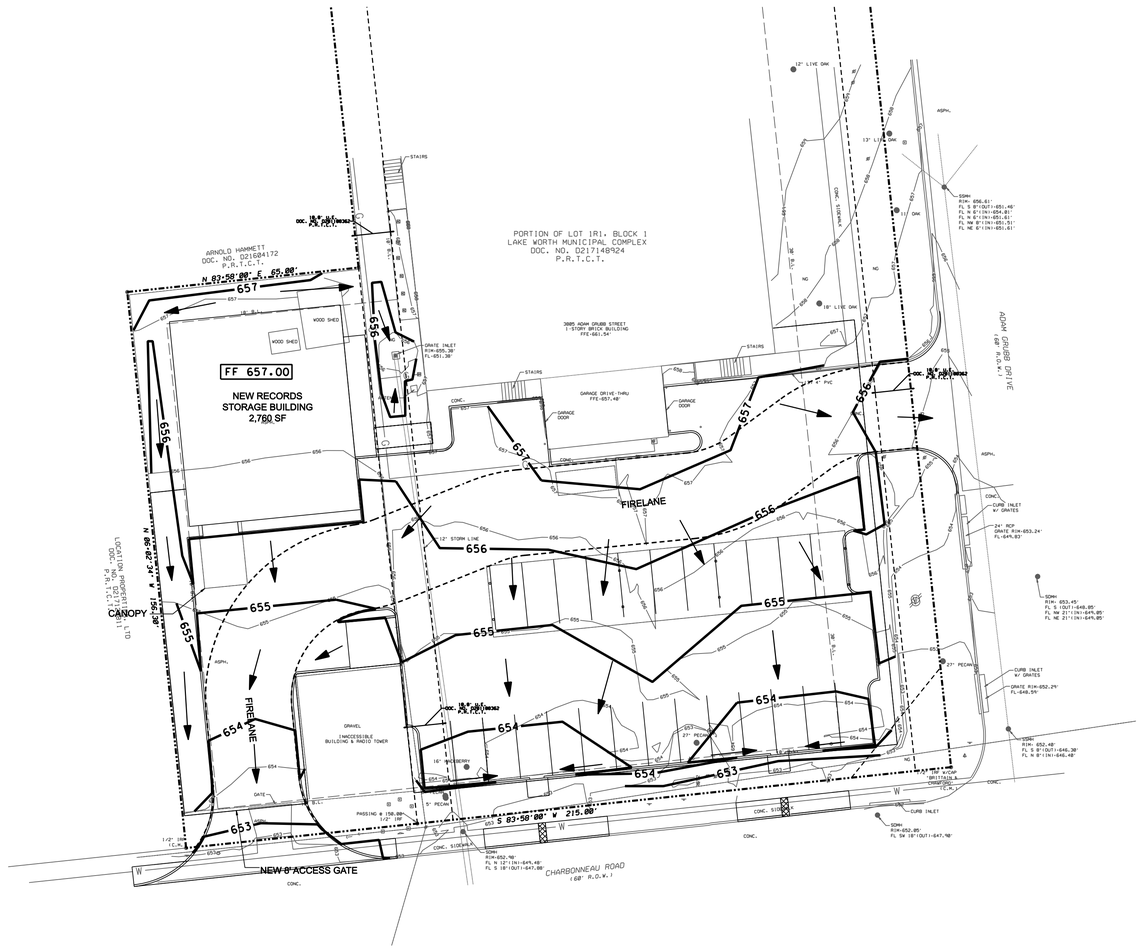
RECORD STORAGE LIFE SAFETY PLAN

G0.2



SITE GRADING LEGEND

FF = FINISHED FLOOR
TP = TOP PAVEMENT
TI = TOP INLET
TG = TOP GRATE INLET
TC = TOP CURB
GT = GUTTER
FG = FINISHED GRADE
TW = TOP WALL
BW = BOTTOM WALL
FL = FLOW LINE
FLOW DIRECTION
—685— EXIST. ELEV. CONTOUR
—687— PROP. ELEV. CONTOUR

GENERAL NOTES

1. CONTRACTOR IS RESPONSIBLE FOR DEMOLITION OF EXISTING STRUCTURES INCLUDING REMOVAL OF ANY EXISTING UTILITIES THAT MAY CONFLICT WITH PROPOSED LAYOUT.
2. THE TOP FOUR (4") INCHES OF TOP SOIL SHALL BE REMOVED FROM SITE AND STOCKPILED FOR LANDSCAPE USE. ALL CUT OR FILL SLOPES TO BE 3H:1V OR FLATTER UNLESS OTHERWISE NOTED.
3. THE CONTRACTOR SHALL RESTORE ALL AREAS DISTURBED BY CONSTRUCTION TO THE ORIGINAL CONDITION OR BETTER. RESTORED AREAS INCLUDE, BUT ARE NOT LIMITED TO, TRENCH BACKFILL, SIDE SLOPES, FENCES, IRRIGATION SYSEMS, CULVERT PIPES, DRAINAGE DITCHES, DRIVEWAYS, PRIVATE YARDS, ROADWAYS, ETC.
4. ALL FILL AND STABILIZATION PROCEDURES SHALL BE PER GEOTECHNICAL REPORT. AT MINIMUM, SELECT FILL SHALL BE PLACED IN 6" LIFTS AND COMPACTED TO 95% STANDARD PROCTOR DENSITY. FIELD DENSITY TESTS SHALL BE PERFORMED BY GEOTECHNICAL ENGINEER OR HIS REPRESENTATIVE. ALL COSTS FOR TESTING SHALL BE BORNE BY THE CONTRACTOR.
5. DRAINAGE SHALL NOT BE DIRECTED TOWARD THE BUILDING PAD. PROVIDE A MINIMUM OF 1% SLOPE AROUND BUILDING PAD.
6. SEE PAVING PLAN FOR CONCRETE SPECIFICATIONS AND JOINT LAYOUT.
7. CONTRACTOR SHALL FURNISH ALL CONSTRUCTION STAKING.
8. ALL PARKING LOT PAVING SHALL BE REINFORCED PER PAVING PLAN.
9. PUBLIC SIDEWALKS SHALL BE CONSTRUCTED PER CITY STANDARDS.
10. CONTRACTOR SHALL ADHERE TO ALL TERMS AND CONDITIONS AS OUTLINED IN THE GENERAL T.P.D.E.S. PERMIT FOR STORM WATER DISCHARGE ASSOCIATED WITH CONSTRUCTION ACTIVITIES.

!! FINAL GRADING NOTE !!

FINISHED GRADES SHOWN HEREON REPRESENT TOP OF PAVING, TOP OF SOD AND/OR LANDSCAPING, UNLESS NOTED OTHERWISE.

UNDER NO CIRCUMSTANCES SHALL SOD OR LANDSCAPING NE PLACED ABOVE THE BRICK LEDGE. FINAL GRADE SHALL ENSURE POSITIVE FLOW AWAY FROM THE BUILDING AND OTHER STRUCTURES.

CONSTRUCTION NOTES:

AREAS DISTURBED BY CONSTRUCTION WILL BE FULLY SODDED WITH NATIVE BERMUDA GRASS OR HYDROMULCHED AS DIRECTED BY ENGINEER.

ALL CONCRETE INTERFACES AND CHANGES IN CONCRETE THICKNESS WILL HAVE AN EXPANSION JOINT FURNISHED AND INSTALLED IN ACCORDANCE WITH THE DETAILS PROVIDED.

ALL SIDEWALKS SHALL CONFORM TO A.D.A. REQUIREMENTS.

ALL SIDEWALKS SHALL BE BACKFILLED TO FINISHED GRADE SO AS NOT TO IMPEDE DRAINAGE.

ALL EXISTING/NEW CONCRETE INTERFACES SHALL BE PROVIDED WITH DOWELED EXPANSION JOINT CONSISTING OF PREMOLDED EXPANSION JOINT MATERIAL AND SEALANT.

MATCH ALL WATER METERS, SANITARY SEWER CLEANOUTS, ETC. WITH FINISHED GRADE

! CONTRACTOR NOTICE !

ALL SIDEWALKS, AND PAVED AREAS, REQUIRING ADA ACCESS SHALL BE CONSTRUCTED WITH 5% (MAX.) SLOPE AND 2.0% (MAX.) CROSS SLOPE IN ORDER TO ENSURE A.D.A. ACCESS TO ALL ENTRANCES. IF ANY GRADES AND/OR CONTOURS SHOWN ON THIS PLAN CONFLICT WITH THESE PARAMETERS, THE CONTRACTOR SHALL REPORT SUCH DISCREPANCIES (IN WRITING) FOR RECONCILIATION BEFORE CONSTRUCTION COMMENCES.

!!! CRITICAL !!!

LOCATIONS OF EXISTING UTILITIES ARE APPROXIMATE AND ARE BASED ON PUBLIC RECORDS. THE CONTRACTOR IS COMPLETELY RESPONSIBLE FOR LOCATING ALL EXISTING UTILITIES, BOTH HORIZONTALLY AND VERTICALLY, BEFORE THE COMMENCEMENT OF ANY CONSTRUCTION.

!!!!IMPORTANT!!!

CONTOURS REPRESENT FINISHED GRADES. ALL PAVING SHALL BE EXCAVATED TO SUBGRADE PER TYPICAL PAVING SECTIONS (SEE DETAILS).

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LAKE WORTH RECORDS STORAGE
AND POLICE PARKING

3805 ADAM GRUBB
LAKE WORTH, TEXAS

GRADING PLAN

STATE OF TEXAS
KEITH M. HAMILTON
87384
LICENSED
PROFESSIONAL ENGINEER

12-19-18

JOB	251-024
DATE	12/19/2018
DESIGNED	K.M.H.
DRAWN	K.M.H.
CHECKED	K.M.H.
TEXAS FIRM REG. NO. F-5260	

NO.	REVISION	BY	DATE

SHEET
C1.01

ALL EXCAVATION, TRENCHING AND SHORING OPERATIONS SHALL COMPLY WITH THE REQUIREMENTS OF THE U.S. DEPARTMENT OF LABOR, OSHA, "CONST. SAFETY AND HEALTH REGULATIONS", VOL. 29, SUB PART P, PG. 128-137, AND ANY AMENDMENTS THERETO.

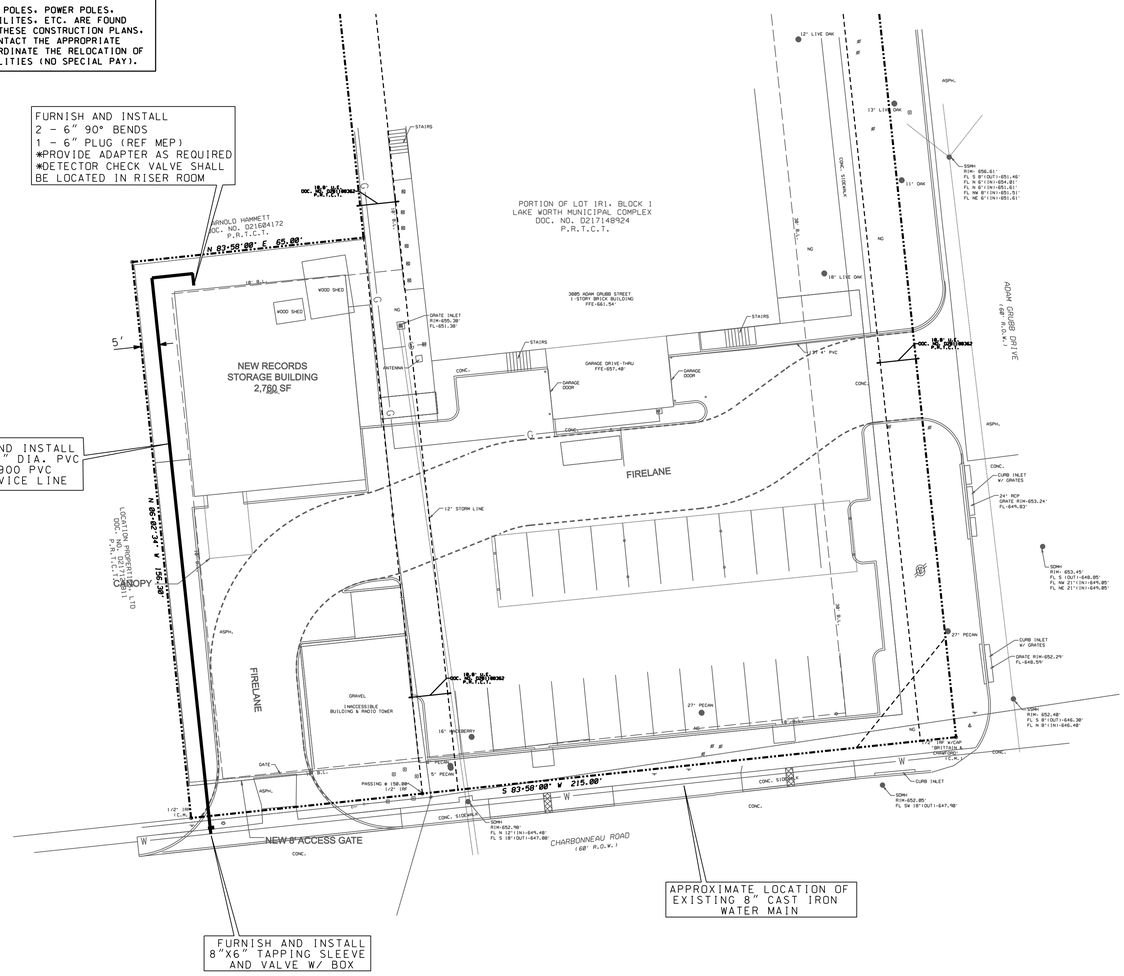
!!! CRITICAL !!!

LOCATIONS OF EXISTING UTILITIES ARE APPROXIMATE AND ARE BASED ON PUBLIC RECORDS. THE CONTRACTOR IS COMPLETELY RESPONSIBLE FOR LOCATING ALL EXISTING UTILITIES, BOTH HORIZONTALLY AND VERTICALLY, BEFORE THE COMMENCEMENT OF ANY CONSTRUCTION.

UTILITY RELOCATION NOTE:

IF ANY EXISTING UTILITY POLES, POWER POLES, GUY WIRES, TELEPHONE UTILITES, ETC. ARE FOUND TO BE IN CONFLICT WITH THESE CONSTRUCTION PLANS, THE CONTRACTOR SHALL CONTACT THE APPROPRIATE UTILITY COMPANY AND COORDINATE THE RELOCATION OF ANY AND/OR ALL SUCH UTILITIES (NO SPECIAL PAY).

CONSTRUCTION MATERIALS AND METHODS SHALL BE PER NORTH CENTRAL TEXAS COUNCIL OF GOVERNMENTS (NCTCOG) 3RD EDITION AND IN STRICT ACCORDANCE WITH THE CITY OF LAKE WORTH STANDARD DETAILS.



NOTES:

1) CONTRACTOR SHALL PROVIDE ADAPTERS/FITTINGS AS REQUIRED FOR CONNECTION TO PROPOSED PLUMBING COMING OUT OF BUILDINGS.

GENERAL NOTES FOR WATER IMPROVEMENTS

1. ALL WATER LINES SHALL BE PVC PIPE CONFORMING TO AWWA STANDARD C900 DR-14 OR POLYETHYLENE (PE) PRESSURE PIPE AWWA C-906 DR 9 (200 PSI) PIPE COLOR CODED BLUE OUTSIDE FOR WATER LINE. WITH NSF SEAL.PRESSURE TESTED AND DISINFECTED IN ACCORDANCE WITH THE NCTCOG STD. SPECS. WATER MAINS TO HAVE A MINIMUM OF 48" COVER TO TOP OF PIPE AS MEASURED FROM THE TOP OF PIPE TO THE EXISTING GROUND OR PROPOSED FINISHED GRADE, WHICHEVER IS GREATER. SERVICE LINE CONNECTORS SHALL BE COMPRESSION-TYPE WITH STAINLESS STEEL TUBE LINERS.
2. ALL WATER LINES TO BE ENCASED IN SAND, UNLESS SPECIFIED OTHERWISE AND DETAILED. BACKFILL SHALL BE SELECT MATERIAL COMPACTED TO 95% STANDARD PROCTOR DENSITY.
3. UTILITY CONTRACTOR TO FURNISH AND INSTALL WATER METER BOXES AFTER THE PAVING CONTRACTOR HAS BEEN COMPLETED.
4. ALL FIRE HYDRANT ASSEMBLIES TO BE EQUIPPED WITH A 6" GATE VALVE AND BOX. ALL VALVES AND FIRE HYDRANTS TO BE PER CITY SPECIFICATIONS.
5. ANY WATER VALVES LOCATED WITHIN PAVEMENT AREAS SHALL BE ADJUSTED TO FINAL GRADE BY THE PAVING CONTRACTOR.
6. ALL PROPOSED WATER LINES ARE TO BE LOCATED AS SHOWN ON THE PLANS. ALL LINES LOCATED WITHIN AREAS OF PAVEMENT SHALL HAVE THE TOP 8" OF BACKFILL REPLACED WITH CRUSHED STONE INCLUDING SERVICES. REF CITY PLUMBING CODE FOR SERVICE LINE INSTALLATION.
7. WATER LINES WILL BE INSTALLED AS SHOWN ON THE PLANS. HOWEVER, FIELD ADJUSTMENTS APPROVED BY THE INSPECTOR OR ENGINEER AND CITY ENGINERING DEPARTMENT MAY BE MADE TO LESSEN DAMAGE TO THE ROAD PAVEMENT OR WHEN OTHER UTILITY LOCATIONS, TREES, OR STRUCTURES WARRANT SUCH AN ADJUSTMENT.
8. ALL WATER LINES AND APPURTENANCES SHALL BE INSTALLED IN STRICT ACCORDANCE WITH THESE PLANS, THE RULES, REGULATIONS, POLICIES AND PROCEDURES OF THE CITY.
9. ALL PVC PIPE AND APPURTENANCES (FITTINGS,VALVES, NIPPLES, ETC.) 3" DIA. AND SMALLER SHALL BE CONSTRUCTED AS SHOWN.
10. BLUE EMS DISK SHALL BE INSTALLED ON THE WATER LINES AT EVERY CHANGE IN DIRECTION, VALVE AND ANY CONNECTION TO MAIN LINE.

SCALE 1" = 20'

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LAKE WORTH RECORDS STORAGE AND POLICE PARKING

3805 ADAM GRUBB
LAKE WORTH, TEXAS

UTILITY PLAN

STATE OF TEXAS
KEITH M. HAMILTON
87384
LICENSED
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JOB	251-024
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CHECKED	K.M.H.
TEXAS FIRM REG. NO. F-5260	

NO.	REVISION	BY	DATE

SHEET
C1.02

RELOCATE EXISTING GATE, OPENER AND FENCE

FENCE TO RELOCATE 5

SCALE: NTS

REMOVE EXISTING CURB

EXCAVATE AS NECESSARY FOR NEW PAVING

REMOVE EXISTING CURB

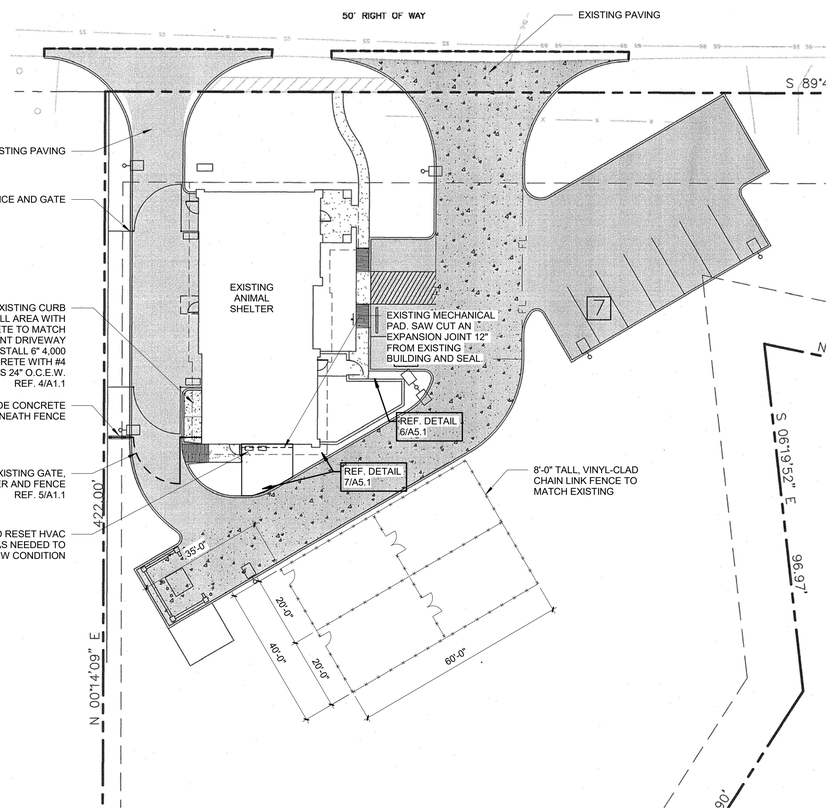
EXCAVATE AS NECESSARY FOR NEW PAVING

REMOVE PORTION OF EXISTING CURB

PORTION OF EXISTING CURB TO REMAIN

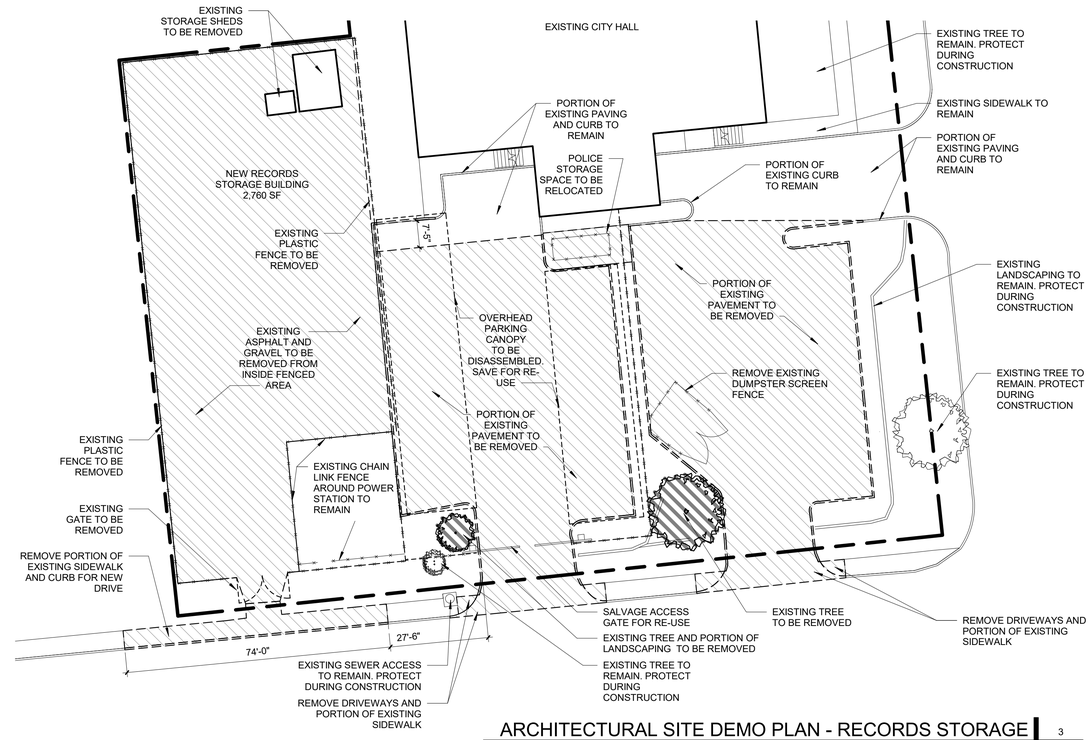
NEW SITE PAVING 4

SCALE: NTS



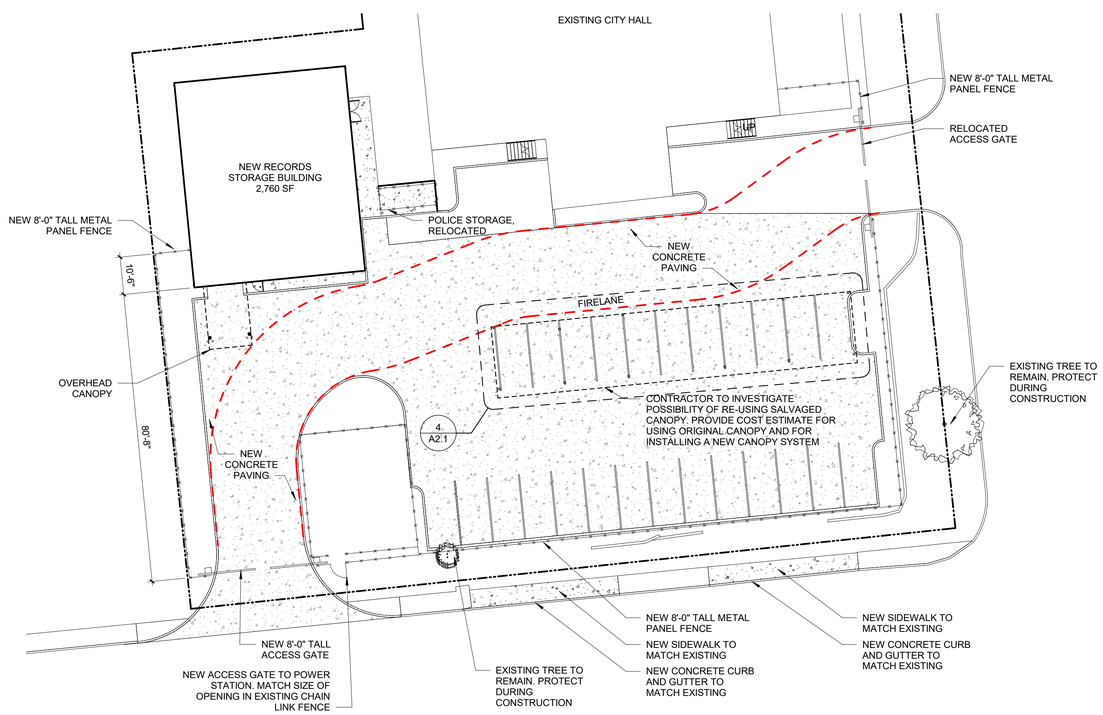
ARCHITECTURAL SITE PLAN - ANIMAL SERVICES 2

SCALE: 1" = 20'-0" A1.1



ARCHITECTURAL SITE DEMO PLAN - RECORDS STORAGE 3

SCALE: 1" = 20'-0" A1.1



ARCHITECTURAL SITE PLAN - RECORDS STORAGE 1

SCALE: 1" = 20'-0" A1.1

REGISTERED ARCHITECT ANDREW P. OXLEY 22705 STATE OF TEXAS

19 DECEMBER 2018

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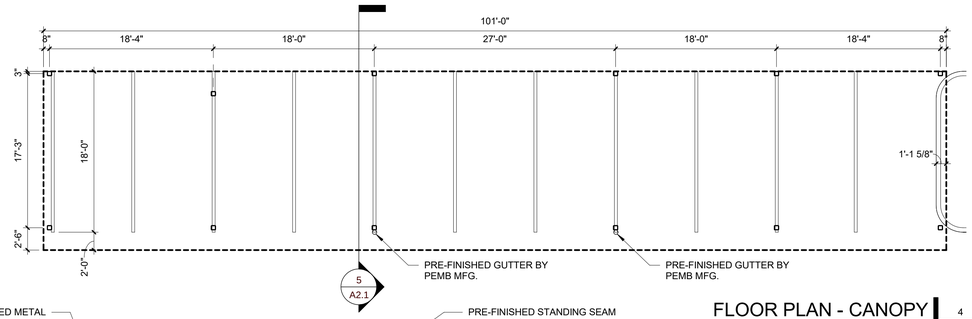
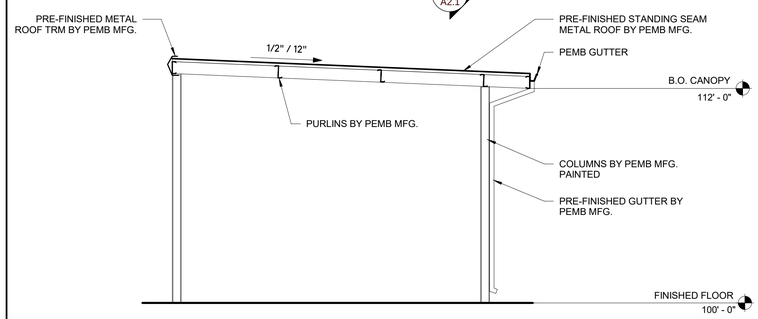
SITE PLANS

A1.1



FLOOR PLAN - CANOPY 4 A2.1
SCALE: 1/8" = 1'-0"



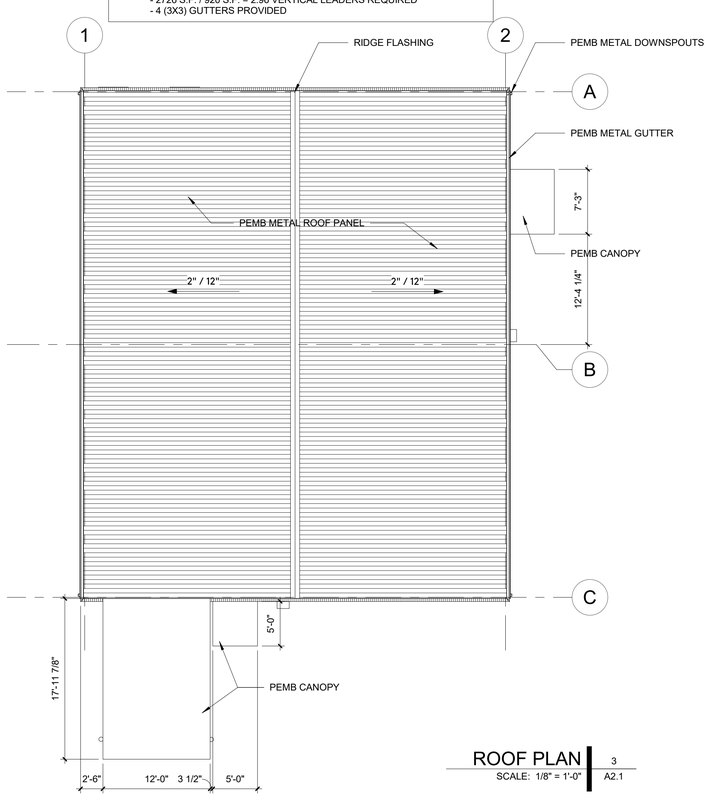
CAR CANOPY SECTION 5 A2.1
SCALE: 1/4" = 1'-0"

ROOF DRAINAGE CALCULATION:

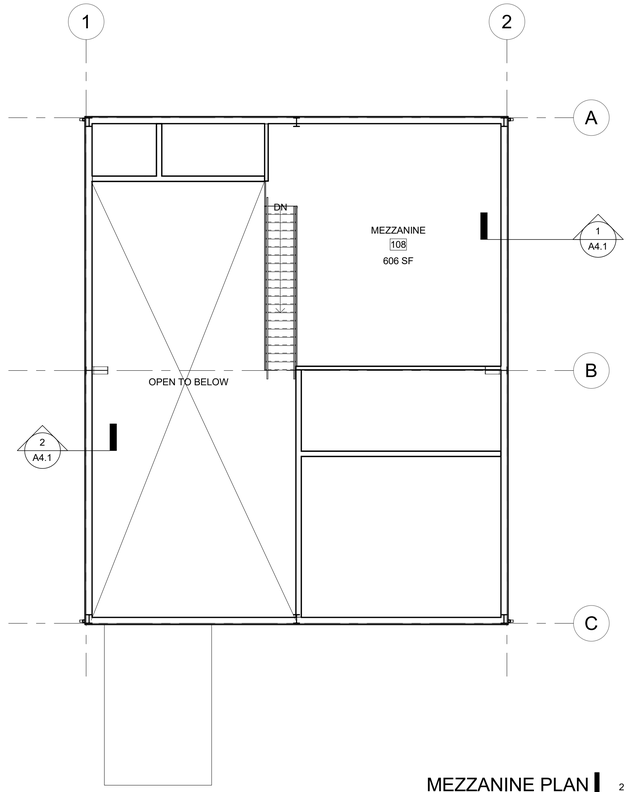
ROOF AREA = 2,726 S.F.

