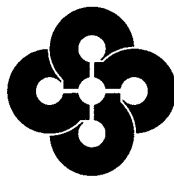


PROJECT MANUAL:
8/21/26
CONSTRUCTION DOCUMENTS

**OZARKS ELECTRIC
1st FLOOR REMODEL
FAYETTEVILLE, ARKANSAS**



Crafton Tull

1450 E. Zion Rd. Suite 9, Fayetteville, AR 72703

Phone : 479.636.4838 Fax: 479.631.6224

www.craftontull.com

CTA No. 25300600

I hereby certify that these plans and specifications have been prepared by me, or under my supervision. I further certify that to the best of my knowledge these plans and specifications are required in compliance with the Arkansas Fire Prevention Code – Current Edition.



8/21/26

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DOCUMENT 002113 - INSTRUCTIONS TO BIDDERS

1. INSTRUCTIONS TO BIDDERS

- A. AIA Document A701, "Instructions to Bidders," is hereby incorporated into the Procurement and Contracting Requirements by reference.

1. A copy of AIA Document A701, "Instructions to Bidders," is bound in this Project Manual.

END OF DOCUMENT 002113

 AIA® Document A701® – 2018**Instructions to Bidders**

for the following Project:
(Name, location, and detailed description)

Ozarks Electric 1st Floor Remodel
3641 W. Wedington Dr.
Fayetteville, AR 72704

THE OWNER:
(Name, legal status, address, and other information)

Ozarks Electric Cooperative
3641 W. Wedington Dr.
Fayetteville, AR 72704

THE ARCHITECT:
(Name, legal status, address, and other information)

Crafton, Tull & Associates, Inc.
1450 E. Zion Rd, Suite 9
Fayetteville, AR 72703
479.455.2207

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- 1 **DEFINITIONS**
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- 5 **CONSIDERATION OF BIDS**
- 6 **POST-BID INFORMATION**
- 7 **PERFORMANCE BOND AND PAYMENT BOND**
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ADDITIONS AND DELETIONS:

The author of this document may have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

FEDERAL, STATE, AND LOCAL LAWS MAY IMPOSE REQUIREMENTS ON PUBLIC PROCUREMENT CONTRACTS. CONSULT LOCAL AUTHORITIES OR AN ATTORNEY TO VERIFY REQUIREMENTS APPLICABLE TO THIS PROCUREMENT BEFORE COMPLETING THIS FORM.

It is intended that AIA Document G612™–2017, Owner's Instructions to the Architect, Parts A and B will be completed prior to using this document.

ARTICLE 1 DEFINITIONS

§ 1.1 Bidding Documents include the Bidding Requirements and the Proposed Contract Documents. The Bidding Requirements consist of Instructions to Bidders, supplementary instructions to bidders, the bid form, and any other bidding forms. The Proposed Contract Documents consist of Drawings, Specifications, and all Addenda.

§ 1.2 Definitions set forth in the General Conditions of the Contract for Construction, or in other Proposed Contract Documents apply to the Bidding Documents.

§ 1.3 Addenda are written or graphic instruments issued by the Architect, which, by additions, deletions, clarifications, or corrections, modify or interpret the Bidding Documents.

§ 1.4 A Bid is a complete and properly executed proposal to do the Work for the sums stipulated therein, submitted in accordance with the Bidding Documents.

§ 1.5 The Base Bid is the sum stated in the Bid for which the Bidder offers to perform the Work described in the Bidding Documents, to which Work may be added or deleted by sums stated in Alternate Bids.

§ 1.6 An Alternate Bid (or Alternate) is an amount stated in the Bid to be added to or deducted from, or that does not change, the Base Bid if the corresponding change in the Work, as described in the Bidding Documents, is accepted.

§ 1.7 A Unit Price is an amount stated in the Bid as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, as described in the Bidding Documents.

§ 1.8 A Bidder is a person or entity who submits a Bid and who meets the requirements set forth in the Bidding Documents.

§ 1.9 A Sub-bidder is a person or entity who submits a bid to a Bidder for materials, equipment, or labor for a portion of the Work.

ARTICLE 2 BIDDER'S REPRESENTATIONS

§ 2.1 By submitting a Bid, the Bidder represents that:

- .1 the Bidder has read and understands the Bidding Documents;
- .2 the Bidder understands how the Bidding Documents relate to other portions of the Project, if any, being bid concurrently or presently under construction;
- .3 the Bid complies with the Bidding Documents;
- .4 the Bidder has visited the site, become familiar with local conditions under which the Work is to be performed, and has correlated the Bidder's observations with the requirements of the Proposed Contract Documents;
- .5 the Bid is based upon the materials, equipment, and systems required by the Bidding Documents without exception; and

ARTICLE 3 BIDDING DOCUMENTS

§ 3.1 Distribution

§ 3.1.1 Bidders shall obtain complete Bidding Documents, as indicated below, from the issuing office.

(Indicate how, such as by email, website, host site/platform, paper copy, or other method Bidders shall obtain Bidding Documents.)

Bid Documents distributed electronically by Architect.

§ 3.1.2 Any paper Bidding Documents shall be printed by Bidder at Bidder's expense..

§ 3.1.3 Bidding Documents will not be issued directly to Sub-bidders .

§ 3.1.4 Bidders shall use complete Bidding Documents in preparing Bids. Neither the Owner nor Architect assumes responsibility for errors or misinterpretations resulting from the use of incomplete Bidding Documents.

§ 3.1.5 The Bidding Documents will be available for the sole purpose of obtaining Bids on the Work. No license or grant of use is conferred by distribution of the Bidding Documents.

§ 3.2 Modification or Interpretation of Bidding Documents

§ 3.2.1 The Bidder shall carefully study the Bidding Documents, shall examine the site and local conditions, and shall notify the Architect of errors, inconsistencies, or ambiguities discovered and request clarification or interpretation pursuant to Section 3.2.2.

§ 3.2.2 Requests for clarification or interpretation of the Bidding Documents shall be submitted by the Bidder in writing and shall be received by the Architect at least seven days prior to the date for receipt of Bids.

(Indicate how, such as by email, website, host site/platform, paper copy, or other method Bidders shall submit requests for clarification and interpretation.)

§ 3.2.3 Modifications and interpretations of the Bidding Documents shall be made by Addendum. Modifications and interpretations of the Bidding Documents made in any other manner shall not be binding, and Bidders shall not rely upon them.

§ 3.3 Substitutions

§ 3.3.1 The materials, products, and equipment described in the Bidding Documents establish a standard of required function, dimension, appearance, and quality to be met by any proposed substitution.

§ 3.3.2 Substitution Process

§ 3.3.2.1 Written requests for substitutions shall be received by the Architect at least ten days prior to the date for receipt of Bids. Requests shall be submitted in the same manner as that established for submitting clarifications and interpretations in Section 3.2.2.

§ 3.3.2.2 Bidders shall submit substitution requests on a Substitution Request Form if one is provided in the Bidding Documents.

§ 3.3.2.3 If a Substitution Request Form is not provided, requests shall include (1) the name of the material or equipment specified in the Bidding Documents; (2) the reason for the requested substitution; (3) a complete description of the proposed substitution including the name of the material or equipment proposed as the substitute, performance and test data, and relevant drawings; and (4) any other information necessary for an evaluation. The request shall include a statement setting forth changes in other materials, equipment, or other portions of the Work, including changes in the work of other contracts or the impact on any Project Certifications (such as LEED), that will result from incorporation of the proposed substitution.

§ 3.3.3 The burden of proof of the merit of the proposed substitution is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution shall be final.

§ 3.3.4 If the Architect approves a proposed substitution prior to receipt of Bids, such approval shall be set forth in an Addendum. Approvals made in any other manner shall not be binding, and Bidders shall not rely upon them.

§ 3.3.5 No substitutions will be considered after the Contract award unless specifically provided for in the Contract Documents.

§ 3.4 Addenda

§ 3.4.1 Addenda will be transmitted to Bidders known by the issuing office to have received complete Bidding Documents.

(Indicate how, such as by email, website, host site/platform, paper copy, or other method Addenda will be transmitted.)

Via email.

§ 3.4.2 Addenda will be issued no later than four days prior to the date for receipt of Bids, except an Addendum withdrawing the request for Bids or one which includes postponement of the date for receipt of Bids.

§ 3.4.3 Prior to submitting a Bid, each Bidder shall ascertain that the Bidder has received all Addenda issued, and the Bidder shall acknowledge their receipt in the Bid.

ARTICLE 4 BIDDING PROCEDURES

§ 4.1 Preparation of Bids

§ 4.1.1 Bids shall be submitted on the forms included with or identified in the Bidding Documents.

§ 4.1.2 All blanks on the bid form shall be legibly executed. Paper bid forms shall be executed in a non-erasable medium.

§ 4.1.3 Sums shall be expressed in both words and numbers, unless noted otherwise on the bid form. In case of discrepancy, the amount entered in words shall govern.

§ 4.1.4 Edits to entries made on paper bid forms must be initialed by the signer of the Bid.

§ 4.1.5 All requested Alternates shall be bid. If no change in the Base Bid is required, enter "No Change" or as required by the bid form.

§ 4.1.6 Each copy of the Bid shall state the legal name and legal status of the Bidder. As part of the documentation submitted with the Bid, the Bidder shall provide evidence of its legal authority to perform the Work in the jurisdiction where the Project is located. Each copy of the Bid shall be signed by the person or persons legally authorized to bind the Bidder to a contract. A Bid by a corporation shall further name the state of incorporation and have the corporate seal affixed. A Bid submitted by an agent shall have a current power of attorney attached, certifying the agent's authority to bind the Bidder.

§ 4.1.7 A Bidder shall incur all costs associated with the preparation of its Bid.

§ 4.2 Bid Security

§ 4.2.1 Each Bid shall be accompanied by the following bid security:

(Insert the form and amount of bid security.)

N/A

§ 4.2.2 The Bidder pledges to enter into a Contract with the Owner on the terms stated in the Bid and shall, if required, furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Should the Bidder refuse to enter into such Contract or fail to furnish such bonds if required, the amount of the bid security shall be forfeited to the Owner as liquidated damages, not as a penalty. In the event the Owner fails to comply with Section 6.2, the amount of the bid security shall not be forfeited to the Owner.

§ 4.2.3 If a surety bond is required as bid security, it shall be written on AIA Document A310™, Bid Bond, unless otherwise provided in the Bidding Documents. The attorney-in-fact who executes the bond on behalf of the surety shall affix to the bond a certified and current copy of an acceptable power of attorney. The Bidder shall provide surety bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 4.2.4 The Owner will have the right to retain the bid security of Bidders to whom an award is being considered until (a) the Contract has been executed and bonds, if required, have been furnished; (b) the specified time has elapsed so that Bids may be withdrawn; or (c) all Bids have been rejected. However, if no Contract has been awarded or a Bidder has not been notified of the acceptance of its Bid, a Bidder may, beginning 60 days after the opening of Bids, withdraw its Bid and request the return of its bid security.

§ 4.3 Submission of Bids

§ 4.3.1 A Bidder shall submit its Bid as indicated below:

(Indicate how, such as by website, host site/platform, paper copy, or other method Bidders shall submit their Bid.)

Via email to Owner's Representative, with a copy to Architect.

§ 4.3.2 Bids shall be submitted by 3:00 PM Central Time on September 11, 2026. Bids submitted after the date and time for receipt of Bids, or at an incorrect place, will not be accepted.

§ 4.3.3 The Bidder shall assume full responsibility for timely delivery at the location designated for receipt of Bids.

§ 4.3.4 A Bid submitted by any method other than as provided in this Section 4.3 will not be accepted.

§ 4.4 Modification or Withdrawal of Bid

§ 4.4.1 Prior to the date and time designated for receipt of Bids, a Bidder may submit a new Bid to replace a Bid previously submitted, or withdraw its Bid entirely, by notice to the party designated to receive the Bids. Such notice shall be received and duly recorded by the receiving party on or before the date and time set for receipt of Bids. The receiving party shall verify that replaced or withdrawn Bids are removed from the other submitted Bids and not considered. Notice of submission of a replacement Bid or withdrawal of a Bid shall be worded so as not to reveal the amount of the original Bid.

§ 4.4.2 Withdrawn Bids may be resubmitted up to the date and time designated for the receipt of Bids in the same format as that established in Section 4.3, provided they fully conform with these Instructions to Bidders. Bid security shall be in an amount sufficient for the Bid as resubmitted.

§ 4.4.3 After the date and time designated for receipt of Bids, a Bidder who discovers that it made a clerical error in its Bid shall notify the Architect of such error within two days, or pursuant to a timeframe specified by the law of the jurisdiction where the Project is located, requesting withdrawal of its Bid. Upon providing evidence of such error to the reasonable satisfaction of the Architect, the Bid shall be withdrawn and not resubmitted. If a Bid is withdrawn pursuant to this Section 4.4.3, the bid security will be attended to as follows:

(State the terms and conditions, such as Bid rank, for returning or retaining the bid security.)

DOCUMENT 004113 - BID FORM - STIPULATED SUM (SINGLE-PRIME CONTRACT)

1.1 BID INFORMATION

- A. Bidder: _____.
- B. Project Name: Ozarks Electric 1st Floor Remodel.
- C. Project Location: Fayetteville, AR.
- D. Owner: Ozarks Electric Cooperative.
- E. Architect: Crafton Tull.
- F. Architect Project Number: 25300600.

1.2 CERTIFICATIONS AND BASE BID

- A. Base Bid, Single-Prime (All Trades) Contract: The undersigned Bidder, having carefully examined the Procurement and Contracting Requirements, Conditions of the Contract, Drawings, Specifications, and all subsequent Addenda, as prepared by Crafton Tull and Architect's consultants, having visited the site, and being familiar with all conditions and requirements of the Work, hereby agrees to furnish all material, labor, equipment and services, including all scheduled allowances, necessary to complete the construction of the above-named project, according to the requirements of the Procurement and Contracting Documents, for the stipulated sum of:

1. _____ Dollars
(\$_____).

1.3 BID GUARANTEE

- A. The undersigned Bidder agrees to execute a contract for this Work in the above amount if Bidder is selected by Owner to do so within **60** days after receipt of bids,

1.4 TIME OF COMPLETION

- A. The undersigned Bidder proposes and agrees hereby to commence the Work of the Contract Documents on a date specified in a written Notice to Proceed to be issued by Architect, and shall fully complete the Work within 600 calendar days.

1.5 ACKNOWLEDGMENT OF ADDENDA

- A. The undersigned Bidder acknowledges receipt of and use of the following Addenda in the preparation of this Bid:

1. Addendum No. 1, dated _____.
2. Addendum No. 2, dated _____.
3. Addendum No. 3, dated _____.

1.6 BID SUPPLEMENTS

- A. The following supplements are a part of this Bid Form and are attached hereto.

1. List any/all documents supplemental to bid submitted:
2. _____
3. _____
4. _____

1.7 CONTRACTOR'S LICENSE

- A. The undersigned further states that it is a duly licensed contractor, for the type of work proposed, in the State of Arkansas, and that all fees, permits, etc., pursuant to submitting this proposal have been paid in full.

1.8 SUBMISSION OF BID

- A. Respectfully submitted this ____ day of _____.
- B. Submitted By: _____ (Name of bidding firm or corporation).
- C. Authorized Signature: _____ (Handwritten signature).
- D. Signed By: _____ (Type or print name).
- E. Title: _____ (Owner/Partner/President/Vice President).
- F. Witnessed By: _____ (Handwritten signature).
- G. Attest: _____ (Handwritten signature).
- H. By: _____ (Type or print name).
- I. Title: _____ (Corporate Secretary or Assistant Secretary).
- J. Street Address: _____.
- K. City, State, Zip: _____.
- L. Phone: _____.
- M. License No.: _____.
- N. Federal ID No.: _____ (Affix Corporate Seal Here).

END OF DOCUMENT 004113

DOCUMENT 006000 - FORMS

1.1 FORM OF AGREEMENT AND GENERAL CONDITIONS

- A. The following form of Owner/Contractor General Conditions shall be used for Project:

1. AIA Document A201, "General Conditions of the Contract for Construction."

1.2 ADMINISTRATIVE FORMS

- A. Administrative Forms: Additional administrative forms are specified in Division 01 General Requirements.

- B. Copies of AIA standard forms may be obtained from the American Institute of Architects; <http://www.aia.org/contractdocs/purchase/index.htm>; docspurchases@aia.org; (800) 942-7732.

- C. Information and Modification Forms:

1. Form for Requests for Information (RFIs): AIA Document G716, "Request for Information (RFI)."
2. Form of Request for Proposal: AIA Document G709, "Work Changes Proposal Request."
3. Change Order Form: AIA Document G701, "Change Order."
4. Form of Architect's Memorandum for Minor Changes in the Work: AIA Document G707, "Architect's Supplemental Instructions."
5. Form of Change Directive: AIA Document G714, "Construction Change Directive."

- D. Payment Forms:

1. Schedule of Values Form: AIA Document G703, "Continuation Sheet."
2. Payment Application: AIA Document G702/703, "Application and Certificate for Payment and Continuation Sheet."

END OF DOCUMENT 006000

DOCUMENT 007300 - SUPPLEMENTARY CONDITIONS – AIA

1.1 SUMMARY

A. Document Includes:

1. Supplementary Conditions.

B. Related Documents:

1. Document 006000 - General Conditions – AIA-201-2007.

1.2 SUPPLEMENTARY CONDITIONS

- A. These Supplementary Conditions modify the General Conditions of the Contract for Construction, AIA Document A201-2007, and other provisions of the Contract Documents as indicated below. All provisions that are not so modified remain in full force and effect.
- B. The terms used in these Supplementary Conditions which are defined in the General Conditions of the Contract for Construction, AIA Document A201-2007, have the meanings assigned to them in the General Conditions.
- C. The following items are supplements that modify, change, delete from or add to the “General Conditions of the Contract for Construction”, AIA Document A201, 2007 Edition. Where any article of the general conditions is modified or any paragraph, subparagraph or clause thereof is modified or deleted by these supplementary conditions, the unaltered provisions of that article, paragraph, subparagraph or clause shall remain in effect.

ARTICLE 1.1 - BASIC DEFINITIONS

Add the following subparagraphs:

- 1.1.8 Products: Means new material, machinery, components, equipment, fixtures, and systems forming the Work, but does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work. Products may also include existing materials or components required for reuse.
- 1.1.9 Furnish: To supply and deliver, unload, inspect for damage.
- 1.1.10 Install: To unpack, assemble, erect, apply, place, finish, cure, protect, clean, and make ready for use.
- 1.1.11 Provide: To furnish and install.

ARTICLE 3 CONTRACTOR

3.5 WARRANTY

The Contractor is to submit to the Owner a Maintenance Bond as shown on the following pages at the end of this section and is hereby made a part of this specification and is hereto attached. The completed Maintenance Bond is to be submitted with the final payment request.

3.6 TAXES

Sales Taxes: The Contractor shall pay Sales Tax.

3.6.2 Unemployment Compensation Taxes: All taxes under this heading shall be paid by the Contractor.

3.6.3 Social Security Taxes: All taxes under this heading shall be paid by the Contractor.

3.7 PERMITS, FEES AND NOTICES

Permits and Ordinances: Permits and ordinances shall be complied with and paid by the Contractor.

Add the following subparagraph:

3.7.5 Building permits, testing costs and other fees: The Contractor shall be responsible for paying for all testing, building permits, utility tap fees and street use permits involved with the construction of this project.

Note: State Statute Title 74 – Sec. 324.11 requires the State Fire Marshal’s office to issue a Building Permit in areas of the state where no permit is issued by a local authority. Accordingly, when no local authority is present, the successful bidder shall be required to submit a permit application and secure a permit from the office of the State Fire Marshal prior to start of construction.

3.10 CONTRACTOR’S CONSTRUCTION SCHEDULES

3.10.4 Cooperation Between Contractors & Coordination of Work: All Contractors shall be responsible to fit and coordinate their work with other trades so that all work may proceed with minimum delays and so that good fit and appearance is achieved. Contractor shall establish and hold periodic jobsite meetings with Subcontractors and Owner as required to insure a smooth and orderly communication procedure between all parties involved in construction. The Contractor is required to take notes at periodic jobsite meetings and distribute copies to Owner and other parties involved (see section Page 01310-1). All questions, directions, etc. required by the Owner shall be directed to the Contractor and not to individual Subcontractors. **No extras will be allowed for changes or additions to the work as directed by the Owner without a written change order signed by Owner and the Architect as provided within these Specifications.**

3.11 DOCUMENTS AND SAMPLES AT THE SITE

3.11.1 Add the following sentence: The Contractor shall tape, with clear tape, to the drawings and project manual all addenda, change orders, proposal requests, Architect’s supplemental instructions, construction change directives and other modifications.

3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

3.12.12 Shop drawings and samples shall be dated and marked to show the names of the project, architect, contractor, originating subcontractor, manufacturer of supplier, and separate detailer if pertinent. Shop drawings shall completely identify specification section and locations at which materials or equipment are to be installed. Reproductions of contract drawings as shop drawings only when specifically authorized in writing by the Architect.

3.12.13 After Contractor’s review of the shop drawing to see that the shop drawing conform to the contract documents, submission of shop drawings and samples shall be accompanied by 2 copies of a transmittal letter containing project name, contractor’s name, number of drawings and number of samples, titles and other pertinent data.

3.12.14.1 Submit 1 prints of each shop drawing, including fabrication, erection, layout and setting drawings and such other drawings as required under various sections of these specifications, until final approval is obtained. Submit 1 copies of manufacturer’s descriptive data including catalog sheets for materials, equipment and fixtures, showing dimensions, performance characteristics and capacities, wiring diagrams and controls, schedules, and other pertinent information as required. Where printed materials describe more than one project or model, clearly identify which is to be furnished.

- 3.12.14.2 Contractor is responsible for obtaining and distributing required prints of shop drawings to his subcontractors and material suppliers after, as well as before, final approval. Prints of reviewed shop drawings shall be made from transparencies that carry the Architect's appropriate stamp.

ARTICLE 7 CHANGES IN THE WORK

7.3 CONSTRUCTION CHANGE DIRECTIVES

- 7.3.3.3 Add the following sentence: Cost shall be limited to the following: cost of materials (including sales tax if applicable) and cost of delivery; cost of supervision, labor (including social security, old age and unemployment insurance and fringe benefits under collective bargaining agreements); hand tools; workmen's compensation insurance; bond premiums; and rental value of power tools and equipment. Overhead shall include the following: superintendence; wages of time keepers; watchmen and clerks; incidentals; general office expense; and all other expenses not included in "cost".

1. Compute requests for changes, be they additions or deductions as follows:

- a. For work performed by the Contractor:

Net cost of material	a
State sales tax	b
Net placing cost	c
W.C. insurance premium and FICA tax	<u>d</u>
	a+b+c+d
Overhead and profit, 12% x (a+b+c+d)	e
Allowable bond premium	<u>f</u>
Total Cost	a+b+c+d+e+f

- b. Credit for work omitted shall be computed as outlined in a, except the Contractor's share of overhead and profit percentage is 0%.
- c. For work performed by Subcontractors, compute as outlined above, plus the Construction Manager shall add an overhead and profit of 5.75% to the Subcontractor's cost plus the allowable bond premium.

ARTICLE 8 TIME

8.2 PROGRESS AND COMPLETION

- 8.2.2.1 The Contractor shall execute the Agreement with the Owner when the Owner issues a written "Notice of Award". The Contractor shall execute the construction of the project when the Owner issues a written "Notice to Proceed". The "Notice of Award" and the "Notice to Proceed" are shown on the following pages at the end of this section and is hereby made a part of this specification and is hereto attached.

ARTICLE 9 PAYMENTS AND COMPLETION

9.2 SCHEDULES OF VALUES

- 9.2.1 Add the following sentence: The schedule of values shall be prepared in such a manner that each item of work and each subcontracted item of work is shown as a single line item.

9.4 CERTIFICATES FOR PAYMENT

- 9.4.3 Payments to the Contractor shall be made as follows: Partial payment will be made as the work progresses on not later than the thirtieth (30th) day of each calendar month for work done during the preceding calendar month on estimates certified by the Architect. In preparing estimates, the material delivered on the site and preparatory work may be taken into consideration. The Architect may, if he so desires, arrive at the method of payment by

- means of considering the amount of work yet to be completed and the value thereof, plus the retained percentage. Estimates for monthly payments must be submitted at least fifteen (15) days in advance of the date set for payment.
- 9.4.4 In making such partial payments for the work, there shall be retained ten percent (10%) of the estimated amount until fifty (50) percent completion and acceptance of all work covered by the contract. A reduction in retainage to five percent (5%) may be authorized by the Owner if project is in conformance with construction schedule. The Final Payment, with retainage, shall be made after Final Written Approval from Owner.
- 9.4.5 All material and work covered by the partial payments shall thereupon become the sole property of the Owner, but this provision shall not be construed as relieving the Contractor from sole responsibility for the care and protection of materials and work upon which payments have been made or the restoration of any damaged work, or as a waiver of the right of the Owner to require the fulfillment of all terms of the contract.
- 9.4.6.1 The Owner/Architect may, before making any payment, require the Contractor to furnish releases, receipts, or waiver of liens from all persons performing work and supplying material to the Contractor, if the Owner/Architect deems the same necessary in order to protect his client's interest. The Owner/Architect, however, may make payment in part or in full to the Contractor without requiring the furnishing of such releases, receipts, or waiver of liens. Any payment so made shall in no way impair the obligations of any sureties on any bond or bonds furnished under the contract.
- 9.4.7 Upon completion and acceptance of all work required hereunder, the amount due the Contractor under this contract shall be paid upon certification by the Architect and approval of the Owner. The Owner may, before making final payment, occupy the building. Final approval of the building & site by the Owner could take 30 days after final acceptance is given by the Architect.
- 9.4.8 The Owner may withhold from any payment otherwise due to the Contractor as much as may be necessary to protect the Owner against any claims that may be urged against the Owner, and if he so elects, may also withhold any amounts due from the Contractor to any sub-contractor or materialmen for labor or material furnished by them. The foregoing provisions shall be construed solely for the benefit of the Owner and shall not require the Owner to determine or adjust any claims or disputes between the Contractor or his sub-contractors or materialmen, or to withhold any monies for their protection unless the Owner elects to do so. The failure or refusal of the Owner to withhold any monies from the Contractor shall in no way impair the obligations of any surety or sureties under any bond or bonds furnished under this contract.

ARTICLE 11 INSURANCE AND BONDS

11.1 CONTRACTOR'S LIABILITY INSURANCE

- 11.1.1 In the first line following the word "maintain", insert the words "in a company or companies licensed to do business in the state in which the project is located".

11.2 OWNER'S LIABILITY INSURANCE

- 11.2.1 Delete this paragraph and add the following: The contractor shall purchase and maintain "Owner's Protective Liability" including architect as an additional insured, insurance to protect the Owner against claims which may arise from operations under the contract with limits equal to those specified in article C, 11.1.2.1 above. A copy of this policy shall be forwarded to the Architect Prior to beginning any portion of the Work.
- 11.2.1.1 If this insurance is written with stipulated amounts deductible under the terms of the policy, the contractor shall pay the difference attributable to deductions in any payments made by the insurance carrier paid by this insurance.

11.3 PROPERTY INSURANCE

- 11.3.1 Add the following sentence: The contractor shall purchase and maintain property insurance upon the entire work, at the site to the full insurable value thereof. Such insurance shall be in a company against which the Owner has no reasonable objection. A copy of this policy must be forwarded to the Architect Prior to beginning any portion of the Work.
- 11.3.1.1 If this insurance is written with stipulated amounts deductible under the terms of the policy, the contractor shall pay the difference attributable to deduction in any payments made by the insurance carrier on claims paid by this insurance.
- 11.3.6 Delete this paragraph and add the following: The contractor shall file the original and two certified copies of all policies with the Owner and architect before exposure to loss may occur. If the Owner is damaged by the failure of the contractor to maintain such insurance and to so notify the Owner, then the contractor shall bear all reasonable costs properly attributed thereto.
- 11.3.7 Add the following sentences:
In waiving rights of recovery under terms of this subparagraph, the term "Owner" shall be deemed to include his employees, and the architect and his employees as the Owner's representative, as provided in the contract documents.
Subrogation: This insurance shall not be invalidated should the named insured waive, in writing prior to a loss, any right of recovery against any party for loss occurring to the property described.

11.4 PERFORMANCE BOND AND PAYMENT BOND

Add the following subparagraph:

- 11.4.3 The bond value requirements are as follows:
1. Provide a 100 percent Performance Bond and Payment Bond on AIA A312 as shown on the following pages and is hereby made a part of this specification and is hereto attached.
 2. Deliver bonds within 10 days after Notice of Award to the successful bidder. The Bond shall be executed by a bonding company authorized to do business in the State of Arkansas.
 3. Bond must comply with all aspects of Arkansas Act No. 351, as enacted by the 1953 General Assembly.
 4. Terms Not Defined In AIA Documents
 - a) Products: Means new material, machinery, components, equipment, fixtures, and systems forming the Work, but does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work. Products may also include existing materials or components required for reuse.
 - b) Furnish or Supply: To supply and deliver, unload, inspect for damage.
 - c) Install: To unpack, assemble, erect, apply, place, finish, cure, protect, clean, and ready for use.
 - d) Provide to furnish or supply, plus install.
 5. An original and four copies of these bonds shall be submitted and shall have issuing agents Power of Attorney attached to each.
 6. The Owner shall not make any payments until the Contractor furnishes the Owner the receipt from the County Clerk that Bonds have been filed.

11.5 INSURANCE REQUIREMENTS

1. The Contractor shall furnish the insurance required herein at his own expense and shall file with the Owner the policies or certificates as required, concurrent with the signing of the

- contract.
2. All insurance policies and certificates shall be submitted with the original and three (3) copies.
 3. All policies delivered to the Owner shall be returned to the Contractor upon termination of the work for cancellation and refund of premium, if any.
 4. The Contractor shall furnish a Certificate of Insurance addressed to the Owner and showing that he carries the following insurance:
 - A. Workmen's Compensation:

State:	Statutory Amount
Employer's Liability:	\$100,000.00
 - B. Comprehensive General Liability: (Including Premises-Operations; Independent Contractors' Protective; Products and Completed Operations; Broad Form Property Damage):

Bodily Injury:	\$1,000,000.00 Each Occurrence \$2,000,000.00 Aggregate, Products and Completed Operations
Property Damage:	\$1,000,000.00 Each Occurrence
Property Damage Liability for explosion and collapse. Contractual Liability (Hold Harmless Coverage):	
Bodily Injury:	\$1,000,000.00 Each Occurrence
Property Damage:	\$1,000,000.00 Each Occurrence \$2,000,000.00 Aggregate
 - C. Comprehensive Automobile Liability (owned, non-owned, hired):

Bodily Injury:	\$1,000,000.00 Each Person \$1,000,000.00 Each Accident
Property Damage:	\$1,000,000.00 Each Occurrence
 - D. Aircraft Liability:

Limits proposed by Contractor for Owner's approval.	
Insurance in those amounts shall be maintained throughout the life of the contract.	
The certificate shall state that coverage afforded by the policies shall not be cancelled without fifteen (15) days notice (written) to the Owner.	
 - E. Builder Risk Insurance: The Contractor shall purchase in the names of the Contractor and the Owner a completed value form builder's risk insurance policy with fire and extended coverage in the amount of the contract price and shall contain a vandalism and malicious mischief endorsement and be subject to the approval of the Owner as to form and substance and shall provide for Owner's Protective Liability Policy in the amount of \$1,000,000.00 for each occurrence and aggregate for bodily injury, property damage and personal injury.

The policy shall provide that any loss is to be adjusted with and paid to the Owner as trustee for all funds. Any adjustment made in good faith by the Owner shall be binding upon the Contractor.

The Owner shall have the right to have said policy issued with a mortgage clause in favor of any mortgagee holding a mortgage on the premises where the insured improvements are to be constructed. The original of the policy shall be delivered to the Owner. A blanket form builder's risk policy covering this and other projects of the Contractor will not be acceptable. In the event of partial or full occupancy by the

Owner prior to substantial completion of the building, the Contractor shall notify the insurance carrier and obtain a "Use and Occupancy Waiver" to prevent invalidation for such insurance by occupancy. Contractor shall deliver the waiver promptly to Owner.

ARTICLE 13 MISCELLANEOUS PROVISION

13.5 TESTING - Not Used.

ARTICLES 15 - 34 MISCELLANEOUS SUPPLEMENTARY CONDITIONS

15.1 UNIT PRICES FOR ROCK EXCAVATION

- 15.1.1 The Contractor, in arriving at his bid, shall assume that it will be possible to accomplish all excavation without the use of air hammers or blasting for removal. In the event that rock is encountered in the footing excavation, the Contractor shall be allowed extra compensation in the form of a unit price for a yard of rock excavated.

16.1 SUBSTITUTION OF MATERIALS OR EQUIPMENT

- 16.1.1 Throughout the specifications, definite materials are specified. It is the intention of the Architect to set and maintain a definite standard and not to discriminate against another manufactured product. Should the Contractor desire to make a substitution, he shall submit to the Architect a written request 10 days prior to the awarding of the contract. No approvals for substitutions shall be made unless authorized in writing by the Architect.

16.2 COOPERATION WITH BUILDING OFFICIALS

- 16.2.1 Cooperate with applicable city or other governmental officials and inspectors at all times. If such officials or inspectors deem special inspection necessary, provide assistance and facilities that will expedite his inspection.

17.1 SUPERINTENDENT

- 17.1.1 The Contractor shall keep on his work throughout its progress, a competent superintendent and any necessary assistants. All directions given to the Superintendent shall be binding as if given to the Contractor in his absence. Important directions shall be so confirmed on written request in each case.

17.2 MEASUREMENTS

- 17.2.1 Before doing any work or ordering any materials, the contractor shall verify all measurements of existing and new work, and shall be responsible for their correctness. Any differences that may be found shall be submitted to the architect for consideration before proceeding with the work. No extra compensation will be allowed because of difference between actual dimensions and measurements indicated on the working drawings.

18.1 SHOP DRAWINGS

- 18.1.1 The Contractor shall submit to the Architect for approval within sixty (60) days after the awarding of the contract, shop drawings and/or brochures which shall include all essential information relating to the materials or specialty specified. Shop drawings and all submittals shall conform to format indicated in Section 013300 - "Submittals". Shop drawings shall be submitted on all items where required by the technical sections of the specification.

18.2 MANUFACTURER'S SPECIFICATIONS AND INSTRUCTIONS

- 18.2.1.1 Install all manufactured items of material or equipment in strict accordance with the manufacturer's recommended specifications, except that the specifications herein, where more stringent, shall be complied with.
- 18.2.1.2 At the completion of the project and prior to final acceptance by the Owner, provide the Owner with three complete sets of operating and maintenance instructions, and demonstrate to him the procedures for proper operation and maintenance of all equipment

19.1 SECTION HEADINGS

- 19.1.1 The specifications following are outlined under the MasterSpec format in order to make explanation clearer, also for the purpose of segregating the various trades. Mention of "work not included" in the various sections refers only to the sections, and such reference shall not act to exclude any part of the work from the Contract or finished buildings.

19.2 JOB MAINTENANCE

- 19.2.1 During the course of their work, all crafts and trades shall protect all work that preceded theirs from damage, and they shall make repairs or replacements to any damage caused either directly or indirectly by them.
- 19.2.2 Site housekeeping and final cleaning shall be done in accordance with Article 14 of the General Conditions.

20.1 BRACING

- 20.1.1 The Contractor shall properly brace, temporarily or permanently, any or all parts of the work as necessary or directed during construction of these buildings.

20.2 LEGAL JURISDICTION

- 20.2.1 If litigation is initiated by any party to tide contract agreement and a legal petition is filed against the Owner, it shall be understood by virtue of the signed contract agreement that said petition shall be filed in the Owner's jurisdiction.

21.1 TEMPORARY ENCLOSURES

- 21.1.1 When necessary for the protection of any of the materials or work, or employees, to erect covered enclosures, walls, fences, etc., or temporarily enclose the openings of the building, or to insure protected and lighted egress from the facility, then this shall be done by the Contractor to the satisfaction of the Architect. See related paragraphs in this section of the specifications.

21.2 USE AND OCCUPANCY PRIOR TO ACCEPTANCE BY OWNER

- 21.2.1 The contractor agrees to the use and occupancy of a portion or unit of the project before formal acceptance by the Owner, provided the Owner:

1. Secures written consent of the contractor except in the event, in the opinion of the architect, the contractor is chargeable with unwarranted delay in final clean-up of punch list items or other contract requirements.
2. Secures endorsement from the insurance-carrier and consent of the surety permitting occupancy of the building or use of the project during the remaining period of construction, or,
3. when the project consists of more than one building and one of the buildings is occupied, secures permanent fire and extended coverage insurance, including a permit to complete construction. Consent of the surety must also be obtained.
4. Except with respect to subparagraph "3", use and occupancy prior to formal acceptance does not relieve the contractor of his responsibility to maintain builder's risk, fire and extended coverage insurance on a 100% basis for the benefit of the Owner, the prime contractor and all subcontractors until the project is completed and accepted by the Owner.

22.1 PROTECTION FROM WEATHER

- 22.1.1 The Contractor shall protect all incomplete walls with suitable coverings during low temperatures, rain or snow. He shall make temporary provisions to take the water away from building before leaders are erected and shall in every way protect the building and contents from damage or unnecessary wettings.

22.2 LOCAL LABOR

- 22.2.1 The contractor is encouraged to use local labor, but not at the expense of poor workmanship and higher cost; however, all things being equal, local workmen shall be given preference.

23.1 SURPLUS MATERIALS

- 23.1.1 All materials delivered on the premises to form a part of the work described in the specifications shall be considered the property of the Owner and shall not be removed prior to final acceptance of the contract work, the Contractor shall then remove all surplus materials (not designated for attic stock) from the premises.

23.2 COMPLIANCE WITH STATE AND FEDERAL LAWS

- 23.2.1 Contractor assumes full responsibility for the payment of all contributions and payroll taxes (State and Federal) as to all subcontractors and employees engaged in the performance of work pursuant hereto and further agrees to check and meet all requirements that might be specified under regulations of the administrative officials or board charged with the enforcement of any State or Federal act. Contractor agrees to furnish Owner, upon request, a certificate or other evidence of compliance therewith.