6" RAINFALL/HOUR PER 2012 IPC - WITH NTCOG AMENDMENTS

2X3 RECTANGULAR VERTICAL LEADER WILL DRAIN 920 S.F. PER TABLE 1106.2(2)
- 2726 S.F. / 920 S.F. = 2.96 VERTICAL LEADERS REQUIRED
- 4 (3X3) GUTTERS PROVIDED



ROOF PLAN 3 A2.1
SCALE: 1/8" = 1'-0"



MEZZANINE PLAN 2 A2.1
SCALE: 1/8" = 1'-0"

GENERAL NOTES

1. ALL EXIT DOORS SHALL BE OPERABLE FROM THE INSIDE WITHOUT ANY SPECIAL EFFORT OR KNOWLEDGE.

2. ALL EXTERIOR DOORS SHALL INCLUDE CLOSERS, WEATHERSTRIPPING, AND THRESHOLDS.

3. ALL DOORS SHALL INCLUDE DOOR STOPS UNLESS NOTED OTHERWISE.

4. PROVIDE MASTER KEY SETS.

5. ALL DOORS RECEIVING CLOSERS ARE TO BE REINFORCED AT THE POINT OF CLOSER CONNECTION.

6. ALL DOOR HARDWARE SHALL COMPLY WITH TAS.

7. PROVIDE SILENCERS IN ALL FRAMES UNLESS WEATHERSTRIPPING IS PROVIDED.

8. INSTALL DOORS PLUMB AND LEVEL.

9. ENSURE DOORS OPERATE FREELY.

10. PROVIDE GALVANIZED HOLLOW METAL FRAMES AT EXTERIOR DOORS.

11. IF FIELD CUTTING FOR HEIGHT IS NECESSARY, CUT BOTTOM ONLY, 1/2" UNDERCUT MAXIMUM.

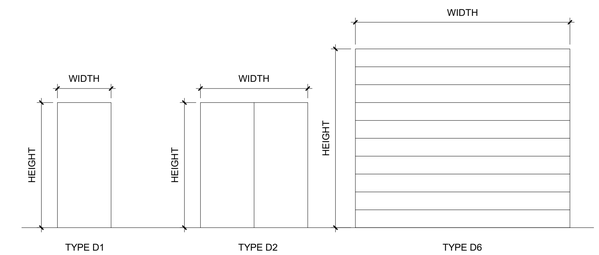
12. TEMPERED GLASS WHERE REQUIRED BY CODE.

13. ALL HOLLOW METAL DOORS TO BE INSULATED.

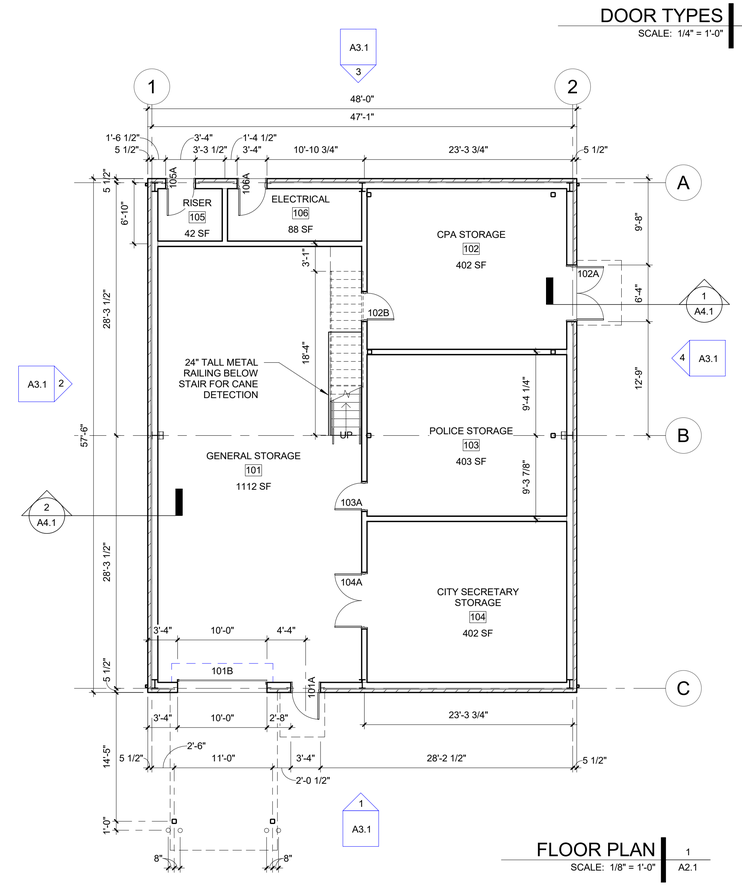
14. REFER TO FINISH LEGEND FOR DOOR AND FRAME FINISHES.

DOOR SCHEDULE

MARK	TYPE MARK	DIMENSIONS		DOOR		FRAME		DETAILS				HARDWARE	COMMENTS
		WIDTH	HEIGHT	MATERIAL	FINISH	MATERIAL	FINISH	SILL	JAMB	JAMB	HEAD		
101A	D1	3' - 0"	7' - 0"	HM	PT	HM	PT						
101B	D6	10' - 0"	10' - 0"	STL	-	STL	PT						OVERHEAD COILING
102A	D2	6' - 0"	7' - 0"	HM	PT	HM	PT						
102B	D1	3' - 0"	7' - 0"	HM		HM							
103A	D1	3' - 0"	7' - 0"	HM	PT	HM	PT						
104A	D2	6' - 0"	7' - 0"	HM	PT	HM	PT						
105A	D1	3' - 0"	7' - 0"	HM	PT	HM	PT						
106A	D1	3' - 0"	7' - 0"	HM	PT	HM	PT						
Y	D1	3' - 0"	7' - 0"	HM		HM							



DOOR TYPES
SCALE: 1/4" = 1'-0"



FLOOR PLAN 1 A2.1
SCALE: 1/8" = 1'-0"

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LAKE WORTH - RECORD STORAGE/ ANIMAL SERVICES

3805 ADAM GRUBB ST.
LAKE WORTH, TX 76135

2018.019.00
DECEMBER 19, 2018

FLOOR PLANS

A2.1

FINISH LEGEND

W B F — WALL, BASE, FLOOR

X — ACCENT FINISH

WALLS	BASE	FLOORS	GENERAL NOTES
PAINT	RUBBER BASE	TILE	
P1 - GENERAL MANUF.: SHERWIN WILLIAMS COLOR: SW 7011 NATURAL CHOICE FINISH: EGGSHELL TEXTURE: ORANGE PEEL TAPE, BED, TEXTURE, AND PAINT	**RB** - RUBBER BASE, 4" TALL MANUF.: JOHNSONITE SERIES: TRADITIONAL WALL BASE COLOR:	**SC** - SEALED CONCRETE	1. FINISH TAGS MAY BE FOUND ON WALL TYPES AND FINISHES PLANS AND INTERIOR ELEVATIONS. 2. ALL FINISH MATERIALS TO MEET OR EXCEED THE REQUIREMENTS OF A CLASS B FINISH. SEE SPECIFICATIONS FOR FURTHER INFORMATION. 3. CONTRACTOR SHALL PROVIDE MOCKUPS OF ALL PAINT COLORS IN THE LIGHTING ENVIRONMENT SPECIFIED FOR DESIGNER APPROVAL PRIOR TO PROCEEDING.	4. REF. SPECIFICATIONS FOR ADDITIONAL INFORMATION PERTAINING TO FINISH LEGEND AND APPROVED EQUALS. 5. FOR ALL FLOOR AND WALL TILES: CONTRACTOR TO PROVIDE TILE TRIM PIECES FOR EXPOSED EDGES, SURFACE CAPS, COVE BASE, CORNERS, AND OUTCORNERS TO COMPLETE DESIGN INTENT OF ARCHITECT.

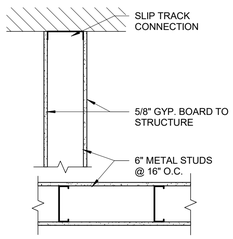
NOTES:
1. WALL TYPE TO CONTINUE AT DOOR & WINDOW OPENINGS (TOP & BOTTOM) U.N.O.

2. THE INTENT OF ACOUSTICAL PARTITIONS IS TO ACHIEVE AS HIGH AN STC RATING AS POSSIBLE WITHOUT USING ACOUSTICAL SEALANT. RUN GYP. BOARD AS TIGHT AS POSSIBLE AT FLOORS, CEILINGS & PENETRATIONS U.N.O.

3. USE WATER RESISTANT GYP. BOARD AT ALL WET WALL LOCATIONS AND AROUND EXTERIOR WINDOW AND DOOR OPENINGS.

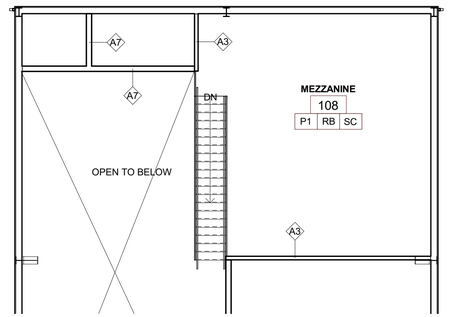
4. USE TILE BACKER BOARD BEHIND ALL WALL TILE.

5. REFER TO REFLECTED CEILING PLAN FOR CEILING HEIGHTS.



WALL TYPE A7

NON-RATED



MEZZANINE WALL TYPES AND FINISH PLAN

SCALE: 1/8" = 1'-0" | 4 A2.2

REFLECTED CEILING PLAN LEGEND

TYPE → A
ELEVATION → 9'-0"

DETAIL NUMBER → 1
SHEET, LOCATED ON → A9.2

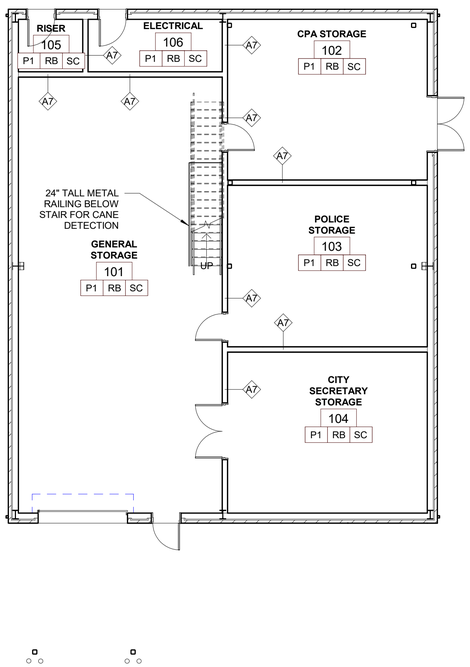
TYPE A	2' X 2' LAY-IN, ACOUSTICAL, CEILING TILE IN SUSPENDED GRID
TYPE X	OPEN CEILING, EXPOSED STRUCTURE AND DUCTWORK, UNFINISHED

NOTES:
1. MECHANICAL AND ELECTRICAL DATA SHOWN FOR REFERENCE ONLY. COORDINATE WITH MECHANICAL AND ELECTRICAL DRAWINGS INCLUDING DUCTS AND GRILLES. ANY CONFLICTS SHOULD BE ADDRESSED WITH ARCHITECT AS SOON AS POSSIBLE.

2. LIGHT FIXTURES ARE LOCATED TO CENTERLINE OF ROOM, CORRIDOR, OR GRID AND EQUALLY SPACED UNLESS NOTED OTHERWISE.

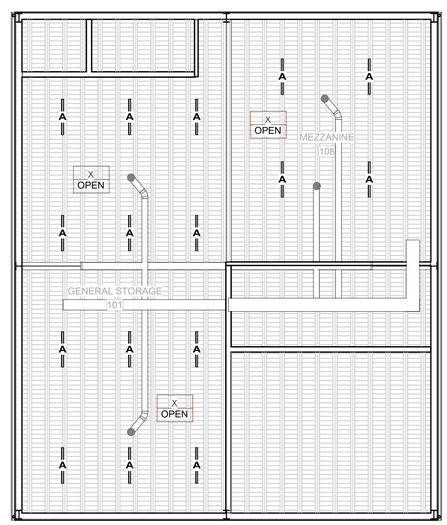
SYMBOL LEGEND

- AIR RETURN
- SUPPLY DIFFUSER
- LED CANOPY FIXTURE
- LINEAR LED FIXTURE
- 2X4 LED FIXTURE



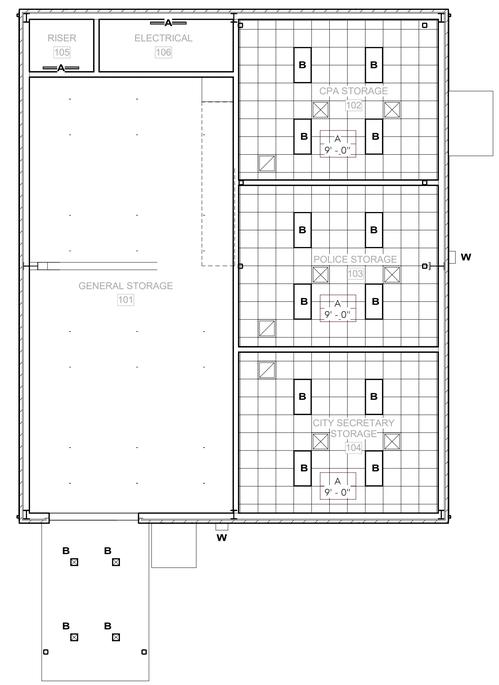
WALL TYPES AND FINISHES PLAN

SCALE: 1/8" = 1'-0" | 3 A2.2



REFLECTED CEILING PLAN - MEZZANINE

SCALE: 1/8" = 1'-0" | 2 A2.2



REFLECTED CEILING PLAN

SCALE: 1/8" = 1'-0" | 1 A2.2

19 DECEMBER 2018

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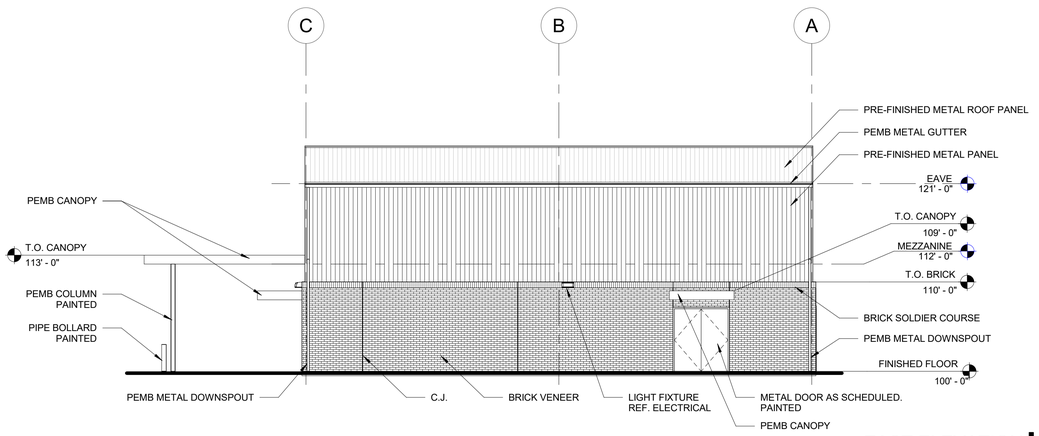
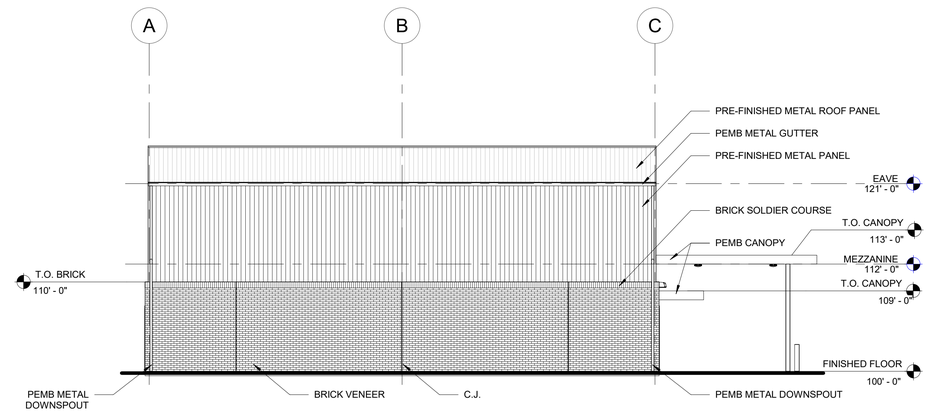
REFLECTED CEILING PLANS/ FINISH PLANS

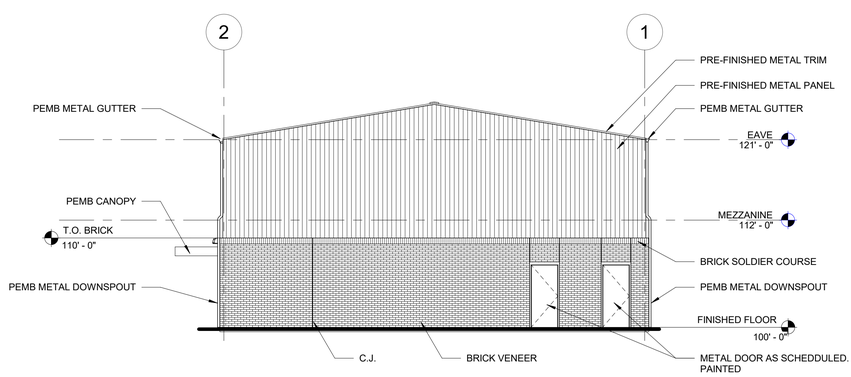
A2.2



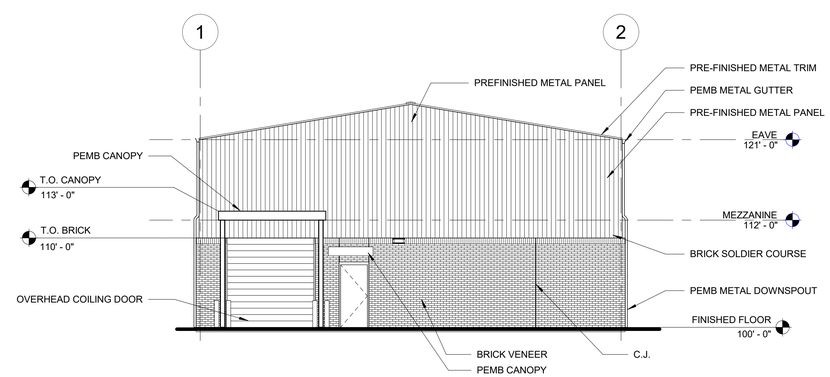
EAST ELEVATION 4
SCALE: 1/8" = 1'-0" A3.1



WEST ELEVATION 2
SCALE: 1/8" = 1'-0" A3.1



NORTH ELEVATION 3
SCALE: 1/8" = 1'-0" A3.1



SOUTH ELEVATION 1
SCALE: 1/8" = 1'-0" A3.1

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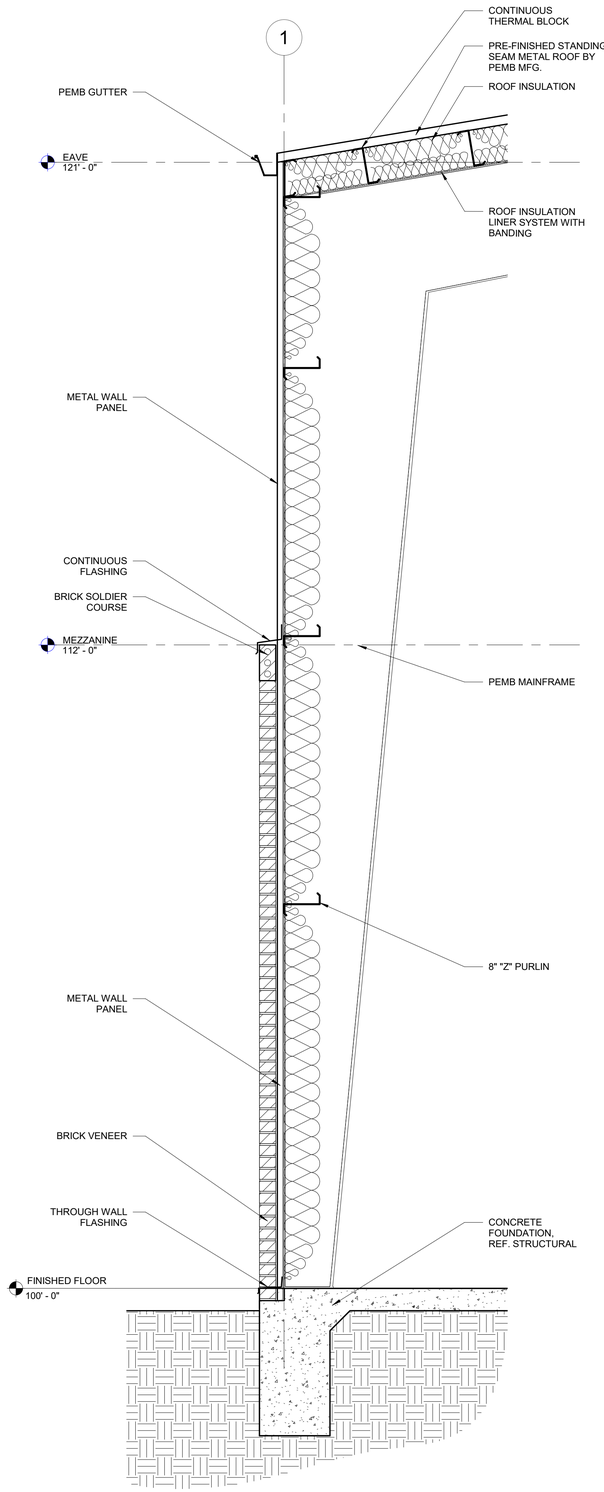
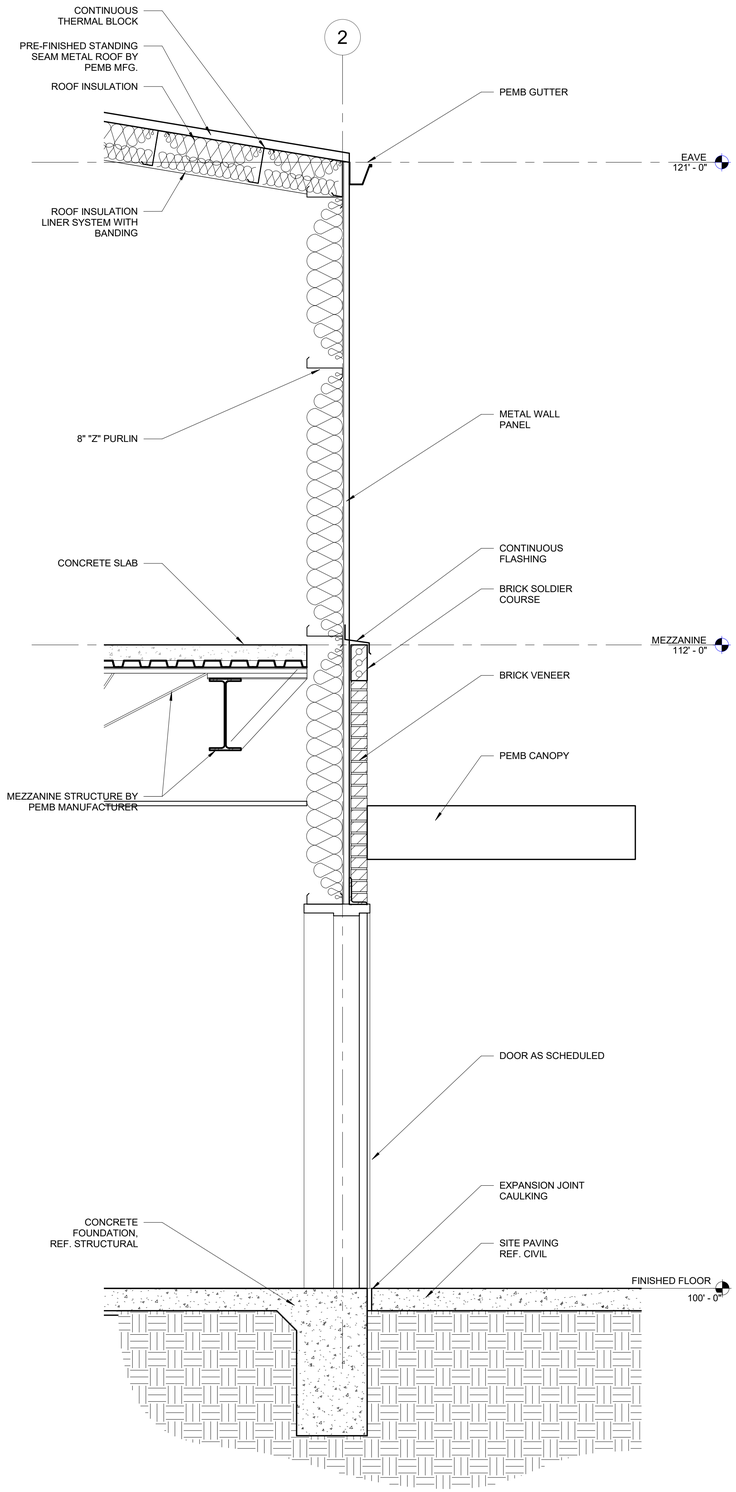
EXTERIOR ELEVATIONS

A3.1



WALL SECTION 2
SCALE: 3/4" = 1'-0" A4.1



WALL SECTION 1
SCALE: 3/4" = 1'-0" A4.1

REGISTERED ARCHITECT ANDREW P. OXLEY 22705 STATE OF TEXAS

19 DECEMBER 2018

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LAKE WORTH - RECORD STORAGE/ ANIMAL SERVICES

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WALL SECTIONS

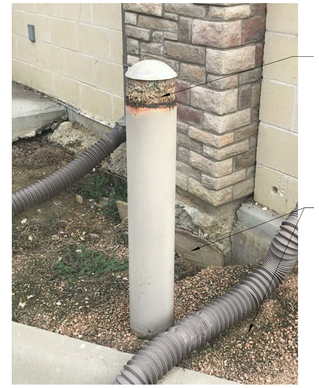
A4.1

GRIND BACK MORTAR JOINT 1/2". INJECT NEW MORTAR INTO CRACKS AND RE-POINT JOINTS TO MATCH EXISTING

REPLACE CRACKED CMU AS NECESSARY TO MAINTAIN STRUCTURAL INTEGRITY OF WALL

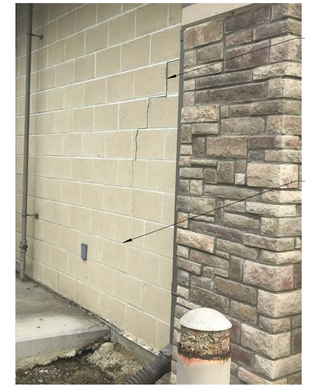
NOTE:
PAINT ALL EXTERIOR CMU COLOR TO BE SELECTED BY OWNER

REMOVE OLD PLYWOOD AND REGRADE EARTH TO DRAIN AWAY FROM BUILDING



CUT/GRIND DOWN CONCRETE ABOVE STEEL PIPE. PROVIDE A SMOOTH MOUNDED TOP AND PAINT TO MATCH PIPE.