24.1 CLEANLINESS OF PREMISES DURING CONSTRUCTION

- 24.1.1 During construction, the Contractor and each sub-contractor shall keep all materials in an orderly manner and shall remove all scraps, debris, cans, etc., from the job site on a daily basis. All debris shall be contained in wire containers or dumpsters prior to removal. Any debris dropped off-site or which blows off-site is the responsibility of the Contractor to clean up.

24.2 RECORD DRAWINGS

- 24.2.1 Provide and maintain in proper order and in good, clean condition in the field office at the project site, one complete set of blue line prints of all working drawings. Neatly and accurately inscribe in red pencil any and all changes in the location and type of partitions, walls, electrical and mechanical services and equipment. This set of prints shall be presented to the Owner at the time of final acceptance of the building by the Owner.

25.1 WORKMANSHIP

- 25.1.1 Work classified within the skilled trades shall be performed by men who possess the skill, talent, and experience with which to produce a finished job of the best workmanship as compared with grades of good, better and best. Workmanship shall be considered of prime importance in all parts of the work.
- 25.1.2 Corrective measures for defective workmanship are limited and very often do not completely correct the defect. Thus, it shall be the duty of Contractor to order the discharge of any person whose skill and ability are not of the best, or whose employment, in the opinion of the Architect, is not for the best interest of the work.

25.2 OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970 (OSHA)

- 25.2.1 The contractor shall comply with the latest edition and revision of the Federal Occupational Safety and Health Act of 1970, for construction.

26.1 BUILDING GUARANTEE

- 26.1.1.1 The construction under this contract, including all materials and equipment shall be guaranteed for a period of one year from the date of substantial completion against all defects in material or workmanship. The guarantee shall be in accordance with the Article 12.2.2 of the General Conditions (AIA Document A-201). Any costs for work or materials required during this period due to failure of original material or workmanship shall be borne by the Contractor.
- 26.1.1.2 All Contractors/Subcontractors will, at no cost to the Owner, maintain and promptly repair or replace any defects due to inferior or faulty workmanship or materials for a period of one (1) year following substantial completion, (some longer guarantee periods are set forth in the sections for certain items of work). All Contractors/Subcontractors shall advise their suppliers, materialmen, etc. of this guarantee requirement for their work and materials.

27.1 TEMPORARY FACILITIES

- 27.1.1 During the duration of the construction, the Contractor shall furnish temporary facilities as indicated in Section 015000 – Temporary Facilities.

27.2 GUARANTY BONDS

- 27.2.1 The contractor does hereby warrant and/or guarantee against defects in all workmanship and materials performed or furnished by him directly or by his subcontractors for a period of one (1) year from the date of completion, as evidenced by the date of the final certificate or final acceptance of the project. Said warranty and/or guarantee shall be in the form of a good and sufficient bond in a sum equal to one-hundred percent (100%) of the value of item submitted.
- 27.2.2 Bonds shall be signed by an official of the bonding company and shall be accompanied by

the bonding agent's written power-of-attorney in order that one copy may be attached to each copy of the contract agreement.

28.1 PROJECT COORDINATION

28.1.1.1 Project coordination shall be performed in accordance with Section 013100 – Project Management and Coordination: Coordination and Meetings.

29.1 RECORD DRAWINGS

29.1.1 Contractor and all trade-contractors shall keep accurate records of any deviations, modifications, field changes, etc. done in the field during construction and shall prepare and submit one (1) set of marked-up (red lined) working drawings, drawings and specifications, catalogue cuts, etc. to the Architect upon completion of project. Record drawings are a condition of project completion, and must be submitted prior to release of final retention.

30.1 CONTRACT CLOSEOUT

30.1.1.1 Contract Closeout shall be performed in accordance with SECTION 017700.

31.1 PROJECT JOB SIGN

31.1.1.1 Design to be furnished by Architect.

33.1 TIME EXTENSION

33.1.1.1 The Contractor shall record all weather delays to be submitted each month with Pay Request.

34.1 PRE-CONSTRUCTION CONFERENCE

34.1.1 The successful contractor, his superintendent, and a representative from his mechanical and electrical subcontractors will be required to attend a pre-construction conference at a place to be designated. The time and date of conference is to be coordinated with the Architect.

END OF SECTION 007300

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Work by Owner.
4. Access to site.
5. Coordination with occupants.
6. Work restrictions.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.2 PROJECT INFORMATION

A. Project Identification: Ozarks Electric Cooperative Office and Maintenance Additions.

1. Project Location: 3641 W. Wedington Drive. Fayetteville, AR 72704.

B. Owner: Ozarks Electric Cooperative.

C. Architect: Crafton Tull.

D. Construction Manager: TBD.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:

1. Complete remodel of approximately 50,000 sf of office space.
2. 2,000 +/- square foot building addition
3. Associated MEP work.

B. Type of Contract.

1. Project will be constructed under a single prime contract.

1.4 WORK BY OWNER

- A. Items noted NIC (Not in Contract): Some equipment will be furnished and installed by Construction Manager; beginning before the project is completed. See Plans.
- B. Construction Manager'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.

1.5 ACCESS TO SITE

- A. General: Construction Manager shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.
- B. General: Construction Manager shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.
- C. Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1.6 COORDINATION WITH OCCUPANTS

- A. Full Owner Occupancy: Owner will occupy site and adjacent building(s) during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.
 - 1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.
 - 2. Notify Owner not less than 72 hours in advance of activities that will affect Owner's operations.

1.7 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
 - 1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
- B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
 - 1. Notify Owner not less than two days in advance of proposed utility interruptions.

2. Obtain Owner's permission before proceeding with utility interruptions.
- C. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
1. Notify Owner not less than two days in advance of proposed disruptive operations.
 2. Obtain Owner's permission before proceeding with disruptive operations.
- D. Controlled Substances: Use of tobacco products and other controlled substances on Project site is not permitted.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

1.2 MINOR CHANGES IN THE WORK

- A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions."

1.3 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
 - 2. Within time specified in Proposal Request or 20 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include costs of labor and supervision directly attributable to the change.
 - d. Include an updated Construction Manager 's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 - e. Quotation Form: Use CSI Form 13.6D, "Proposal Worksheet Summary," and Form 13.6C, "Proposal Worksheet Detail." Or forms acceptable to Architect.
- B. Construction Manager -Initiated Work Change Proposals: If latent or changed conditions require modifications to the Contract, Construction Manager may initiate a claim by submitting a request for a change to Architect.
 - 1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.

2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Construction Manager 's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Work Change Proposal Request Form: Use CSI Form 13.6A, "Change Order Request (Proposal)," with attachments CSI Form 13.6D, "Proposal Worksheet Summary," and Form 13.6C, "Proposal Worksheet Detail." or form acceptable to Architect.

1.4 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Work Changes Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

1.5 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Construction Manager to proceed with a change in the Work, for subsequent inclusion in a Change Order.
 1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
 1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Requirements:
 - 1. Section 012600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.

1.2 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Construction Manager 's construction schedule.
 - 1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:
 - a. Application for Payment forms with continuation sheets.
 - b. Submittal schedule.
 - c. Items required to be indicated as separate activities in Construction Manager 's construction schedule.
 - 2. Submit the schedule of values to Architect at earliest possible date but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values.
 - 1. Identification: Include the following Project identification on the schedule of values:
 - a. Project name and location.
 - b. Name of Architect.
 - c. Architect's project number.
 - d. Construction Manager 's name and address.
 - e. Date of submittal.
 - 2. Arrange schedule of values consistent with format of AIA Document G703.
 - 3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents.
 - 4. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
 - 5. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.

6. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
 - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Construction Manager 's option.
7. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.3 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Construction Manager. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
- C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Construction Manager. Architect will return incomplete applications without action.
 1. Entries shall match data on the schedule of values and Construction Manager 's construction schedule. Use updated schedules if revisions were made.
 2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- E. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
 2. Electronic submittals in pdf form are preferred.
- F. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
 1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
 2. When an application shows completion of an item, submit conditional final or full waivers.

3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 4. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.
- G. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
 2. Schedule of values.
 3. Construction Manager 's construction schedule (preliminary if not final).
 4. Submittal schedule (preliminary if not final).
 5. List of Construction Manager 's staff assignments.
 6. List of Construction Manager 's principal consultants.
 7. Copies of building permits.
 8. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 9. Initial progress report.
 10. Report of preconstruction conference.
 11. Certificates of insurance and insurance policies.
- H. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- I. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
 2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 3. Updated final statement, accounting for final changes to the Contract Sum.
 4. AIA Document G706-1994, "Contractor's Affidavit of Payment of Debts and Claims."
 5. AIA Document G706A-1994, "Contractor's Affidavit of Release of Liens."
 6. AIA Document G707-1994, "Consent of Surety to Final Payment."
 7. Evidence that claims have been settled.
 8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
 9. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. Coordination drawings.
 - 2. Requests for Information (RFIs).
 - 3. Project meetings.
- B. Related Requirements:
 - 1. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.

1.2 DEFINITIONS

- A. RFI: Request from Owner, Architect, or Construction Manager seeking information required by or clarifications of the Contract Documents.

1.3 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Use CSI Form 1.5A. Include the following information in tabular form:
 - 1. Name, address, and telephone number of entity performing subcontract or supplying products.
 - 2. Number and title of related Specification Section(s) covered by subcontract.
 - 3. Drawing number and detail references, as appropriate, covered by subcontract.

1.4 GENERAL COORDINATION PROCEDURES

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 - 2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.

- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
 - 1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 - 1. Preparation of Construction Manager's construction schedule.
 - 2. Preparation of the schedule of values.
 - 3. Installation and removal of temporary facilities and controls.
 - 4. Delivery and processing of submittals.
 - 5. Progress meetings.
 - 6. Preinstallation conferences.
 - 7. Project closeout activities.
 - 8. Startup and adjustment of systems.

1.5 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
 - 1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
 - a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
 - b. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
- B. Coordination Drawing Organization: Organize coordination drawings as follows:
 - 1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid.
 - 2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings.
 - 3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
 - 4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
 - 5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles,

door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.

6. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Construction Manager's responsibility.

1.6 REQUESTS FOR INFORMATION (RFIs)

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
 1. Architect will return RFIs submitted to Architect by other entities controlled by Construction Manager with no response.
 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Construction Manager's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
 1. Project name.
 2. Project number.
 3. Date.
 4. Name of Construction Manager.
 5. Name of Architect.
 6. RFI number, numbered sequentially.
 7. RFI subject.
 8. Specification Section number and title and related paragraphs, as appropriate.
 9. Drawing number and detail references, as appropriate.
 10. Field dimensions and conditions, as appropriate.
 11. Construction Manager's suggested resolution. If Construction Manager's solution(s) impacts the Contract Time or the Contract Sum, Construction Manager shall state impact in the RFI.
 12. Construction Manager's signature.
 13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
- C. RFI Forms: AIA Document G716 or Software-generated form with substantially the same content as indicated above, acceptable to Architect.
- D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
 1. The following RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for coordination information already indicated in the Contract Documents.
 - d. Requests for adjustments in the Contract Time or the Contract Sum.
 - e. Requests for interpretation of Architect's actions on submittals.
 - f. Incomplete RFIs or inaccurately prepared RFIs.

2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
 3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Construction Manager to submit Change Proposal according to Section 012600 "Contract Modification Procedures."
 - a. If Construction Manager believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 five working days of receipt of the RFI response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log bi-weekly. Software log with not less than the following:
1. Project name.
 2. Name and address of Construction Manager.
 3. Name and address of Architect.
 4. RFI number including RFIs that were dropped and not submitted.
 5. RFI description.
 6. Date the RFI was submitted.
 7. Date Architect's response was received.
- F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within five working days if Construction Manager disagrees with response.
1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
 2. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.7 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.
- B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.
1. Attendees: Authorized representatives of Owner Architect, and their consultants; Construction Manager and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Tentative construction schedule.

- b. Phasing.
 - c. Critical work sequencing and long-lead items.
 - d. Designation of key personnel and their duties.
 - e. Procedures for processing field decisions and Change Orders.
 - f. Procedures for RFIs.
 - g. Procedures for testing and inspecting.
 - h. Procedures for processing Applications for Payment.
 - i. Distribution of the Contract Documents.
 - j. Submittal procedures.
 - k. Preparation of record documents.
 - l. Use of the premises.
 - m. Work restrictions.
 - n. Working hours.
 - o. Owner's occupancy requirements.
 - p. Responsibility for temporary facilities and controls.
 - q. Procedures for moisture and mold control.
 - r. Procedures for disruptions and shutdowns.
 - s. Construction waste management and recycling.
 - t. Parking availability.
 - u. Office, work, and storage areas.
 - v. Equipment deliveries and priorities.
 - w. First aid.
 - x. Security.
 - y. Progress cleaning.
3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
- 1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
 - 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. Contract Documents.
 - b. Options.
 - c. Related RFIs.
 - d. Related Change Orders.
 - e. Purchases.
 - f. Deliveries.
 - g. Submittals.
 - h. Review of mockups.
 - i. Possible conflicts.
 - j. Compatibility problems.
 - k. Time schedules.
 - l. Weather limitations.
 - m. Manufacturer's written instructions.
 - n. Warranty requirements.
 - o. Compatibility of materials.
 - p. Acceptability of substrates.
 - q. Temporary facilities and controls.

- r. Space and access limitations.
 - s. Regulations of authorities having jurisdiction.
 - t. Testing and inspecting requirements.
 - u. Installation procedures.
 - v. Coordination with other work.
 - w. Required performance results.
 - x. Protection of adjacent work.
 - y. Protection of construction and personnel.
3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Progress Meetings: Conduct progress meetings at biweekly intervals.
1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Construction Manager 's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Construction Manager 's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - 1) Review schedule for next period.
 - b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.
 - 4) Deliveries.
 - 5) Off-site fabrication.
 - 6) Access.
 - 7) Site utilization.
 - 8) Temporary facilities and controls.
 - 9) Progress cleaning.
 - 10) Quality and work standards.
 - 11) Status of correction of deficient items.
 - 12) Field observations.
 - 13) Status of RFIs.
 - 14) Status of proposal requests.
 - 15) Pending changes.

- 16) Status of Change Orders.
- 17) Pending claims and disputes.
- 18) Documentation of information for payment requests.

- 3. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
 - a. Schedule Updating: Revise Construction Manager 's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

1.2 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action.
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements.

1.3 ACTION SUBMITTALS

- A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.

1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - 2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- B. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
 - 1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.

2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 3. Resubmittal Review: Allow 15 days for review of each resubmittal.
- C. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
 2. Name file with submittal number or other unique identifier, including revision identifier.
 - a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., BTV-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., BTV-061000.01.A).
 3. Provide means for insertion to permanently record Construction Manager's review and approval markings and action taken by Architect.
 4. Transmittal Form for Electronic Submittals: Use electronic form acceptable to Owner, containing the following information:
 - a. Project name.
 - b. Date.
 - c. Name and address of Architect.
 - d. Name of Contractor.
 - e. Name of firm or entity that prepared submittal.
 - f. Names of subcontractor, manufacturer, and supplier.
 - g. Category and type of submittal.
 - h. Submittal purpose and description.
 - i. Specification Section number and title.
 - j. Specification paragraph number or drawing designation and generic name for each of multiple items.
 - k. Drawing number and detail references, as appropriate.
 - l. Location(s) where product is to be installed, as appropriate.
 - m. Related physical samples submitted directly.
 - n. Indication of full or partial submittal.
 - o. Transmittal number.
 - p. Submittal and transmittal distribution record.
 - q. Other necessary identification.
 - r. Remarks.
- D. Options: Identify options requiring selection by Architect.
- E. Deviations: Identify deviations from the Contract Documents on submittals.
- F. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
1. Note date and content of previous submittal.
 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.

- G. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- H. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements:

1. Submit electronic submittals via email as PDF electronic files.
 - a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
2. Action Submittals: Submit one electronic copy of each submittal unless otherwise indicated. Architect will return copy once review is complete.
3. Informational Submittals: Submit one electronic copy of each submittal unless otherwise indicated. Architect will not return copies.
4. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
 - a. Provide a digital signature with digital certificate on electronically-submitted certificates and certifications where indicated.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams showing factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.

- d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
- 5. Submit Product Data before or concurrent with Samples.
- 6. Submit Product Data in the following format:
 - a. PDF electronic file.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal based on Architect's digital data drawing files is otherwise permitted.
 - 1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.
 - 2. Submit Shop Drawings in the following format:
 - a. PDF electronic file.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
 - 1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 - 2. Identification: Attach label on unexposed side of Samples that includes the following:
 - a. Generic description of Sample.
 - b. Product name and name of manufacturer.
 - c. Sample source.
 - d. Number and title of applicable Specification Section.
 - 3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
 - 4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
 - 5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

- a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
- 6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned.
 - 1) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
 - 1. Submit product schedule in the following format:
 - a. PDF electronic file.
- F. Coordination Drawings Submittals: Comply with requirements specified in Section 013100 "Project Management and Coordination."
- G. Application for Payment and Schedule of Values: Comply with requirements specified in Section 012900 "Payment Procedures."
- H. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."
- I. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."
- J. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- K. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- L. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

- M. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- N. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- O. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- P. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- Q. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- R. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project.
- S. Schedule of Tests and Inspections: Comply with requirements specified in Section 014000 "Quality Requirements."
- T. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- U. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- V. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- W. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

PART 3 - EXECUTION

3.1 CONSTRUCTION MANAGER'S REVIEW

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

- B. Project Closeout and Maintenance Material Submittals: See requirements in Section 017700 "Closeout Procedures."
- C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Construction Manager 's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

- A. General: Architect will not review submittals that do not bear Construction Manager 's approval stamp and will return them without action.
- B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.
- C. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 013300

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Construction Manager of responsibility for compliance with the Contract Document requirements.
 - 1. Specified tests, inspections, and related actions do not limit Construction Manager 's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
 - 2. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
 - 3. Specific test and inspection requirements are not specified in this Section.

1.2 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.
- C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
 - 1. Laboratory Mockups: Full-size physical assemblies constructed at testing facility to verify performance characteristics.
- D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
- E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

- F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.
- G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- I. Installer/Applicator/Erector: Construction Manager or another entity engaged by Construction Manager as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
 - 1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
- J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.3 CONFLICTING REQUIREMENTS

- A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.4 INFORMATIONAL SUBMITTALS

- A. Construction Manager 's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:
 - 1. Seismic-force-resisting system, designated seismic system, or component listed in the designated seismic system quality-assurance plan prepared by Architect.
 - 2. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Architect.
- B. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

1.5 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
1. Date of issue.
 2. Project title and number.
 3. Name, address, and telephone number of testing agency.
 4. Dates and locations of samples and tests or inspections.
 5. Names of individuals making tests and inspections.
 6. Description of the Work and test and inspection method.
 7. Identification of product and Specification Section.
 8. Complete test or inspection data.
 9. Test and inspection results and an interpretation of test results.
 10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 12. Name and signature of laboratory inspector.
 13. Recommendations on retesting and reinspecting.
- B. Manufacturer's Field Reports: Prepare written information documenting tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of representative making report.
 2. Statement on condition of substrates and their acceptability for installation of product.
 3. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 4. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 5. Other required items indicated in individual Specification Sections.
- C. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.6 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.
- F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
 - 1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
- H. Manufacturer's Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
 - 1. Construction Manager responsibilities include the following:
 - a. Provide test specimens representative of proposed products and construction.
 - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - c. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
 - d. When testing is complete, remove test specimens, assemblies, and mockups, and laboratory mockups; do not reuse products on Project.
 - 2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Construction Manager. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
- J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
 - 1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
 - 2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
 - 3. Demonstrate the proposed range of aesthetic effects and workmanship.
 - 4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
 - a. Allow seven days for initial review and each re-review of each mockup.

5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 6. Demolish and remove mockups when directed unless otherwise indicated.
- K. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Specification Sections.

1.7 QUALITY CONTROL

- A. Construction Manager Responsibilities: Tests and inspections not explicitly assigned to Owner are Construction Manager 's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
1. Where services are indicated as Construction Manager 's responsibility, engage a qualified testing agency to perform these quality-control services.
 2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
 3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 4. Testing and inspecting requested by Construction Manager and not required by the Contract Documents are Construction Manager 's responsibility.
 5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- B. Manufacturer's Field Services: Where indicated, engage a manufacturer's representative to observe and inspect the Work. Manufacturer's representative's services include examination of substrates and conditions, verification of materials, inspection of completed portions of the Work, and submittal of written reports.
- C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Construction Manager 's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- D. Testing Agency Responsibilities: Cooperate with Architect and Construction Manager in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect and Construction Manager promptly of irregularities or deficiencies observed in the Work during performance of its services.
 2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Construction Manager.
 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 6. Do not perform any duties of Construction Manager.
- E. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.

2. Incidental labor and facilities necessary to facilitate tests and inspections.
 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 4. Facilities for storage and field curing of test samples.
 5. Delivery of samples to testing agencies.
 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 7. Security and protection for samples and for testing and inspecting equipment at Project site.
- F. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.8 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:
- B. Special Tests and Inspections: Conducted by a qualified testing agency as required by authorities having jurisdiction, as indicated in individual Specification Sections, and as follows:
1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
 2. Notifying Architect and Construction Manager promptly of irregularities and deficiencies observed in the Work during performance of its services.
 3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Construction Manager and to authorities having jurisdiction.
 4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
 5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
 6. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
1. Date test or inspection was conducted.
 2. Description of the Work tested or inspected.
 3. Date test or inspection results were transmitted to Architect.
 4. Identification of testing agency or special inspector conducting test or inspection.

- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
 - 1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Construction Manager's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.

1.2 USE CHARGES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.
- B. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.3 INFORMATIONAL SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
- B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.
- C. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire prevention program.

1.4 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.5 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 TEMPORARY FACILITIES

- A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly.
- C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

2.2 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
 - 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 - 2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
 - 3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction and clean HVAC system as required in Section 017700 "Closeout Procedures".

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
 - 1. Locate facilities to limit site disturbance as specified in Section 011000 "Summary."

- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
 - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.
- C. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
- D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
- E. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- F. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
- G. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
- H. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
 - 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
- I. Electronic Communication Service: Provide a desktop computer in the primary field office adequate for use by Architect and Owner to access project electronic documents and maintain electronic communications.

3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
 - 1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.

2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
- B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.
1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.
- C. Traffic Controls: Comply with requirements of authorities having jurisdiction.
1. Protect existing site improvements to remain including curbs, pavement, and utilities.
 2. Maintain access for fire-fighting equipment and access to fire hydrants.
- D. Parking: Provide temporary parking areas for construction personnel.
- E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
 2. Remove snow and ice as required to minimize accumulations.
- F. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
1. Identification Signs: Architect will provide design for the project sign prior to start of construction.
 2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
 - a. Provide temporary, directional signs for construction personnel and visitors.
 3. Maintain and touchup signs so they are legible at all times.
- G. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 017300 "Execution."
- H. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
- I. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.
- J. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
- C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings.
- D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- E. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.
- F. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.
- G. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.
- H. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- I. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.
- J. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
 - 1. Where heating or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures.

3.5 MOISTURE AND MOLD CONTROL

- A. Construction Manager 's Moisture Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.
- B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect materials from water damage and keep porous and organic materials from coming into prolonged contact with concrete.

- C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
 - 1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
 - 2. Keep interior spaces reasonably clean and protected from water damage.
 - 3. Discard or replace water-damaged and wet material.
 - 4. Discard, replace, or clean stored or installed material that begins to grow mold.
 - 5. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.
- D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
 - 1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
 - 2. Remove materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.6 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
 - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
 - 1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
 - 2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION 015000

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

1.2 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.3 ACTION SUBMITTALS

- A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
 - a. Form of Approval: As specified in Section 013300 "Submittal Procedures."
 - b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

1.4 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
 - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 - 4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.
- C. Storage:
 - 1. Store products to allow for inspection and measurement of quantity or counting of units.
 - 2. Store materials in a manner that will not endanger Project structure.
 - 3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
 - 4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
 - 5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
 - 6. Protect stored products from damage and liquids from freezing.

1.6 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Construction Manager of obligations under requirements of the Contract Documents.
 - 1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
 - 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
 - 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 - 2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
 - 3. Refer to other Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
 - 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 - 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 - 3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 - 4. Where products are accompanied by the term "as selected," Architect will make selection.
 - 5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
- B. Product Selection Procedures:
 - 1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Construction Manager 's convenience will not be considered.
 - 2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Construction Manager 's convenience will not be considered.
 - 3. Products:
 - a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Construction Manager 's convenience will be considered unless otherwise indicated.
 - b. Nonrestricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.
 - 4. Manufacturers:

- a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Construction Manager 's convenience will be considered unless otherwise indicated.
 - b. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.
- 5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
- C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
 - 1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

- A. Conditions for Consideration: Architect will consider Construction Manager 's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
 - 1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
 - 2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 - 3. Evidence that proposed product provides specified warranty.
 - 4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
 - 5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
 - 1. Construction layout.
 - 2. Field engineering and surveying.
 - 3. Installation of the Work.
 - 4. Cutting and patching.
 - 5. Coordination of Owner-installed products.
 - 6. Progress cleaning.
 - 7. Starting and adjusting.
 - 8. Protection of installed construction.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for limits on use of Project site.
 - 2. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

1.2 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.
- B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
 - 1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural element during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection
 - 2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
 - 3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.

4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.
 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
 1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Construction Manager, submit a request for information to Architect according to requirements in Section 013100 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.
- B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.
 - 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
 - 2. Establish limits on use of Project site.
 - 3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 - 4. Inform installers of lines and levels to which they must comply.
 - 5. Check the location, level and plumb, of every major element as the Work progresses.
 - 6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
 - 7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. Make vertical work plumb and make horizontal work level.
 - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 - 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 - 2. Allow for building movement, including thermal expansion and contraction.
 - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.5 CUTTING AND PATCHING

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Adjacent Occupied Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.
- G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 6. Proceed with patching after construction operations requiring cutting are complete.
- H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.6 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
1. Remove liquid spills promptly.
 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways.
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

- J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.7 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements"

3.8 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 017300

SECTION 017700 - CLOSEOUT PROCEDURES

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion procedures.
 - 2. Final completion procedures.
 - 3. Warranties.
 - 4. Final cleaning.
 - 5. Repair of the Work.

1.2 ACTION SUBMITTALS

- A. Construction Manager's List of Incomplete Items: Initial submittal at Substantial Completion.
- B. Certified List of Incomplete Items: Final submittal at Final Completion.

1.3 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.
- C. Field Report: For pest control inspection.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.5 SUBSTANTIAL COMPLETION PROCEDURES

- A. Construction Manager's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Construction Manager 's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction

- photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.
 - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.
 5. Submit test/adjust/balance records.
 6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Advise Owner of pending insurance changeover requirements.
 2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 3. Complete startup and testing of systems and equipment.
 4. Perform preventive maintenance on equipment used prior to Substantial Completion.
 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
 6. Advise Owner of changeover in heat and other utilities.
 7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
 8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 9. Complete final cleaning requirements, including touchup painting.
 10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Construction Manager of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Construction Manager of items, either on Construction Manager's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 2. Results of completed inspection will form the basis of requirements for final completion.

1.6 FINAL COMPLETION PROCEDURES

- A. Preliminary Procedures: Before requesting final inspection for determining final completion, complete the following:
 - 1. Submit a final Application for Payment according to Section 012900 "Payment Procedures."
 - 2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 - 3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 - 4. Submit pest-control final inspection report and warranty.
 - 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
- B. Inspection: Submit a written request for final inspection to determine acceptance. On receipt of request, Architect will either proceed with inspection or notify Construction Manager of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Construction Manager of construction that must be completed or corrected before certificate will be issued.
 - 1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.7 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
 - 1. Organize list of spaces in sequential order.
 - 2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
 - 3. Submit list of incomplete items in the following format:
 - a. PDF electronic file. Architect will return annotated copy.

1.8 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
 - 1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.

2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Construction Manager.
 4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
- C. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Remove snow and ice to provide safe access to building.
 - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.

- h. Sweep concrete floors broom clean in unoccupied spaces.
 - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
 - j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - k. Remove labels that are not permanent.
 - l. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - o. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
 - p. Leave Project clean and ready for occupancy.
- C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.

3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
- 1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
 - 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
 - 3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
 - 4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 017700

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
 - 1. Demonstration of operation of systems, subsystems, and equipment.
 - 2. Training in operation and maintenance of systems, subsystems, and equipment.
 - 3. Demonstration and training video recordings.

1.2 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
 - 1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

1.3 CLOSEOUT SUBMITTALS

- A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.
 - 1. At completion of training, submit complete training manual(s) for Owner's use prepared and bound in format matching operation and maintenance manuals and in PDF electronic file format on compact disc.

1.4 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.
- C. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to demonstration and training.

1.5 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
- B. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
 - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.
 - h. Performance curves.
 - 2. Documentation: Review the following items in detail:
 - a. Emergency manuals.
 - b. Operations manuals.
 - c. Maintenance manuals.
 - d. Project record documents.
 - e. Identification systems.
 - f. Warranties and bonds.
 - g. Maintenance service agreements and similar continuing commitments.
 - 3. Emergencies: Include the following, as applicable:
 - a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:
 - a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Control sequences.
 - f. Safety procedures.
 - g. Instructions on stopping.
 - h. Normal shutdown instructions.
 - i. Operating procedures for emergencies.
 - j. Operating procedures for system, subsystem, or equipment failure.
 - k. Seasonal and weekend operating instructions.
 - l. Required sequences for electric or electronic systems.
 - m. Special operating instructions and procedures.
5. Adjustments: Include the following:
 - a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
 - a. Diagnostic instructions.
 - b. Test and inspection procedures.
7. Maintenance: Include the following:
 - a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.
8. Repairs: Include the following:
 - a. Diagnosis instructions.
 - b. Repair instructions.
 - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - d. Instructions for identifying parts and components.
 - e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Division 01.

3.2 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Construction Manager and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 - 1. Owner will furnish Contractor with names and positions of participants.
- C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 - 1. Schedule training with Owner through Construction Manager.
- D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.

3.3 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

- A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
 - 1. At beginning of each training module, record each chart containing learning objective and lesson outline.
- B. Video Recording Format: Provide high-quality color video recordings with menu navigation in format acceptable to Architect.
- C. Narration: Describe scenes on video recording by audio narration by microphone while or dubbing audio narration off-site after video recording is recorded. Include description of items being viewed.
- D. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

END OF SECTION 017900

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.
3. Salvage of existing items to be reused or recycled.

1.2 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.3 INFORMATIONAL SUBMITTALS

- A. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.

1.4 CLOSEOUT SUBMITTALS

- A. Inventory of items that have been removed and salvaged.

1.5 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
1. Before selective demolition, coordinate with Owner for all items to be removed by Owner.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
 - E. Storage or sale of removed items or materials on-site is not permitted.
 - F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 1. Maintain fire-protection facilities in service during selective demolition operations.
 - G. Arrange selective demolition schedule so as not to interfere with Owner's operations.
- 1.6 WARRANTY
- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Inventory and record the condition of items to be removed and salvaged.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.
 1. Arrange to shut off utilities with utility companies.
 2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.

3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
 - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
 - f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 - g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

3.3 PROTECTION

- A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
- B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
- C. Remove temporary barricades and protections where hazards no longer exist.

3.4 SELECTIVE DEMOLITION

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
 2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
 4. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 5. Dispose of demolished items and materials promptly.
- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

C. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area on-site.
5. Protect items from damage during transport and storage.

D. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 CLEANING

A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

B. Burning: Do not burn demolished materials.

C. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Design Mixtures: For each concrete mixture.
- C. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement.

1.3 INFORMATIONAL SUBMITTALS

- A. Material certificates.
- B. Material test reports.
- C. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer, detailing fabrication, assembly, and support of formwork.
- D. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- B. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1.5 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures.

1.6 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with ACI 306.1.
 - 1. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- B. Hot-Weather Placement: Comply with ACI 301.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301.
 - 2. ACI 117.

2.2 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

2.3 STEEL REINFORCEMENT

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.
- B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 deformed.
- C. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.
- D. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, plain, fabricated from as-drawn steel wire into flat sheets.
- E. Deformed-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, flat sheet.
- F. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice."

2.4 CONCRETE MATERIALS

- A. Cementitious Materials:

1. Portland Cement: ASTM C 150/C 150M, Type I/II, gray
 2. Fly Ash: ASTM C 618, Class F or C.
 3. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.
- B. Normal-Weight Aggregates: ASTM C 33/C 33M, graded.
1. Maximum Coarse-Aggregate Size: 1-1/2 inches nominal.
 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Lightweight Aggregate: ASTM C 330/C 330M, 3/4-inch nominal maximum aggregate size.
- D. Micro Fiber Admixture: UltraFiber 500, manufactured by Buckeye Building Fibers LLC, 1001 Tilman, Memphis, TN 28108, Ph: 866-663-8999.
1. Unless shown otherwise on structural drawings, provide micro fiber admixture for **all** interior slab-on-grade concrete.
 - a. Refer to structural drawings for slabs with additional means of reinforcement.
 - b. Refer to Civil drawings for sidewalks and concrete paving.
 2. Micro fiber admixture will be added to concrete at batch plant. Adding admixture to mix at jobsite will not be permitted. Follow normal mixing, time and speed, as recommended by ASTM C94.
 3. Application Rate: 2.0 pounds per cubic yard of concrete.
- D. Air-Entraining Admixture: ASTM C 260/C 260M.
- E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
- F. Water: ASTM C 94/C 94M and potable.

2.5 WATERSTOPS

- A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch.
1. Available products:
 - a. Colloid Environmental Technologies Company; Volclay Waterstop-RX.
 - b. Concrete Sealants Inc.; Conseal CS-231.
 - c. Greenstreak; Swellstop.
 - d. Henry Company, Sealants Division; Hydro-Flex.
 - e. JP Specialties, Inc.; Earthshield Type 20.
 - f. Progress Unlimited, Inc.; Superstop.
 - g. TCMiraDRI; Mirastop.

2.6 VAPOR RETARDERS

- A. Plastic Vapor Retarder: ASTM E 1745, Class A vapor retarder with minimum WVTR of 0.008 as tested by ASTM E96. Include manufacturer's recommended adhesive or pressure-sensitive tape (minimum width of tape shall be 4 inches). Construct pipe boots from vapor retarder material and pressure sensitive tape per manufacturer's recommendations.
 - 1. Available Products:
 - a. Stego Wrap (15 mil) Vapor Barrier by Stego Industries
- B. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

2.7 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.

2.8 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- C. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
 - 1. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- D. Reglets: Fabricate reglets of not less than 0.0217-inch- thick, galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- E. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.0336 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.9 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI.
- B. Cementitious Materials: Use fly ash, pozzolan, slag cement, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.

- C. Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use water-reducing, high-range water-reducing, or plasticizing admixture in concrete, as required, for placement and workability.
 2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a w/c ratio below 0.50.

2.10 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Proportion normal-weight concrete mixture for grade beams, pier caps and drilled piers as follows:
1. Minimum Compressive Strength: 4000 psi at 28 days or as shown on drawings.
 2. Maximum Water-Cementitious Materials Ratio: 0.45.
 3. Minimum Cementitious Materials Content: 564 lb/cu. yd.
 4. Slump Limit: 8 inches, plus or minus 1 inch.
 5. Air Content: 5-1/2 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.
- B. Proportion normal-weight concrete mixture for Slabs-on-Grade as follows:
1. Minimum Compressive Strength: 3500 psi at 28 days or as shown on drawings.
 2. Micro Fiber Admixture: UltraFiber 500, apply at a rate of 2.0 pounds per cubic yard of concrete,
 3. Maximum Water-Cementitious Materials Ratio: 0.05.
 4. Minimum Cementitious Materials Content: 470 lb/cu. yd.
 5. Slump Limit: 4 inches, plus or minus 1 inch.
 6. Air Content: Do not allow air content of troweled finished slabs to exceed 3 percent.
- C. Proportion normal-weight concrete mixture for topping slabs and elevated slabs on metal decking as follows:
1. Minimum Compressive Strength: 3500 psi at 28 days.
 2. Micro Fiber Admixture: UltraFiber 500, apply at a rate of 2.0 pounds per cubic yard of concrete,
 3. Maximum Water-Cementitious Materials Ratio: 0.50.
 4. Minimum Cementitious Materials Content: 470 lb/cu. yd.
 5. Slump Limit: 6 inches, plus or minus 1 inch.
 6. Air Content: Do not allow air content of troweled finished slabs to exceed 3 percent.
- D. Proportion normal-weight concrete mixture for walls as follows:
1. Minimum Compressive Strength: 4000 psi at 28 days.
 2. Maximum Water-Cementitious Materials Ratio: 0.45
 3. Minimum Cementitious Materials Content: 564 lb/cu. yd.
 4. Slump Limit: 4 inches, plus or minus 1 inch.
 5. Air Content: Do not allow air content of walls to exceed 3 percent.

2.11 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.12 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
 - 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Chamfer exterior corners and edges of permanently exposed concrete.

3.2 EMBEDDED ITEM INSTALLATION

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.3 VAPOR-RETARDER INSTALLATION

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
 - 1. Lap joints 6 inches and seal with manufacturer's recommended tape.

3.4 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

3.5 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
 - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 - 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

3.6 WATERSTOP INSTALLATION

- A. Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions.

3.7 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
 - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 - 1. before starting finishing operations.
- F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.

3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
4. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
5. Maintain reinforcement in position on chairs during concrete placement.
6. Screed slab surfaces with a straightedge and strike off to correct elevations.
7. Slope surfaces uniformly to drains where required.
8. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces
9. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
10. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
11. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

G. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.8 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view, or to be covered with a coating or covering material applied directly to concrete.

C. Rubbed Finish: Apply the following to smooth-formed-finished as-cast concrete where indicated:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix 1 part portland cement to 1-1/2 parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces.

- Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix 1 part portland cement and 1 part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.9 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, re-straightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce profile amplitude of 1/4 inch in one direction.
1. Apply scratch finish to surfaces indicated.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Re-straighten, cut down high spots, and fill low spots. Repeat float passes and re-straightening until surface is left with a uniform, smooth, granular texture.
1. Apply float finish to surfaces indicated.
- D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and re-straighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
1. Apply a trowel finish to surfaces indicated and to floor and slab surfaces to be exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
 2. Finish surfaces to the following tolerances, according to ASTM E 1155 for a randomly trafficked floor surface:
 - a. Specified overall values of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15.
 - b. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.
 - c. Specified overall values of flatness, F(F) 30; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 15; for suspended slabs.
- E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated or where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.
1. Comply with flatness and levelness tolerances for trowel finished floor surfaces.