REMOVE OLD PLYWOOD AND REGRADE EARTH TO DRAIN AWAY FROM BUILDING



GRIND BACK MORTAR JOINT 1/2". INJECT COLOR MATCHED MORTAR INTO EXISTING CRACKS AND RE-POINT JOINTS

REPLACE CRACKED CMU AS NECESSARY TO MAINTAIN STRUCTURAL INTEGRITY OF WALL

EXT. REPAIR - SOUTHEAST CORNER 2

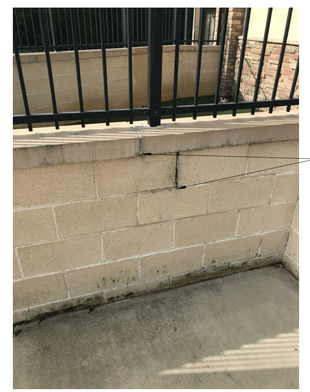
SCALE: NTS

CUT/GRIND DOWN CONCRETE ABOVE STEEL PIPE. PROVIDE A SMOOTH MOUNDED TOP AND PAINT TO MATCH PIPE.

REPAINT PIPE

EXT. REPAIR - BOLLARDS 7

SCALE: 12" = 1'-0"

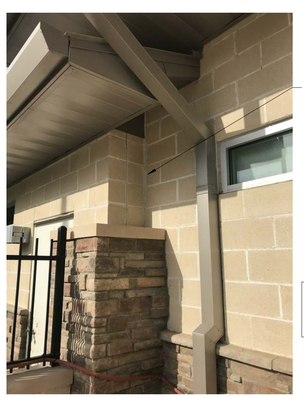


GRIND BACK MORTAR JOINT 1/2". INJECT NEW MORTAR INTO CRACKS AND RE-POINT JOINTS TO MATCH EXISTING

NOTE:
PAINT ALL EXTERIOR CMU COLOR TO BE SELECTED BY OWNER

EXT. REPAIR - LOW WALL 6

SCALE: 12" = 1'-0"

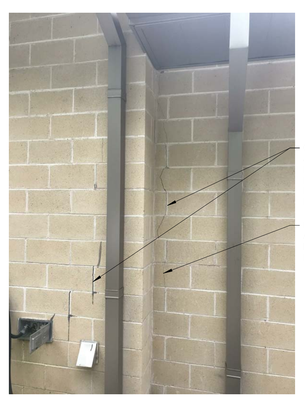


GRIND BACK MORTAR JOINT 1/2". INJECT NEW MORTAR INTO CRACKS AND RE-POINT JOINTS TO MATCH EXISTING

NOTE:
PAINT ALL EXTERIOR CMU COLOR TO BE SELECTED BY OWNER

EXT. REPAIR - EAST WALL 5

SCALE: 12" = 1'-0"

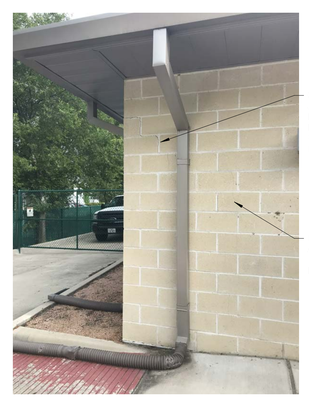


GRIND BACK MORTAR JOINT 1/2". INJECT NEW MORTAR INTO CRACKS AND RE-POINT JOINTS TO MATCH EXISTING

REPLACE CRACKED CMU AS NECESSARY TO MAINTAIN STRUCTURAL INTEGRITY OF WALL

EXT. REPAIR - WEST WALL 4

SCALE: 12" = 1'-0"

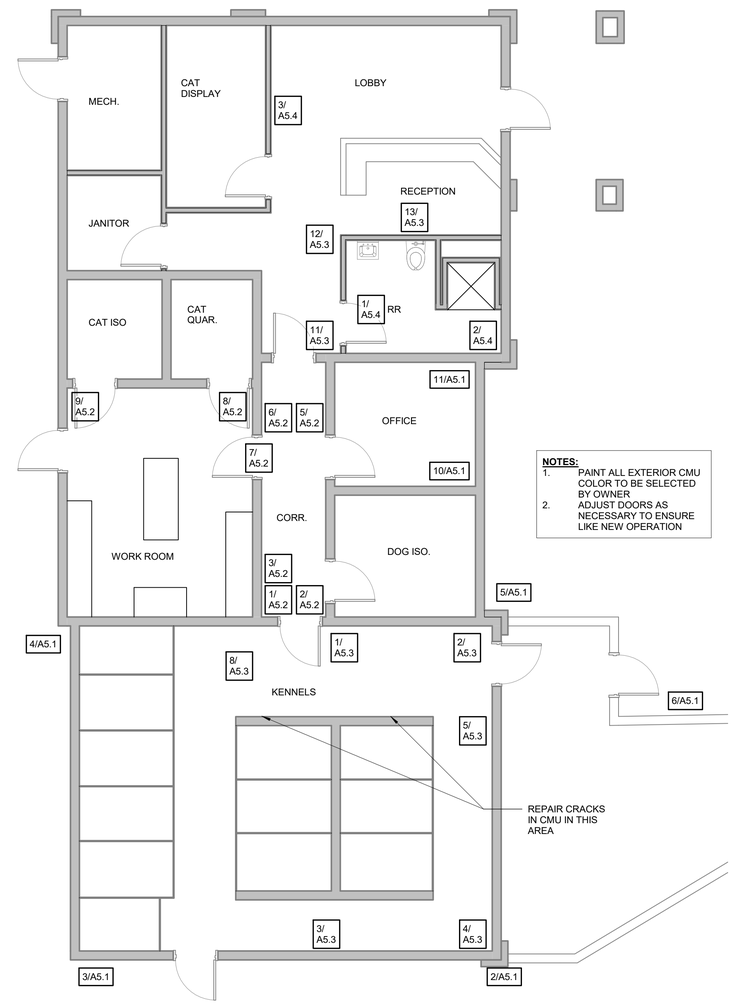


GRIND BACK MORTAR JOINT 1/2". INJECT NEW MORTAR INTO CRACKS AND RE-POINT JOINTS TO MATCH EXISTING

REPLACE CRACKED CMU AS NECESSARY TO MAINTAIN STRUCTURAL INTEGRITY OF WALL

EXT. REPAIR - SOUTHWEST CORNER 3

SCALE: 12" = 1'-0"



NOTES:
1. PAINT ALL EXTERIOR CMU COLOR TO BE SELECTED BY OWNER
2. ADJUST DOORS AS NECESSARY TO ENSURE LIKE NEW OPERATION

FLOOR PLAN - ANIMAL SERVICES REPAIR LOCATION KEY 1 / A5.1

SCALE: 3/16" = 1'-0"

REGISTERED ARCHITECT ANDREW P. OXLEY 22705 STATE OF TEXAS

19 DECEMBER 2018

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LAKE WORTH - RECORD STORAGE/ ANIMAL SERVICES

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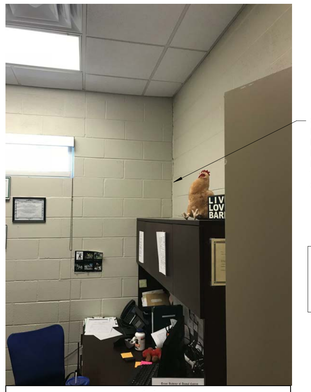
DECEMBER 19, 2018

EXTERIOR REPAIRS/ LOCATION KEY

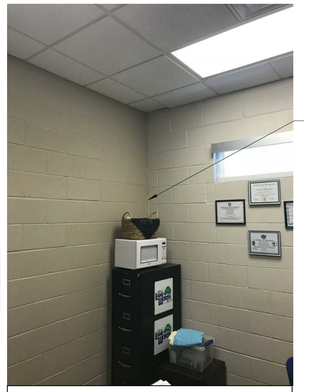
A5.1



11

GRIND BACK DAMAGED MORTAR JOINTS 1/2". INJECT MORTAR INTO EXISTING CRACKS AND RE-POINT JOINTS. PAINT TO MATCH EXISTING COLOR.

NOTE:
PAINT ALL INTERIOR CMU IN AREAS OF REPAIR. COLOR TO BE SELECTED BY OWNER.



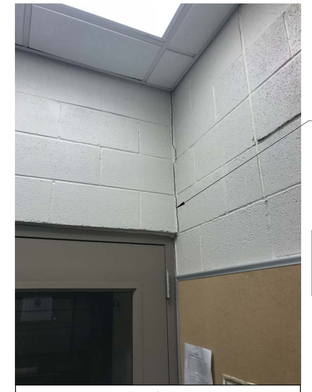
10

GRIND BACK DAMAGED MORTAR JOINTS 1/2". INJECT MORTAR INTO EXISTING CRACKS AND RE-POINT JOINTS. PAINT TO MATCH EXISTING COLOR.

INT. REPAIR - OFFICE

SCALE: 12" = 1'-0"

9



8

REPLACE CRACKED CMU AS NECESSARY TO MAINTAIN STRUCTURAL INTEGRITY OF WALL

GRIND BACK DAMAGED MORTAR JOINTS 1/2". INJECT MORTAR INTO EXISTING CRACKS AND RE-POINT JOINTS. PAINT TO MATCH EXISTING COLOR.

NOTE:
PAINT ALL INTERIOR CMU IN AREAS OF REPAIR. COLOR TO BE SELECTED BY OWNER.

7

INT. REPAIR - WORK ROOM

SCALE: 12" = 1'-0"

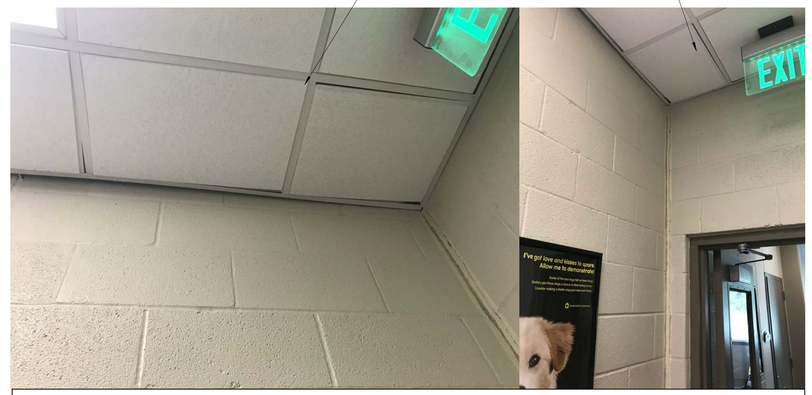
REPLACE CRACKED CMU AS NECESSARY TO MAINTAIN STRUCTURAL INTEGRITY OF WALL

7

GRIND BACK DAMAGED MORTAR JOINTS 1/2". INJECT MORTAR INTO EXISTING CRACKS AND RE-POINT JOINTS. PAINT TO MATCH EXISTING COLOR.

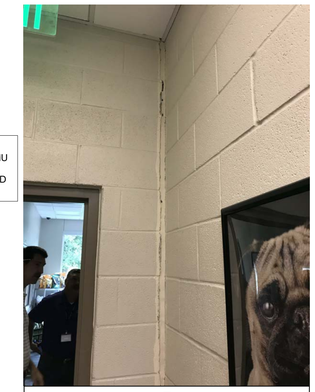
NOTE:
PAINT ALL INTERIOR CMU IN AREAS OF REPAIR. COLOR TO BE SELECTED BY OWNER.

REPLACE OR RE-CUT CEILING TILES AS NEEDED TO PROVIDE LIKE NEW INSTALLATION. RE-INSTALL GRID AS NEEDED FOR LIKE NEW INSTALLATION,



6

NOTE:
PAINT ALL INTERIOR CMU IN AREAS OF REPAIR. COLOR TO BE SELECTED BY OWNER.



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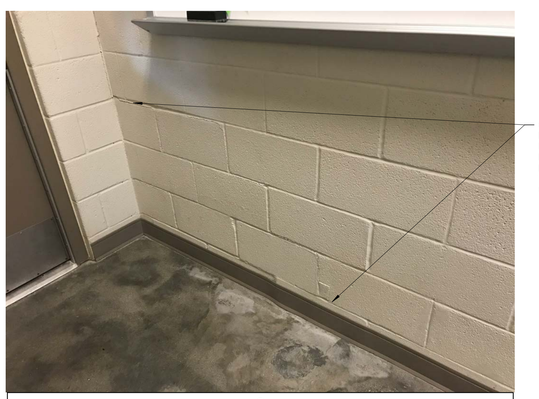
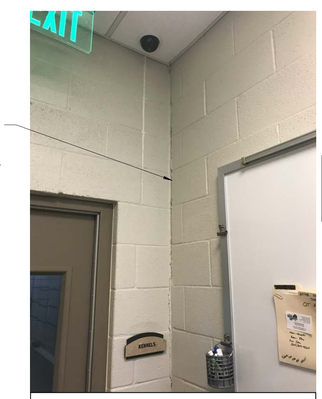


3

GRIND BACK DAMAGED MORTAR JOINTS 1/2". INJECT MORTAR INTO EXISTING CRACKS AND RE-POINT JOINTS. PAINT TO MATCH EXISTING COLOR.

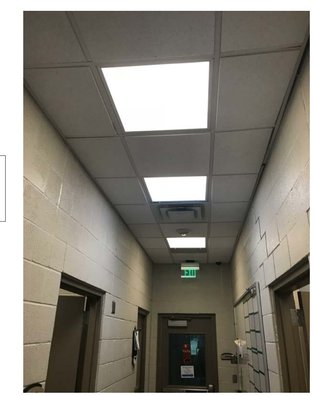
2

GRIND BACK DAMAGED MORTAR JOINTS 1/2". INJECT MORTAR INTO EXISTING CRACKS AND RE-POINT JOINTS. PAINT TO MATCH EXISTING COLOR.



1

NOTE:
PAINT ALL INTERIOR CMU IN AREAS OF REPAIR. COLOR TO BE SELECTED BY OWNER.



INT. REPAIR - HALLWAY

SCALE: 12" = 1'-0"

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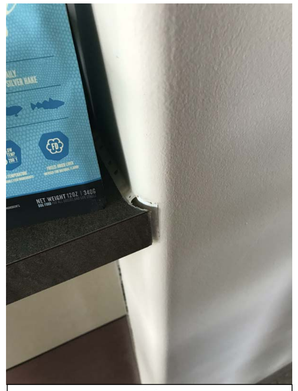
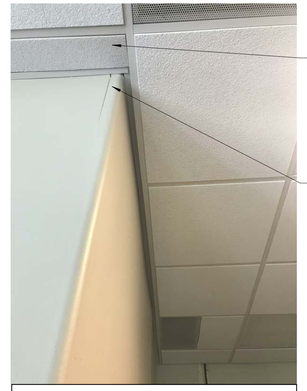
INTERIOR REPAIRS

A5.2



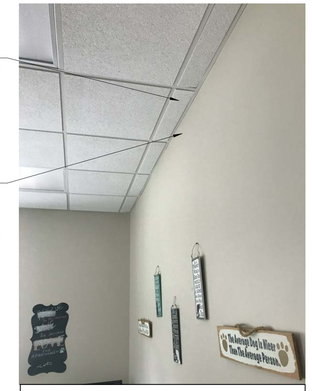
14



13

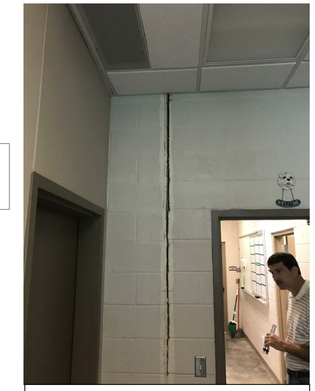
REPLACE OR RE-CUT CEILING TILES AS NEEDED TO PROVIDE LIKE NEW INSTALLATION.

REPLACE DAMAGED TAPING AND BEDDING. REPAIR CRACKS. INSPECT DRYWALL FOR DAMAGE AND REPLACE IF NECESSARY TO PROVIDE A LIKE NEW CONDITION.



12

NOTE:
PAINT ALL INTERIOR CMU IN AREAS OF REPAIR. COLOR TO BE SELECTED BY OWNER.



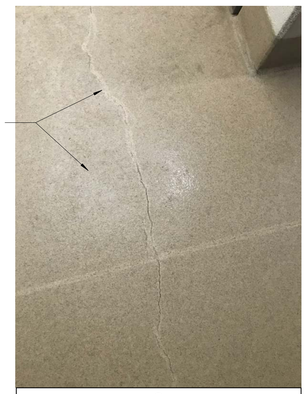
11

INT. REPAIR - ROOM 3

SCALE: 12" = 1'-0"

10

GRIND AND FILL ALL CRACKS IN FLOORING PER MANUFACTURERS RECOMMENDATIONS. PREPARE OVERALL SURFACE PER MANUFACTURERS SPECIFICATIONS FOR RE-COATING EPOXY FLOORING. RE-SURFACE ENTIRE FLOOR.



9

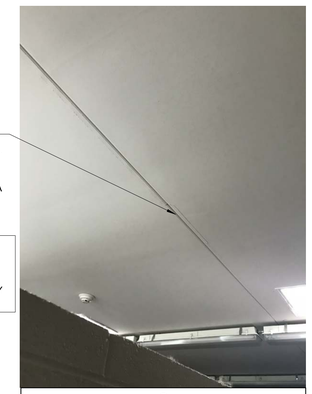
GRIND AND FILL ALL CRACKS IN FLOORING PER MANUFACTURERS RECOMMENDATIONS. PREPARE OVERALL SURFACE PER MANUFACTURERS SPECIFICATIONS FOR RE-COATING EPOXY FLOORING. RE-SURFACE ENTIRE FLOOR.

8

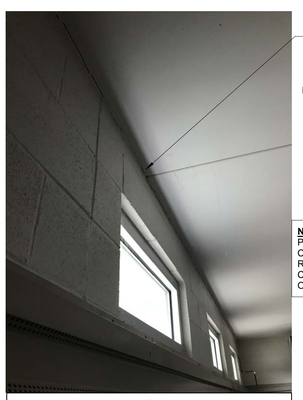
7

REPLACE DAMAGED TAPING AND BEDDING. REPAIR CRACKS. INSPECT DRYWALL FOR DAMAGE AND REPLACE IF NECESSARY TO PROVIDE A LIKE NEW CONDITION.

NOTE:
PAINT ALL GYPSUM BOARD CEILINGS IN AREAS OF REPAIR. COLOR TO BE SELECTED BY OWNER.



6



5

REPLACE DAMAGED TAPING AND BEDDING. REPAIR CRACKS. INSPECT DRYWALL FOR DAMAGE AND REPLACE IF NECESSARY TO PROVIDE A LIKE NEW CONDITION.

NOTE:
PAINT ALL GYPSUM BOARD CEILINGS IN AREAS OF REPAIR. COLOR TO BE SELECTED BY OWNER.

4

GRIND BACK MORTAR JOINT 1/2". INJECT MORTAR INTO EXISTING CRACKS AND RE-POINT JOINTS. PAINT TO MATCH EXISTING COLOR.

NOTE:
PAINT ALL INTERIOR CMU IN AREAS OF REPAIR. COLOR TO BE SELECTED BY OWNER.

3

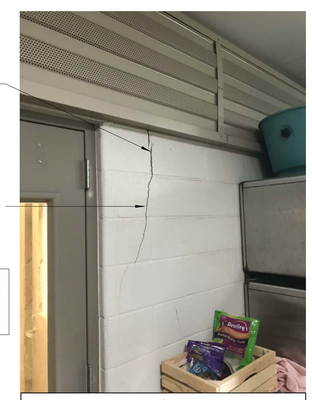
REPLACE CRACKED CMU AS NECESSARY TO MAINTAIN STRUCTURAL INTEGRITY OF WALL

2

GRIND BACK MORTAR JOINT 1/2". INJECT MORTAR INTO EXISTING CRACKS AND RE-POINT JOINTS. PAINT TO MATCH EXISTING COLOR.

REPLACE CRACKED CMU AS NECESSARY TO MAINTAIN STRUCTURAL INTEGRITY OF WALL

NOTE:
PAINT ALL INTERIOR CMU IN AREAS OF REPAIR. COLOR TO BE SELECTED BY OWNER.



1

INT. REPAIR - KENNEL

SCALE: 12" = 1'-0"

REGISTERED ARCHITECT ANDREW P. OXLEY 22705 STATE OF TEXAS

19 DECEMBER 2018

Revision Schedule		
Rev. #	Revision Description	Revision Date

OWT ARCHITECTS

509 PECAN STREET
SUITE 100
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www.owtarchitects.com

LAKE WORTH - RECORD STORAGE/ ANIMAL SERVICES

3805 ADAM GRUBB ST.
LAKE WORTH, TX 76135

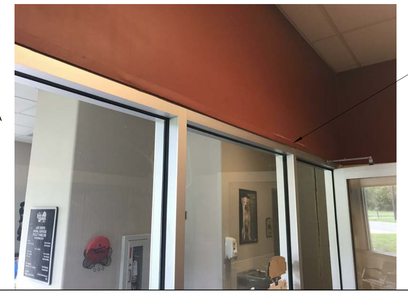
2018.019.00
DECEMBER 19, 2018

INTERIOR REPAIRS

A5.3

CONTRACTOR TO INSPECT STOREFRONT FOR DAMAGE FROM WALL MOVEMENT. REINSTALL IF NECESSARY TO REMOVE WARPING AND STRESS ON GLASS.

REPLACE DAMAGED TAPING AND BEDDING. INSPECT DRYWALL FOR DAMAGE AND REPLACE IF NECESSARY TO PROVIDE A LIKE NEW CONDITION.

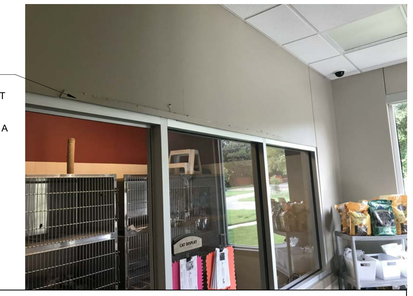


REPLACE DAMAGED TAPING AND BEDDING. REPAIR CRACKS. INSPECT DRYWALL FOR DAMAGE AND REPLACE IF NECESSARY TO PROVIDE A LIKE NEW CONDITION.

NOTE:
PAINT ALL GYPSUM BOARD WALLS IN AREAS OF REPAIR. COLOR TO BE SELECTED BY OWNER.

NOTE:
PAINT ALL INTERIOR CMU IN AREAS OF REPAIR. COLOR TO BE SELECTED BY OWNER.

REPLACE DAMAGED TAPING AND BEDDING. REPAIR CRACKS. INSPECT DRYWALL FOR DAMAGE AND REPLACE IF NECESSARY TO PROVIDE A LIKE NEW CONDITION.



3

INT. REPAIR - LOBBY

SCALE: 12" = 1'-0"

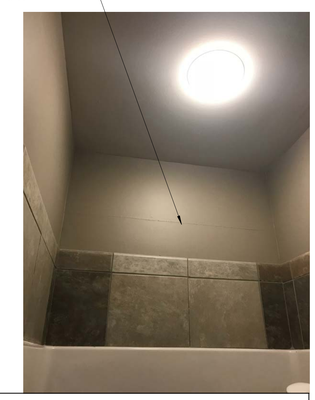
NOTE:
PAINT ALL GYPSUM BOARD CEILINGS IN AREAS OF REPAIR. COLOR TO BE SELECTED BY OWNER.

NOTE:
PAINT ALL INTERIOR CMU IN AREAS OF REPAIR. COLOR TO BE SELECTED BY OWNER.

REPLACE DAMAGED TAPING, BEDDING AND CONTROL JOINTS. REPAIR CRACKS. INSPECT DRYWALL FOR DAMAGE AND REPLACE IF NECESSARY TO PROVIDE A LIKE NEW CONDITION.

REMOVE ANY LOOSE OR BROKEN TILES. REINSTALL TILE AS NECESSARY TO RE-ALIGN GROUTLINES. USE COLOR MATCHED GROUT.

GRIND BACK MORTAR JOINT 1/2". INJECT MORTAR INTO EXISTING CRACKS AND RE-POINT JOINTS. PAINT TO MATCH EXISTING COLOR.



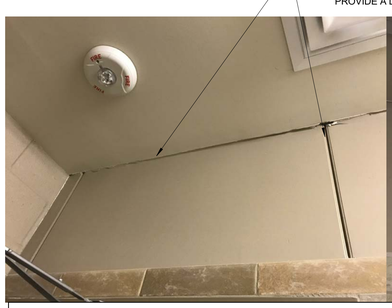
2

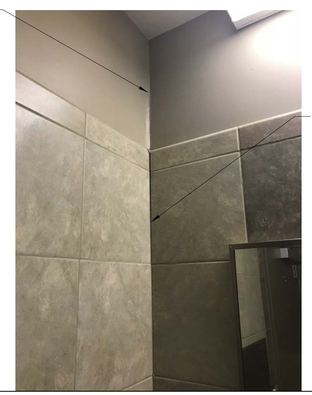
NOTE:
PAINT ALL GYPSUM BOARD CEILINGS IN AREAS OF REPAIR. COLOR TO BE SELECTED BY OWNER.

NOTE:
PAINT ALL INTERIOR CMU IN AREAS OF REPAIR. COLOR TO BE SELECTED BY OWNER.

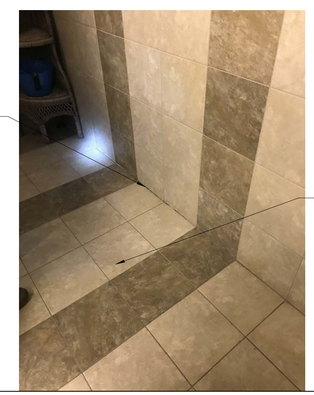
REPLACE DAMAGED TAPING, BEDDING AND CONTROL JOINTS. INSPECT DRYWALL FOR DAMAGE AND REPLACE IF NECESSARY TO PROVIDE A LIKE NEW CONDITION.

REPLACE DAMAGED TAPING, BEDDING AND CONTROL JOINTS. INSPECT DRYWALL FOR DAMAGE AND REPLACE IF NECESSARY TO PROVIDE A LIKE NEW CONDITION.



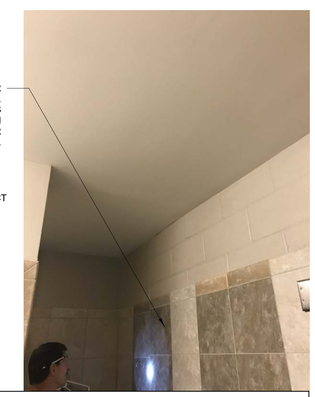


REMOVE ALL GROUT ALONG CRACKED AND SEPARATED LINES. RE-PLACE WITH A COLOR MATCHED GROUT FOR A LIKE NEW APPEARANCE.



REMOVE ANY LOOSE OR BROKEN TILES. REINSTALL TILE AS NECESSARY TO RE-ALIGN GROUTLINES. USE COLOR MATCHED GROUT.

CONTRACTOR TO INSPECT FLOOR FOR AND ISSUES WITH TRIPPING HAZARDS AND ADA COMPLIANCE. REPLACE FLOOR TILE IF NECESSARY TO PROVIDE A LEVEL SURFACE.



1

INT. REPAIR - BATHROOM

SCALE: 12" = 1'-0"

REGISTERED ARCHITECT ANDREW P. OXLEY 22705 STATE OF TEXAS

19 DECEMBER 2018

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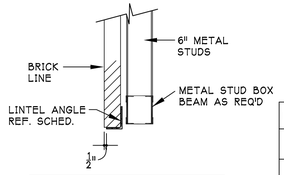
INTERIOR REPAIRS

A5.4

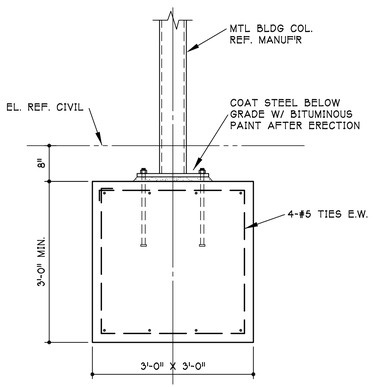


LOOSE BRICK LINTEL SCHEDULE	
LINTEL SIZE	OPENING WIDTH (MAX.)
L6X3 1/2 X 5/16	TO 5'-2"
L6X3 1/2 X 3/8	5'-2" TO 8'-1"

1 TYPICAL LOOSE BRICK LINTEL

NO SCALE STL-DTL16

NOTE:
LOOSE LINTEL ANGLE SHALL BE USED ONLY AT OPENINGS LESS THAN SHOWN ABOVE. AT LARGER OPENINGS, MASONRY SHALL BE STRUCTURALLY SUPPORTED. REF. PLANS.



2 ISOLATED COLUMN ON FOOTING

SCALE: 3/4"=1'-0" COL-PIER

STRUCTURAL GENERAL NOTES

I. DESIGN - -

1. BUILDING CODE - 2015 INTERNATIONAL BUILDING CODE
   ADDITIONAL DESIGN CODES (LATEST EDITION USED UNLESS NOTED OTHERWISE)
   A. "BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE", ACI 318
   B. "SPECIFICATION FOR THE DESIGN, FABRICATION AND ERECTION OF STRUCTURAL STEEL FOR BUILDINGS", AISC
   C. "SPECIFICATION FOR THE DESIGN OF STEEL HOLLOW STRUCTURAL SECTIONS", AISC
2. FLOOR LIVE LOAD
   A. GENERAL FLOOR 100 PSF
3. ROOF LIVE LOAD 20 PSF
4. GROUND SNOW LOAD 5 PSF
5. WIND LOAD
   A. BASIC WIND SPEED V_{ULT} =115 MPH V_{ASD} =89 MPH
   B. RISK CATEGORY II
   C. EXPOSURE CLASSIFICATION C
   D. DESIGN WIND PRESSURE (MWFRS IN PSF - ASD)
      HEIGHT 0 TO 25'
      1. PRIMARY STRUCTURE END =16.2, INT. =10.7
      2. ROOF UPLIFT PRESSURE END =19.5, INT. =13.5
   E. DESIGN WIND PRESSURE (COMPONENTS AND CLADDING IN PSF - ASD)
      HEIGHT 0 TO 25'
      1. WALLS
         INTERIOR ZONE 18.8 OR -20.4
         EXTERIOR ZONE 18.8 OR -25.3
      2. ROOF
         INTERIOR ZONE 10.0 OR -18.2
         EXTERIOR ZONE 10.0 OR -30.9
         CORNER ZONE 10.0 OR -46.5
      3. OVERHANGS -43.7
      4. WIDTH OF EDGE STRIP 6.5 FT.
6. EARTHQUAKE DESIGN DATA
   A. SEISMIC DESIGN CATAGORY A
   B. SPECIAL RESPONSE COEFFS. S_{DS} = 0.128, S_{D1} = 0.096
   C. SITE CLASS D
   D. SEISMIC FORCE RESISTING SYSTEM ORDINARY BRACED FRAME
   E. DESIGN BASE SHEAR 0.1W
   F. ANALYSIS PROCEDURE N.A.

II. FOUNDATION - -

1. THE FOUNDATION DESIGN IS BASED ON A SUBSURFACE EXPLORATION AND REPORT BY CMJ ENGINEERING INC., REPORT NO.419-18-04, DATED NOV. 1, 2018. THE CONCRETE SLAB-ON-GRADE DESIGN IS BASED ON POTENTIAL MOVEMENT OF THE SLAB AND FOUNDATION OF 1 INCH. IF THIS VALUE IS UNACCEPTABLE TO THE OWNER, THE FOUNDATION DESIGN MUST BE REVISED. THE FOLLOWING REQUIREMENTS ARE A SUMMARY OF THE RECOMMENDATIONS OF THE GEOTECHNICAL REPORT. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REVIEWING AND COMPLYING WITH THE ENTIRE REPORT.
2. CONCRETE BEAMS AND FOOTINGS ARE DESIGNED FOR AN ALLOWABLE BEARING PRESSURE OF 1,800 PSF FOUNDED IN PROPERLY PLACED AND COMPACTED, NON-EXPANSIVE SELECT FILL OVER CONDITIONED ON-SITE SOILS A GEOTECHNICAL ENGINEER SHALL VERIFY THAT SOILS OF THE DESIGN BEARING CAPACITY HAVE BEEN ENCOUNTERED, AND THE BUILDING PAD IS SUITABLE FOR CONSTRUCTION.
3. ALL SURFACE SOIL, VEGETATION, AND DEBRIS SHALL BE REMOVED, AND UNDERLYING SOILS REMOVED TO A MINIMUM DEPTH OF 6 FEET BELOW FINISHED PAD GRADE FOR THE AREA OF THE BUILDING PAD, AND EXTEND REMOVAL A MINIMUM OF 5 FEET BEYOND THE BUILDING PERIMETER LINE. EXCAVATION AND CONSTRUCTION SHALL BE PROVIDED FOR INCLUSION OF AN 8' HORIZONTAL, POLY MOISTURE BARRIER AS PER THE SOIL REPORT.
4. THE EXPOSED SUBGRADE SHALL BE SCARIFIED A DEPTH OF 8", MOISTURE CONDITIONED TO A MINIMUM OF +3% ABOVE OPTIMUM AND RE-COMPACTED TO BETWEEN 93% AND 98% OF ASTM D698 STANDARD PROCTOR DENSITY.
5. FILL TO WITHIN 12" OF FINISHED GRADE ELEVATION WITH A MINIMUM OF 4.5 FEET OF MOISTURE CONDITIONED ON-SITE SOILS. PLACE SOILS IN 9 INCH THICK LOOSE LIFTS AND COMPACT TO BETWEEN 93% TO 98% OF MAXIMUM DRY DENSITY AS DETERMINED BY ASTM D698 STANDARD PROCTOR. ON-SITE FILL SOILS SHALL BE MOISTURE CONDITIONED TO A MINIMUM OF +3% ABOVE OPTIMUM.
6. COMPLETE FILL OPERATIONS WITH A MINIMUM OF 1 FOOT OF SELECT FILL TO PROPER FINSHED GRADE ELEVATIONS. SELECT FILL SHALL BE PLACED IN 9" THICK LOOSE LIFTS AND COMPACTED TO A MINIMUM OF 95% OF MAXIMUM DRY DENSITY AS DETERMINED BY ASTM D698 STANDARD PROCTOR. SELECT FILL SOILS SHALL BE MOISTURE CONDITIONED TO BETWEEN -2% TO +3% ABOVE OPTIMUM.
7. SELECT FILL SHALL CONSIST OF INORGANIC, NON-EXPANSIVE SANDY CLAY MATERIAL WITH A PLASTICITY INDEX (PI) BETWEEN 5 AND 16, AND A LIQUID LIMIT LESS THAN 35; AND PLACED WITHIN 48 HOURS OF PLACMENT OF MOISTURE CONDITIONED SOILS. A GEOTECHNICAL ENGINEER SHALL VERIFY THAT THE SELECT FILL SOILS ARE APPROPRIATE FOR THIS APPLICATION.
8. THE CONCRETE SLAB SHALL BE PLACED OVER A CONTINUOUS 15 MIL. "STEGO" MEMBRANE VAPOR BARRIER OVER PROPERLY COMPACTED MOISTURE CONDITIONED SELECT FILL. LAP ALL VAPOR SEAMS 6 INCHES AND SEAL ALL LAPS AND PENETRATIONS WITH WATERPROOF TAPE.
9. THE EXTERIOR FACE OF ALL PERIMETER CAST-IN-PLACE CONCRETE BEAMS AND FOOTINGS SHALL BE FORMED FULL HEIGHT. EARTH FORMS SHALL BE PERMITTED AT INTERIOR, UNEXPOSED BEAM FACES AND INTERIOR RIB BEAMS CAST WITH THE SLAB.
10. CONCRETE BEAM AND FOOTING EXCAVATIONS SHALL BE REINFORCED AND CONCRETE FILLED AS SOON AS PRACTICAL TO PREVENT SOIL DESSICATION AND STANDING WATER WITHIN EXCAVATIONS.
11. ALL WALLS SHALL HAVE ADEQUATE TEMPORARY BRACING BEFORE BACKFILL IS PLACED AGAINST THEM. TEMPORARY BRACING MUST NOT BE REMOVED UNTIL WALLS ARE PERMANENTLY BRACED.

III. CONCRETE AND REINFORCING STEEL - -

1. CONCRETE SHALL BE PROPORTIONED TO MEET THE FOLLOWING REQUIREMENTS:

LOCATION	28 DAY COMPRESSIVE CYLINDER STRENGTH	MAXIMUM SLUMP	AGGREGATE TYPE	AGGREGATE MAX. SIZE
FOOTINGS	3000 PSI	6 INCHES	HARDROCK	1 INCH
CONCRETE BEAMS	3000 PSI	5 INCHES	HARDROCK	1 INCH
SLAB ON GRADE	3000 PSI	5 INCHES	HARDROCK	1 INCH

2. CONCRETE MIX DESIGNS FOR 3,000 PSI CONC. SHALL SHOW THE USE OF A MINIMUM OF 5 SACKS (470 LBS) OF CEMENTITIOUS MATERIAL.
3. ALL CONCRETE MIX DESIGNS SHALL BE PREPARED WITH TYPE 1 PORTLAND CEMENT MEETING ASTM C150. FLY ASH MEETING ASTM C618 TYPE C OR F MAY BE SUBSTITUTED FOR UP TO 25% BY WEIGHT OF CEMENTITIOUS MATERIAL.
4. UNLESS NOTED OTHERWISE, THE MINIMUM CONCRETE COVER FOR REINFORCEMENT SHALL BE AS FOLLOWS.
   3" FOR ALL CONCRETE CAST AGAINST AND IN CONTACT WITH EARTH.
   2" FOR SIDES AND BOTTOM OF CONCRETE BEAM, COLUMN, WALL CAST AGAINST FORMS AND IN CONTACT WITH EARTH.
   1 1/2" FOR CONCRETE BEAM AND COLUMN CAST AGAINST FORMS AND NOT IN CONTACT WITH EARTH.
   1" FOR CONCRETE SLAB AND WALL CAST AGAINST FORMS AND NOT IN CONTACT WITH EARTH.
5. REINFORCING STEEL SHALL BE ASTM A 615 GR 60. REINFORCING SHALL BE DETAILED AND FABRICATED IN ACCORDANCE WITH THE "DETAILS AND DETAILING OF CONCRETE REINFORCEMENT" (ACI 315). PLACING OF BARS AND BAR SUPPORTS SHALL CONFORM TO THE CRSI "MANUAL OF STANDARD PRACTICE". LAP ALL CONTINUOUS BARS (MARKED "CONT" ON PLANS) 40 BAR DIAMETERS. TOP BARS SHALL BE SPLICED AT MID-SPAN OF PIER OR FOOTING SUPPORTS. BOTTOM BARS SHALL BE LAP-SPLICED AT CENTERLINE OF PIER OR FOOTING SUPPORTS. PROVIDE CORNER BARS AT ALL CORNERS AND BEAM INTERSECTIONS.
6. WELDED WIRE FABRIC SHALL CONFORM TO ASTM A 185, GRADE 65. ALL WELDED WIRE FABRIC SHALL BE SUPPLIED IN FLAT SHEETS, NOT IN ROLLS.
7. REFER TO ARCHITECTURAL DRAWINGS FOR LOCATION OF ALL DRAINS, SLEEVES, RECESSES OR OPENINGS NOT SHOWN ON STRUCTURAL PLANS.
8. VERIFY LOCATION AND DEPTH OF FLOOR DEPRESSIONS WITH ARCHITECTURAL PLANS.
9. ALL EXTERIOR EXPOSED CONCRETE SHALL BE AIR-ENTRAINED. AIR CONTENT SHALL BE 3%-6%.
10. THE TESTING LABORATORY SHALL BE NOTIFIED AFTER THE STEEL REINFORCEMENT AND EMBEDS ARE POSITIONED PRIOR TO EACH CONCRETE PLACEMENT. NO CONCRETE SHALL BE PLACED UNTIL THESE ITEMS ARE CHECKED AND APPROVED BY THE TESTING LABORATORY.

V. STRUCTURAL STEEL - -

1. STRUCTURAL STEEL SHALL MEET THE FOLLOWING MINIMUM YIELD STRENGTHS AND SPECIFICATIONS:

	YIELD	ASTM
A. STRUCTURAL SHAPES	50 KSI	A992
B. PLATES AND BARS	36 KSI	A36
C. HOLLOW STRUCTURAL SECTIONS	46 KSI	A500 GRADE B
D. ANCHOR RODS	55 KSI	F1554 (HEADED ONLY)
E. HEADED STUD ANCHORS	60 KSI	A108

2. BOLTED CONNECTIONS OF PRIMARY MEMBERS SHALL CONFORM TO THE REQUIREMENTS OF THE A.I.S.C. "SPECIFICATION FOR STRUCTURAL JOINTS USING ASTM A-325 OR A-490 BOLTS" UNLESS NOTED OTHERWISE ALL PRIMARY CONNECTIONS WITH HIGH STRENGTH BOLTS SHALL USE ASTM A-325 BOLTS AND HEAVY HEX NUTS TIGHTENED TO "SNUG TIGHT" CONDITION OR "LOHR" TENSION CONTROL BOLTS. PROVIDE A MINIMUM OF 2 BOLTS PER CONNECTION.
3. ALL WELDED CONSTRUCTION SHALL MEET ANSI/AWS D1.1 STRUCTURAL WELDING CODE, LATEST REVISION. ELECTRODES SHALL BE E70XX SERIES FOR STRUCTURAL STEEL.
4. THE FABRICATOR SHALL BE RESPONSIBLE FOR THE DESIGN AND ADEQUACY OF ALL CONNECTIONS THAT ARE NOT DESIGNED OR FULLY DETAILED ON THE CONTRACT DOCUMENTS. BEAM CONNECTIONS SHALL BE DESIGNED TO SUPPORT A REACTION "R" EQUAL TO 60% THE TOTAL ALLOWABLE UNIFORM LOAD CAPACITY FOR A GIVEN SHAPE, SPAN, AND STEEL SPECIFICATION IN ACCORDANCE WITH THE AISC.
5. STEEL MEMBERS SHALL NOT BE SPLICED EXCEPT AS SHOWN ON THE DRAWINGS.
6. ALL STRUCTURAL STEEL NOT CONCEALED FROM VIEW MUST CONFORM TO "ARCHITECTURALLY EXPOSED STRUCTURAL STEEL" REQUIREMENTS OF THE AISC CODE OF STANDARD PRACTICE.
7. REFER TO ARCHITECTURAL DRAWINGS FOR LOCATIONS OF ALL AESS MEMBERS NOT FULLY DIMENSIONED ON STRUCTURAL DRAWINGS.
8. ALL GROUT UNDER BASE PLATES SHALL BE NON-SHRINK, NON-METALLIC, PRE-MIXED AND FLOWABLE.
9. ALL EXTERIOR STEEL EXPOSED TO WEATHER, INCLUDING LINTELS, SHALL BE GALVANIZED.

IX. CONSTRUCTION - -

1. THE CONTRACTOR SHALL PROVIDE TEMPORARY ERECTION BRACING AND SHORING OF ALL STRUCTURAL WORK AS REQUIRED FOR STABILITY OF THE STRUCTURE DURING ALL PHASES OF CONSTRUCTION. THE FRAMING SHALL BE TEMPORARILY BRACED BY THE CONTRACTOR UNTIL ALL BRACING AND DIAPHRAGMS HAVE BEEN INSTALLED AND ALL CONNECTIONS BETWEEN THESE ELEMENTS AND THE STRUCTURE HAVE BEEN MADE.
2. THE STRUCTURAL DRAWINGS AND SPECIFICATION'S REPRESENT THE FINISHED STRUCTURE. CONSTRUCTION MEANS AND METHODS, PROCEDURES AND SEQUENCES ARE THE RESPONSIBILITY OF THE CONTRACTOR. THE CONTRACTOR SHALL TAKE ALL NECESSARY MEANS TO MAINTAIN AND PROTECT THE STRUCTURAL INTEGRITY OF ALL CONSTRUCTION. ANY DEVIATION FROM THE CONTRACT DOCUMENTS WITHOUT PRIOR APPROVAL MUST BE CORRECTED BY OBTAINING THE SERVICES OF A TEXAS LICENSED PROFESSIONAL ENGINEER.
3. THE CONTRACTOR SHALL VERIFY AND BE RESPONSIBLE FOR ALL DIMINSIONS AND CONDITIONS AT THE SITE AND SHALL NOTIFY THE ENGINEER OF ANY DISCREPANCIES BETWEEN THE ACTUAL CONDITIONS AND INFORMATION SHOWN ON THE DRAWINGS BEFORE PROCEEDING WITH THE WORK.
4. THE STRUCTURAL DRAWINGS SHALL NOT BE SCALED FOR DETERMINATION OF QUANTITIES, LENGTHS, OR FIT OF MATERIALS.
5. CONSTRUCTION MATERIALS SHALL NOT BE STORED ON FLOORS OR ROOFS IN EXCESS OF THE DESIGN LIVE LOADS WHICH ARE INDICATED ON THE DRAWINGS. IT IS THE CONTRACTOR'S RESPONSIBILITY TO ENFORCE THIS REQUIREMENT. IMPACT SHALL BE AVOIDED WHEN PLACING MATERIALS ON FLOORS OR ROOFS.
6. COMPLETE SHOP DRAWINGS FOR THE STRUCTURAL WORK SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW PRIOR TO COMMENCEMENT OF CONSTRUCTION IN ACCORDANCE WITH THE SPECIFICATIONS. SUCH REVIEW BY THE ENGINEER DOES NOT RELIEVE THE CONTRACTOR OF FULL RESPONSIBILITY FOR CORRECT FABRICATION AND CONSTRUCTION OF THE WORK. METRO STRUCTURAL CONSULTANTS, INC. SHALL NOT BE RESPONSIBLE FOR MATERIALS PURCHASED PRIOR TO REVIEW OF SHOP DRAWINGS.
7. ANY DEVIATION FROM, ADDITION TO, SUBSTITUTION FOR, OR MODIFICATION TO THE STRUCTURE OR ANY PART OF THE STRUCTURE DETAILED ON THESE DRAWINGS SHALL BE SUBMITTED IN WRITING TO THE ENGINEER FOR REVIEW. SHOP DRAWINGS THAT ARE SUBMITTED FOR REVIEW DO NOT CONSTITUTE "IN-WRITING" UNLESS IT IS CLEARLY NOTED THAT SPECIFIC CHANGES ARE SUGGESTED.
8. THE CONTRACTOR SHALL REFER TO ARCHITECTURAL DRAWINGS FOR ELEVATIONS NOT SHOWN AND VERIFY FLOOR AND ROOF ELEVATIONS, AND EXACT LOCATIONS OF ALL ARCHITECTURAL DETAILS. THE CONTRACTOR SHALL COMPARE THE STRUCTURAL SECTIONS WITH THE ARCHITECTURAL SECTIONS AND REPORT ANY DISCREPANCIES IN TOP OF STEEL ELEVATIONS OR DETAILS TO THE ENGINEER PRIOR TO SUBMITTAL AND COMPLETION OF THE SHOP DRAWINGS.
9. REPRODUCTION OF THESE DESIGN DRAWINGS BY ANY CONTRACTOR OR SUBCONTRACTOR FOR USE AS SHOP DRAWINGS SHALL BE DEEMED AS ACCEPTANCE BY THAT PARTY THAT ALL INFORMATION SHOWN IS CORRECT AND THAT ANY ADDED JOB EXPENSE, WHETHER REAL OR IMPLIED, DUE TO ERRORS THAT MAY BE FOUND, SHALL BE THE RESPONSIBILITY OF THE PARTY USING THESE DOCUMENTS AS SHOP DWGS.
10. THE DETAILS DESIGNATED AS "TYPICAL DETAILS" APPLY GENERALLY TO THE DRAWINGS IN ALL AREAS WHERE CONDITIONS ARE SIMILAR TO THOSE DESCRIBED IN THE DETAILS.

X. PRE-MANUFACTURED METAL BUILDING NOTES - -

1. METAL BUILDING MANUFACTURER SHALL SUBMIT CALCULATIONS FOR REVIEW LISTING LOADS APPLIED, AND BUILDING CODES USED IN DESIGN. CALCULATIONS SHALL BE SEALED AND SIGNED BY A REGISTERED ENGINEER IN THE STATE OF TEXAS.
2. ROOF PURLIN AND FRAME DESIGN SHALL INCLUDE 5 PSF COLLATERAL ROOF LOAD, 20 PSF LIVE LOAD ON ROOF, SUPPORT FOR MECH. UNIT HEATERS, SPRINKLERS, MECH./ELEC. PIPING.
3. THE METAL BUILDING MANUFACTURER SHALL REFER TO MECHANICAL AND ELECTRICAL PLANS FOR LOCATIONS AND WEIGHTS OF EQUIPMENT AND PIPING TO BE SUSPENDED FROM ROOF STRUCTURE.
4. METAL BUILDING MANUFACTURER SHALL DESIGN AND PROVIDE FRAMING FOR STORAGE MEZZANINE INSIDE BUILDING. PROVIDE ALL FLOOR FRAMING, COLUMNS, AND LATERAL SUPPORTS AS REQUIRED FOR SUPPORT AND STABILITY. FLOOR MEMBER DESIGN SHALL INCLUDE 10 PSF DEAD LOAD FOR CEILINGS, LIGHTS, MISC. MECH./ELEC., AND 50 PSF LIVE LOAD.
5. THE METAL BUILDING MANUFACTURER SHALL PROVIDE A STRUCTURE CAPABLE OF SUPPORTING LOADS INDICATED IN GENERAL NOTES AS WELL AS APPLICABLE CODES WITH A MAXIMUM LATERAL DRIFT OF H/180.
6. CONTRACTOR SHALL COORDINATE FOUNDATION CONSTRUCTION WITH METAL BUILDING MANUF'R REQUIRED EMBEDS, ANCHOR BOLTS AND CONNECTIONS TO CONCRETE SLAB AND BEAMS.
7. MEMBER DEFLECTION FOR HORIZONTAL WIND BEAMS SHALL BE LIMITED AS FOLLOWS:

	THE LESSER OF
HORIZ. WIND BEAM/GIRT SUPPORTING MASONRY	L/480, 3/4" MAX.
HORIZ. WIND BEAM/GIRT AT MTL PANEL	L/180, 1 3/4" MAX.

8. THE GENERAL CONTRACTOR SHALL EMPLOY THE ENGINEER OF RECORD OR AN ALTERNATIVE REGISTERED ENGINEER IN THE STATE OF TEXAS TO DESIGN AND PROVIDE THE ANCHOR BOLT LENGTHS FOR THE METAL BUILDING ANCHOR BOLTS BASED ON COLUMN BASE REACTIONS SUPPLIED BY THE METAL BUILDING MANUFACTURER.

REBAR CONVERSION CHART (SOFT METRIC)	
STANDARD BAR SIZE	MILLIMETER BAR SIZE
#3	10MM
#4	13MM
#5	16MM
#6	19MM
#7	22MM
#8	25MM
#9	29MM
#10	32MM
#11	35MM

METRO STRUCTURAL CONSULTANTS
305 NE LOOP 820 SUITE 507
HURST,TX 76053 (817)284-8833
MSC JOB # 18051 ENGINEER: PTL
TBPE FIRM #3489

STATE OF TEXAS
P.T. LUNDSTROM, JR.
59965
REGISTERED PROFESSIONAL ENGINEER
12-18-2018
MSC, INC.
F-3489

REVISIONS

LAKE WORTH - RECORD STORAGE/ ANIMAL SERVICES

3805 ADAM GRUBB ST.
LAKE WORTH, TX 76135

2018.019.00
DECEMBER 18, 2018

GENERAL NOTES TYPICAL DETAILS

S0.1

REQUIRED SPECIAL INSPECTIONS AND TESTS OF SOILS

TYPE	INSPECTION FREQUENCY
1. VERIFY MATERIALS BELOW SHALLOW FOUNDATIONS ARE ADEQUATE TO ACHIEVE THE DESIGN BEARING CAPACITY.	PERIODIC
2. VERIFY EXCAVATIONS ARE EXTENDED TO PROPER DEPTH AND HAVE REACHED PROPER MATERIAL.	PERIODIC
3. PERFORM CLASSIFICATION AND TESTING OF COMPACTED FILL MATERIALS.	PERIODIC
4. VERIFY USE OF PROPER MATERIALS, DENSITIES AND LIFT THICKNESSES DURING PLACEMENT AND COMPACTION OF FILL.	CONTINUOUS
5. PRIOR TO PLACEMENT AND COMPACTION OF FILL, INSPECT SUBGRADE AND VERIFY THE SITE HAS BEEN PROPERLY PREPARED.	PERIODIC

REQUIRED SPECIAL INSPECTIONS AND TESTS OF CONCRETE CONSTRUCTION

TYPE	INSPECTION FREQUENCY	REFERENCED STANDARD	IBC REFERENCE
1. INSPECT REINFORCING STEEL, INCLUDING PRESTRESSING TENDONS, AND VERIFY PLACEMENT.	PERIODIC	ACI 318: Ch. 20, 25.2, 25.3, 26.6.1-26.6.3	1908.4
2. REINFORCING BAR WELDING a. VERIFY WELDABILITY OF REINFORCING BARS OTHER THAN ASTM A706 b. INSPECT ALL WELDS	 PERIODIC CONTINUOUS	 AWS D1.4 ACI 318: 26.6.4	
3. INSPECT ANCHORS CAST IN CONCRETE.	PERIODIC	ACI 318: 17.8.2	
4. INSPECT ANCHORS POST-INSTALLED IN HARDENED CONCRETE MEMBERS a. ADHESIVE ANCHORS INSTALLED IN HORIZONTALLY OR UPWARDLY INCLINED ORIENTATIONS TO RESIST SUSTAINED TENSION LOADS b. MECHANICAL AND ADHESIVE ANCHORS NOT DEFINED IN 4.a.	 CONTINUOUS PERIODIC	 ACI 318: 17.8.2.4 ACI 318: 17.8.2	
5. VERIFY USE OF REQURIED MIX DESIGN.	PERIODIC	ACI 318: Ch. 19, 26.4.3, 26.4.4	1904.1,1904.2, 1908.2, 1908.3
6. PRIOR TO CONCRETE PLACEMENT, FABRICATE SPECIMENS FOR FOR STRENGTH TESTS, PERFORM SLUMP AND AIR CONTENT TESTS, AND DETERMINE THE CONCRETE TEMPERATURE.	CONTINUOUS	ASTM C172, ASTM C31, ACI 318: 26.4, 26.12	1908.10
7. INSPECT CONCRETE AND SHOTCRETE PLACEMENT FOR PROPER APPLICATION TECHNIQUES.	CONTINUOUS	ACI 318: 26.5	1908.6, 1908.7, 1908.8
8. VERIFY MAINTAINANCE OF SPECIFIED CURING TEMPERATURE AND TECHNIQUES. 9. VERIFY IN-SITU CONCRETE STRENGTH, PRIOR TO STRESSING OF TENDONS IN POST-TENSIONED CONCRETE AND PRIOR TO REMOVAL OF SHORES AND FORMS FROM BEAM AND STRUCTURAL SLABS.	PERIODIC PERIODIC	ACI 318: 26.5.3-26.5.5 ACI 318: 26.11.2	1908.9
10. INSPECT FORMWORK FOR SHAPE, LOCATION AND DIMENSIONS OF THE CONCRETE MEMBER BEING FORMED.	PERIODIC	ACI 318: 26.11.1.2(b)	

1 SPECIAL INSPECTIONS
NO SCALE SPIN-15

REQUIRED SPECIAL INSPECTIONS AND TESTS OF STEEL CONSTRUCTION

TYPE	INSPECTION FREQUENCY	REFERENCED STANDARD
1. MATERIAL VERIFICATION OF HIGH-STRENGTH BOLTS, NUTS, WASHERS:		
a. IDENTIFICATION MARKINGS TO CONFORM TO ASTM STANDARDS SPECIFIED IN THE APPROVED CONTRACT DOCUMENTS.	PERIODIC	ASTM 360, Section A3.3 and applicable ASTM material standards
b. MANUFACTURER'S CERTIFICATE OF COMPLIANCE REQUIRED.	PERIODIC	
2. INSPECTION OF HIGH-STRENGTH BOLTING:		
a. SNUG-TIGHT JOINTS.	PERIODIC	AISC 360, Section M2.5
b. PRETENSIONED AND SLIP-CRITICAL JOINTS USING TURN-OF-NUT WITH MATCHMAKING, TWIST-OFF BOLT OR DIRECT TENSION INDICATOR METHODS OF INSTALLATION.	PERIODIC	
3. MATERIAL VERIFICATION OF STRUCTURAL STEEL AND COLD-FORMED STEEL DECK:		
a. FOR STRUCTURAL STEEL, IDENTIFICATION MARKINGS TO CONFORM TO AISC 360.	PERIODIC	AISC 360, Section M5.5
b. FOR COLD-FORMED STEEL DECK, IDENTIFICATION MARKINGS TO CONFORM TO THE STEEL DECK INSTITUTE [SDI].	PERIODIC	SDI
c. MANUFACTURER'S CERTIFIED TEST REPORTS.	PERIODIC	
4. MATERIAL VERIFICATION OF WELD FILLER MATERIALS:		
a. IDENTIFICATION MARKINGS TO CONFORM TO AWS SPECIFICATION IN THE APPROVED CONSTRUCTION DOCUMENTS.	PERIODIC	AISC 360, Section A3.5 and applicable AWS A5 documents.
5. INSPECTION OF WELDING:		
a. STRUCTURAL STEEL AND COLD-FORMED DECK: 1) COMPLETE AND PARTIAL JOINT PENETRATION GROOVE WELDS 2) MULTIPASS FILLET WELDS 3) SINGLE-PASS FILLET WELDS > 5/16" 4) PLUG AND SLOT WELDS 5) SINGLE-PASS FILLET WELDS <= 5/16" 6) FLOOR AND ROOF DECK WELDS	 CONTINUOUS CONTINUOUS CONTINUOUS CONTINUOUS PERIODIC PERIODIC	 AWS D1.1 AWS D1.3
6. INSPECTION OF STEEL FRAME JOINT DETAILS FOR COMPLIANCE:		
a. DETAILS SUCH AS BRACING AND STIFFENING	PERIODIC	
b. MEMBER LOCATIONS	PERIODIC	
c. APPLICATION OF JOINT DETAILS AT EACH CONNECTION	PERIODIC	

ADDITIONAL SPECIAL INSPECTION REQUIREMENTS:

- ADDITIONAL SPECIAL INSPECTIONS REQUIRED BY THE OPINION OF THE BUILDING OFFICIAL SHALL BE PERFORMED.
- COORDINATION OF SPECIAL INSPECTIONS WITH CONSTRUCTION OF THE INSPECTED ITEMS SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
- IF SPECIAL INSPECTION IS WAIVED BY THE AUTHORITY HAVING JURISDICTION, THE GENERAL CONTRACTOR SHALL PROVIDE THE ENGINEER OF RECORD WITH A COPY OF THE WRITTEN EXEMPTION FOR EACH ITEM THAT HAS BEEN WAIVED.
- THE BUILDING OFFICIAL MAY PERFORM INSPECTIONS IN ADDITION TO AND/OR CONCURRENTLY WITH THE REQUIRED SPECIAL INSPECTIONS OUTLINED IN THE TABLES.
- THE GENERAL CONTRACTOR IS RESPONSIBLE FOR IMPLEMENTING A QUALITY CONTROL PROGRAM. THE QUALITY CONTROL PROGRAM IS IN ADDITION TO THE SPECIAL INSPECTION REQUIREMENTS AND MUST MEET OR EXCEED THOSE RESPONSIBILITIES REQUIRED AS PART OF THE CONTRACT DOCUMENTS AND SPECIFICATIONS.