- F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
 - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.10 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.
- D. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.11 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

3.12 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

END OF SECTION 033000

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Structural steel.
2. Grout.

B. Related Requirements:

1. Section 051213 "Architecturally Exposed Structural Steel Framing" for additional requirements for architecturally exposed structural steel.

1.2 DEFINITIONS

- A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show fabrication of structural-steel components.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator
- B. Welding certificates.
- C. Mill test reports for structural steel, including chemical and physical properties.
- D. Source quality-control reports.
- E. Field quality-control and special inspection reports.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD, or who has an acceptable code compliant quality control process in place and will be verified by an outside third party special inspector in conjunction with this project.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

- C. Comply with applicable provisions of the following specifications and documents:
 - 1. AISC 303.
 - 2. AISC 360.
 - 3. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand loads indicated and comply with other information and restrictions indicated.
 - 1. Select and complete connections using schematic details indicated and AISC 360
 - 2. Use Allowable Stress Design; data are given at service-load level.
- B. Moment Connections: Type FR, fully restrained.
- C. Construction: Combined system of moment frame, braced frame, and shear walls.

2.2 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A 992/A 992M.
- B. Channels, Angles: ASTM A 36/A 36M.
- C. Plate and Bar: ASTM A 36/A 36M.
- D. Cold-Formed Hollow Structural Sections: ASTM A 500/A 500M, Grade B, structural tubing.
- E. Steel Pipe: ASTM A 53/A 53M, Type E or Type S, Grade B.
- F. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers; all with plain finish.
 - 1. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with plain finish.
- B. High-Strength Bolts, Nuts, and Washers: ASTM A 490, Type 1, heavy-hex steel structural bolts or tension-control, bolt-nut-washer assemblies with splined ends; ASTM A 563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers with plain finish.

1. Direct-Tension Indicators: ASTM F 959, Type 490, compressible-washer type with plain finish.
- C. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers.
 1. Finish: Hot-dip or mechanically deposited zinc coating.
 2. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with mechanically deposited zinc coating finish.
- D. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hexhead assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
 1. Finish: Mechanically deposited zinc coating.
- E. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.
- F. Unheaded Anchor Rods: ASTM F 1554, Grade 36.
 1. Configuration: Hooked.
 2. Finish: Hot-dip zinc coating.
- G. Headed Anchor Rods: ASTM F 1554, Grade 55, weldable, straight.
 1. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.
- H. Threaded Rods: ASTM A 36/A 36M.
 1. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.

2.4 PRIMER

- A. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Primer: Comply with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- C. Primer: SSPC-Paint 25, Type I zinc oxide, alkyd, linseed oil primer.
- D. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

2.5 GROUT

- A. Metallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, metallic aggregate grout, mixed with water to consistency suitable for application and a 30-minute working time.

- B. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.6 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.
- B. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

2.7 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

2.8 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
 - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
 - 2. Surfaces to be field welded.
 - 3. Surfaces of high-strength bolted, slip-critical connections.
 - 4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
 - 5. Galvanized surfaces.
 - 6. Surfaces enclosed in interior construction.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
 - 1. SSPC-SP 2, "Hand Tool Cleaning."
 - 2. SSPC-SP 3, "Power Tool Cleaning."
 - 3. SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.9 SOURCE QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform shop tests and inspections.
 - 1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- B. Bolted Connections: Inspect shop-bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Welded Connections: Visually inspect shop-welded connections according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - 1. Liquid Penetrant Inspection: ASTM E 165.
 - 2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 - 3. Ultrasonic Inspection: ASTM E 164.
 - 4. Radiographic Inspection: ASTM E 94.
- D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Baseplates and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of baseplate.
 - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - 4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure.
- C. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

3.3 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
 - 2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
 - 3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," for mill material.

3.4 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 - 1. Verify structural-steel materials and inspect steel frame joint details.
 - 2. Verify weld materials and inspect welds.
 - 3. Verify connection materials and inspect high-strength bolted connections.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- C. Bolted Connections: Inspect and test bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Welded Connections: Visually inspect field welds according to AWS D1.1/D1.1M.
 - 1. In addition to visual inspection, test and inspect field welds according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - a. Liquid Penetrant Inspection: ASTM E 165.
 - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 - c. Ultrasonic Inspection: ASTM E 164.
 - d. Radiographic Inspection: ASTM E 94.

END OF SECTION 051200

SECTION 054000 - COLD-FORMED METAL FRAMING

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. Load-bearing wall framing.
 - 2. Exterior non-load-bearing wall framing.
 - 3. Floor joist framing.
- B. Related Requirements:
 - 1. Section 055000 "Metal Fabrications".
 - 2. Section 092216 "Non-Structural Metal Framing".

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Welding certificates.
- C. Product Test Reports.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- B. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment, indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
- C. Welding certificates.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- 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. AllSteel & Gypsum Products, Inc.
 2. ClarkDietrich Building Systems.
 3. Consolidated Fabricators Corp.; Building Products Division.
 4. Formetal Co. Inc. (The).
 5. Nuconsteel, A Nucor Company.

2.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.
1. Design Loads: As indicated on Drawings.
 2. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
 3. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building .
- B. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing shall comply with AISI S100, AISI S200.

2.3 COLD-FORMED STEEL FRAMING MATERIALS

- A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:
1. Grade: ASTM A653. Minimum yield strength of 33 ksi (33,000 psi) with the exception that 16 gauge and heavier studs and joists shall have a minimum yield strength of 50 ksi.
 2. Coating: G60, A60, AZ50, or GF30.
- B. Steel Sheet for Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
1. Grade: 50, Class 1 or 2.
 2. Coating: G90.

2.4 LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: As indicated on the Contract Documents.

2. Flange Width: As indicated on the Contract Documents.
 3. Section Properties: As indicated on the Contract Documents.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and matching minimum base-metal thickness of steel studs.
1. Minimum Base-Metal Thickness: As indicated on the Contract Documents.
 2. Flange Width: 1-1/4 inches.
- C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, unpunched, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: As indicated on the Contract Documents.
 2. Section Properties: As indicated on the Contract Documents.

2.5 EXTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: As indicated on the Contract Documents..
 2. Section Properties: As indicated on the Contract Documents.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and matching minimum base-metal thickness of steel studs.
- C. Vertical Deflection Clips: Manufacturer's standard bypass clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
1. 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:
 - a. AllSteel & Gypsum Products, Inc.
 - b. ClarkDietrich Building Systems.
 - c. Simpson Strong-Tie Co., Inc.
- D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure.
- E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
- F. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.6 FLOOR JOIST FRAMING

- A. Steel Joists: Manufacturer's standard C-shaped steel joists, of web depths indicated, with stiffened flanges.
- B. Steel Joist Track: Manufacturer's standard U-shaped steel joist track, of web depths indicated, unpunched, with unstiffened flanges.

2.7 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration.

2.8 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.
- B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.
- C. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E 488 conducted by a qualified testing agency.
- D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.
- E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
 - 1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

2.9 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20 or MIL-P-21035B.
- B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- C. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107/C 1107M, with fluid consistency and 30-minute working time.

- D. Shims: Load bearing, high-density multimonomer plastic, and nonleaching; or of cold-formed steel of same grade and coating as framing members supported by shims.
 - 1. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.
- B. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.2 INSTALLATION, GENERAL

- A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
 - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.
- D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

- G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.
- H. Install insulation, specified in Section 072100 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- I. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.3 LOAD-BEARING WALL INSTALLATION

- A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:
 - 1. Anchor Spacing: To match stud spacing.
- B. Squarely seat studs against top and bottom tracks, with gap not exceeding 1/8 inch between the end of wall-framing member and the web of track. Fasten both flanges of studs to top and bottom tracks. Space studs as follows:
 - 1. Stud Spacing: As indicated on Drawings.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.
- D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.
- E. Align floor and roof framing over studs according to AISI S200, Section C1. Where framing cannot be aligned, continuously reinforce track to transfer loads.
- F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure.
- G. Install headers over wall openings wider than stud spacing. Locate headers above openings. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.
 - 1. Frame wall openings with not less than a double stud at each jamb of frame. Fasten jamb members together to uniformly distribute loads.
 - 2. Install tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.
- H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.
 - 1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.
- I. Install horizontal bridging in stud system, spaced vertically as indicated on Drawings. Fasten at each stud intersection.

1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of two screws into each flange of the clip angle for framing members up to 6 inches deep.
 2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges, and secure solid blocking to stud webs or flanges.
 3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- J. Install steel sheet diagonal bracing straps to both stud flanges; terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.
- K. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.4 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.
- B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
1. Stud Spacing: As indicated on the Contract Documents.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
1. Install single deep-leg deflection tracks and anchor to building structure.
 2. Install double deep-leg deflection tracks and anchor outer track to building structure.
 3. Connect vertical deflection clips to bypassing studs and anchor to building structure.
 4. Connect drift clips to cold-formed metal framing and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
- F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 JOIST INSTALLATION

- A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated.

- B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.
 - 1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches.
 - 2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections.
- C. Space joists not more than 2 inches from abutting walls, and as follows:
 - 1. Joist Spacing: As indicated on Drawings.
- D. Frame openings with built-up joist headers, consisting of joist and joist track or another combination of connected joists if indicated.
- E. Install bridging at intervals indicated.
- F. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.
- G. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.6 FIELD QUALITY CONTROL

- A. Field and shop welds will be subject to testing and inspecting.
- B. Testing agency will report test results promptly and in writing to Contractor and Architect.
- C. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.7 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780/A 780M and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Miscellaneous steel framing and supports.
2. Shelf angles.
3. Miscellaneous steel trim.
4. Loose bearing and leveling plates.

B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

1.2 ACTION SUBMITTALS

- A. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.
- D. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

- E. Rolled-Stainless-Steel Floor Plate: ASTM A 793.
- F. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.
- G. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.
- H. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
 - 1. Size of Channels: As indicated.
 - 2. Material: Galvanized steel, ASTM A 653/A 653M, commercial steel, Type B, with G90 coating; 0.108-inch nominal thickness.
 - 3. Material: Cold-rolled steel, ASTM A 1008/A 1008M, commercial steel, Type B; 0.0966-inch minimum thickness; coated with rust-inhibitive, baked-on, acrylic enamel.
- I. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.
- J. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6.
- K. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.
- L. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
 - 1. Provide stainless-steel fasteners for fastening aluminum.
 - 2. Provide stainless-steel fasteners for fastening stainless steel.
 - 3. Provide stainless-steel fasteners for fastening nickel silver.
 - 4. Provide bronze fasteners for fastening bronze.
- B. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.
- C. Post-Installed Anchors: Torque-controlled expansion anchors.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
 - 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.
- D. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

- A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- D. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- E. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi.

2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Use connections that maintain structural value of joined pieces.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.
- C. Weld corners and seams continuously to comply 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. At exposed connections, finish exposed welds and surfaces smooth and blended.
- D. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Locate joints where least conspicuous.
- E. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- F. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors not less than 8 inches from ends and corners of units and 24 inches o.c.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

2.7 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
- C. Galvanize exterior miscellaneous steel trim.
- D. Prime miscellaneous steel trim.

2.8 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

2.9 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.
- B. Galvanize loose steel lintels located in exterior walls.

2.10 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.11 FINISHES, GENERAL

- A. Finish metal fabrications after assembly.

2.12 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
- B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
 - 1. Shop prime with universal shop primer unless otherwise indicated.
- C. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
 - 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. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2 INSTALLING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with nonshrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.3 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 055000

SECTION 055113 - METAL RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Steel tube handrails and guardrails attached to walls or anchored to concrete floors, ramps, or stairs.

1.2 ACTION SUBMITTALS

- A. Product Data:
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance of Railings: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 2. Infill of Guards:
 - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
 - b. Infill load and other loads need not be assumed to act concurrently.

2.2 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Steel Tubing: ASTM A 500 (cold formed).
- D. Uncoated, Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, either commercial steel, Type B, or structural steel, Grade 25, unless another grade is required by design loads; exposed.

- E. Uncoated, Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, either commercial steel, Type B, or structural steel, Grade 30, unless another grade is required by design loads.
- F. Perforated Metal: Cold-rolled steel sheet, ASTM A 1008/A 1008M, or hot-rolled steel sheet, ASTM A 1011/A 1011M, commercial steel Type B, 0.060 inch thick, with 1/4-inch holes 3/8 inch o.c. in staggered rows.

2.3 FASTENERS

- A. Provide zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.

2.4 MISCELLANEOUS MATERIALS

- A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
- B. Concrete Materials and Properties: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.

2.5 FABRICATION, GENERAL

- A. Provide complete assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
 - 1. Join components by welding unless otherwise indicated.
 - 2. Use connections that maintain structural value of joined pieces.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Weld connections to comply 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. Weld exposed corners and seams continuously unless otherwise indicated.
 - 5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 4 welds: good quality, uniform undressed weld with minimal splatter.
- E. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Locate joints where least conspicuous.

2.6 STAIR RAILINGS

- A. Steel Tube Railings: Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand indicated loads.
 - 1. Tube Rails: 1-1/2-inch-diameter round.
 - 2. Intermediate Rails Infill: 1/2-inch-diameter round, spaced @ 4" o.c. horizontally.
- B. Welded Connections: Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - 1. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 4 welds: good quality, uniform undressed weld with minimal splatter as shown in NAAMM AMP 521.
- C. Form changes in direction of railings by bending.
- D. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- E. Close exposed ends of railing members with prefabricated end fittings.
- F. Provide wall returns at ends of wall-mounted handrails.
- G. Connect posts to stair framing by direct welding.
- H. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work.
- I. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses.

2.7 FINISHES

- A. Finish metal stairs after assembly.
- B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."
- C. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLING RAILINGS

- A. Adjust railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loads. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:
 - 1. Anchor posts to steel by welding to steel supporting members.
 - 2. Anchor handrail ends to concrete and masonry with steel round flanges welded to rail ends and anchored with postinstalled anchors and bolts.
- B. Attach handrails to wall with wall brackets. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets to building construction as required to comply with performance requirements.

3.2 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

END OF SECTION 055113

SECTION 061100 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Wood blocking and nailers.
 - 2. Wood furring and grounds.
 - 3. Wood sleepers.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. Dress lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC2.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat all items indicated on Drawings, and the following:
 - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - 2. Wood sills, sleepers, blocking, furring, and similar concealed members in contact with masonry or concrete.
 - 3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
 - 4. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
 - 1. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
 - 2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
 - 3. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D 5664, and design value adjustment factors shall be calculated according to ASTM D 6841.
- B. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.
- C. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
- D. Application: Treat items as follows and as indicated on Drawings:
 - 1. Plywood backing panels and sheathing in interior and exterior wall assemblies.

2.4 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
 - 3. Rooftop equipment bases and support curbs.
 - 4. Cants.
 - 5. Furring.
 - 6. Grounds.
 - 7. Utility shelving.
- B. Concealed Blocking: 19 percent maximum moisture content of any of the following species and grades:
 - 1. Mixed southern pine or southern pine, No. 2 grade; SPIB.
 - 2. Eastern softwoods, No. 2 Common grade; NELMA.
 - 3. Northern species, No. 2 Common grade; NLGA.
 - 4. Western woods, Construction or No. 2 Common grade; WCLIB or WWPA.

2.5 PLYWOOD BACKING PANELS

- A. Backing Panels: Plywood, DOC PS 1, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2-inch nominal thickness.

2.6 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M or of Type 304 stainless steel.
- B. Screws for Fastening to Metal Framing: ASTM C 1002, length as recommended by screw manufacturer for material being fastened.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- C. Install plywood backing panels by fastening to studs; Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.
- D. Do not splice structural members between supports unless otherwise indicated.
- E. Comply with AWPAC M4 for applying field treatment to cut surfaces of preservative-treated lumber.
- F. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
 - 2. ICC-ES evaluation report for fastener.

3.2 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061100

SECTION 062023 - INTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior trim.

B. Related Requirements:

1. Section 064023 "Plastic Laminate-Faced Architectural Cabinets."

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Lumber: DOC PS 20.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by grading agency.

2.2 INTERIOR TRIM

A. Hardwood Lumber Trim:

1. Species and Grade: Poplar, Paint Grade or as shown on Drawings.
2. Maximum Moisture Content: 13 percent.
3. Finger Jointing: Not allowed.

2.3 MISCELLANEOUS MATERIALS

- A. Multipurpose Construction Adhesive: Formulation complying with ASTM D 3498 that is recommended for indicated use by adhesive manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours unless longer conditioning is recommended by manufacturer.

3.2 INSTALLATION, GENERAL

- A. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.
 - 1. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
 - 2. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.
 - 3. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining interior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.

3.3 STANDING AND RUNNING TRIM INSTALLATION

- A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long, except where necessary. Stagger joints in adjacent and related standing and running trim. Miter at returns, miter at outside corners, and cope at inside corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints.

END OF SECTION 062023

SECTION 064116 - PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plastic-laminate-faced architectural cabinets.
2. Plastic-laminate-faced countertops.
3. Solid Surface countertops and facing.
4. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced architectural cabinets unless concealed within other construction before cabinet installation.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product high-pressure decorative laminate and cabinet hardware and accessories.
- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
- C. Samples:
1. Plastic laminates, for each color, pattern, and surface finish.
 2. Thermoset decorative panels, for each color, pattern, and surface finish.
 3. Solid Surfacing, for each color, pattern, and surface finish.

1.3 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.
- B. Grade: Custom.

- C. Type of Construction: Frameless.
- D. Cabinet, Door, and Drawer Front Interface Style: Flush overlay.
- E. Reveal Dimension: 1/4 inch.
- F. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.
 - 1. Manufacturers: Subject to compliance with requirements, provide the product(s) listed in the Finish Specification in the Drawings and Room Finish Schedule.
- G. Laminate Cladding for Exposed Surfaces:
 - 1. Balanced construction is mandatory.
 - 2. Horizontal Surfaces: Grade HGS.
 - 3. Horizontal Surfaces Other Than Tops: Grade HGS.
 - 4. Vertical Surfaces: Grade VGS.
 - 5. Cabinet Doors, Inside and Outside, unless otherwise noted: Grade VGS.
 - 6. Pattern Direction: Vertically for drawer fronts, doors, and fixed panels.
- H. Materials for Semiexposed Surfaces:
 - 1. Surfaces Other Than Drawer Bodies: Thermoset decorative panels.
 - 2. Drawer Sides and Backs: Prefabricated, prefinished metal box assemblies.
 - 3. Drawer Bottoms: Thermoset decorative panels.
 - 4. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKL.
- I. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 - 1. As selected by Architect from laminate manufacturer's full range and indicated in the Finish Specification in the Drawings.
- J. Edges of Plastic-Laminate Clad Doors, Drawer Fronts, Shelves: PVC tape, 3-mm thickness, matching laminate in color, pattern, and finish.
 - 1. Charter Industries. PVC Edgebanding.
 - 2. Doellken-Woodtape PVC Edgebanding.

2.2 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
 - 1. Wood Moisture Content: 8 to 13 percent.