STATE OF TEXAS
P.T. LUNDSTROM, JR.
59965
REGISTERED PROFESSIONAL ENGINEER
12-18-2018
MSC, INC.
F-3489

REVISIONS

LAKE WORTH - RECORD STORAGE/ ANIMAL SERVICES

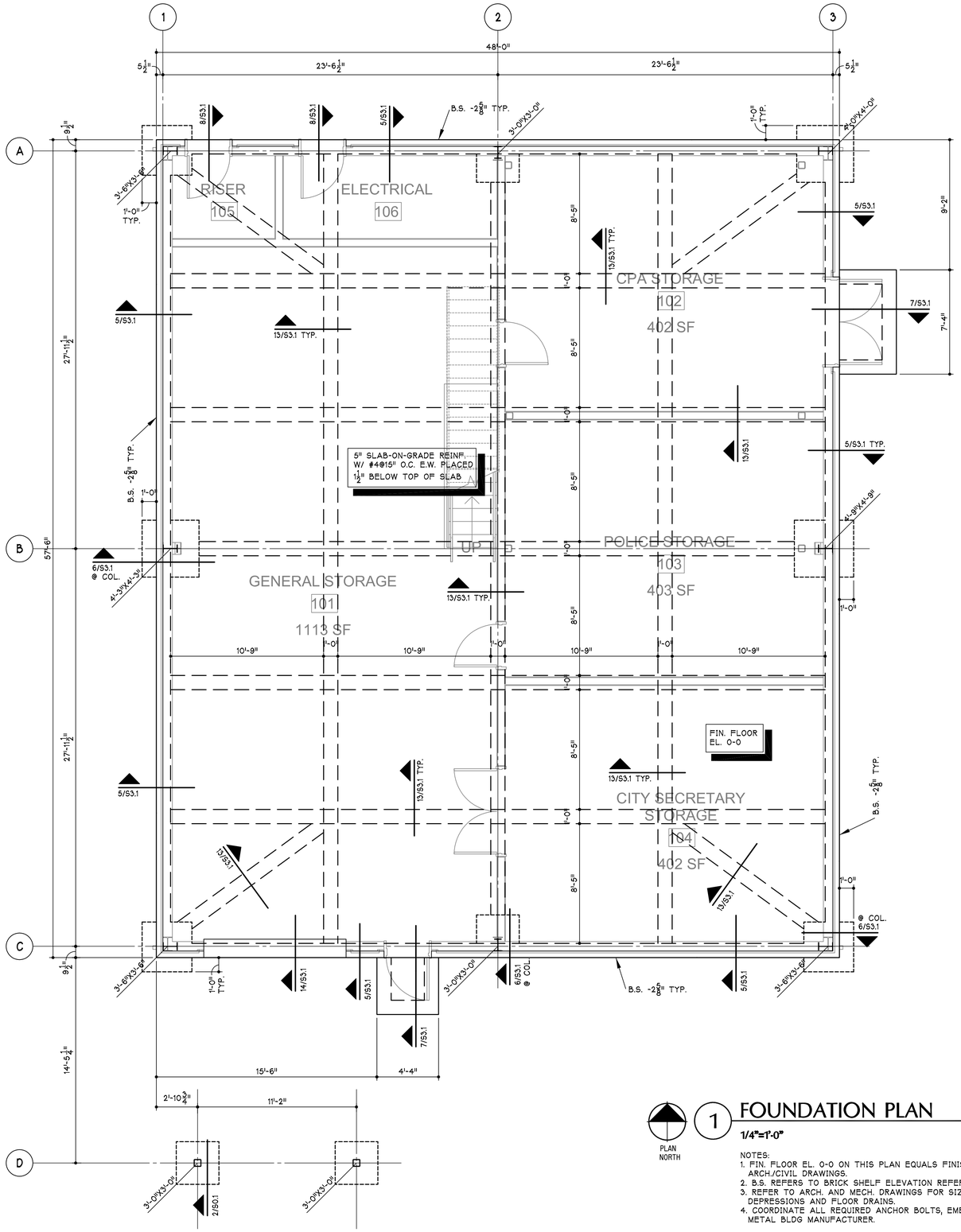
3805 ADAM GRUBB ST.
LAKE WORTH, TX 76135

2018.019.00
DECEMBER 18, 2018

SPECIAL INSPECTIONS

S0.2

METRO STRUCTURAL CONSULTANTS
305 NE LOOP 820 SUITE 507
HURST,TX 76053 (817)284-8833
MSC JOB # 18051 ENGINEER: PTL
TBPE FIRM #3489



1 FOUNDATION PLAN

1/4"=1'-0"

PLAN NORTH

NOTES:
1. FIN. FLOOR EL. 0-0 ON THIS PLAN EQUALS FINISHED FLOOR ELEVATION ON ARCH./CIVIL DRAWINGS.
2. B.S. REFERS TO BRICK SHELF ELEVATION REFERENCED FROM FIN. FLOOR EL. 0-0.
3. REFER TO ARCH. AND MECH. DRAWINGS FOR SIZE AND LOCATIONS OF SLAB DEPRESSIONS AND FLOOR DRAINS.
4. COORDINATE ALL REQUIRED ANCHOR BOLTS, EMBEDS, AND FRAMING W/ METAL BLDG MANUFACTURER.

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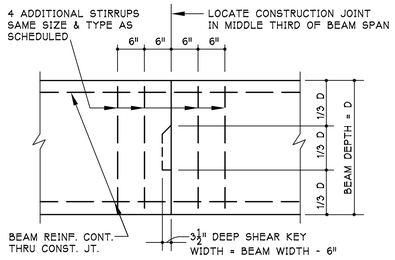
FOUNDATION PLAN

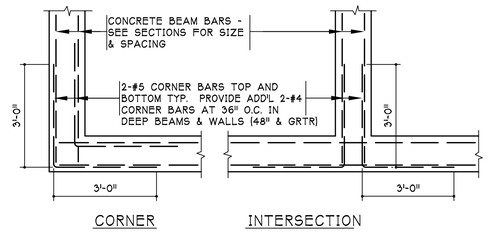
S1.1



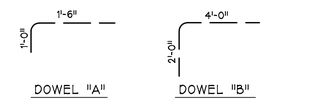
NOTES: 1. CONSTRUCTION JOINTS SHALL NOT OCCUR IN ANY END SPAN OR SINGLE SPAN CONDITION.

ELEVATION OF CONSTRUCTION JOINT AT BEAM

1 TYPICAL DETAIL
NO SCALE 027-CON2

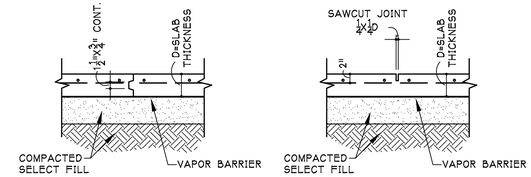


2 TYPICAL DETAIL CONCRETE BEAM CORNER BARS
NO SCALE 027-CON11



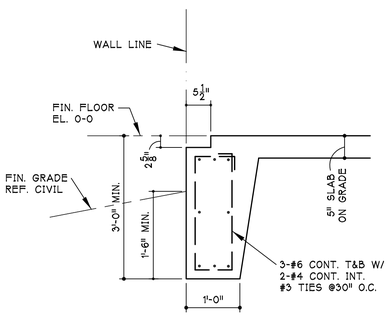
NOTES:
1. #3 BARS UNLESS NOTED OTHERWISE.
2. SPACE DOWELS @ 12" O.C. UNLESS NOTED OTHERWISE.
3. PROVIDE MINIMUM RADIUS NOT LESS THAN 1 BAR DIA.

3 TYPICAL DETAIL CONCRETE DOWELS
NO SCALE 027-CON9

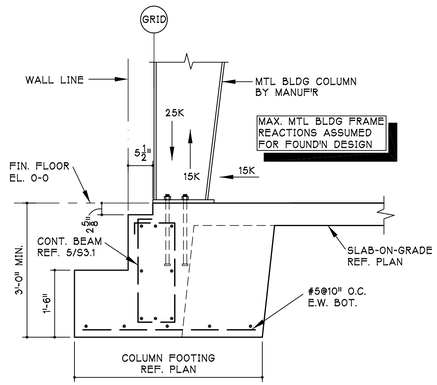


TYP. FORMED JOINT TYP. SAWCUT JOINT

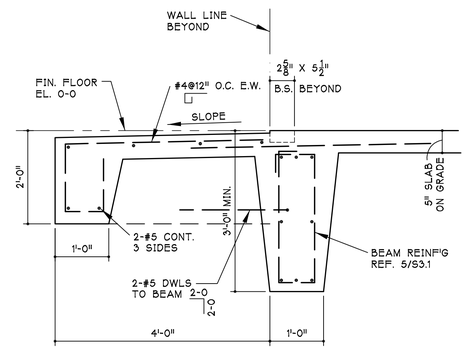
4 TYPICAL DETAIL
SCALE: 3/4"=1'-0" SECT7



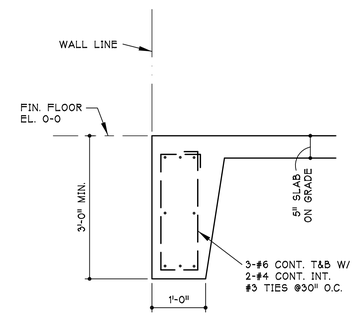
5 SECTION
SCALE: 3/4"=1'-0" FDN4



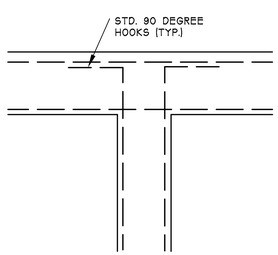
6 SECTION (TYP. EXTERIOR COLUMN FOOTING)
SCALE: 3/4"=1'-0" 083CON5



7 SECTION
SCALE: 3/4"=1'-0" 083CON8

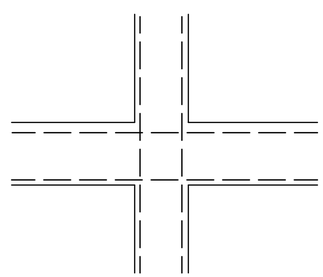


8 SECTION
SCALE: 3/4"=1'-0" CONCMU3

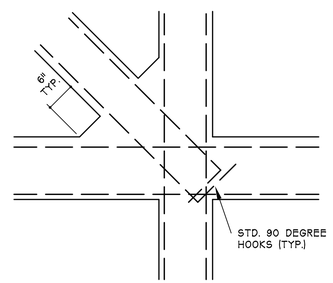


REINFORCING SHOWN APPLIES TO TOP & BOT. BARS

9 PLAN EXTERIOR INTERSECTION
NO SCALE 00052-DTL-K

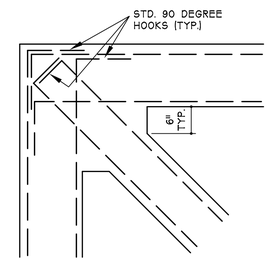


10 PLAN INTERSECTION
NO SCALE DL8



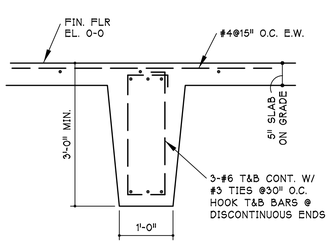
REINFORCING SHOWN APPLIES TO TOP & BOT. BARS

11 PLAN INTERIOR INTERSECTION
NO SCALE DL5

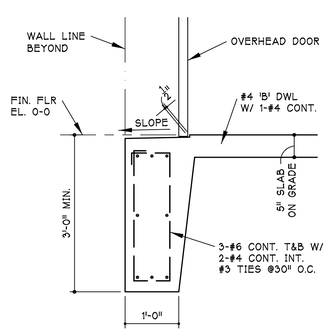


REINFORCING SHOWN APPLIES TO TOP & BOT. BARS

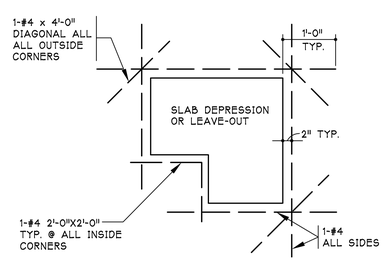
12 PLAN CORNER
NO SCALE DL7



13 TYP. INTERIOR RIB BEAM
SCALE: 3/4"=1'-0" FDTN3F



14 SECTION
SCALE: 3/4"=1'-0" FWC12



15 TYPICAL DETAIL SLAB DEPRESSION OR SLAB LEAVE-OUT
NO SCALE CON27

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REVISIONS

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LAKE WORTH, TX 76135

2018.019.00
DECEMBER 18, 2018

CONCRETE SECTIONS

S3.1

MECHANICAL GENERAL NOTES

1. PERFORM ALL WORK IN ACCORDANCE WITH MECHANICAL CODE, PLUMBING CODE, ENERGY CODE AND LOCAL CODES AND AUTHORITIES HAVING JURISDICTION. PROVIDE ALL PERMITS, INSPECTIONS, LICENSES AND FEES.
2. FURNISH ALL LABOR, EQUIPMENT, SUPPLIES AND MATERIALS NECESSARY TO PROVIDE COMPLETE AND OPERATIONAL SYSTEMS.
3. DRAWINGS AND SPECIFICATIONS: THE MECHANICAL DRAWINGS INDICATE THE GENERAL DESIGN AND ARRANGEMENT OF PIPES, EQUIPMENT, SYSTEMS, ETC. INFORMATION SHOWN IS DIAGRAMMATIC IN CHARACTER AND DOES NOT NECESSARILY INDICATE EVERY REQUIRED OFFSET, FITTING, ETC. DO NOT SCALE THE DRAWINGS FOR DIMENSIONS. TAKE DIMENSIONS, MEASUREMENTS, EQUIPMENT LOCATIONS, LEVELS, ETC. FROM THE ARCHITECTURAL DRAWINGS AND EQUIPMENT TO BE FURNISHED. CONDUIT, PIPING AND/OR DUCTWORK MAY BE RELOCATED OR OFFSET FOR PROPER CLEARANCES. DEVIATION FROM DRAWING MUST HAVE THE ENGINEER'S APPROVAL. THE DESIGN INTENT I.E., PITCHES, VELOCITIES, PRESSURE DROPS, VOLTAGE DROPS, ETC. , CANNOT BE GREATLY ALTERED WITHOUT THE APPROVAL OF THE ENGINEER. COST OF THESE DEVIATIONS TO AVOID INTERFERENCES SHALL BE PART OF THE ORIGINAL CONTRACT.
4. BASE FINAL INSTALLATION OF MATERIALS AND EQUIPMENT ON ACTUAL DIMENSIONS AND CONDITIONS AT THE PROJECT SITE. FIELD MEASURE FOR MATERIALS OR EQUIPMENT REQUIRING EXACT FIT. NO EXTRAS WILL BE GIVEN FOR CONTRACTORS FAILURE TO FIELD COORDINATE.
5. CONTRACTOR SHALL LOCATE ALL EQUIPMENT WHICH MUST BE SERVICED, OPERATED, OR MAINTAINED IN FULLY ACCESSIBLE POSITIONS. EQUIPMENT SHALL INCLUDE, BUT NOT BE LIMITED TO VALVES, SHOCK ABSORBERS, TRAPS, CLEANOUTS, MOTORS, CONTROLLERS, SWITCHGEAR, AND DRAIN POINTS IF REQUIRED FOR BETTER ACCESSIBILITY. MINOR DEVIATIONS FROM DRAWINGS MAY BE ALLOWED TO PROVIDE FOR BETTER ACCESSIBILITY. ANY CHANGES SHALL BE APPROVED BY THE ENGINEER PRIOR TO MAKING THE CHANGE.
6. CONTRACTOR SHALL PROVIDE ACCESS DOORS, WALL OPENINGS, ROOF OPENINGS OR ANY OTHER CONSTRUCTION REQUIREMENTS NEEDED TO ACCOMMODATE THE MECHANICAL EQUIPMENT. LOCATIONS OF THESE OPENINGS SHALL BE SUBMITTED IN SUFFICIENT TIME TO BE INSTALLED IN THE NORMAL COURSE OF WORK. ACCESS DOOR TYPES AND LOCATIONS SHALL BE COORDINATED WITH ARCHITECT PRIOR TO INSTALLATION.
7. CONTRACTOR SHALL COORDINATE ELECTRICAL REQUIREMENTS OF APPROVED MECHANICAL EQUIPMENT WITH THE ELECTRICAL CONTRACTOR PRIOR TO THE INSTALLATION OF ANY ELECTRICAL GEAR OR CONDUIT.
8. MECHANICAL CONTROL DEVICE POWER REQUIREMENTS SHALL BE COORDINATED WITH THE ELECTRICAL CONTRACTOR PRIOR TO INSTALLATION AND SHALL BE INCLUDED AS PART OF THE BASE BID.
9. PROVIDE VIBRATION ISOLATORS FOR MOTOR DRIVEN MECHANICAL EQUIPMENT UNLESS SPECIFICALLY NOTED OTHERWISE. PROVIDE ISOLATION AS RECOMMENDED BY THE EQUIPMENT MANUFACTURER.
10. FINAL EQUIPMENT ELECTRICAL MCA'S AND MOCP'S SHALL BE ON ACTUAL SUBMITTED EQUIPMENT DATA. THIS CONTRACTOR SHALL COORDINATE WITH ELECTRICAL CONTRACTOR PRIOR TO ORDERING OF EQUIPMENT TO INSURE PROPER WIRE SIZES AND BREAKER SIZES ARE INSTALLED. THIS SHALL BE ACCOMPLISHED AT NO ADDITIONAL COST TO THE PROJECT.
11. COORDINATE THERMOSTAT LOCATION WITH LIGHT SWITCHES, MILLWORK, WINDOWS, ETC. PRIOR TO INSTALLATION. IF A CONFLICT EXISTS COORDINATE WITH THE ARCHITECT FOR ALTERNATE INSTALLATION CONFIGURATIONS.
12. UNLESS OTHERWISE INDICATED THE DUCTWORK RUNOUT FROM THE DIFFUSER/GRILLE TO THE MAIN SHALL BE THE SAME SIZE AS THE DIFFUSER/GRILLE NECK.
13. DOUBLE THICKNESS VANED ELBOWS SHALL BE USED FOR ALL RECTANGULAR SUPPLY, RETURN AND EXHAUST DUCTWORK INCLUDING THE TOP AND BOTTOM OF VERTICAL DUCT TRANSITIONS.
14. MOUNT THERMOSTATS AND HUMIDISTATS AT 4'-0" AFF T0 THE CENTER OF THE DEVICE. ALL INSTALLATIONS SHALL COMPLY WITH TEXAS ACCESSIBILITY STANDARDS.
15. ALL DIMENSIONS SHOWN ON THE DRAWINGS FOR DUCTWORK ARE NET INSIDE CLEAR DIMENSIONS. THE FIRST FIGURE OF THE DUCT SIZE INDICATES THE DIMENSION OF THE FACE SHOWN. VERIFY THAT THE DUCTWORK SPECIFIED WILL FIT IN THE SPACE AVAILABLE USING THE ARCHITECTURAL, STRUCTURAL, AND ELECTRICAL DRAWINGS AS REFERENCE PRIOR TO FABRICATION AND INSTALLATION.
16. CONTRACTOR SHALL COORDINATE EXACT LOCATION OF EQUIPMENT AND DUCTS WITH ELECTRICAL PANELS AND GEAR PRIOR TO ANY INSTALLATION IN ORDER TO PROVIDE THE REQUIRED ELECTRICAL PANEL CLEARANCES AND EQUIPMENT OPERATION AND MAINTENANCE CLEARANCES.
17. BACK PANEL OF ALL CEILING MOUNTED AIR DEVICES SHALL BE INSULATED.
18. EXPANDED METAL GRILLES SHALL BE 1" MESH TYPE (1"x1" GRID). THESE TYPES OF DEVICES SHALL BE INSTALLED ON ALL OPEN-END RETURN AIR DUCTS.
19. COORDINATE WITH STRUCTURAL DRAWINGS FOR INSTALLATION OF NEW EQUIPMENT.
20. EQUIPMENT SHALL BE INSTALLED WITH REQUIRED CLEARANCES PER CODE AND MANUFACTURER INSTALLATION INSTRUCTIONS.
21. REFRIGERANT PIPING INTERIOR AND EXTERIOR OF BUILDING SHALL BE ROUTED AND SUPPORTED IN A NEATLY, ORGANIZED MANNER AND AVOID ROUTING PIPING ON EXTERIOR OF BUILDING.
22. TRANSITION AS REQUIRED FROM DUCT SIZES INDICATED TO EQUIPMENT CONNECTION SIZES.
23. COORDINATE MOUNTING HEIGHT OF LOUVERS WITH ARCHITECT PRIOR TO INSTALLATION.

MECHANICAL SYMBOLS

- 20/10 — RECTANGULAR DUCT (FIRST FIG. IS SIDE SHOWN)
- 24"Ø — ROUND DUCT
- TURNING VANES
- SUPPLY DUCT IN SECTION
- SUPPLY DUCT
- RETURN DUCT IN SECTION
- RETURN DUCT
- VENTILATION DUCT IN SECTION
- VENTILATION DUCT
- EXHAUST DUCT IN SECTION
- EXHAUST DUCT
- SQUARE CEILING DIFFUSER (SUPPLY) (4-WAY UNLESS OTHERWISE INDICATED)
- SQUARE CEILING RETURN GRILLE
- SQUARE CEILING EXHAUST GRILLE
- T — THERMOSTAT OR TEMPERATURE SENSOR
- H — HUMIDISTAT OR HUMIDITY SENSOR
- C — FAN CONTROLLER
- (3) A 10/10 250 — NECK SIZE OR WIDTH X HEIGHT; AMOUNT OF AIR; DIFFUSER, GRILLE DESIGNATION; QUANTITY, IF SPECIFIED
- M — MOTORIZED DAMPER
- MANUAL VOLUME DAMPER
- FD — FIRE DAMPER
- FS — COMBINATION FIRE/SMOKE DAMPER (MOTORIZED)
- CONNECT TO EXISTING
- CO_2 — CARBON DIOXIDE SENSOR
- RISE FALL — DUCT OFFSET IN DIRECTION OF AIRFLOW

ABBREVIATIONS

AD	ACCESS DOOR	L	LENGTH
A/C	AIR CONDITIONING UNIT	LAT	LEAVING AIR TEMPERATURE
A/E	ARCHITECT/ENGINEER	LPC	LOW PRESSURE CONDENSATE
AFF	ABOVE FINISHED FLOOR	LPS	LOW PRESSURE STEAM
AFS	AIR FLOW SWITCH	LB	POUNDS
AHU	AIR HANDLING UNIT	LRA	LOCKED ROTOR AMPS
AMS	AIR MEASURING STATION	LWT	LEAVING WATER TEMPERATURE
APPROX	APPROXIMATE	MAX	MAXIMUM
BHP	BRAKE HORSE POWER	MBH	1000 BRITISH THERMAL UNITS / HOUR
BOD	BOTTOM OF DUCT	MCA	MINIMUM CIRCUIT AMPACITY
BTU	BRITISH THERMAL UNIT PER HOUR	MFR	MANUFACTURER
C/A	COMBUSTION AIR	MOCP	MAXIMUM OVERLOAD CURRENT PROTECTION
CC	COOLING COIL	MIN	MINIMUM
CFH	CUBIC FEET PER HOUR	N/A	NOT APPLICABLE
CFM	CUBIC FEET PER MINUTE	N/O,N/C	NORMALLY OPEN, NORMALLY CLOSED
CLG	CEILING	O/A	OUTSIDE AIR/FRESH AIR
CU	CONDENSING UNIT	OBD	OPPOSED BLADE DAMPER
D	EQUIPMENT DRAIN	O/C	ON CENTER
DEG	DEGREES	PEF	PURGE EXHAUST FAN
DB	DRY BULB	PH	PHASE
DN	DOWN	PROVIDE	FURNISH AND INSTALL
(E)	EXISTING	PRV	PRESSURE REDUCING VALVE
EAT	ENTERING AIR TEMPERATURE	PSI	POUNDS PER SQUARE INCH
E/A	EXHAUST AIR	R/A	RETURN AIR
EDH	ELECTRIC DUCT HEATER	RE:	REFERENCE, REFER
EF	EXHAUST FAN	RL	REFRIGERANT LIQUID
EQUIP	EQUIPMENT	RLA	RUNNING LOAD AMPS
EWT	ENTERING WATER TEMPERATURE	RM	ROOM
°F	DEGREES FAHRENHEIT	RPM	REVOLUTIONS PER MINUTE
FCU	FAN COIL UNIT	RS	REFRIGERANT SUCTION
FD	FIRE DAMPER	S/A	SUPPLY AIR
FLA	FULL LOAD AMPS	SD	SMOKE DETECTOR
FLR	FLOOR	SF	SQUARE FOOT, SUPPLY FAN
FPVAV	FAN POWERED VAV	SPECS	SPECIFICATIONS
FSD	FIRE SMOKE DAMPER	T, TSTAT	THERMOSTAT, ROOM SENSOR
FT,	FOOT, FEET	T/A	TRANSFER AIR
FT, WG	FEET WATER GAUGE	THRU	THROUGH
GA	U.S. GAUGE	TSP	TOTAL STATIC PRESSURE
GPM	GALLONS PER MINUTE	TSTAT	THERMOSTAT OR ROOM SENSOR
H	HEIGHT	TYP	TYPICAL
HP	HORSEPOWER	UL	UNDERWRITERS LABORATORIES, INC.
HPC	HIGH PRESSURE CONDENSATE	UH	UNIT HEATER
HPS	HIGH PRESSURE STEAM	V	VOLTS
HWR	HEATING WATER RETURN	VAV	VARIABLE AIR VOLUME
HWS	HEATING WATER SUPPLY	VEL	VELOCITY
HZ	HERTZ	VFD	VARIABLE FREQUENCY DRIVE
IN.	INCH, INCHES	W/	WITH
IN.WG	INCHES WATER GAUGE	WB	WET BULB
J-BOX	JUNCTION BOX	W/O	WITHOUT
kW	KILOWATT		

DRAWING/DETAIL REFERENCE

REFER TO
DRAWING/DETAIL NUMBER
RE: 2/M1.0
SHEET NUMBER

AIR DEVICE SCHEDULE

MARK	SERVES	NECK SIZE	FACE SIZE	MOUNTING	DESCRIPTION	MATERIAL	MANUFACTURER MODEL NUMBER	NOTES
A	SUPPLY	6"Ø	24" X 24"	VARIES	SQUARE LOUVER	STEEL	TITUS TMS	1, 2, 3
B	SUPPLY	8"Ø	24" X 24"	VARIES	SQUARE LOUVER	STEEL	TITUS TMS	1, 2, 3
C	RETURN	22" X 22"	24" X 24"	VARIES	EGGCRATE - 1/2" X 1/2"	STEEL	TITUS 50F	1, 2, 3

1. DIFFUSERS, REGISTERS, AND GRILLES SHALL BE TYPE FOR MOUNTING IN RESPECTIVE SURFACE TYPE. CONFIRM AND COORDINATE WITH ARCHITECTURAL DRAWINGS AND WITH HVAC PLAN.
2. FINISH FOR DIFFUSERS, REGISTERS, AND GRILLES SHALL BE MANUFACTURER'S STANDARD WHITE FOR THOSE LOCATED IN A CEILING AND OTHERS THAT ARE LOCATED ON EXPOSED DUCTS SHALL BE ALUMINUM.
3. BALANCING DAMPERS SHALL BE PROVIDED AND LOCATED AT THE RUN-OUT CONNECTION FROM MAIN. IF UNABLE TO ACCESS, THEN PROVIDE MANUAL OPPOSED BLADE BALANCING DAMPER FULL SIZE OF AIR DEVICE NECK ACCESSIBLE THROUGH DEVICE FACE.

FAN COIL UNIT SCHEDULE WITH ELECTRIC HEAT

MARK	TYPE	SUPPLY AIRFLOW (ACFM)	OUTSIDE AIRFLOW (ACFM)	EXTERNAL STATIC PRESSURE (IN WTR)	EVAPORATOR PERFORMANCE				MOTOR	ELECTRIC HEAT		ELECTRICAL DATA					WEIGHT (LB)	MANUFACTURER	NOTES
					T.C. (MBH)	S.C. (MBH)	ENTERING D.B.	ENTERING W.B.	HP	INPUT KW	INPUT MBH	VOLTS	PHASE	HZ	MCA	MOCP			
FCU-1	HORIZONTAL	1,600	180	0.6	40.5	35.8	76.5	61.6	3/4	15	51.2	230	1	60	83.4	90	160	CARRIER FB4C 048	1 THRU 5

1. EXTERNAL STATIC PRESSURE EXCLUDES EQUIPMENT AND FILTER LOSSES. PROVIDE WITH COOLING COIL TO MEET THE REQUIRED SEER RATING AND MINIMIZE PRESSURE DROP.
2. PROVIDE UNIT WITH RETURN AIR FILTER ASSEMBLY, TXV VALVE, COOLING COIL, AND ELECTRIC HEATER. SINGLE POINT ELECTRICAL CONNECTION.
3. PROVIDE FLOAT SWITCH CONTROLLER IN COOLING COIL OVERFLOW DRAIN PAN TO SHUT DOWN UNIT UPON WATER DETECTION.
4. COORDINATE INSTALLATION OF UNIT WITH FIELD CONDITIONS.
5. ELECTRIC HEAT SHALL OPERATE TO SUPPLEMENT HEAT PUMP OPERATION.