- B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
1. Medium-Density Fiberboard (MDF): ANSI A208.2, Grade 130, made with binder containing no urea formaldehyde.
 2. Particleboard:
 - a. ANSI A208.1, Grade M-2, made with binder containing no urea formaldehyde
 - b. Grade M-2-Exterior Glue, for countertops at sinks and lavatories.
 3. Softwood Plywood: DOC PS 1, medium-density overlay.
 4. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no urea formaldehyde.
 5. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for test methods 3.3, 3.4, 3.6, 3.8, and 3.10.

2.3 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 087100 "Door Hardware (Descriptive Specification)."
- B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 100 degrees of opening.
- C. Spring Close Invisible Hinges (where shown): Model 216IC by Soss Door Hardware.
- D. Back-Mounted Pulls: BHMA A156.9, B02011.
- E. Wire Pulls: Back mounted, solid metal, 4 inches long, 5/16 inch in diameter.
- F. Shelf Rests: BHMA A156.9, B04013; plastic.
- G. Drawer Slides: BHMA A156.9.
1. Manufactured Unitized Drawer System: Blum: "Metabox." Version C15. Series 330, or approved alternate product: Full Extension plus 3/4 inch (18 mm) override. Available Heights: Select slide height best suited to height of drawer box indicated on Drawings.
 - a. Type N: 2-1/8 inches (54 mm).
 - b. Type M: 3-5/8 inches (86 mm).
 - c. Type K: 4-5/8 inches (118 mm).
 - d. Type H: 5-7/8 inches (150 mm).
 - e. Limited to drawers not exceeding 100 lbf applied static load or 75 lbf applied dynamic load.
- H. Drawer Locks: BHMA A156.11, E07041.
- I. Door and Drawer Silencers: BHMA A156.16, L03011.

- J. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

1. Oil Rubbed Bronze, BHMA 703 or 704 (US10B).

2.4 PLASTIC-LAMINATE COUNTERTOPS

- A. Grade: Custom or better, unless otherwise noted.
- B. High-Pressure Decorative Laminate Grade: HGS.
- C. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
1. As indicated by manufacturer's designations in Finish Specification in the Drawings.
- D. Core Material: 1-1/8 inch thick particleboard or medium-density fiberboard.
1. Provide paper backing on underside of countertop substrate.
- E. Core Material at Sinks: 1-1/8-inch thick particleboard made with exterior glue, medium-density fiberboard made with exterior glue, or exterior-grade plywood.
1. Provide paper backing on underside of countertop substrate.
- F. Splashes: Provide 4-inch high splashes fabricated from same material as countertop substrate, not less than 1/2 inch thick, and complying with the following:
1. Provide endsplashes or sidesplashes at countertops which die into walls, partitions, or taller millwork.
 2. Match material, color, and height of sidesplashes or endsplashes to backsplashes, and to material and color of countertop.
 3. Provide full-height backsplashes, end- and side-splashes where indicated on Drawings.
- G. Plastic-Laminate Countertop Edges: Plastic-laminate of same material, thickness, and pattern as countertop indicated in Finish Legend and Room Finish Schedule, applied with hot-melt adhesive.
- H. PVC Countertop Edges: PVC tape, 3-mm thickness, matching laminate in color, pattern, and finish. Match color of countertop laminate, unless otherwise indicated in Finish Schedule
1. Charter Industries. PVC Edgebanding.
 2. Doellken-Woodtape PVC Edgebanding.

2.5 SOLID SURFACE COUNTERTOPS AND FACING

- A. Manufacturers: Provide products as indicated by manufacturer's designations in Finish Specifications in the Drawings.
- B. Thickness: 1cm, 2cm, and 3cm where indicated

- C. Edge Treatment: Eased edges, total edge profile to be 1 ½" unless otherwise noted.
- D. Adhesives, sealants, & hardware: As required for a complete installation according to Manufacturer's written instructions.

2.6 MISCELLANEOUS TRIM AND MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content. Where required, provide fire-retardant treated softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- C. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement. Do not use adhesives that contain urea formaldehyde.
 - 1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.7 FABRICATION

- A. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
- B. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.

3.2 INSTALLATION

- A. Grade: Install cabinets to comply with same grade as item to be installed.
- B. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.

- C. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- D. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.
- E. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
 - 1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 - 2. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.
- F. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
 - 1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
 - 2. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 - 3. Secure backsplashes to walls with adhesive.
 - 4. Calk space between backsplash and wall with sealant specified in Division 07 Section "Joint Sealants."
 - 5. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.
 - 6. Refer to Division 09 Sections for final finishing of installed architectural woodwork not indicated to be shop finished.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.

END OF SECTION 064116

SECTION 071900 - WATER REPELLENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes penetrating water-repellent treatments for the following vertical and horizontal surfaces:
 - 1. Precast concrete.
 - 2. Concrete masonry units.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

- A. Product certificates.

1.4 QUALITY ASSURANCE

- A. Applicator Qualifications: An employer of workers trained and approved by manufacturer.

PART 2 - PRODUCTS

2.1 PENETRATING WATER REPELLENTS

- A. Silane/Siloxane-Blend, Penetrating Water Repellent: Clear, silane and siloxane blend with 600 g/L or less of VOCs.
 - 1. 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:
 - a. BASF Corporation-Construction Systems.
 - b. Euclid Chemical Company (The); an RPM company.
 - c. L&M Construction Chemicals, Inc.
 - d. Pecora Corporation.
 - e. PROSOCO, Inc.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements and conditions affecting performance of the Work.
 - 1. Verify that surfaces are clean and dry according to water-repellent manufacturer's requirements. Check moisture content in representative locations by method recommended by manufacturer.
 - 2. Verify that there is no efflorescence or other removable residues that would be trapped beneath the application of water repellent.
 - 3. Verify that required repairs are complete, cured, and dry before applying water repellent.
- B. Test pH level according to water-repellent manufacturer's written instructions to ensure chemical bond to silica-containing or siliceous minerals.

3.2 PREPARATION

- A. New Construction and Repairs: Allow concrete and other cementitious materials to age before application of water repellent, according to repellent manufacturer's written instructions.
- B. Cleaning: Before application of water repellent, clean substrate of substances that could impair penetration or performance of product according to water-repellent manufacturer's written instructions.
- C. Coordination with Mortar Joints: Do not apply water repellent until pointing mortar for joints adjacent to surfaces receiving water-repellent treatment has been installed and cured.
- D. Coordination with Sealant Joints: Do not apply water repellent until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.
 - 1. Water-repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those required.

3.3 APPLICATION

- A. Apply coating of water repellent on surfaces to be treated using low-pressure spray to the point of saturation. Apply coating in dual passes of uniform, overlapping strokes. Remove excess material; do not allow material to puddle beyond saturation. Comply with manufacturer's written instructions for application procedure unless otherwise indicated.
 - 1. Precast Concrete: At Contractor's option, first application of water repellent may be completed before installing units. Mask mortar and sealant bond surfaces to prevent water repellent from migrating onto joint surfaces. Remove masking after repellent has cured.
- B. Apply a second saturation coating, repeating first application. Comply with manufacturer's written instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if written instructions are not applicable to Project conditions.

3.4 CLEANING

- A. Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses. Correct damage to work of other trades caused by water-repellent application.
- B. Comply with manufacturer's written cleaning instructions.

END OF SECTION 071900

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Glass-fiber blanket.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Research reports.

PART 2 - PRODUCTS

2.1 GLASS-FIBER BLANKET

- A. Glass-Fiber Blanket, Kraft Faced: ASTM C 665, Type II (nonreflective faced), Class C; Category 1 (membrane is a vapor barrier).

2.2 ACCESSORIES

- A. Insulation for Miscellaneous Voids:
 - 1. Glass-Fiber Insulation: ASTM C 764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E 84.
- B. Insulation Anchors, Spindles, and Standoffs: As recommended by manufacturer.
- C. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.2 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

- A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - 3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
 - 4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
 - 5. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.
 - a. Exterior Walls: Set units with facing placed toward interior of construction.
 - b. Interior Walls: Set units with facing placed as indicated on Drawings.
- B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
 - 1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft..

END OF SECTION 072100

SECTION 072400 - WATER-DRAINAGE EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. EIFS-clad drainage-wall assemblies that are field applied over substrate.

1.2 ACTION SUBMITTALS

A. Product Data: For each EIFS component, trim, and accessory.

B. Samples: For each exposed product and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

A. Manufacturer certificates.

B. Product certificates.

C. Product test reports.

D. Field quality-control reports.

E. Evaluation reports.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An installer who is certified in writing by EIFS manufacturer as qualified to install manufacturer's system using trained workers.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, to set quality standards for materials and execution, and to set quality standards for fabrication and installation.

1. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- 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. Dryvit Systems, Inc.
 - 2. Parex USA, Inc.
 - 3. Sto Corp.
- B. Source Limitations: Obtain EIFS from single source from single EIFS manufacturer and from sources approved by EIFS manufacturer as compatible with EIFS components.

2.2 PERFORMANCE REQUIREMENTS

- A. EIFS Performance: Comply with ASTM E 2568 and with the following:
 - 1. Weathertightness: Resistant to uncontrolled water penetration from exterior, with a means to drain water entering EIFS to the exterior.
 - 2. Impact Performance: ASTM E 2568, Standard impact resistance.
 - 3. Bond Integrity: Free from bond failure within EIFS components or between EIFS and substrates, resulting from exposure to fire, wind loads, weather, or other in-service conditions.

2.3 EIFS MATERIALS

- A. Primer/Sealer: EIFS manufacturer's standard substrate conditioner designed to protect substrates from moisture penetration and to improve the bond between substrate and insulation adhesive.
- B. Flexible-Membrane Flashing: Cold-applied, self-adhering, self-healing, rubberized-asphalt and polyethylene-film composite sheet or tape and primer; EIFS manufacturer's standard or product recommended in writing by EIFS manufacturer.
- C. Insulation Adhesive: EIFS manufacturer's standard formulation designed for indicated use; specifically formulated to be applied to back side of insulation in a manner that creates open vertical channels designed to serve as an integral part of the water-drainage system of the EIFS-clad drainage-wall assembly, compatible with substrate.
- D. Molded, Rigid Cellular Polystyrene Board Insulation: Comply with ASTM C 578, Type I.
- E. Reinforcing Mesh: Balanced, alkali-resistant, open-weave, glass-fiber mesh treated for compatibility with other EIFS materials, made from continuous multiend strands with retained mesh tensile strength of not less than 120 lbf/in. according to ASTM E 2098.
- F. Base-Coat Materials: EIFS manufacturer's standard mixture.
- G. Primer: EIFS manufacturer's standard factory-mixed, elastomeric-polymer primer for preparing base-coat surface for application of finish coat.
- H. Finish-Coat Materials: EIFS manufacturer's standard acrylic-based coating.

1. Colors: Match Architect's sample.
 2. Textures: As selected by Architect from manufacturer's full range.
- I. Trim Accessories: Type as designated or required to suit conditions indicated and to comply with EIFS manufacturer's written instructions; manufactured from UV-stabilized PVC; and complying with ASTM D 1784, manufacturer's standard cell class for use intended, and ASTM C 1063.

PART 3 - EXECUTION

3.1 EIFS INSTALLATION

- A. Comply with ASTM C 1397, ASTM E 2511, and EIFS manufacturer's written instructions for installation of EIFS as applicable to each type of substrate indicated.
- B. Trim: Apply trim accessories at perimeter of EIFS, at expansion joints, at windowsills, and elsewhere as indicated. Coordinate with installation of insulation.
- C. Board Insulation: Adhere insulation to substrate in compliance with ASTM C 1397 and the following:
1. Apply adhesive to insulation by notched-trowel method, with notches oriented vertically to produce drainage channels that remain functional after the insulation is adhered to substrate.
 2. Coordinate installation of flashing and insulation to produce wall assembly that does not allow water to penetrate behind flashing and water-resistive barrier.
- D. Expansion Joints: Install at locations indicated and where required by EIFS manufacturer.
- E. Reveals: Install $\frac{3}{4}$ " V-shaped vertical reveals at every vertical joint location shown in the modular metal wall panel system in the Drawings.
- F. Base Coat: Apply to exposed surfaces of insulation in minimum thickness recommended in writing by EIFS manufacturer.
- G. Reinforcing Mesh: Embed reinforcing mesh in wet base coat to produce wrinkle-free installation with mesh continuous at corners, overlapped not less than 2-1/2 inches or otherwise treated at joints to comply with ASTM C 1397 and EIFS manufacturer's written instructions. Do not lap reinforcing mesh within 8 inches of corners. Completely embed mesh, applying additional base-coat material if necessary, so reinforcing-mesh color and pattern are invisible.
- H. Primer: Apply over dry base coat according to EIFS manufacturer's written instructions.
- I. Finish Coat: Apply over dry base coat, maintaining a wet edge at all times for uniform appearance, in thickness required by EIFS manufacturer to produce a uniform finish of color and texture matching approved sample and free of cold joints, shadow lines, and texture variations.

3.2 FIELD QUALITY CONTROL

- A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:

1. As stipulated in Ch. 17 of the IBC.

B. EIFS will be considered defective if it does not pass tests and inspections.

END OF SECTION 072400

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Manufactured reglets with counterflashing.
 - 2. Formed low-slope roof sheet metal fabrications.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For sheet metal flashing and trim.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Distinguish between shop- and field-assembled work.
 - 3. Include identification of finish for each item.
 - 4. Include pattern of seams and details of termination points, expansion joints and expansion-joint covers, direction of expansion, roof-penetration flashing, and connections to adjoining work.
- C. Samples: For each exposed product and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

- A. Product certificates.
- B. Product test reports.
- C. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
- B. Mockups: Build mockups to verify selections made under Sample submittals to demonstrate aesthetic effects and to set quality standards for fabrication and installation.

1. Build mockup of each typical roof edge, including built-in gutter, fascia, fascia trim, approximately 10 feet long.

1.6 WARRANTY

- A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. SPRI Wind Design Standard: Manufacture and install copings and roof edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressure:
 1. Design Pressure: As required by adopted local building codes.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required.
 1. Exposed Coil-Coated Finish:
 - a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 2. Color: As selected by Architect from manufacturer's full range of at least 25 colors.

- C. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet according to ASTM A 653/A 653M, G90 coating designation or aluminum-zinc alloy-coated steel sheet according to ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40; prepainted by coil-coating process to comply with ASTM A 755/A 755M.

1. Exposed Coil-Coated Finish:

- a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

2. Color: As selected by Architect from manufacturer's full range of at least 25 colors.

2.3 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

- a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
- b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
- c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

3. Fasteners for Zinc-Coated (Galvanized) Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

- C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

- D. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

- E. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

- F. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.

- G. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.4 MANUFACTURED REGLETS

- A. Reglets: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and -welded corners and junctions and with interlocking counterflashing on exterior face, of same metal as reglet.

2.5 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
 - 1. Obtain field measurements for accurate fit before shop fabrication.
 - 2. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
 - 3. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
 - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
 - 2. Use lapped expansion joints only where indicated on Drawings.
- C. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.
- D. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- E. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.
- F. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.

2.6 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Roof Edge Flashing (Gravel Stop) and Fascia Cap: Fabricate in minimum 96-inch-long, but not exceeding 12-foot-long sections. Furnish with 6-inch-wide, joint cover plates.
 - 1. Fabricate from the Following Materials:
 - a. Aluminum-Zinc Alloy-Coated Steel: 22 gauge minimum thickness.

- B. Copings: Fabricate in minimum 96-inch-long, but not exceeding 12-foot-long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and interior leg. Miter corners, watertight.
 - 1. Fabricate from the Following Materials:
 - a. Aluminum-Zinc Alloy-Coated Steel: 22 gauge minimum thickness.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - 1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 - 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 - 3. Space cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
 - 4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
 - 5. Torch cutting of sheet metal flashing and trim is not permitted.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
 - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
 - 2. Use lapped expansion joints only where indicated on Drawings.
- D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."
- G. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

3.2 ROOF-DRAINAGE SYSTEM INSTALLATION

- A. General: Install sheet metal roof-drainage items to produce complete roof-drainage system according to cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.

3.3 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
- B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate.
- C. Copings: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated.
- D. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints minimum of 4 inches.

3.4 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Install Metal Screen Wall Panels in accordance with Manufacturer's written instructions.

3.5 CLEANING AND PROTECTION

- A. Clean off excess sealants.
- B. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

END OF SECTION 076200

SECTION 079200 - JOINT SEALERS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes sealants and joint backing, precompressed foam sealers, hollow gaskets and accessories.

1.2 REFERENCES

- A. American Society for Testing and Materials:
 - 1. ASTM C834 - Latex Sealing Compounds.
 - 2. ASTM C919 - Practice for Use of Sealants in Acoustical Applications.
 - 3. ASTM C920 - Elastomeric Joint Sealants.
 - 4. ASTM C1193 - Guide for Use of Joint Sealants.
 - 5. ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.
 - 6. ASTM D1565 - Flexible Cellular Materials--Vinyl Chloride Polymers and Copolymers (Open-Cell Foam).
 - 7. ASTM D1667 - Flexible Cellular Materials--Vinyl Chloride Polymers and Copolymers (Closed-Cell Foam).
 - 8. ASTM D2628 - Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Submittal procedures.
- B. Products Data: Submit data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.
- C. Samples: Submit samples illustrating sealant colors for selection.
- D. Manufacturer's Installation Instructions: Submit special procedures, surface preparation, and perimeter conditions requiring special attention.
- E. Warranty: Include coverage for installed sealants and accessories failing to achieve airtight seal, watertight seal, exhibit loss of adhesion or cohesion, and sealants which do not cure.

1.4 QUALITY ASSURANCE

- A. Maintain one copy of each referenced document covering installation requirements on site.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

- B. Applicator: Company specializing in performing Work of this section with minimum three years experience and approved by manufacturer.

1.6 MOCKUP

- A. Section 014000 - Quality Requirements: Requirements for mockup.
- B. Construct mockup of sealant joints in conjunction with window, wall, and doors mockups specified in other sections.
- C. Construct mockup with specified sealant types and with other components noted.
 - 1. Determine preparation and priming requirements based on manufacturers recommendations; take action necessary for correction of failure of sealant tests on mock-up.
 - 2. Verify sealants, primers, and other components do not stain adjacent materials.
- D. Locate where directed by Architect/Engineer.
- E. Incorporate accepted mockup as part of Work.
- F. Remove mockup when directed by Architect/Engineer.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Section 016000 - Products Requirements.
- B. Maintain temperature and humidity recommended by sealant manufacturer during and after installation.

1.8 COORDINATION

- A. See Section 013100 – Project Management and Coordination: Coordination and project conditions.
- B. Coordinate Work with sections referencing this section.

PART 2 PRODUCTS

2.1 JOINT SEALERS

- A. Manufacturers:
 - 1. Dow Corning Corp.
 - 2. GE Silicones.
 - 3. Illbruck Sealant Systems.
 - 4. Mameco International Inc.
 - 5. Pecora Corp.
 - 6. Sika Corp.
 - 7. Sonneborn.
 - 8. Substitutions: Section 016000 - Products Requirements.

B.