AIR COOLED HEAT PUMP UNIT SCHEDULE

MARK	SERVES	CONDENSER UNIT DATA			ELECTRICAL CHARACTERISTICS					SEER / HSPF	MANUFACTURER	NOTES
		REFRIG TYPE	COOLING DATA TMBH	AMBIENT TEMP. (°F)	VOLTS	PHASE	HZ	MCA	MOCP			
HP-1	FCU-1	R410A	40.0	105	208-230	1	60	25.2	40	14 / 8.2	CARRIER 25HCE448 (4-TON)	1, 2, 3

1. SIZE, ROUTE, INSULATE AND PROVIDE REQUIRED APPURTENANCES FOR DX PIPING SYSTEMS IN ACCORDANCE WITH THE MANUFACTURERS RECOMMENDATIONS AND TO MINIMIZE ANY CAPACITY LOSSES. REVIEW LAYOUT AND PROVIDE LONG-LINE REFRIGERANT PIPING AS REQUIRED WITH ALL NECESSARY TRIM. PROVIDE AND INSTALL ALL REQUIRED REFRIGERANT PIPING ACCESSORIES.
2. UNIT SHALL BE SET ON 4 INCH CONCRETE PAD. UNITS SHALL BE ANCHORED TO PAD THROUGH INTERIOR OF UNIT.
3. PROVIDE WITH LOW AMBIENT CONTROLS.

LOUVER SCHEDULE

MARK	TYPE/LOCATION	SIZE W X H (FT)	MIN NET FREE AREA (SF)	MANUFACTURER AND MODEL NO.	REMARKS
LV-1	OUTSIDE AIR INTAKE	1'-6" W X 1'-0" H	0.49	RUSKIN ELF6375DX	1, 2

1. PROVIDE EXTRUDED ALUMINUM, EXTENDED SILL, 6" DRAINABLE STATIONARY WALL LOUVER WITH BIRD SCREEN. PROVIDE WITH KYNAR FINISH, COLOR SHALL BE AS DIRECTED BY ARCHITECT.
2. COORDINATE MOUNTING HEIGHT WITH ARCHITECT.

ELECTRIC UNIT HEATER SCHEDULE

MARK	TYPE	WATTS	HEATING BTU'S	TEMP RISE (°F)	ELECTRICAL DATA				MANUFACTURER AND MODEL NUMBER	NOTES
					KW	VOLTS	PHASE	HZ		
EUH-1	SUSPENDED	3,300	11,200	40	3.3	240	1	60	MARKEL SERIES 5100	1, 2

1. UNIT HEATER SHALL BE SUSPENDED AT 9'-0" AFF. SETPOINT OF THERMOSTAT SHALL BE 50°F (ADJUSTABLE). PROVIDE WITH MOUNTING BRACKET.
2. PROVIDE WITH REMOTE THERMOSTAT, THERMAL OVERLOAD, AND DISCONNECT.

COMcheck Software Version 4.0.8.2

Mechanical Compliance Certificate

Project Information

Energy Code: 2015 IECC
Project Title: Lake Worth Records Storage
Location: Lake Worth, Texas
Climate Zone: 3a
Project Type: New Construction

Construction Site:
3805 Adam Grubb St
Lake Worth, TX 76135

Owner/Agent:

Designer/Contractor:
Timothy Maltz
Maltz Engineering LLC
2801 Carmel St.
Denton, TX 76205
940-382-0949
tmaltz@maltzengineering.com

Additional Efficiency Package(s)

Reduced interior lighting power. Requirements are implicitly enforced within interior lighting allowance calculations.

Mechanical Systems List

Quantity System Type & Description

1 HVAC System 1 (Single Zone):
Split System Heat Pump
Heating Mode: Capacity = 51 kBtu/h,
Proposed Efficiency = 8.20 HSPF, Required Efficiency = 8.20 HSPF
Cooling Mode: Capacity = 41 kBtu/h,
Proposed Efficiency = 14.00 SEER, Required Efficiency: 14.00 SEER
Fan System: FAN SYSTEM 1 -- Compliance (Motor nameplate HP method) : Passes

Fans:
FAN 1 Supply, Constant Volume, 1600 CFM, 0.8 motor nameplate hp, 0.0 fan efficiency grade

Mechanical Compliance Statement

Compliance Statement: The proposed mechanical design represented in this document is consistent with the building plans, specifications, and other calculations submitted with this permit application. The proposed mechanical systems have been designed to meet the 2015 IECC requirements in COM*check* Version 4.0.8.2 and to comply with any applicable mandatory requirements listed in the Inspection Checklist.

Timothy Maltz — Engineer — Signature — 12-19-2018
Name - Title — Date

Project Title: Lake Worth Records Storage — Report date: 12/19/18
Data filename: C:\Projects\ME18331\ComCheck\Lake Worth Mech Comcheck.cck — Page 1 of 9

STATE OF TEXAS — TIMOTHY M. MALTZ — 94231 — LICENSED PROFESSIONAL ENGINEER
12/19/2018
F-11112

Revision Schedule		
Rev. #	Revision Description	Revision Date

MALTZ engineering LLC
Firm #: 11112
Phone: 940-382-0949
2801 Carmel St
Denton, TX 76205

LAKE WORTH RECORDS STORAGE
3805 ADAM GRUBB ST.
LAKE WORTH, TX 76135

2018.019.00
DECEMBER 19, 2018

MECHANICAL GENERAL NOTES, SCHEDULES

M0.1

GENERAL MECHANICAL NOTES

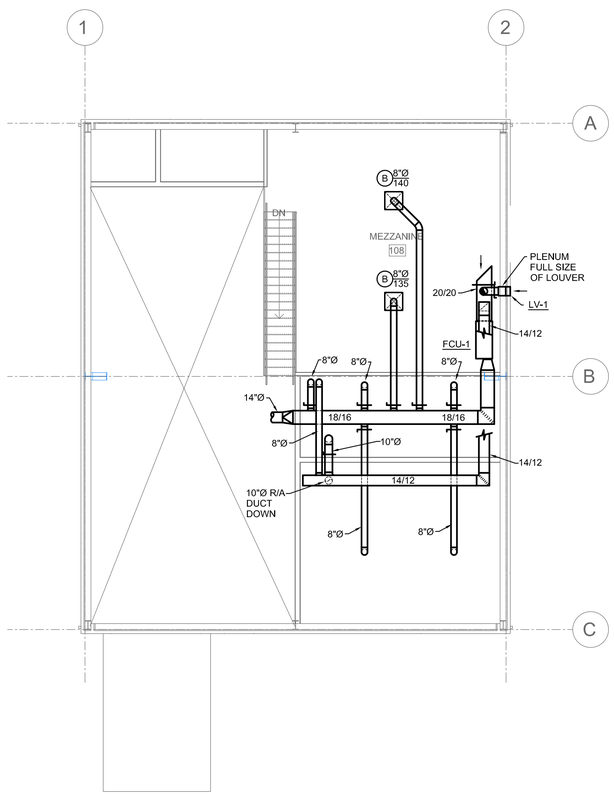
A. THESE GENERAL NOTES AND NOTES BY SYMBOL APPLY TO BOTH DETAILS.

B. EQUIPMENT SHALL BE INSTALLED WITH REQUIRED CLEARANCES PER CODE AND MANUFACTURER INSTALLATION INSTRUCTIONS.

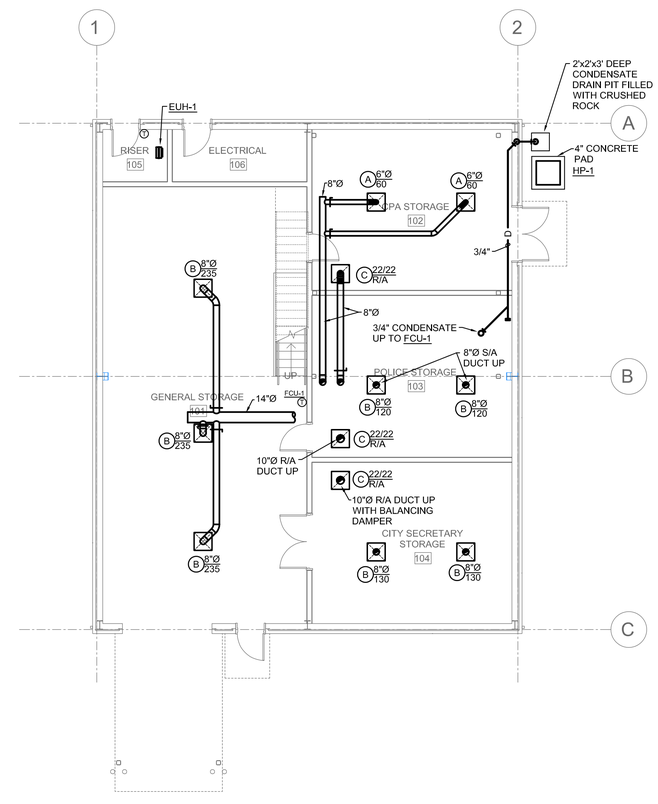
C. TRANSITION AS REQUIRED FROM DUCT SIZES INDICATED TO EQUIPMENT CONNECTION SIZES.

D. COORDINATE MOUNTING HEIGHTS OF EXPOSED DUCTWORK AND AIR DEVICES WITH ARCHITECTURAL DRAWINGS AND ARCHITECT PRIOR TO INSTALL.

E. COORDINATE DUCT INSTALLATION WITH STRUCTURAL FRAMING.

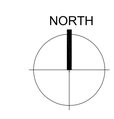


MECHANICAL MEZZANINE PLAN 2
SCALE: 1/8" = 1'-0" M2.1



MECHANICAL FLOOR PLAN 1
SCALE: 1/8" = 1'-0" M2.1

Revision Schedule		
Rev. #	Revision Description	Revision Date



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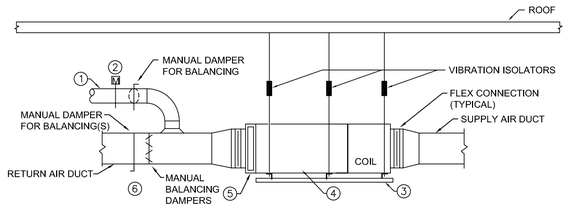
MECHANICAL FLOOR PLANS

M2.1

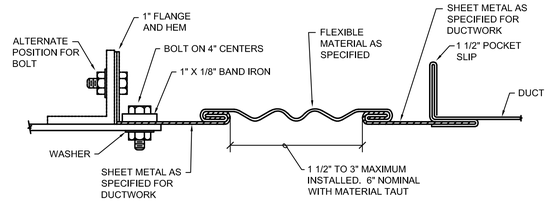


NOTES FOR DETAIL:

1. OUTSIDE AIR INTAKE DUCT EXTENDED AS SHOWN ON THE FLOOR PLANS. SIZE AND LOCATE OUTSIDE AIR INTAKE AS SHOWN ON FLOOR PLAN, BALANCE ACCORDING TO SCHEDULED OUTSIDE AIR.
2. MOTORIZED DAMPER OUTSIDE AIR DAMPER.
3. AUXILIARY DRAIN PAN SIZE AS REQUIRED PER CODE. CONTRACTOR SHALL PROVIDE AND INSTALL A WATER SENSING DISK IN DRAIN PAN. DISK SHALL BE INTERLOCKED WITH AIR HANDLER UNIT STARTER TO TURN OFF AIR HANDLER UNIT WHEN DRAIN PAN FILLS WITH CONDENSATE. DISK SWITCH SHALL BE WIRED THROUGH AN INTERPOSING RELAY TO THE STARTER CIRCUIT.
4. PROVIDE CONDENSATE DRAIN PIPING FROM UNIT.
5. ACCESSIBLE FILTER. FILTERS FOR ALL THE AHU'S SHALL BE THE SAME SIZE. CONTRACTOR SHALL BASE OVERALL SIZE FOR ALL OF THE FILTERS ON THE LARGEST UNIT'S REQUIREMENT. BASED ON THAT FILTER SIZE, CONTRACTOR SHALL PROVIDE SAME SIZE FILTER FOR EACH FCU. AS SUCH, CONTRACTOR SHALL PROVIDE FILTER ASSEMBLY TO ACCOMMODATE SAME SIZE FILTER FOR EACH UNIT.
6. RETURN AIR DAMPER(S), AS REQUIRED.

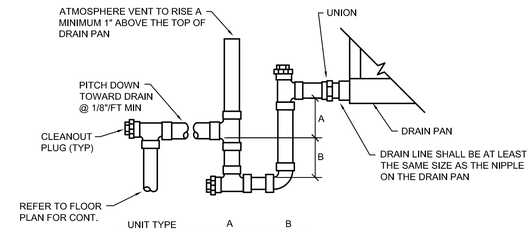
1 HORIZONTAL FCU UNIT DETAIL

SCALE: NO SCALE



2 DUCT FLEXIBLE CONNECTION DETAIL

SCALE: NO SCALE

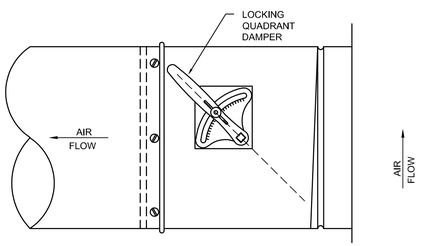


UNIT TYPE	A	B
DRAW THRU	2" PLUS X	X
BLOW THRU	1" MINIMUM	2X

WHERE X = STATIC PRESSURE IN PAN

3 TYPICAL CONDENSATE CONNECTION DETAIL

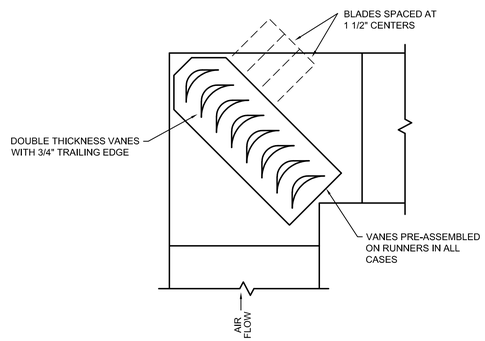
SCALE: NO SCALE



REQUIRED AT EACH RUN-OUT TAP TO EVERY SUPPLY AIR DEVICE, AND OTHERWISE AS INDICATED.

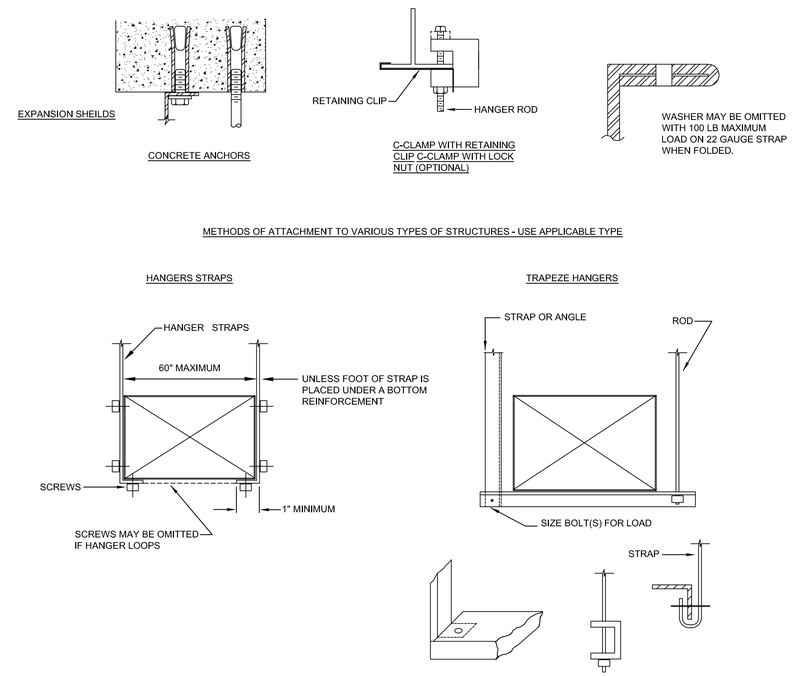
4 SPIN-IN TAP DETAIL

SCALE: NO SCALE



5 TYPICAL SQUARE ELBOW WITH VANES

SCALE: NO SCALE



6 DUCT HANGER DETAIL

SCALE: NO SCALE

NOTE:

1. HANGER STRAP GAUGE, WIDTH, AND SPACING SHALL BE PER SMACNA DUCT CONSTRUCTION STANDARDS. PERFORATED "PLUMBERS STRAP" SHALL NOT BE USED.
2. SIZE ALL THREAD ROD AND TRAPEZE UNISTRUT CHANNEL FOR LOADS.

STATE OF TEXAS
TIMOTHY M. MALTZ
94231
LICENSED PROFESSIONAL ENGINEER
12/19/2018
F-11112

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MECHANICAL DETAILS

M3.1

GENERAL FIRE PROTECTION NOTES

1. PERFORM ALL WORK IN ACCORDANCE WITH ALL APPLICABLE CODES AND AUTHORITIES HAVING JURISDICTION. PROVIDE ALL PERMITS, INSPECTIONS, LICENSES AND FEES. FURNISH ALL LABOR, EQUIPMENT, SUPPLIES AND MATERIALS NECESSARY TO PROVIDE COMPLETE AND OPERATIONAL SYSTEMS.

2. THE DRAWINGS AND SPECIFICATIONS INDICATE THE GENERAL DESIGN AND ARRANGEMENT OF PIPES, FIXTURES, EQUIPMENT, SYSTEMS, ETC. INFORMATION SHOWN IS DIAGRAMMATIC IN CHARACTER AND DOES NOT NECESSARILY INDICATE EVERY REQUIRED OFFSET, FITTING, ETC. DO NOT SCALE THE DRAWINGS FOR DIMENSIONS. TAKE ALL DIMENSIONS, MEASUREMENTS, EQUIPMENT LOCATIONS, LEVELS, ETC FROM THE ARCHITECTURAL DRAWINGS AND FROM THE EQUIPMENT TO BE FURNISHED. PIPING MAY BE RELOCATED OR OFFSET FOR PROPER CLEARANCES OR TO AVOID CONFLICTS WITH OTHER TRADES. THE DESIGN INTENT (I.E. PITCHES, VELOCITIES, PRESSURE DROPS, VOLTAGE DROPS, ETC) CANNOT BE GREATLY ALTERED WITHOUT THE APPROVAL OF THE ARCHITECT. THE COST OF THESE DEVIATIONS TO AVOID INTERFERENCE'S SHALL BE PART OF THE ORIGINAL CONTRACT BID.

3. EACH SUBCONTRACTOR SHALL CONFER AND COOPERATE WITH ALL OTHER TRADES TO COORDINATE THEIR WORK. COORDINATION SHALL INCLUDE, BUT SHALL NOT BE LIMITED TO MATERIALS AND EQUIPMENT ROUTED IN CEILING AND WALL CAVITIES, EQUIPMENT ARRANGEMENT IN MECHANICAL SPACES, INCLUDING EQUIPMENT CLEARANCE REQUIREMENTS, ELEVATIONS AND DIMENSIONS OF STRUCTURAL MEMBERS AND OPENINGS, ETC. THE CONTRACTOR SHALL NOTIFY THE ARCHITECT OF ANY CONFLICTS.

4. BASE FINAL INSTALLATION OF MATERIALS AND EQUIPMENT ON ACTUAL DIMENSIONS AND CONDITIONS AT THE PROJECT SITE. FIELD MEASURE FOR MATERIALS AND EQUIPMENT REQUIRING EXACT FIT. NO EXTRAS WILL BE GIVEN FOR THE CONTRACTORS FAILURE TO FIELD COORDINATE.

5. THE OWNER OR ENGINEER ARE NOT RESPONSIBLE FOR THE CONTRACTOR'S SAFETY PRECAUTIONS OR FOR MEANS, METHODS, TECHNIQUES, CONSTRUCTION SEQUENCES, OR PROCEDURES REQUIRED TO PERFORM THE WORK.

6. THE CONTRACTOR SHALL LOCATE ALL EQUIPMENT THAT MUST BE SERVICED, OPERATED, OR MAINTAINED IN FULLY ACCESSIBLE POSITIONS. EQUIPMENT SHALL INCLUDE (BUT NOT LIMITED TO) VALVES, MOTORS, CONTROLLERS, SWITCHGEAR, AND DRAIN POINTS IF REQUIRED FOR BETTER ACCESSIBILITY. FURNISH ACCESS DOORS FOR THIS PURPOSE. MINOR DEVIATIONS FROM THE DRAWINGS MAY BE ALLOWED TO PROVIDE FOR BETTER ACCESSIBILITY. ANY CHANGES SHALL BE APPROVED BY THE ARCHITECT AND CONSTRUCTION MANAGER/GENERAL CONTRACTOR PRIOR TO MAKING THE CHANGE.

7. THE CONTRACTOR SHALL PROVIDE ACCESS DOORS, WALL OPENINGS, ROOF OPENINGS OR ANY OTHER CONSTRUCTION REQUIREMENT NEEDED TO ACCOMMODATE THE FIRE SPRINKLER EQUIPMENT. LOCATIONS OF THESE OPENINGS SHALL BE SUBMITTED IN SUFFICIENT TIME TO BE INSTALLED IN THE NORMAL COURSE OF WORK.

8. THE CONTRACTOR SHALL COORDINATE ELECTRICAL REQUIREMENTS OF FIRE SPRINKLER EQUIPMENT WITH THE ELECTRICAL CONTRACTOR PRIOR TO THE PURCHASE AND INSTALLATION OF ANY ELECTRICAL GEAR OR CONDUIT.

9. PROVIDE VIBRATION ISOLATORS FOR MOTOR DRIVEN FIRE SPRINKLER EQUIPMENT UNLESS NOTED OTHERWISE. PROVIDE ISOLATION AS RECOMMENDED BY THE EQUIPMENT MANUFACTURER.

10. SOME PIPES SHOWN ON EACH FLOOR PLAN MAY BE SHOWN WITH AN OFFSET FOR CLARITY.

11. SEAL ALL PIPE PENETRATIONS THROUGH FIRE RATED BUILDING ELEMENTS WITH AN APPROVED FIRE PROOFING MATERIAL.

ABBREVIATIONS

A/E	ARCHITECT/ENGINEER	L	LENGTH
AFF	ABOVE FINISHED FLOOR	LB	POUNDS
AHU	AIR HANDLING UNIT	LRA	LOCKED ROTOR AMPS
APPROX	APPROXIMATE	MAX	MAXIMUM
BD	BUILDING DRAIN (BELOW FLOOR)	MCA	MINIMUM CIRCUIT AMPACITY
		MIN	MINIMUM
B.F.G.	BELOW FINISHED GRADE	MSB	MOP SINK BASIN
BFP	BACKFLOW PREVENTER		NOT APPLICABLE
BS	BUILDING SEWER (OUTSIDE OF BLDG)	N/A	NATIONAL FIRE PROTECTION ASSOCIATION
		NFPA	
CU	COPPER, CONDENSING UNIT		NON-FREEZE WALL HYDRANT
CW	DOMESTIC COLD WATER	NFWH	NORMALLY OPEN, NORMALLY CLOSED
D	EQUIPMENT DRAIN	N/O,N/C	ON CENTER
DCO	TWO-WAY GRADE CLEANOUT	O/C	ROOF OVERFLOW DRAIN
DEG	DEGREES	OFD	PLUG CLEANOUT
DSN	DOWNSPOUT NOZZLE	PCO	PHASE
(E)	EXISTING	PH	FURNISH AND INSTALL
EQUIP	EQUIPMENT	PROVIDE	POUNDS PER SQUARE INCH
EWC	ELECTRIC WATER COOLER	PSI	ROOF DRAIN
°F	DEGREES FAHRENHEIT	RD	REFERENCE, REFER
FCO	FLOOR CLEANOUT	RE:	RUNNING LOAD AMPS
FCU	FAN COIL UNIT	RLA	ROOM
FD	FLOOR DRAIN	RM	REDUCED PRESSURE PRINCIPLE
FS	FLOOR SINK	RPBFP	BACKFLOW PREVENTER
FT,	FOOT, FEET		REDUCED PRESSURE ZONE
FVC	FIRE VALVE CABINET	RPZ	SINK
G	NATURAL GAS	S	STORM DRAIN (BELOW FLOOR)
GCO	GRADE CLEANOUT	SD	STORM WATER (ABOVE CEILING)
GWH	NATURAL GAS WATER HEATER	ST	SUBSURFACE DRAIN
H	HEIGHT	SSD	THROUGH
HB	HOSE BIBB	THRU	TRAP PRIMER
HP	HORSEPOWER	TP	TYPICAL
HW	DOMESTIC HOT WATER	TYP	URINAL
HWC	DOMESTIC HOT WATER CIRCULATION LOOP	U	UNDERWRITERS LABORATORIES, INC.
		UL	SANITARY VENT
HWTM	HOT WATER TEMPERATURE MAINTENANCE CABLE	V	SANITARY VENT THRU ROOF
		VTR	SANITARY WASTE (ABOVE FLOOR)
HZ	HERTZ	W	WATER CLOSET
IE	INVERT ELEVATION	WC	WALL CLEANOUT
IN.	INCH, INCHES	WCO	WITH
J-BOX	JUNCTION BOX	W/	WITHOUT
kW	KILOWATT	W/O	

FIRE PROTECTION NOTES

1. PROVIDE COMPLETE AND OPERABLE STANDARD DRY PIPE FIRE SUPPRESSION SYSTEMS ENGINEERED AND DESIGNED CONFORMING TO NFPA 13, INSTALLATION OF SPRINKLER SYSTEMS; NFPA 24, NFPA 33, PRIVATE SERVICE MAINS AND THEIR APPURTENANCES; ALL APPLICABLE CITY, STATE AND NATIONAL CODES AND THE CODES AND ORDINANCES OF ALL OTHER AUTHORITIES HAVING JURISDICTION. THE DRY-PIPE SYSTEM SHALL MEET ALL APPLICABLE REQUIREMENTS OF THE CITY FIRE DEPARTMENT. NEW DRY-PIPE SPRINKLER SYSTEM SHALL BE PROVIDED FOR ENTIRE BUILDING INCLUDING ANY CANOPY AREAS.

2. CONTRACTOR SHALL COORDINATE AND ATTEND A PRE-SPRINKLER SHOP DRAWING SUBMITTAL CONFERENCE BETWEEN THE ARCHITECT, CONTRACTOR AND SPRINKLER SUBCONTRACTOR DURING THE SUBMITTAL PHASE OF CONSTRUCTION. PURPOSE OF THE MEETING SHALL BE TO LOCATE ROUTING OF FIRE SPRINKLER PIPING AND SPRINKLER HEAD LOCATIONS IN THE LOBBIES AND PUBLIC SPACES (WITH EMPHASIS ON SPACES WITH EXPOSED STRUCTURE THAT ARE EXPOSED TO PUBLIC VIEW). FINAL ROUTING OF SPRINKLER PIPING AND LOCATIONS OF SPRINKLER HEADS SHALL BE COORDINATED / APPROVED BY THE ARCHITECT PRIOR TO SUBMITTING TO THE AUTHORITY HAVING JURISDICTION.

3. EXPOSED SPRINKLER PIPE WITH EXPOSED (FINISHED) STRUCTURE SHALL BE PAINTED AS DIRECTED BY THE ARCHITECT. COLOR SAMPLES SHALL BE MADE AVAILABLE FOR THE ARCHITECT TO REVIEW AND SELECT. PIPE ROUTING SHALL BE BASED UPON THE SPACE EXPOSED STRUCTURE, CENTERLINES AND AXES TO ESTABLISH A PATTERN COMPLIMENTARY TO EACH SPACE STRUCTURE.

4. CONTRACTOR SHALL ARRANGE SPRINKLER HEADS COMPLIMENTARY TO EACH CEILING TYPE.

5. ALL SPRINKLER HEAD LOCATIONS SHALL BE COORDINATED WITH THE STRUCTURE, LIGHT FIXTURES, HVAC ELEMENTS, PLUMBING ELEMENTS, ARCHITECTURAL CEILING TREATMENTS. LAYOUT SHALL BE COORDINATED WITH AND REVIEWED BY THE ARCHITECT.

6. THE CONTRACTOR SHALL VERIFY WITH THE OWNER, OWNER'S INSURANCE AND THE AUTHORITY HAVING JURISDICTION ALL SPACE CLASSIFICATIONS, COMMODITY TYPES, ROOM USE, AND LOCATIONS OF OBSTACLES PRIOR TO PROVIDING DESIGN CALCULATIONS OR SPRINKLER SHOP DRAWINGS. FIRE PROTECTION DENSITY AND FLOW RATE REQUIREMENTS TO BE BASED ON NFPA AND LOCAL AUTHORITY REQUIREMENTS.

7. THE FIRE PROTECTION CONTRACTOR SHALL UNCONDITIONALLY WARRANT ALL WORK TO BE FREE OF DEFECTS IN MATERIAL AND WORKMANSHIP FOR A PERIOD OF ONE (1) YEAR FROM THE DATE OF FINAL ACCEPTANCE AND WILL REPAIR OR REPLACE ANY DEFECTIVE WORK PROMPTLY AND WITHOUT CHARGE AND RESTORE ANY OTHER EXISTING WORK DAMAGED IN THE COURSE OF REPAIRING DEFECTIVE MATERIALS AND WORKMANSHIP.

9. LOCATIONS OF SYSTEM TEST AND DRAIN VALVES SHALL BE COORDINATED WITH THE OWNER BY SPECIFICALLY CALLING TO THE OWNERS ATTENTION THE LOCATIONS OF THESE SUB-SYSTEMS.

10. THE FIRE SUPPRESSION SYSTEM SHALL CONFORM TO ALL APPLICABLE NFPA CODES IN ADDITION TO THE FOLLOWING:

    A. HYDRAULIC CALCULATIONS SHALL SHOW THE ELEVATIONS OF INDIVIDUAL HEADS AND REFERENCE POINTS (NODES).

    B. HYDRAULIC CALCULATIONS SHALL DESCRIBE EACH INDIVIDUAL HEAD IN THE ZONE BEING CALCULATED. HYDRAULIC CALCULATIONS USING "K" FACTORS TO DESCRIBE WHOLE BRANCH LINES ARE NOT ACCEPTABLE.

    C. PROVIDE A SAFETY FACTOR OF 10 PSI OR 10 PERCENT OF SYSTEM DEMAND (WHICHEVER IS GREATER).

    D. SUBMITTALS SHALL BE COMPLETE AND INCLUDE: HYDRAULIC CALCULATIONS, SHOP DRAWINGS AND MATERIAL SUBMITTAL.

    E. SUBMITTALS SHALL BE APPROVED BY THE AUTHORITY HAVING JURISDICTION PRIOR TO SUBMITTING HYDRAULIC CALCULATIONS, SHOP DRAWINGS AND MATERIALS TO THE ENGINEER FOR REVIEW.

11. SUBMITTALS NOT CONFORMING TO THE ABOVE WILL BE REJECTED WITH NO COMMENT.

12. CONTRACTOR SHALL PROVIDE FIRE HYDRANT TEST.

STATE OF TEXAS
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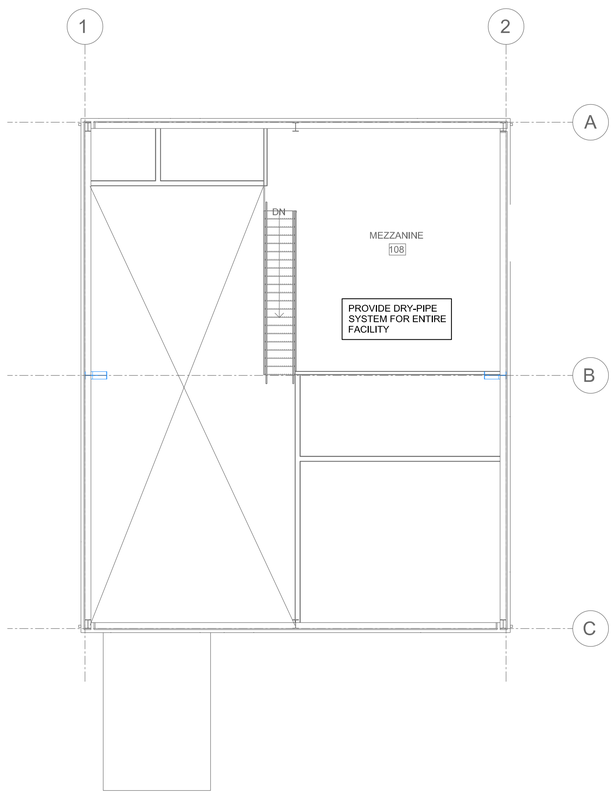
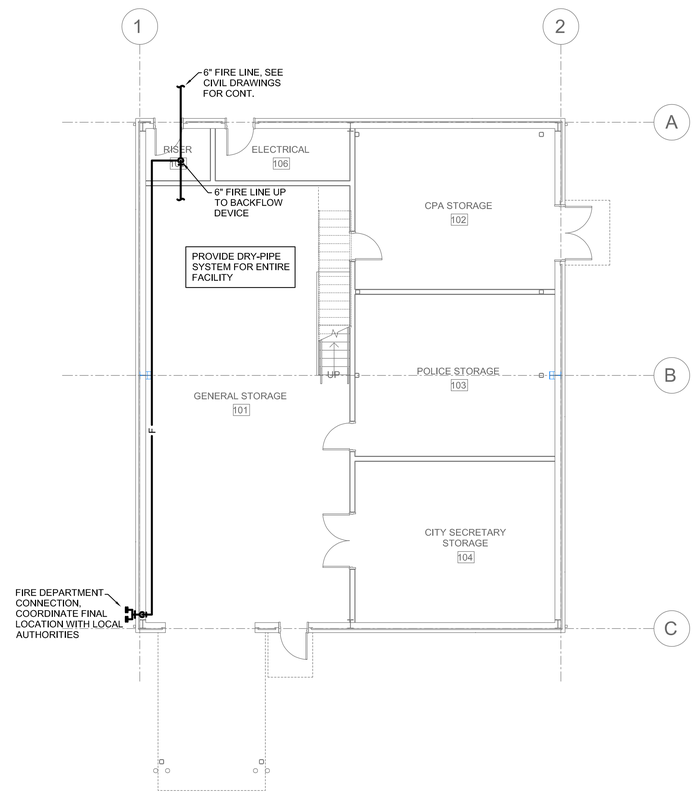
FIRE PROTECTION GENERAL NOTES

FP0.1

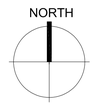


MEZZANINE PLAN 2
SCALE: 1/8" = 1'-0" FP2.1



FLOOR PLAN 1
SCALE: 1/8" = 1'-0" FP2.1

Revision Schedule		
Rev. #	Revision Description	Revision Date



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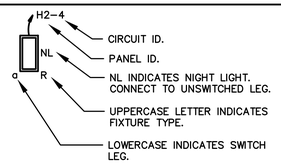
2018.019.00
DECEMBER 19, 2018

FIRE PROTECTION FLOOR PLANS

FP2.1

ELECTRICAL SYMBOLS

LIGHTING FIXTURE NOTATION



SYMBOL	DESCRIPTION
	POWER SYMBOLS
	PANELBOARD
60/60/3/3R	DISCONNECT: FRAME/FUSES/POLES/NEMA
	DISTRIBUTION BOARD
	SWITCHBOARD
	CONTROL PANEL.
	CIRCUIT HOMERUN TO PANELBOARD (2#12, 1#12G., 3/4"C. 20A/1P CB UNO)

REFER TO LIGHTING FIXTURE SCHEDULE FOR LIGHTING FIXTURE SYMBOL INFORMATION.

REFER TO RECEPTACLE SCHEDULE FOR POWER RECEPTACLE TYPES, MOUNTING HEIGHTS AND OTHER INFORMATION.

REFER TO LOW-VOLTAGE DEVICE SCHEDULE FOR DATA, IT SECURITY AND OTHER LOW VOLTAGE SYMBOL INFORMATION.

REFER TO DISTRIBUTED LIGHTING CONTROL SYSTEM SCHEDULE FOR LIGHTING SYSTEM CONTROL DEVICE SYMBOL INFORMATION.

REFER TO EQUIPMENT SCHEDULE FOR EQUIPMENT SYMBOL INFORMATION.

ELECTRICAL ABBREVIATIONS

AIC	AMPERE INTERRUPTING CAPACITY	(N)	NEW
AC	ABOVE COUNTER	NC	NORMALLY CLOSED
AFF	ABOVE FINISHED FLOOR	NF	NONFUSED
AFG	ABOVE FINISHED GRADE	NIC	NOT IN CONTRACT
BFC	BELOW FINISHED CEILING	NL	NIGHT LIGHT
BOF	TO BOTTOM OF FIXTURE	NO	NORMALLY OPEN
C	CONDUIT	(R)	RELOCATE OR TO BE RELOCATED
CB	CIRCUIT BREAKER	RCPT	RECEPTACLES
DZ	DAYLIGHT ZONE	OS	OCCUPANCY SENSOR
(D)	TO BE DEMOLISHED	SPD	SURGE PROTECTION DEVICE
EC	EMPTY CONDUIT	ST	SHUNT TRIP
(E)	EXISTING	SW	SWITCH
F	FUSE	UF	UNDERFLOOR
FT	FEET	UG	UNDERGROUND
G	GROUND (EQUIPMENT)	UNO	UNLESS NOTED OTHERWISE
GEC	GROUNDING ELECTRODE CONDUCTOR	W/	WITH
GFI	GROUND FAULT INTERRUPTER	W/O	WITHOUT
IC	INTERRUPTING CAPACITY	WAP	WIRELESS ACCESS POINT
LCP	LIGHTING CONTROL PANEL	WP	WEATHER-PROOF
MTD	MOUNT OR MOUNTED	XFRMR	TRANSFORMER

CONDUCTOR DERATING SCHEDULE

FUSE OR BREAKER SIZE	120V			277V		
	<65 FT	65 TO 100 FT	>110 FT	<150 FT	150 TO 250 FT	>250 FT
20A	#12	#10	#8	#12	#10	#8
30A	#10	#8	#6	#10	#8	#6
40A	#8	#6	#4	#8	#6	#4

NOTES:
1. SIZE RACEWAYS ACCORDING TO THE NATIONAL ELECTRICAL CODE.
2. SIZING OF CONDUCTORS FOR VOLTAGE DROP SHALL BE PER THIS TABLE, UNLESS NOTED OTHERWISE ON THE DRAWINGS.

ELECTRICAL SHEET INDEX

1732 – CITY OF LAKE WORTH RECORD STORAGE

DRAWING	TITLE
E0.0	SYMBOLS AND GENERAL NOTES
E0.1	SITE
E1.1	DEMOLITION
E2.1	LIGHTING
E3.1	POWER
E4.1	RISER DIAGRAM
E5.1	SCHEDULES

GENERAL NOTES

0.0 DEFINITIONS

0.1 FURNISH: TO SUPPLY AND DELIVER TO PROJECT SITE, READY FOR UNLOADING, UNPACKING, ASSEMBLY, INSTALLATION AND SIMILAR OPERATION.

0.2 INSTALL: TO PERFORM OPERATIONS AT PROJECT SITE, INCLUDING UNLOADING, TEMPORARY STORING, PACKING, ASSEMBLING, ERECTING, PLACING, ANCHORING, WORKING TO DIMENSION, FINISHING, PROTECTING, CLEANING, AND SIMILAR OPERATION.

0.3 PROVIDE: TO FURNISH AND INSTALL, COMPLETE AND READY FOR INTENDED USE.

0.4 REMOVE: TO DISCONNECT, DISMOUNT AND REMOVE FROM SITE DEVICE AND ASSOCIATED CONDUCTORS, RACEWAYS AND APPURTENANCES ALL THE WAY TO NEAREST POINT OF CONNECTION.

0.5 MODIFY AND EXTEND: TO SELECTIVELY DEMOLISH AND CHANGE EXISTING WIRE, RACEWAY, AND BUSWAY AND TO PROVIDE NEW MATERIALS AND LABOR NECESSARY FOR A COMPLETE AND OPERABLE INSTALLATION.

1.0 GENERAL

1.1 GENERAL NOTES IN THIS DRAWING APPLY TO THE WHOLE ELECTRICAL SET. DRAWING NOTES APPLY TO THE DRAWING WHERE THEY OCCUR.

1.2 DO NOT SCALE OR DIMENSION FROM THESE DRAWINGS.

1.3 COORDINATE THE EXACT LOCATION OF ALL MECHANICAL EQUIPMENT AND REQUIREMENTS FOR CONTROL AND POWER WIRING WITH THE MECHANICAL CONTRACTOR OR THE TRADE PROVIDING EQUIPMENT.

1.4 REFER TO ARCHITECTURAL AND MECHANICAL PLANS, ELEVATIONS, AND DETAILS FOR LOCATIONS OF CEILING ELEMENTS (LIGHTING FIXTURES, DIFFUSERS, ETC.) AND OTHER WALL MOUNTED DEVICES. IN CASE OF CONFLICT, ARCHITECTURAL PLANS AND ELEVATIONS TAKE PRECEDENCE FOR DEVICE LOCATIONS. IF LOCATION FOR ITEMS IS NOT SHOWN, VERIFY LOCATIONS WITH ARCHITECT OR OWNER'S REPRESENTATIVE.

1.5 ELECTRICAL SYSTEMS SHOWN ON DRAWINGS ARE FOR DIAGRAMMATIC PURPOSES ONLY. ACTUAL FIELD CONDITIONS MAY REQUIRE ADDITIONAL WORK. PROVIDE ALL WORK AND MATERIALS NECESSARY FOR A COMPLETE AND SAFE WORKING SYSTEM. COORDINATE ALL WORK WITH OTHER TRADES AS NEEDED.

1.6 INDICATED CIRCUIT RUNS ARE DIAGRAMMATIC. SIZE AND LOCATE PULL BOXES PER NEC AND APPLICABLE CODES AND COORDINATE OTHER DISCIPLINES. BUILDING CONDITIONS SHALL DETERMINE ACTUAL CONDUIT RUNS. PVC SHALL NOT BE USED IN INTERIOR SPACES.

1.7 CONTRACTOR IS RESPONSIBLE FOR FOLLOWING SAFETY PROCEDURES BY OSHA, NFPA AND APPLICABLE CODES. CONTRACTOR IS RESPONSIBLE FOR METHODS AND MEANS TO ACCOMPLISH WORK DESCRIBED IN THESE CONSTRUCTION DOCUMENTS.

1.8 COORDINATE OVERCURRENT PROTECTION DEVICES, DISCONNECT SWITCHES, CONDUCTOR AND CONDUIT SIZES WITH MECHANICAL EQUIPMENT REQUIREMENTS. SIZES SHOWN ON THESE DOCUMENTS ARE BASED ON MECHANICAL EQUIPMENT SPECIFIED. VARIATIONS IN REQUIREMENTS MAY OCCUR AS A RESULT OF THE PROVISION OF OTHER MANUFACTURER'S EQUIPMENT OR IN CHANGES TO THE SPECIFIED EQUIPMENT. SUCH REVISED REQUIREMENTS ARE A PART OF THIS CONTRACT AND SHALL BE ACCOMMODATED WITHOUT ADDITIONAL CHARGE.

1.9 FOR PURPOSES OF COORDINATION, LIGHTING FIXTURES AND OTHER DEVICES MAY BE MOVED A DISTANCE OF FIVE FEET WITH NO ADDITIONAL COST TO THE OWNER, UPON INSTRUCTION BY THE ARCHITECT OR ENGINEER.

1.10 THE DESIGN OF CONNECTIONS TO EQUIPMENT PROVIDED BY OTHERS HAS BEEN DONE USING AVAILABLE INFORMATION AT TIME OF DESIGN. VERIFY THAT ACTUAL EQUIPMENT INSTALLED MATCHES DESIGN AND MAKE NECESSARY ADJUSTMENTS TO INSTALL EQUIPMENT ACCORDING TO MANUFACTURER'S RECOMMENDATIONS.

1.11 IN CASE INFORMATION IN THESE DOCUMENTS IS IN CONFLICT WITH OTHER DISCIPLINES, CONTRACTOR SHALL SEND A REQUEST FOR INFORMATION TO CLARIFY INTENT. CONTRACTOR SHALL BE RESPONSIBLE FOR ANY CHANGES TO INSTALLATION DUE TO FAILURE TO CLARIFY INTENT PRIOR TO INSTALLATION OF EQUIPMENT.

1.12 IN CASE EQUIPMENT SHOWN IN OTHER DISCIPLINES REQUIRES ELECTRICAL CONNECTIONS AND IS NOT SHOWN ON THESE DRAWINGS, CONTRACTOR SHALL INCLUDE IN THE BID COSTS TO PROVIDE REQUIRED ELECTRICAL POWER AND/OR DATA RACEWAYS TO EQUIPMENT AND ISSUE AN RFI TO CLARIFY INTENT. CONTRACTOR WILL BE RESPONSIBLE TO INSTALL SUCH EQUIPMENT WITHOUT ADDITIONAL COST TO THE OWNER.

2,0 WIRING

2.1 CONDUCTOR SIZES SHOWN ARE MINIMUM SIZES. FEEDERS AND BRANCH CIRCUIT SIZES ARE BASED ON 60 DEGREE INSULATION UP TO #1 AWG, AND 75 DEGREE INSULATION FOR LARGER SIZES. CONTRACTOR SHALL MAKE CORRECTIONS TO CONDUCTOR SIZES ACCORDING TO THE NEC IF USING LOWER TEMPERATURE CONDUCTORS.

2.2 SINGLE PHASE HOMERUNS CAN BE COMBINED INTO THREE PHASE CONDUCTORS ONE NEUTRAL AND ONE GROUND CONDUCTOR IN A SINGLE CONDUIT.

2.3 THREE PHASE HOMERUN ARE DESIGNATED FOR THREE PHASE CONDUCTORS AND ONE GROUND IN A SINGLE CONDUIT. CONTRACTOR HAS THE OPTION OF CONSOLIDATING RUNS INTO A SINGLE CONDUIT. DE-RATE CONDUCTORS AS REQUIRED PER NEC AND DO NOT COMBINE NEUTRAL CONDUCTORS

2.4 UNLESS NOTED OTHERWISE, THE MINIMUM CIRCUIT RUN SIZE SHALL BE 2#12,#12G, 3/4"C.

2.5 REFER TO MINIMUM CONDUCTOR SIZING SCHEDULE ON THIS SHEET FOR CONDUCTOR SIZE ADJUSTMENT DUE TO CONDUIT RUN DISTANCE.

2.6 INSTALL SWITCHES WITHIN 18" OF LATCHING SIDE OF DOOR UNLESS NOTED OTHERWISE.

2.7 DO NOT ROUTE CONDUITS ON ROOF. ROUTE CONDUITS UNDER ROOF STRUCTURE. ALL CONDUIT PENETRATIONS THROUGH THE ROOF TO SERVE MECHANICAL EQUIPMENT SHALL BE WITHIN THE ASSOCIATED EQUIPMENT ROOF CURB. COORDINATE LOCATIONS OF PENETRATIONS WITH THE MECHANICAL CONTRACTOR.

2.8 PROVIDE A GROUND CONDUCTOR FOR EVERY FEEDER AND BRANCH CIRCUIT PER NEC ARTICLE 250. WHERE A SINGLE CONDUIT HAS SEVERAL BRANCH CIRCUITS, PROVIDE A SINGLE GROUND CONDUCTOR U.N.O.

2.9 PROVIDE A PULL CORD WITH A MINIMUM 200 LB TENSILE STRENGTH FOR ALL EMPTY RACEWAYS AND CONDUITS.

2.10 NO SPLICES ARE ACCEPTABLE INSIDE PANELBOARDS OR DISCONNECT SWITCHES. TERMINATE ONLY ONE CONDUCTOR PER LUG.

3.0 WIRING DEVICES AND DATA OUTLETS

3.1 PROVIDE ADDITIONAL GROUNDING CONDUCTOR FOR ALL RECEPTACLES WITH ISOLATED GROUND.

4.0 LIGHTING

4.1 LIGHTING PLANS INDICATE SWITCHING AND BRANCH CIRCUIT NUMBERS FOR ALL LIGHTING FIXTURES. LOWER CASE LETTERS AT SWITCHES AND LIGHTING FIXTURES INDICATE SWITCHING WHERE CONTROL PATTERN IS NOT OBVIOUS. INSTALL BRANCH CIRCUIT WIRING IN RACEWAY TO ALL RIGIDLY ATTACHED LIGHTING FIXTURES AND TO JUNCTION BOXES FOR ALL LAY-IN FIXTURES AS REQUIRED TO PROVIDE SWITCHING AND CIRCUITING AS SHOWN ON DRAWINGS.

4.2 CONNECT ALL LAY-IN FIXTURES TO A BRANCH CIRCUIT JUNCTION BOX WITH A FLEXIBLE FIXTURE TAIL. CONNECT NO MORE THAN FOUR FIXTURES TAILS TO A SINGLE JUNCTION BOX. FIXTURE-TO-FIXTURE WIRING IS NOT ACCEPTABLE EXCEPT WHERE SPECIFICALLY STATED ON THE DRAWINGS OR SPECIFICATIONS.

OWNER PROVIDED EQUIPMENT

1. THIS PROJECT INCLUDES ELECTRICAL CONNECTIONS TO OWNER-PROVIDED EQUIPMENT. CONSTRUCTION DOCUMENTS ARE BASED ON INFORMATION AVAILABLE DURING DESIGN.
2. CONTRACTOR SHALL VERIFY ELECTRICAL REQUIREMENTS OF ACTUAL OWNER-FURNISHED EQUIPMENT PRIOR TO ROUGH-IN AND ACCOMMODATE FOR ANY DIFFERENCES DURING CONSTRUCTION.

LIGHTING FIXTURE SCHEDULE

CALLOUT	SYMBOL	DESCRIPTION	MODEL	LAMP	LUMENS / LAMP	MOUNTING	INPUT WATTS	VOLTS	NOTES
A		4FT LED STRIP WITH INTEGRATED OCCUPANCY SENSOR	LITHONIA: ZL1F L48 4500LM MDD MVOLT 50K 80CRI LSXR	(1) 39W LED	4000	SUSPENDED AT 20'-0' AFF	39	120V 1P 2W	SET SENSOR TO 30 MIN
A8		4FT LED STRIP WITH INTEGRATED OCCUPANCY SENSOR	LITHONIA: ZL1F L48 4500LM MDD MVOLT 50K 80CRI LSXR	(1) 39W LED	4000	SUSPENDED AT 8'-0" AFF	39	120V 1P 2W	SET SENSOR TO 30 MIN
AW		4FT LED STRIP WITH INTEGRATED OCCUPANCY SENSOR	LITHONIA: ZL1F L48 4500LM MDD MVOLT 50K 80CRI LSXR	(1) 39W LED	4000	WALL MOUNTED AT 9'-0" AFF	39	120V 1P 2W	SET SENSOR TO 30 MIN
B		LED CANOPY LIGHT	LITHONIA: CNY LED P1 40K MVOLT DDB	(1) 35W LED	4500	CANOPY	35	120V 1P 2W	
C		2X4 LAY-IN 4800 LUMEN LED FIXTURE	LITHONIA: 2GTL 4 48L LP840	(1) 48W LED	4800	RECESSED	48	120V 1P 2W	
W		DECORATIVE EXTERIOR SCONCE WITH TYPE 4 DISTRIBUTION	LITHONIA: CSXW LED 30C 700 40K T4M MVOLT	(1) LED	0	WALL	69	120V 1P 2W	MOUNT 6" ABOVE DOOR.
X2		LED EMERGENCY LIGHT WITH 90-MINUTE BATTERY	LITHONIA: ELM2 LED	(1) 5W LED	0	WALL/CEILING	5	120V 1P 2W	
XC		ILLUMINATED EXIT SIGN / EMERGENCY LIGHT COMBO WITH RED LED LETTERS AND THERMOPLASTIC HOUSING	LITHONIA: ECG LED HO M6	(1) 5W LED	0	WALL/CEILING	5	120V 1P 2W	
XE		EMERGENCY EXTERIOR SCONCE WITH 90-MINUTE BATTERY	DMF LIGHTING: DEL600	(1) 5W LED	0	WALL 6" ABOVE DOOR	5	120V 1P 2W	VERIFY FINISH WITH ARCHITECT PRIOR TO PROCUREMENT.

STATE OF TEXAS
ROBERTO TORRES
83419
LICENSED
PROFESSIONAL ENGINEER

12/19/18

Revision Schedule		
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2018.019.00
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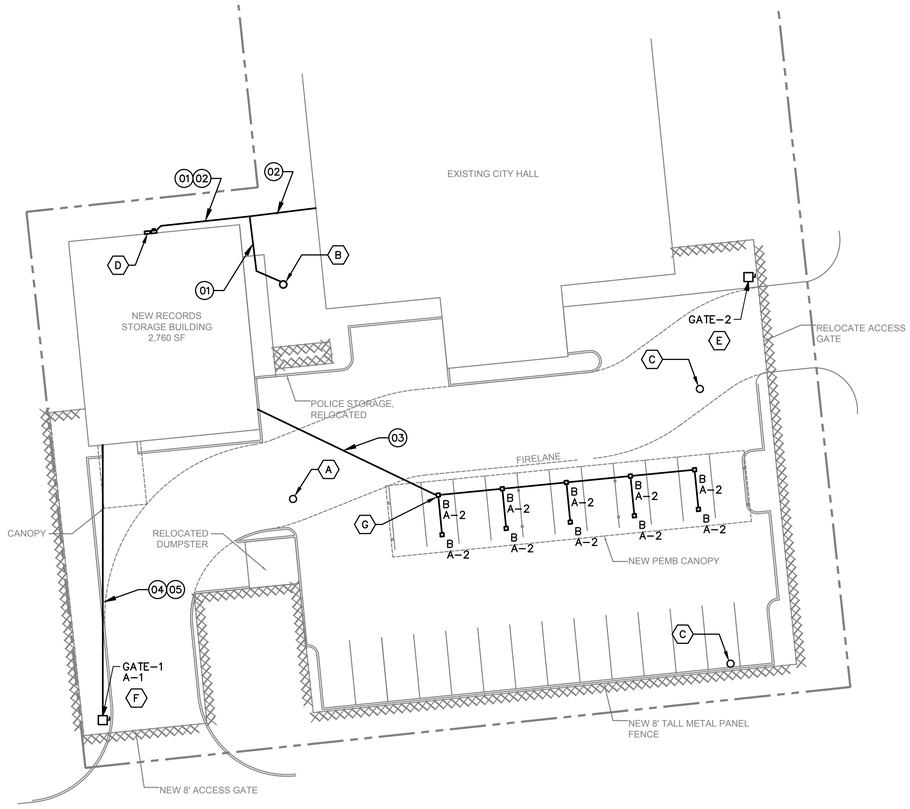
SYMBOLS AND GENERAL NOTES

E0.1



ELECTRICAL SITE PLAN - RECORDS STORAGE 1

SCALE: 1" = 20'-0" E1.1

DRAWING NOTES

1. LOCATIONS OF EQUIPMENT SHOWN ON THIS DRAWING ARE DIAGRAMMATIC. DO NOT SCALE FROM THIS DRAWING. REFER TO CIVIL DRAWINGS FOR EXACT LOCATIONS.
2. EQUIPMENT AND LIGHTING FIXTURE LOCATIONS ARE APPROXIMATE. REFER TO CIVIL AND ARCHITECTURAL SITE PLANS FOR EXACT LOCATIONS.
3. ENSURE EQUIPMENT DOES NOT ENCROACH IN EASEMENTS OR RIGHT-OF-WAYS AND NOTIFY ENGINEER AT ONCE IF THERE IS A CONFLICT.
4. REFER TO FEEDER SCHEDULE ON SHEET E4.1 FOR FEEDER SIZE INFORMATION.

NOTES BY SYMBOL ⬡

A. LOCATION OF (E) POWER UTILITY POLE TO BE RELOCATED.

B. PROPOSED LOCATION OF RELOCATED POWER UTILITY POLE AND TRANSITION FOR NEW SERVICE

C. (E) LIGHT POLE TO BE REMOVED. REMOVE POLE, FIXTURE, AND ASSOCIATED CONDUCTORS AND RACEWAYS TO PANEL.

D. LOCATION OF NEW METER AND SERVICE DISCONNECT.

E. RELOCATE EXISTING GATE OPERATOR AND CONTROLS. MODIFY AND EXTEND EXISTING FEEDERS, RACEWAYS AND CONDUCTORS AND PROVIDE A COMPLETE AND OPERATIONAL SYSTEM.

F. INSTALL NEW GATE ACCORDING TO MANUFACTURER'S INSTRUCTIONS, INCLUDING CONTROLS AND OTHER ACCESSORIES. PROVIDE RACEWAYS, CONDUCTORS AND APPURTENANCES FOR A COMPLETE AND OPERATIONAL SYSTEM.

G. ROUTE CANOPY LIGHTING FEEDER THROUGH CANOPY STRUCTURAL SUPPORT. PAINT RACEWAYS TO MATCH STRUCTURE.

SITE CONDUIT SCHEDULE (XX)

IMPORTANT: FEEDERS ARE CALCULATED USING 60 DEGREE INSULATION FOR SIZES UP TO #1 AND 75 DEGREE INSULATION FOR SIZES LARGER THAN #1. CONTRACTOR HAS THE OPTION OF COMBINING CONDUITS RUNNING IN SAME TRENCH. DO NOT COMBINE NEUTRALS. DERATE CONDUCTORS AS REQUIRED BY NEC.

PROVIDE PULL STRING FOR ALL DATA AND SECURITY CONDUITS.

ID	CIRCUIT	DESTINATION	FEEDER	NOTES
01	SERVICE	UTILITY	SEE ONE-LINE	
02	N/A	CITY HALL	(2) 2"C WITH STRING	SEE NOTE 1
03	A-2	PARKING CANOPY	2#8,#10G,3/4"C	
04	A-1	GATE	2#8,#10G,3/4"C	
05	N/A	GATE	(1)1"C W/STRING	

NOTES:

1. EXTEND CONDUITS INSIDE CITY HALL TO 4" ABOVE ACCESSIBLE CEILING. LABEL CONDUITS "RECORDS STORAGE".

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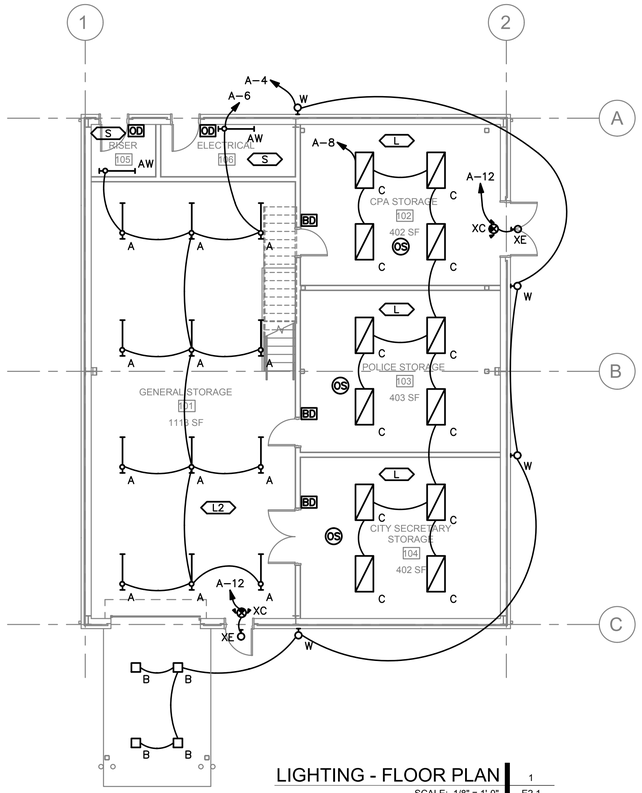
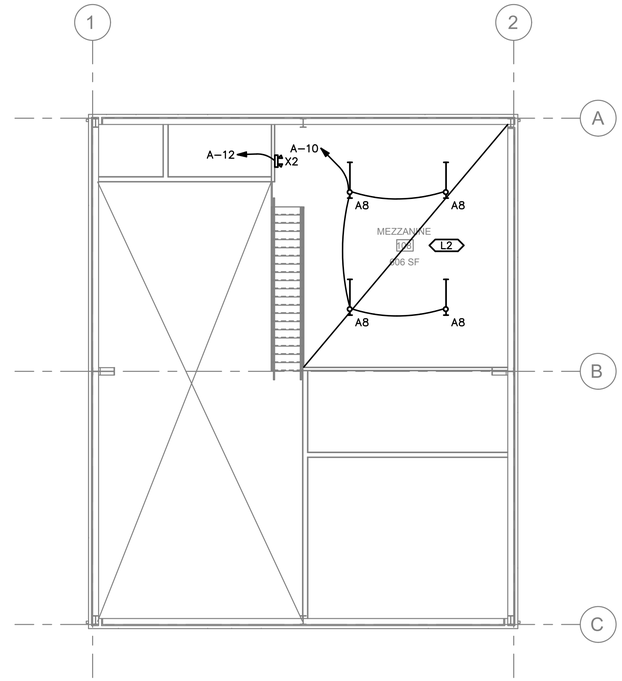
ELECTRICAL SITE PLAN

E1.1



LIGHTING - FLOOR PLAN 1 E2.1
SCALE: 1/8" = 1'-0"



LIGHTING - MEZZANINE 2 E2.1
SCALE: 1/8" = 1'-0"

DRAWING NOTES

1. LIGHTING FIXTURE LOCATIONS ARE DIAGRAMMATIC. REFER TO ARCHITECTURAL REFLECTED CEILING PLAN FOR EXACT LOCATION OF FIXTURES.
2. CONTRACTOR SHALL MAKE FINAL CONNECTIONS TO ALL DEVICES AND EQUIPMENT SHOWN OR REFERRED TO IN THIS DRAWING.

NOTES BY SYMBOL

A. NOT USED.

LIGHTING CONTROL SYSTEM SCHEDULE

ID	SYMBOL	NOTES
BD	BD	LOW-VOLTAGE WALL DIMMER CONTROL STATION.
OD	OD	COMBINATION WALL OCCUPANCY SENSOR AND DIMMER. PROVIDE SENSOR SWITCH WSX-D.
OS	OS	CEILING-MOUNTED OCCUPANCY SENSOR WITH 360 DEGREE, 25-FT RADIUS COVERAGE

WALL-MOUNTED DEVICE MOUNTING HEIGHT = 48" AFF TO CENTER OF DEVICE .

LCP-1 CONTROL SCHEDULE

RELAY	CIRCUIT	ROOM	NOTES
1	A-2	PARKING CANOPY	
2	A-4	BLDG EXTERIOR	
3			
4			
5			
6			
7			
8			

IMPORTANT NOTES:
1. PROVIDE 2-HR OVERRIDE SWITCH AT A LOCATION INDICATED BY OWNER.

LCP-1 AUTOMATION SCHEDULE

CHANNEL	SCHEME	ON/OFF TIMES	BLINK	TIME DELAY	NOTES
A					
B					
C					
D					
E					
F					
G					
H					

IMPORTANT: THIS SCHEDULE TO BE COMPLETED BY OWNER.

SCHEME: ENTER THE DESIRED CONTROL SCHEME:
1. MANUAL ON/SCHEDULE OFF
2. SCHEDULE ON/OFF
3. MANUAL ON/SENSOR OFF
4. PHOTOCELL ON/OFF
5. PHOTOCELL AND SCHEDULE ON/OFF
6. ASTRONOMIC ON/OFF
7. ASTRONOMIC AND SCHEDULE ON/OFF

BLINK: SELECT YES OR NO TO LIGHTS BLINKING BEFORE TURNING OFF.

TIME DELAY: TIME BETWEEN BLINK AND LIGHTS OFF.

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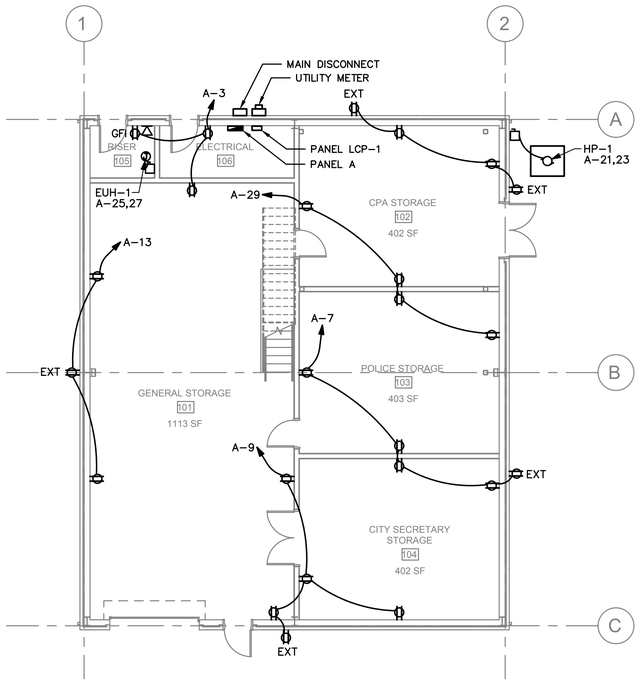
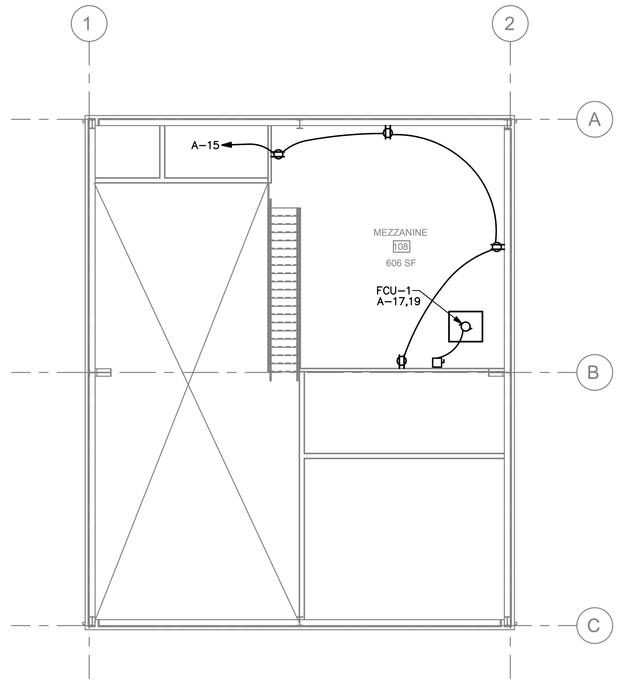
LIGHTING

E2.1



POWER - FLOOR PLAN 1
SCALE: 1/8" = 1'-0" E3.1



POWER - MEZZANINE 2
SCALE: 1/8" = 1'-0" E3.1

DRAWING NOTES

1. THIS DESIGN WAS DONE USING EXISTING LOAD INFORMATION AVAILABLE AT TIME OF DESIGN. CONTRACTOR SHALL VERIFY EXISTING LOADS AND PROVIDE FEEDERS FROM BUILDING DISTRIBUTION IF NECESSARY.
2. CONTRACTOR SHALL MAKE FINAL CONNECTIONS TO ALL DEVICES AND EQUIPMENT SHOWN OR REFERRED TO IN THIS DRAWING.

NOTES BY SYMBOL

A. NOT USED.

RECEPTACLE SCHEDULE

CALLOUT	SYMBOL	NEMA	HEIGHT	NOTES
DUPLEX		5-20R	+18" AFF	
DUPLEX GFI	GFI	5-20R	+18" AFF	
EXTERIOR	EXT	5-20R	+18" AFF	GFI, WP

LOW-VOLTAGE DEVICE SCHEDULE

CALLOUT	SYMBOL	MOUNTING HEIGHT	NOTES
DATA		MATCH MOUNTING HEIGHT OF ADJACENT RECEPTACLE. STANDALONE OUTLET: 18" AFF U.N.O.	PROVIDE SINGLE BOX WITH 1-1/4" CONDUIT WITH PULL STRING TO 4" ABOVE ACCESSIBLE CEILING

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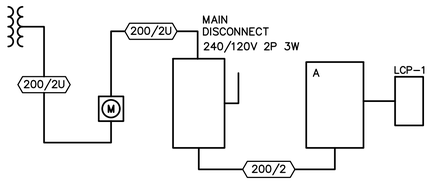
POWER

E3.1

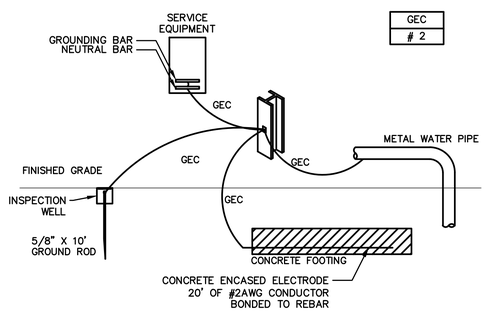


NEW ELECTRICAL SERVICE

THIS PROJECT REQUIRES THE INSTALLATION OF NEW ELECTRICAL SERVICE. CONTRACTOR SHALL COORDINATE WITH THE ELECTRICAL UTILITY AND PROVIDE SERVICE CONDUCTORS AS SHOWN IN THESE DOCUMENTS TO POINT OF SERVICE BY UTILITY.

CONDUCTORS SIZES SHOWN ARE FOR THHW/THHN COPPER CONDUCTORS. CONTRACTOR HAS THE OPTION OF PROVIDING ALUMINUM CONDUCTORS FOR SERVICE LATERAL. UPSIZE CONDUCTORS AND RACEWAYS ACCORDING TO NEC OR UTILITY COMPANY REQUIREMENTS.

1 RISER DIAGRAM
SCALE: NO SCALE



NOTES:
1 DIAGRAM ABOVE SHOWS BUILDING STEEL AS THE MAIN GROUNDING ELECTRODE POINT OF CONNECTION. CONTRACTOR HAS THE OPTION TO SELECT THE GROUNDING ROD OR CONCRETE-ENCASED CONDUCTOR AS THE MAIN GROUNDING ELECTRODE, BONDING ALL OTHER SYSTEMS TO IT. THE METAL WATER PIPE SHOULD NOT BE USED AS THE MAIN GROUNDING ELECTRODE POINT OF CONNECTION.

2 GROUNDING SCHEMATIC
SCALE: NO SCALE

DISCONNECT SCHEDULE

CALLOUT	TYPE	VOLTS	FRAME SIZE	BREAKER TRIP / FUSE RATING	ENCLOSURE	FEEDER SIZE	NOTES
MAIN DISCONNECT	FUSED DISCONNECT	240/120V 2P 3W	200	200	NEMA 3R	1-1/2"C, 2#3/0, #3/0N	

FEEDER SCHEDULE

ID	FEEDER AMPS	CONDUIT AND FEEDER	FEEDING THESE DEVICES
20/2DJ	20	3/4"C,2#12,#8G	UTILITY
200/2	200	2"C,2#3/0,#3/0N,#6G	A
200/2U	200	1-1/2"C,2#3/0,#3/0N	MAIN DISCONNECT, METER

SIZING METHOD: COPPER, 60°C #12 THROUGH #1, 75°C 1/0 AND ABOVE

A

ROOM — VOLTS **240/120V 2P 3W** — AIC **22,000**
MOUNTING **SURFACE** — BUS AMPS **200** — MAIN BKR **200**
FED FROM **MAIN DISCONNECT** — NEUTRAL **100%** — LUGS **STANDARD**
NOTE

CKT #	CKT BKR	LOAD KVA	CIRCUIT DESCRIPTION		CKT #	CKT BKR	LOAD KVA	CIRCUIT DESCRIPTION
1	20/1	0.5	GATE-1	a	2	20/1	0.4	LIGHTING
3	20/1	0.5	RECEPTACLE, ELECTRICAL 106, GEN STOR 101, RISER 105	b	4	20/1	0.4	LIGHTING
5	20/1	0.7	RECEPTACLE, CPA STOR 102	a	6	20/1	0.5	LIGHTING, ELECTRICAL 106, GEN STOR 101, RISER 105
7	20/1	0.9	RECEPTACLE, CITY SEC STOR 104, POLICE STOR 103	b	8	20/1	0.6	LIGHTING, CITY SEC STOR 104, CPA STOR 102, POLICE STOR 103
9	20/1	0.9	RECEPTACLE, CITY SEC STOR 104, GEN STOR 101	a	10	20/1	0.2	LIGHTING, MEZZANINE 108
11	20/1	0.0	SPARE	b	12	20/1	0.0	EM LIGHTING, CPA STOR 102, GEN STOR 101, MEZZANINE 108
13	20/1	0.5	RECEPTACLE, GEN STOR 101	a	14	20/1	0.0	SPARE
15	20/1	0.7	RECEPTACLE, MEZZANINE 108	b	16	20/1	0.0	SPARE
17	90/2	19.0	FCU-1, MEZZANINE 108	a	18	20/1	0.0	SPARE
19	|			b	20	20/1	0.0	SPARE
21	40/2	4.8	HP-1	a	22	20/1	0.0	SPARE
23	|			b	24	20/1	0.0	SPARE
25	20/2	3.3	EUH-1, RISER 105	a	26	20/1	0.0	SPARE
27	|			b	28	20/1	0.0	SPARE
29	20/1	0.7	RECEPTACLE, CPA STOR 102, POLICE STOR 103	a	30	20/1	0.0	SPARE
31	20/1	0.0	SPARE	b	32	20/1	0.0	SPARE
33	20/1	0.0	SPARE	a	34	20/1	0.0	SPARE
35	20/1	0.0	SPARE	b	36	20/1	0.0	SPARE
37	20/1	0.0	SPARE	a	38	20/1	0.0	SPARE
39	20/1	0.0	SPARE	b	40	20/1	0.0	SPARE
41	20/1	0.0	SPARE	a	42	20/1	0.0	SPARE

	CONN. KVA	CALC. KVA			CONN. KVA	CALC. KVA	
LIGHTING	2.6	3.2	(125%)	CONTINUOUS	0.0	0.0	(125%)
LARGEST MOTOR	4.8	1.2	(125%)	HEATING	18.3	18.3	(100%)
OTHER MOTORS	0.0	0.0	(100%)	NONCONTINUOUS	0.0	0.0	(100%)
RECEPTACLES	5.0	5.0	(50%>10)	KITCHEN EQUIP	0.0	0.0	(N/A)
COOLING	8.8	0.0	(100%)	NONCOIN/DIVERSE	0.0	0.0	(N/A)
				TOTAL KVA	34.7	27.8	

BALANCED PHASE AMPS **115.7**
PHASE BALANCE PERCENT: PHASE A **104%** PHASE B **96.4%**

RTU-1
480V, 3-PHASE
FED FROM PANEL: HB
CIRCUIT: HB-1,3,5

NOTES:
1. PROVIDE IDENTIFICATION PLAQUE FOR ALL EQUIPMENT DISCONNECTS AND EQUIPMENT CONNECTED DIRECTLY. PLAQUE SHALL INCLUDE THE FOLLOWING:
   NAME OF EQUIPMENT
   VOLTAGE AND PHASES
   PANEL SERVED FROM
   CIRCUIT SERVED FROM
2. REFER TO SPECIFICATIONS FOR ADDITIONAL INFORMATION

3 EQUIPMENT IDENTIFICATION
SCALE: NO SCALE

FIRE ALARM SYSTEM DESIGN

1. DRAWINGS DO NOT SHOW PLACEMENT OF DEVICES. CONTRACTOR SHALL EMPLOY A FIRE ALARM PLANNING SUPERINTENDENT, CERTIFIED BY THE STATE FIRE MARSHAL'S OFFICE TO DESIGN AND INSTALL THE FIRE ALARM SYSTEM. THE FIRE ALARM PLANNING SUPERINTENDENT SHALL PREPARE PERMIT DOCUMENT, USING EXACT DEVICES TO BE PROVIDED BY THE MANUFACTURER, AND SHALL BE RESPONSIBLE TO INSURE THAT THE DESIGN MEETS ALL OF THE REQUIREMENTS OF NFPA, ADA, NEC, ALL LOCAL CODES AND AMENDMENTS, AND THE REQUIREMENTS OF THE AUTHORITY HAVING JURISDICTION.
2. AUDIBLE ALARMS SHALL PRODUCE A SOUND LEVEL THAT EXCEEDS PREVAILING EQUIVALENT SOUND LEVEL IN THE ROOM OR SPACE BY AT LEAST 15dBA OR EXCEEDS ANY MAXIMUM SOUND LEVEL WITH A DURATION OF 60 SECONDS BY 5dBA WHICHEVER IS LOUDER. SOUND LEVELS FOR ALARMS SHALL NOT EXCEED 120dBA.
3. STROBE DEVICES SHALL BE XENON TYPE WHITE WITH A PULSE DURATION OF 2/10 OF ONE SECOND AND MINIMUM OF 75 CANDELA FLASH RATE SHALL BE 1Hz MINIMUM UP TO 3 Hz MAXIMUM.
4. MOUNTING STROBE/SPEAKER DEVICES SHALL BE 6" BELOW CEILING OF SPACE SERVED OR 80" ABOVE HIGHEST FLOOR LEVEL WITHIN SPACE WHICHEVER IS LOWER.
5. SPACING OF STROBE/SPEAKER DEVICES SHALL NOT EXCEED 50 FEET MEASURED HORIZONTALLY. IN LARGE ROOMS AND SPACES EXCEEDING 100 FEET ACROSS WITHOUT OBSTRUCTIONS DEVICES MAY BE MOUNTED AT 6' AFF AROUND THE PERIMETER SPACED NO MORE THAN 100 FEET MEASURED HORIZONTALLY USING A MINIMUM 110 CANDELA DEVICE.
6. IN ADDITION, PROVIDE SMOKE DUCT DETECTORS FOR EACH AIR HANDLING UNIT AS REQUIRED BY CODE OR THE AHJ. CONNECT DETECTORS IN SUPERVISORY OR ALARM INITIATION MODE PER LOCAL FIRE MARSHALL REQUIREMENTS.
7. WIRING FOR INITIATION DEVICES SHALL BE CLASS A WIRING FOR INDICATION DEVICES CLASS B WIRING IS ALLOWED. FOLLOW LOCAL FIRE MARSHALL REQUIREMENTS.
8. PROVIDE INTERLOCKS AND NECESSARY SIGNALS FOR FIRE PROTECTION SYSTEM TO OPERATE AS REQUIRED FOR A COMPLETE AND OPERATIONAL SYSTEM.

EQUIPMENT SCHEDULE

CALLOUT	DESCRIPTION	SYMBOL	VOLTS	KVA	AMPS	MCA	MOCP	DISCONNECT DESCRIPTION	BREAKER	CIRCUIT	WIRE CALLOUT	NOTES
EUH-1	ELECTRIC UNIT HEATER		240V 2P 2W	3.3	13.75			30/NF/2	20/2	A-25,27	3/4"C,2#12,#12G	
FCU-1	AIR HANDLER		240V 2P 2W	19.01	79.2	83.4	90	30/NF/2	90/2	A-17,19	1"C,2#2,#8G	
GATE-1	MOTORIZED GATE		120V 1P 2W	0.5	4.17	30		30/NF/2/3R	20/1	A-1	3/4"C,1#10,#10N,#12G	PROVIDE (1) 1" CONDUIT WITH PULL STRING FOR COMMUNICATIONS.
HP-1	CONDENSING UNIT		240V 2P 2W	4.82	20.1	25.2	40	30/NF/2/3R	40/2	A-21,23	3/4"C,2#10,#10G	

STATE OF TEXAS
ROBERTO TORRES
83419
LICENSED PROFESSIONAL ENGINEER
12/19/18

Revision Schedule		
Rev. #	Revision Description	Revision Date

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Torres Engineering Services, Inc.
Texas Firm Number F-10147
8237 Delafield Dr. Fort Worth, TX 76131
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Project # 1732

OWT ARCHITECTS
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www.owtarchitects.com

LAKE WORTH RECORDS STORAGE

3805 ADAM GRUBB ST.
LAKE WORTH, TX 76135

2018.019.00
DECEMBER 19, 2018

RISER DIAGRAM

E4.1

COMcheck Software Version 4.1.0.0
Interior Lighting Compliance Certificate

Project Information

Energy Code: 2015 IECC
Project Title: Lake Worth Records Storage
Project Type: New Construction

Construction Site:
3805 Adam Grubb St
Lake Worth, TX 76135

Owner/Agent:

Designer/Contractor:
Roberto Torres
Torres Engineering Services, Inc.
8237 Delafield Dr.
Fort Worth, TX 76131
682-556-0848
rtorres@torres-inc.com

Additional Efficiency Package(s)

Reduced interior lighting power. Requirements are implicitly enforced within interior lighting allowance calculations.

Allowed Interior Lighting Power

A Area Category	B Floor Area (ft2)	C Allowed Watts / ft2	D Allowed Watts (B X C)
1-Warehouse	3342	0.59	1985
		Total Allowed Watts =	1985

Proposed Interior Lighting Power

A Fixture ID : Description / Lamp / Wattage Per Lamp / Ballast	B Lamps/ Fixture	C # of Fixtures	D Fixture Watt.	E (C X D)
1-Warehouse				
LED 1: Type A, AB, AW: Other:	1	18	39	702
LED 1 copy 1: Type C: Other:	1	12	48	576
			Total Proposed Watts =	1278

Interior Lighting PASSES: Design 36% better than code

Interior Lighting Compliance Statement

Compliance Statement: The proposed interior lighting design represented in this document is consistent with the building plans, specifications, and other calculations submitted with this permit application. The proposed interior lighting systems have been designed to meet the 2015 IECC requirements in COMcheck Version 4.1.0.0 and to comply with any applicable mandatory requirements listed in the Inspection Checklist.

ROBERTO TORRES, PE — Name - Title
Signature
12/19/18 — Date

COMcheck Software Version 4.1.0.0
Exterior Lighting Compliance Certificate

Project Information

Energy Code: 2015 IECC
Project Title: Lake Worth Records Storage
Project Type: New Construction
Exterior Lighting Zone 2 (Neighborhood business district)

Construction Site:
3805 Adam Grubb St
Lake Worth, TX 76135

Owner/Agent:

Designer/Contractor:
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rtorres@torres-inc.com

Allowed Exterior Lighting Power

A Area/Surface Category	B Quantity	C Allowed Watts / Unit	D Tradable Wattage	E Allowed Watts (B X C)
Parking area	7800 ft2	0.06	Yes	468
Main entry	6 ft of door	20	Yes	120
Entry canopy	212 ft2	0.25	Yes	53
Other door (not main entry)	9 ft of door	20	Yes	180
Illuminated area of facade wall or surface	1330 ft2	0.1	No	133
			Total Tradable Watts (a) =	821
			Total Allowed Watts =	954
			Total Allowed Supplemental Watts (b) =	600

(a) Wattage tradeoffs are only allowed between tradable areas/surfaces.
(b) A supplemental allowance equal to 600 watts may be applied toward compliance of both non-tradable and tradable areas/surfaces.

Proposed Exterior Lighting Power

A Fixture ID : Description / Lamp / Wattage Per Lamp / Ballast	B Lamps/ Fixture	C # of Fixtures	D Fixture Watt.	E (C X D)
Parking area (7800 ft2): Tradable Wattage				
LED 1: Type B: Other:	1	10	35	350
Main entry (6 ft of door width): Tradable Wattage				
LED 1 copy 2: Type W: Other:	1	1	89	89
Entry canopy (212 ft2): Tradable Wattage				
LED 1 copy 1: Type B: Other:	1	4	35	140
Other door (not main entry) (9 ft of door width): Tradable Wattage				
LED 1 copy 3: Type W: Other:	1	1	89	89
Illuminated area of facade wall or surface (1330 ft2): Non-tradable Wattage				
LED 1 copy 4: Type W: Other:	1	2	89	178
			Total Tradable Proposed Watts =	668

Exterior Lighting PASSES: Design 51% better than code

Exterior Lighting Compliance Statement

Compliance Statement: The proposed exterior lighting design represented in this document is consistent with the building plans, specifications, and other calculations submitted with this permit application. The proposed exterior lighting systems have been designed to meet the 2015 IECC requirements in COMcheck Version 4.1.0.0 and to comply with any applicable mandatory requirements listed in the Inspection Checklist.

ROBERTO TORRES, PE — Name - Title
Signature
12/19/18 — Date

ENERGY CODE SYMBOLS

DAYLIGHT ZONE LIMITS

XX — ENERGY CODE IDENTIFIER. REFER TO 2105 ENERGY CODE REQUIREMENTS FOR ADDITIONAL INFORMATION.

2015 ENERGY CODE REQUIREMENTS

1. LIGHTING SYSTEM SHALL BE COMPLIANT WITH THE 2015 VERSION OF THE INTERNATIONAL ENERGY CONSERVATION CODE.
2. ALL EXTERIOR LIGHTING SHALL BE CONNECTED THROUGH LIGHTING CONTROL PANEL OR PHOTOCELL CONTROL.
3. OCCUPANCY SENSORS SHALL BE SET FOR A 20-MINUTE DELAY. UPON ACTIVATION, SENSORS SHALL TURN ON LIGHTS AT 50% IF CONTROLLING A DIMMER STATION OR 50% OF THE LIGHTS IF CONTROLLING A NON-DIMMED STATION.
4. DAYLIGHT AREAS ARE IDENTIFIED ON FLOOR PLAN.
5. THE FOLLOWING ARE ROOM CLASSIFICATIONS FOR THE PURPOSE OF LIGHTING CONTROLS. REQUIREMENTS SHOWN ARE MINIMUM REQUIREMENTS. ADDITIONAL REQUIREMENTS APPLY AS SHOWN ELSEWHERE IN THE CONSTRUCTION DOCUMENTS. ROOMS ARE IDENTIFIED ON FLOOR PLANS.

S — SMALL SPACES WITH OCCUPANCY SENSORS

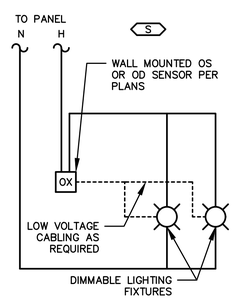
1. PROVIDE WALL-MOUNTED OCCUPANCY SENSOR.
2. PROVIDE MANUAL CONTROL TO DIM LIGHTS 50%.

L — LARGE SPACES WITH OCCUPANCY SENSORS

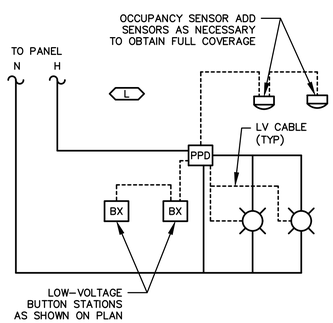
1. PROVIDE CEILING-MOUNTED OCCUPANCY SENSORS.
2. PROVIDE MANUAL CONTROL TO DIM LIGHTS 50%.

IMPORTANT SCHEMATIC NOTES

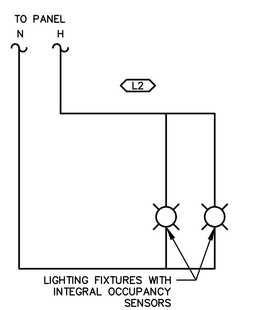
1. SCHEMATICS SHOWN ARE NOT WIRING DIAGRAMS. THEY SHOW THE INTENT OF CONTROLS AND THE RELATIONSHIPS BETWEEN CONTROL DEVICES AND FIXTURES. ACTUAL INSTALLATION MAY REQUIRE ADDITIONAL WIRING DUE TO THE NATURE OF THE DEVICES. INSTALL ACCORDING TO MANUFACTURER'S INSTRUCTIONS.
2. PROVIDE UNSWITCHED LEG FOR ALL EMERGENCY FIXTURES WITH BATTERY BACKUP. FIXTURES SHALL SWITCH/DIM WITH OTHER FIXTURES IN THE ZONE AND TURN ON WHEN POWER IS LOST.
3. WHEN A FIXTURE TYPE IS SHOWN, ALSO ITS EMERGENCY COUNTERPART SHALL BE INCLUDED. FOR EXAMPLE, IF SCHEMATIC SHOWS FIXTURE TYPE "J1", IT MEANS FIXTURES TYPE "J1" AND TYPE "J1E" ARE INCLUDED.
4. IN MOST INSTANCES, ONLY ONE COMMON (NEUTRAL) IS SHOWN FOR CLARITY. DO NOT SHARE NEUTRALS. PROVIDE ONE NEUTRAL PER CIRCUIT. NO EXCEPTIONS.
5. SCHEMATICS DO NOT SHOW REQUIRED 2-HR OVERRIDE STATIONS. REFER TO PLANS FOR LOCATIONS OF OVERRIDE STATIONS.



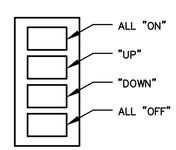
1 TYPE S SCHEMATIC
SCALE: NO SCALE



2 TYPE L SCHEMATIC
SCALE: NO SCALE



3 TYPE L2 SCHEMATIC
SCALE: NO SCALE



4 BD STATION
SCALE: NO SCALE

STATE OF TEXAS
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SCHEMATICS

E5.1