Products Description:

1. High Performance General Purpose Exterior (Nontraffic) Sealant: Polyurethane; ASTM C920, Grade NS, Class 25, Uses M, G, and A; single component.
 - a. Color: Colors as selected.
 - b. Applications: Use for:
 - 1) Control, expansion, and soft joints in masonry.
 - 2) Joints between concrete and other materials.
 - 3) Joints between metal frames and other materials.
 - 4) Other exterior nontraffic joints for which no other sealant is indicated.
2. Exterior Metal Lap Joint Sealant: Butyl or polyisobutylene, non-drying, non-skinning, non-curing.
 - a. Applications: Use for concealed sealant bead in sheet metal work and concealed sealant bead in siding overlaps.
3. General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C834, single component, paintable.
 - a. Color: Colors as selected by Architect.
 - b. Applications: Use for interior wall and ceiling control joints and other interior joints for which no other type of sealant is indicated.
4. Bathtub/Tile Sealant: Silicone; ASTM C920, Uses M and A; single component, mildew resistant.
 - a. Applications: Use for joints between plumbing fixtures and floor and wall surfaces, and joints between toilet room counter tops and wall surfaces.
5. Acoustical Sealant: Butyl or acrylic sealant; ASTM C920, Grade NS, Class 12-1/2, Uses M and A; single component, solvent release curing, non-skinning.
 - a. Applications: Use for concealed locations only at acoustically rated construction.
 - 1) Provide sealant bead between top stud runner and structure and between bottom stud track and floor.
 - 2) Sealant bead between ceiling material and wall material.
6. Interior Floor Joint Sealant: Polyurethane, self-leveling; ASTM C920, Grade P, Class 25, Uses T, M and A; Multi-component.
 - a. Approved by manufacturer for wide joints up to 1-1/2 inches.
 - b. Color as selected.
 - c. Applications: Use for: Expansion joints in floors and Control joints in floor.
 - d. Shore hardness of 80 (in truck area only).

7. Type S – Silicone Sealant: C920, Grade NS, Class 25, Uses NT, A; single component, acid curing for nonporous material bonding; non-acid curing for porous surfaces, non-sagging, non-staining, fungus resistant, non-bleeding.
 - a. Color as selected.
 - b. Movement Capability: 100 percent, minus 25 percent.
 - c. Service Temperature Range: 77 degrees F.
 - d. Shore A Hardness Range: 15 to 35.
 - e. Applications: Use for exterior windows, doors, frames, etc. and interior door frames, windows, etc.
8. Precompressed, Self-expanding polyurethane foam joint sealant: Willseal 600 by Illbruck Sealant Systems, open cell polyurethane flexible foam impregnated with flame retardant modified acrylic.
 - a. Color: Black
 - b. Width: Determined by width of joint to be sealed.
 - c. Applications: Use in locations shown on Drawings and miscellaneous joints where gun-applied sealant use is not practical.

2.2 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 D1056, sponge or expanded rubber; 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

3.1 EXAMINATION

- A. See Section 013100 – Project Management and Coordination: Coordination and project conditions.
- B. Verify substrate surfaces and joint openings are ready to receive work.
- C. Verify joint backing and release tapes are compatible with sealant.

3.2 PREPARATION

- A. Remove loose materials and foreign matter impairing adhesion of sealant.
- B. Clean and prime joints.
- C. Perform preparation in accordance with ASTM C1193.

- D. Protect elements surrounding Work of this section from damage or disfiguration.

3.3 INSTALLATION

- A. Perform installation in accordance with ASTM C1193.
- B. Perform acoustical sealant application work in accordance with ASTM C919.
- C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by Manufacturer.
- 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. Precompressed Foam Sealant: Do not stretch; avoid joints except at corners, ends, and intersections; install with face 1/8 to 1/4 inch below adjoining surface.
- I. Compression Gaskets: Avoid joints except at ends, corners, and intersections; seal joints with adhesive; install with face 1/8 to 1/4 inch below adjoining surface.

3.4 CLEANING

- A. Section 017300 - Execution: Final cleaning.
- B. Clean adjacent soiled surfaces.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

- A. Section 017300 - Execution: Protecting installed construction.
- B. Protect sealants until cured.

3.6 SCHEDULE

Not Used.

END OF SECTION 079200

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes hollow-metal work.

1.2 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include elevations, door edge details, frame profiles, metal thicknesses, preparations for hardware, and other details.
- C. Schedule: Prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Product test reports.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- 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. Ceco Door; ASSA ABLOY.
 - 2. Curries Company; ASSA ABLOY.
 - 3. Steelcraft; an Allegion brand.

2.2 REGULATORY REQUIREMENTS

- A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.
- B. Fire-Rated, Borrowed-Lite Assemblies: Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

2.3 INTERIOR DOORS AND FRAMES

- A. Standard-Duty Doors and Frames: SDI A250.8, Level 1. At locations indicated in the Door and Frame Schedule.
 1. Physical Performance: Level C according to SDI A250.4.
 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches.
 - c. Face: Uncoated, cold-rolled steel sheet, minimum thickness of 0.032 inch.
 - d. Edge Construction: Model 1, Full Flush.
 - e. Core: Manufacturer's standard.
 3. Frames:
 - a. Materials: Uncoated, cold-rolled steel sheet, minimum thickness of 0.042 inch.
 - b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
 - c. Construction: Full profile welded.
 4. Exposed Finish: Prime.

2.4 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

- A. Heavy-Duty Doors and Frames: SDI A250.8, Level 2. At locations indicated in the Door and Frame Schedule.
 1. Physical Performance: Level B according to SDI A250.4.
 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches.
 - c. Face: Metallic-coated steel sheet, minimum thickness of 0.042 inch, with minimum A40 coating.
 - d. Edge Construction: Model 1, Full Flush.
 - e. Core: Manufacturer's standard insulation material.
 3. Thermal-Rated Doors: Provide doors fabricated with thermal-resistance value (R-value) of not less than 2.1 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.
 4. Frames:

- a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A40 coating.
 - b. Construction: Full profile welded.
- 5. Exposed Finish: Prime.

2.5 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
 - 2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
 - 3. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
 - 4. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch-diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
- B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch, and as follows:
 - 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
 - 2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.

2.6 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.
- D. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
 - 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- F. Power-Actuated Fasteners in Concrete: From corrosion-resistant materials.
- G. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.
- H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing).

- I. Glazing: Section 088100 "Glazing."
- J. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat.

2.7 FABRICATION

- A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Hollow-Metal Doors:
 - 1. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
- C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
 - 1. Sidelite and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
 - 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 - 3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
 - 4. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
 - 5. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 16 inches from top and bottom of frame. Space anchors not more than 32 inches o.c., to match coursing, and as follows:
 - 1) Two anchors per jamb up to 60 inches high.
 - 2) Three anchors per jamb from 60 to 90 inches high.
 - 3) Four anchors per jamb from 90 to 120 inches high.
 - 4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
 - b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 - c. Compression Type: Not less than two anchors in each frame.

- d. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.
- 6. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- D. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
 - 1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
 - 2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.
- E. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
 - 1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
 - 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
 - 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
 - 4. Provide loose stops and moldings on inside of hollow-metal work.
 - 5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.8 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
 - 1. Shop Primer: SDI A250.10.

2.9 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Hollow-Metal Frames: Install hollow-metal frames for doors, transoms, sidelites, borrowed lites, and other openings, of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - c. Install frames with removable stops located on secure side of opening.
 - d. Install door silencers in frames before grouting.
 - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - g. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.
 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
 4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
 5. Concrete Walls: Solidly fill space between frames and concrete with mineral-fiber insulation.
 6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 7. In-Place Metal or Wood-Stud Partitions: Secure slip-on drywall frames in place according to manufacturer's written instructions.
 8. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- B. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
1. Non-Fire-Rated Steel Doors:
 - a. Between Door and Frame Jambs and Head: 1/8 inch plus or minus 1/32 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch to 1/4 inch plus or minus 1/32 inch.
 - c. At Bottom of Door: 3/4 inch plus or minus 1/32 inch.
 - d. Between Door Face and Stop: 1/16 inch to 1/8 inch plus or minus 1/32 inch.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
 3. Smoke-Control Doors: Install doors and gaskets according to NFPA 105.
- C. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.
1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.2 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow-metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 081113

SECTION 081400 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-core doors with wood-veneer faces.
2. Factory finishing flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of door. Include factory-finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:

1. Dimensions and locations of blocking.
2. Dimensions and locations of mortises and holes for hardware.
3. Dimensions and locations of cutouts.
4. Undercuts.
5. Requirements for veneer matching.
6. Doors to be factory finished and finish requirements.
7. Fire-protection ratings for fire-rated doors.

C. Samples: For factory-finished doors.

1.3 INFORMATIONAL SUBMITTALS

A. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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. Algoma Hardwoods, Inc.
2. Eggers Industries.
3. Graham Wood Doors; ASSA ABLOY Group company.
4. Marshfield DoorSystems, Inc.
5. Mohawk Flush Doors, Inc.

2.2 FLUSH WOOD DOORS, GENERAL

- A. Quality Standard: In addition to requirements specified, comply with AWI's, AWMAC's, and WI's "Architectural Woodwork Standards."
 - 1. Provide AWI Quality Certification Labels indicating that doors comply with requirements of grades specified.
- B. WDMA I.S.1-A Performance Grade:
 - 1. Heavy Duty unless otherwise indicated.
- C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
 - 1. Cores: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
 - 2. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
 - 3. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
- D. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.
- E. Particleboard-Core Doors:
 - 1. Particleboard: ANSI A208.1, Grade LD-1 or Grade LD-2.
 - 2. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.
 - 3. Provide doors with glued-wood-stave or structural-composite-lumber cores instead of particleboard cores for doors indicated to receive exit devices.
- F. Structural-Composite-Lumber-Core Doors:
 - 1. Structural Composite Lumber: WDMA I.S.10.
 - a. Screw Withdrawal, Face: 700 lbf.
 - b. Screw Withdrawal, Edge: 400 lbf.
- G. Mineral-Core Doors:
 - 1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
 - 2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as needed to eliminate through-bolting hardware.
 - 3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

2.3 VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:

1. Grade: Premium, with Grade A faces.
2. Species: Match Species of existing wood doors.
3. Cut: Match existing.
4. Match between Veneer Leaves: Slip match.
5. Assembly of Veneer Leaves on Door Faces: Center-balance match.
6. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
7. Core: Either glued wood stave or structural composite lumber.
8. Construction: Five or seven plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering. Faces are bonded to core using a hot press.

2.4 LIGHT FRAMES AND LOUVERS

- ### A. Wood-Veneered Beads for Light Openings in Fire-Rated Doors:
- Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.

2.5 FABRICATION

- ### A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
1. Comply with NFPA 80 requirements for fire-rated doors.
- ### B. Factory machine doors for hardware that is not surface applied.
- ### C. Openings: Factory cut and trim openings through doors.
1. Light Openings: Trim openings with moldings of material and profile indicated.
 2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088100 "Glazing."

2.6 FACTORY FINISHING

- ### A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.
- ### B. Factory finish doors that are indicated to receive transparent finish.
- ### C. Transparent Finish:
1. Grade: Premium.

2. Finish: AWI's, AWMAC's, and WI's "Architectural Woodwork Standards" System 5, conversion varnish System 9, UV curable, acrylated epoxy, polyester, or urethane System 10, UV curable, water based or System 11, catalyzed polyurethane.
3. Staining: Match existing doors.
4. Sheen: Satin.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Hardware: For installation, see Section 087100 "Door Hardware."
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
 1. Install fire-rated doors according to NFPA 80.
 2. Install smoke- and draft-control doors according to NFPA 105.
- C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
 1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.
 - a. Comply with NFPA 80 for fire-rated doors.
- D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

END OF SECTION 081400

SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes access doors and frames for walls and ceilings.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Access Doors and Frames: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection and temperature-rise limit ratings indicated, according to NFPA 252 or UL 10B.

2.2 ACCESS DOORS AND FRAMES

- A. Flush Access Doors with Concealed Flanges:
 - 1. Product standard to be B-RW Series by Babcock-Davis, or equal.
 - 2. Description: Face of door flush with frame; with concealed flange for gypsum board installation and concealed hinge.
 - 3. Locations: Wall and ceiling.
 - 4. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gage, factory primed.
 - 5. Frame Material: Same material and thickness as door.
 - 6. Latch and Lock: Cam latch, screwdriver operated.

2.3 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.
- C. Frame Anchors: Same material as door face.
- D. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.4 FABRICATION

- A. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- B. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.
- C. Latch and Lock Hardware:
 - 1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.

2.5 FINISHES

- A. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - 1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 083113

SECTION 083213 - FRAMELESS GLASS DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes top hung sliding and hinged frameless glass doors for interior locations.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For frameless glass doors.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification data.
- B. Product test reports.
- C. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer capable of fabricating frameless glass doors that meet or exceed performance requirements indicated and of documenting this performance by inclusion in lists and by labels, test reports, and calculations.

1.6 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of frameless glass doors that fail in materials or workmanship within specified warranty period.

- 1. Warranty Period:

- a. Frameless Door Hardware: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- 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. CR Laurence Company.

2.2 SLIDING FRAMELESS GLASS DOORS

- A. Top Hung Single Slider with Fixed Panels: CRL51 Ceiling Mount System.
 - 1. Provide all hardware necessary for a complete, operable system, including overhead track, hanger assemblies, track cover, door brakes, and guides.
 - 2. Door Panels: As indicated on Drawings and Specified in Section 088100.
 - 3. Configuration: As indicated on Drawings.
 - 4. Door Pull: Forms+Surfaces Model DT1214, 36" long, Satin stainless steel finish.
- B. Hinged Swing Doors with and without Fixed Panel: CRL Frameless Storefront and Entrance Patch Hardware.
 - 1. Provide all hardware necessary for a complete, operable system, including door pivots and fixed panel anchors.
 - 2. Door Panels: As indicated on Drawings and Specified in Section 088100.
 - 3. Configuration: As indicated on Drawings.
 - 4. Door Pull: Forms+Surfaces Model DT1214, 36" long, Satin stainless steel finish.

2.3 FABRICATION

- A. Fabricate frameless glass doors in sizes indicated. Include a complete system for assembling components and anchoring doors.

2.4 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing doors, hardware, accessories, and other components.
- B. Install frameless glass doors level, plumb, square, true to line, without distortion, without warp or rack of frames and panels, and without impeding thermal movement; anchored securely in place to structural support; and in proper relation to wall finishes and other adjacent construction.

- C. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.
- D. Adjust operating panels to provide a tight fit without binding. Adjust hardware for proper alignment, smooth operation, and proper latching without unnecessary force or excessive clearance.

END OF SECTION 083213

SECTION 083613 - SECTIONAL DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Sectional-door assemblies.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type and size of sectional door and accessory.
- B. Shop Drawings: For each installation and for components not dimensioned or detailed in manufacturer's product data.
- C. Samples: For each exposed product and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

- A. Sample warranties.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

1.6 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of sectional doors that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Finish Warranty: Manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Provide sectional doors that comply with performance requirements specified without failure from defective manufacture, fabrication, installation, or other defects in construction.
- B. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.
 - 1. Design Wind Load: As indicated on Drawings.

2.2 SECTIONAL-DOOR ASSEMBLY

- A. Steel and Aluminum Sectional Doors: Provide sectional door formed with hinged sections and fabricated so that finished door assembly is rigid and aligned with tight hairline joints; free of warp, twist, and deformation; and complies with requirements in DASMA 102.
 - 1. 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:
 - a. Clopay Building Products.
 - b. Overhead Door Corporation.
 - c. Raynor Garage Doors.
 - 2. Basis of Design shall be Overhead Door Model 521 Glazed Aluminum Sectional Door.
- B. Operation Cycles: Door components and operators capable of operating for not less than 50,000 operation cycles for aluminum doors and not less than 10,000 operation cycles for steel door. One operation cycle is complete when door is opened from closed position to the open position and returned to closed position.
- C. Air Infiltration: Maximum rate of 0.4 cfm/sq. ft. when tested in accordance with ASTM E283 or DASMA 105.
- D. Aluminum Sections: ASTM B221 extruded-aluminum stile and rail members of alloy and temper standard with manufacturer for type of use and finish indicated; in minimum thickness required to comply with requirements; with rail and stile dimensions and profiles indicated on Drawings; and with overlapped or interlocked weather- and pinch-resistant seal at meeting rails.
 - 1. Door-Section Thickness: 1-3/4 inches.
 - 2. Section Reinforcing: Continuous horizontal and diagonal reinforcement as required to stiffen door and for wind loading. Ensure that reinforcement does not obstruct vision lites.
 - a. Hardware Locations: Provide reinforcement for hardware attachment.
 - 3. Glazed Panels: Manufacturer's standard, aluminum-framed section with glazing sealed with glazing tape and aluminum glazing bead. Glazing as follows:
 - a. Insulating Glass Units: Manufacturers' standard unit with tempered glass lites complying with ASTM C1048, Kind FT (fully tempered), Condition A (uncoated), Type I, Class 1 (clear), Quality-Q3.

- E. Track: Manufacturer's standard, galvanized-steel, low-headroom track system. Provide complete system including brackets, bracing, and reinforcement to ensure rigid support of ball-bearing roller guides.
1. Material: Galvanized steel, ASTM A653/A653M, minimum G60 zinc coating.
 2. Size: As recommended in writing by manufacturer for door size, weight, track configuration and door clearances indicated on Drawings.
 3. Track Reinforcement and Supports: Provide galvanized-steel members to support track without sag, sway, and vibration during opening and closing of doors. Slot vertical sections of track spaced 2 inches apart for door-drop safety device.
 - a. Horizontal Track: Provide continuous reinforcing angle from curve in track to end of track, attached to track and supported at points by laterally braced attachments to overhead structural members.
- F. Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom top and jambs of door. Provide combination bottom weatherseal and sensor edge for bottom seal.
- G. Locking Device:
1. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on single-jamb side, operable from inside only.
 2. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.
- H. Counterbalance Mechanism:
1. Torsion Spring: Adjustable-tension torsion springs complying with requirements of DASMA 102 for number of operation cycles indicated, mounted on torsion shaft.
 2. Cable Drums and Shaft for Doors: Cast-aluminum cable drums mounted on torsion shaft and grooved to receive door-lifting cables as door is raised.
 - a. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of torsion shaft.
 3. Cables: Galvanized-steel, multistrand, lifting cables.
 4. Cable Safety Device: Include a spring-loaded steel or bronze cam mounted to bottom door roller assembly on each side and designed to automatically stop door if lifting cable breaks.
 5. Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level the shaft and prevent sag.
 6. Bumper: Provide spring bumper at each horizontal track to cushion door at end of opening operation.
- I. Metal Finish:
1. Baked-Enamel 70% PVDF: AAMA 2603 except with a minimum dry film thickness of 1.5 mils:
 - a. Color and Gloss: As selected by Architect from framing manufacturer's full range of standard colors.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install sectional doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; in accordance with manufacturer's written instructions.
- B. Tracks:
 - 1. Fasten vertical track assembly to opening jambs and framing with fasteners spaced not more than 24 inches apart.
 - 2. Hang horizontal track assembly from structural overhead framing with angles or channel hangers attached to framing by welding or bolting, or both. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.
- C. Accessibility: Install sectional doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.
- D. Power-Operated Doors: Install automatic garage doors openers in accordance with UL 325.

3.2 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain sectional doors.

END OF SECTION 083613

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior and interior storefront framing.
2. Exterior and interior manual-swing entrance doors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include plans, elevations, sections, full-size details, and attachments to other work.

1. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

C. Samples: For each exposed finish required.

D. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams.

1.3 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Field quality-control reports.

C. Sample warranties.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who have at least 10 years minimum in like project installation. Submit list of five (5) like projects within 30 mile representative area of project.

B. Building Enclosure System: When aluminum curtainwall are part of building enclosure system, including entrances, entrance hardware, storefront, and windows and related products, provide building enclosure system products from a single source manufacturer.

- C. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.
- D. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
 - 1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.6 WARRANTY

- A. Special Assembly Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
 - 1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 - 2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Glass breakage.
 - c. Noise or vibration created by wind and thermal and structural movements.
 - d. Loosening or weakening of fasteners, attachments, and other components.
 - e. Failure of operating units.
- B. Structural Loads:
 - 1. Wind Loads: As required to comply with the 2012 International Building Code.
 - 2. Other Design Loads: As indicated on Drawings.
- C. Deflection of Framing Members: At design wind pressure, as follows:

1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding 1/175 of the glass edge length for each individual glazing lite .
2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller.
3. Cantilever Deflection: Where framing members overhang an anchor point, as follows:
 - a. Perpendicular to Plane of Wall: No greater than 1/240 of clear span plus 1/4 inch for spans greater than 11 feet 8-1/4 inches or 1/175 times span, for spans less than 11 feet 8-1/4 inches.

D. Structural: Test according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

E. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:

1. Fixed Framing and Glass Area:
 - a. Maximum air leakage of 0.06 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft..
2. Entrance Doors:
 - a. Pair of Doors: Maximum air leakage of 1.0 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..
 - b. Single Doors: Maximum air leakage of 0.5 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..

F. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 8.00 lbf/sq. ft.

2.2 MANUFACTURERS

- 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. EFCO Corporation.
 2. Kawneer North America; an Alcoa company.
 3. Wausau.

2.3 FRAMING

- A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: Thermally broken at exterior applications, Non-thermal at interior.
 2. Glazing System: Retained mechanically with gaskets on four sides.
 3. Glazing Plane: Front.
 4. Finish: 70% PVDF fluoropolymer based coating.
 5. Fabrication Method: Field-fabricated stick system.
- B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.
- C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- D. Materials:
1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - a. Sheet and Plate: ASTM B 209.
 - b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
 - c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
 - d. Structural Profiles: ASTM B 308/B 308M.
 2. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.
 - a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
 - b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
 - c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.4 ENTRANCE DOOR SYSTEMS

- A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.
1. Door Construction: 1-3/4-inch overall thickness, with minimum 0.125-inch-thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
 2. Door Design: Medium stile; 3-1/2-inch nominal width.
 3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.
 - a. Provide nonremovable glazing stops on outside of door.

2.5 ENTRANCE DOOR HARDWARE

- A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 087100 "Door Hardware."
- B. General: Provide entrance door hardware and entrance door hardware sets indicated in door and frame schedule for each entrance door to comply with requirements in this Section.
1. Opening-Force Requirements:

- a. Egress Doors: Not more than 15 lbf to release the latch and not more than 30 lbf to set the door in motion.
 - b. Accessible Interior Doors: Not more than 5 lbf to fully open door.
- C. Hardware: Furnish manufacturer's standard door hardware for types of doors and applications indicated, and as specified below.
 - 1. Weather Stripping: Wool pile, continuous and replaceable.
 - 2. Sill Sweep Strips: Retracting resilient seal type, of neoprene compound.
 - 3. Threshold: National Guard Model 950N or approved equal. Threshold shall be ADA compliant with a maximum total height of ½".
 - 4. Hinges: Manufacturer's standard pivot hinges.
 - 5. Pull: Forms + Surfaces model DT1031, 12" or approved equal. Finish to be US32D Satin Stainless Steel.
 - 6. Panic Device: Door-O-Matic Model 1690. Provide at all doors.
 - 7. Finish: Exposed hardware to match hardware finishes specified in Section 087100.
 - 8. Lock Cylinders: Specified in Section 087100.

2.6 GLAZING

- A. Glazing: Comply with Section 088100 "Glazing."
- B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.
- C. Glazing Sealants: As recommended by manufacturer.

2.7 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Physical and thermal isolation of glazing from framing members.
 - 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - 5. Provisions for field replacement of glazing from exterior at front glazed framing and interior at center glazed framing.
 - 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- E. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
- F. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

- G. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
- H. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.8 ALUMINUM FINISHES

- A. Baked-Enamel 70% PVDF: AAMA 2603 except with a minimum dry film thickness of 1.5 mils.
 - 1. Color and Gloss: As selected by Architect from framing manufacturer's full range of standard colors.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General:
 - 1. Comply with manufacturer's written instructions.
 - 2. Do not install damaged components.
 - 3. Fit joints to produce hairline joints free of burrs and distortion.
 - 4. Rigidly secure nonmovement joints.
 - 5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
 - 6. Seal perimeter and other joints watertight unless otherwise indicated.
- B. Metal Protection:
 - 1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
 - 2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- C. Set continuous sill members and flashing in full sealant bed as specified in Section 079200 "Joint Sealants" to produce weathertight installation.
- D. Install components plumb and true in alignment with established lines and grades.
- E. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.
- F. Install glazing as specified in Section 088100 "Glazing."
- G. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.
 - 1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
 - 2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.2 FIELD QUALITY CONTROL

- A. Field Quality-Control Testing: Perform the following test on representative areas of aluminum-framed entrances and storefronts.
 - 1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.
 - a. Perform a minimum of two tests in areas as directed by Architect.
- B. Aluminum-framed entrances and storefronts will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 084113

SECTION 086200 - UNIT SKYLIGHTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Unit skylights mounted on site-erected curbs.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of unit skylight.
- B. Shop Drawings: For unit skylight work. Include plans, elevations, sections, details, and connections to supporting structure and other adjoining work.
- C. Samples: For each type of exposed finish required and each type of glazing.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification data.
- B. Product test reports.
- C. Field quality-control reports.
- D. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.5 WARRANTY

- A. Provide a single source skylight system manufacturer warranty against defective materials and fabrication. Submit manufacturer's written warranty agreeing to repair skylight system work, which fails in materials within 2 years of the date of delivery. In addition, provide single source skylight's manufacturer 10 year glazing panel warranty. Third party warranty for glazing panels shall not be acceptable.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- 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. Velux.

2.2 PERFORMANCE REQUIREMENTS

- A. Unit Skylight Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
 - 1. Performance Class and Grade: Class CW-PG to meet design loads indicated in Structural Drawings.

2.3 UNIT SKYLIGHTS

- A. Dynamic Dome Skylight unit by Velux.
- B. Unit Shape and Size: 36" x 72" nominal size.
- C. Glazing:
 - 1. Double-Glazing (LuxGuard Plus).
 - a. Thicknesses: Manufacturer's standard.
 - b. Inner Glazing Color: Clear Prismatic.
 - c. Outer Glazing Color: Clear Smooth.
- D. Glazing Gaskets: Manufacturer's standard.
- E. Condensation Control: Fabricate unit skylights with integral internal gutters and nonclogging weeps to collect and drain condensation to the exterior.
- F. Thermal Break: Fabricate unit skylights with thermal barrier separating exterior and interior metal framing.
- G. Fasteners: Same metal as metal being fastened, nonmagnetic stainless steel, or other noncorrosive metal as recommended by manufacturer. Finish exposed fasteners to match material being fastened. Provide nonremovable fastener heads.

2.4 ALUMINUM FINISHES

- A. Mill Finish: Manufacturer's standard.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Coordinate installation of unit skylight with installation of substrates, vapor retarders, roof insulation, roofing membrane, and flashing as required to ensure that each element of the Work performs properly and that combined elements are waterproof and weathertight.
- B. Comply with recommendations in AAMA 1607 and with manufacturer's written instructions for installing unit skylights.

3.2 CLEANING

- A. Clean exposed unit skylight surfaces according to manufacturer's written instructions. Touch up damaged metal coatings and finishes.

END OF SECTION 086200

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Mechanical door hardware for the following:
 - a. Swinging doors.
 - b. Sliding doors.
2. Cylinders for door hardware specified in other Sections.
3. Electrified door hardware.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For electrified door hardware.
1. Include diagrams for power, signal, and control wiring.
 2. Include details of interface of electrified door hardware and building safety and security systems.
- C. Samples: For each exposed product in each finish specified.
- D. Door hardware schedule.
- E. Keying schedule.

1.3 INFORMATIONAL SUBMITTALS

- A. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and of an Architectural Hardware Consultant who is available during the course of the Work to consult Contractor, Architect, and Owner about door hardware and keying.

1. Scheduling Responsibility: Preparation of door hardware and keying schedule.
- B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as an Architectural Hardware Consultant (AHC).

1.6 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
 1. Warranty Period: Three years from date of Substantial Completion unless otherwise indicated below:
 - a. Electromagnetic Locks: Five years from date of Substantial Completion.
 - b. Exit Devices: Two years from date of Substantial Completion.
 - c. Manual Closers: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Door Assemblies: Where fire-rated doors are indicated, provide door hardware complying with NFPA 80 that is listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
- B. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.
- D. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the DOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.

2.2 SCHEDULED DOOR HARDWARE

- A. Provide products for each door that comply with requirements indicated in Part 2 and door hardware schedule.
 1. Door hardware is scheduled on Drawings.

2.3 HINGES

- A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.

1. 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:
 - a. Schlage.
 - b. Von Duprin.
 - c. Hager Companies.
 - d. LCN.
 - e. Ives.
 - f. Glynn-Johnson.
 - g. Stanley Commercial Hardware; a division of Stanley Security Solutions.

2.4 MECHANICAL LOCKS AND LATCHES

- A. Lock Functions: As indicated in door hardware schedule.
- B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
 1. Mortise Locks: Minimum 3/4-inch latchbolt throw.
- C. Lock Backset: 2-3/4 inches unless otherwise indicated.
- D. Lock Trim:
 1. Description: Schlage L Series mortise lever locks.
 2. Levers: 07 Lever.
 3. Dummy Trim: Match lever lock trim and escutcheons.
- E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.
 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
 3. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.
 4. Rabbet Front and Strike: Provide on locksets for rabbeted meeting stiles.

2.5 MANUAL FLUSH BOLTS

- A. Manual Flush Bolts: BHMA A156.16; minimum 3/4-inch throw; designed for mortising into door edge.
 1. 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:
 - a. Adams Rite Manufacturing Co; an ASSA ABLOY Group company.
 - b. Allegion plc.
 - c. Trimco.

2.6 AUTOMATIC AND SELF-LATCHING FLUSH BOLTS

- A. Automatic and Self-Latching Flush Bolts: BHMA A156.16; minimum 3/4-inch throw; designed for mortising into door edge.
 - 1. 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:
 - a. Allegion plc.
 - b. Trimco.

2.7 EXIT DEVICES AND AUXILIARY ITEMS

- A. Exit Devices and Auxiliary Items: BHMA A156.3.
 - 1. Product shall be Von Duprin 99 series, no substitutions:
 - a. Provide electric locking capabilities to integrate with the Owner's existing access control system
 - b. Coordinate exact requirements with Owner.

2.8 LOCK CYLINDERS

- A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver. Provide cylinder from same manufacturer of locking devices.
- B. Standard Lock Cylinders: BHMA A156.5; Grade 2 permanent cores; face finished to match lockset.
 - 1. Core Type: Removable.
- C. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

2.9 KEYING

- A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, appendix. Provide one extra key blank for each lock.
 - 1. Grand Master Key System: Change keys, a master key, and a grand master key operate cylinders.
 - a. Provide three cylinder change keys and five each of master and grand master keys.
 - 2. Existing System:
 - a. Master key or grand master key locks to Owner's existing system.
- B. Keys: Brass.

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:
 - a. Notation: "DO NOT DUPLICATE."

2.10 SURFACE CLOSERS

- A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.
 1. 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:
 - a. Allegion plc.
 - b. Corbin Russwin, Inc.; an ASSA ABLOY Group company.
 - c. DORMA USA, Inc.
 - d. SARGENT Manufacturing Company; ASSA ABLOY.
 - e. Yale Security Inc; an ASSA ABLOY Group company.

2.11 MECHANICAL STOPS AND HOLDERS

- A. Wall- and Floor-Mounted Stops: BHMA A156.16.
 1. 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:
 - a. Allegion plc.
 - b. Hager Companies.
 - c. Rockwood Manufacturing Company; an ASSA ABLOY Group company.
 - d. Trimco.

2.12 ELECTRIFIED ACCESS CONTROL HARDWARE

- A. Electric locksets, exit devices, and 10-wire hinges. All hardware shall be compatible with Owner's existing access control system and devices.
 1. 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:
 - a. Allegion plc.

2.13 DOOR GASKETING

- A. Door Gasketing: BHMA A156.22; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.
 - 1. 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:
 - a. Hager Companies.
 - b. National Guard Products, Inc.
 - c. Pemko Manufacturing Co.
- B. Maximum Air Leakage: When tested according to ASTM E 283 with tested pressure differential of 0.3-inch wg, as follows:
 - 1. Gasketing on Single Doors: 0.3 cfm/sq. ft. of door opening.
 - 2. Gasketing on Double Doors: 0.50 cfm per foot of door opening.

2.14 THRESHOLDS

- A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.
 - 1. 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:
 - a. National Guard Products, Inc. Model 950 or equal.

2.15 SLIDING DOOR HARDWARE

- A. Sliding Door Hardware: Provided by Door Manufacturer.

2.16 METAL PROTECTIVE TRIM UNITS

- A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch-thick bronze; with manufacturer's standard machine or self-tapping screw fasteners.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Craftsman Hardware, Field Style Kick Plate, 18"x48".

2.17 DOOR PUSH / PULLS

- A. Door Push / Pull units:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. Allegion plc.

2.18 FINISHES

- A. Provide finishes complying with BHMA A156.18. Finish to be US 26D.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Mounting Heights: Mount door hardware units to comply with the following unless otherwise indicated or required to comply with governing regulations.
 - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 - 2. Custom Steel Doors and Frames: HMMA 831.
 - 3. Wood Doors: DHI's "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.
- C. Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- D. Lock Cylinders: Install construction cores to secure building and areas during construction period.
 - 1. Replace construction cores with permanent cores as directed by Owner.
 - 2. Furnish permanent cores to Owner for installation.
- E. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."
- F. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.
- G. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
 - 1. Do not notch perimeter gasketing to install other surface-applied hardware.
- H. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- I. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.2 ADJUSTING

- A. Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

END OF SECTION 087100

SECTION 088100 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Glass for windows, doors, storefront and curtain wall framing.
 - 2. Glazing film
 - 3. Glazing sealants and accessories.

1.2 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Glass Samples: For each type of glass product; 12 inches square.
- C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.4 QUALITY ASSURANCE

- A. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

1.5 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- B. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1. Warranty Period: Five Insert number years from date of Substantial Completion.
- C. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the International Building Code and ASTM E 1300.
 1. Design Wind Pressures: As indicated on Drawings.
 2. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.
- B. Safety Glazing: Where safety glazing is required, provide glazing that complies with 16 CFR 1201, Category II.
- C. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
 1. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
 2. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
 3. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.2 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 1. GANA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
 2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Safety Glazing Labeling: Where safety glazing is required, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

- C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.
- D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.
- E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.3 GLASS PRODUCTS

- A. See Schedule at end of this Section.

2.4 GLAZING FILM

- 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. Ghost Glass (ghostglassfilm.com): Ghost Premium White film.
 - 2. Polytronix (polytronixglass.com): Polyvision Switchable Privacy Film.
- B. Product: Low-voltage powered switchable privacy film to be adhered to all glass panels of Folding Glass Partition specified in Section 102239.
- C. Accessories: provide all power components, kits, and accessories for a complete, operational installation.

2.5 GLAZING SEALANTS

- A. General:
 - 1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
 - 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
 - 3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.
- B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.
- C. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT.

- D. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use NT.
- E. Glazing Sealant: Acid-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use NT.

2.6 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
 - 1. AAMA 804.3 tape, where indicated.
 - 2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 - 3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
 - 1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
 - 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.7 MISCELLANEOUS GLAZING MATERIALS

- A. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- B. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- C. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- D. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- E. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

PART 3 - EXECUTION

3.1 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches.
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

3.2 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Apply heel bead of elastomeric sealant.
- F. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- G. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.3 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at

corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.4 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.5 INSTALLATION OF GLAZING FILM

- A. Install film and all required components in accordance with Manufacturer's instructions. Coordinate power supply installation with folding wall provider and electrical.

3.6 CLEANING AND PROTECTION

- A. Immediately after installation remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
 - 1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.

3.7 GLASS SCHEDULE

- A. Glass Type G1: 1" Tinted Insulated Glazing.
 - 1. Double Pane Insulated Glass Units (Type IG-DP): ASTM E774 and E773; with silicone sealant edge seal; purge interpane space with dry hermetic air.

2. Exterior Pane to be PPG Solarban 70XL Solexia low-e glass or equal, interior pane to be clear.
- B. Glass Type G2: 1/4" Clear single glazing.
1. Clear Float Glass (Type FG-CF): ASTM C1036, Type 1 transparent flat, Class 1 clear, Quality q3 glazing select.
 2. Clear Heat Strengthened Glass (Type FG-CH): ASTM C1048, Kind HS, heat strengthened, Condition A uncoated, Type 1 transparent flat, Class 1 clear, Quality q3 glazing select.
- C. Glass Type G3: 3/8" Clear single glazing.
1. Clear Float Glass (Type FG-CF): ASTM C1036, Type 1 transparent flat, Class 1 clear, Quality q3 glazing select.
 2. Clear Heat Strengthened Glass (Type FG-CH): ASTM C1048, Kind HS, heat strengthened, Condition A uncoated, Type 1 transparent flat, Class 1 clear, Quality q3 glazing select.

END OF SECTION 088100

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Non-load-bearing steel framing systems for interior partitions.
 - 2. Suspension systems for interior ceilings and soffits.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 FRAMING SYSTEMS

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
 - 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
 - 2. Protective Coating: ASTM A 653/A 653M, G40 or Coating with equivalent corrosion resistance of ASTM A 653/A 653M, G40, hot-dip galvanized unless otherwise indicated.
- B. Studs and Runners: ASTM C 645.
 - 1. Steel Studs and Runners:
 - a. Minimum Base-Metal Thickness: As required by performance requirements for horizontal deflection.
 - b. Depth: As indicated on Drawings.
- C. Slip-Type Head Joints: Where indicated, provide one of the following:

1. Clip System: Clips designed for use in head-of-wall deflection conditions that provide a positive attachment of studs to runners while allowing adequate minimum vertical movement.
 2. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch-deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
 3. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch-deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
 4. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
- D. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
- E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
- F. Cold-Rolled Channel Bridging: Steel, 0.0538-inch minimum base-metal thickness, with minimum 1/2-inch-wide flanges.
- G. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
1. Minimum Base-Metal Thickness: 0.0179 inch.
 2. Depth: As indicated on Drawings.
- H. Resilient Furring Channels: 1/2-inch-deep, steel sheet members designed to reduce sound transmission.
1. Configuration: Asymmetrical or hat shaped.
- I. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges.
1. Depth: As indicated on Drawings.
 2. Furring Brackets: Adjustable, corrugated-edge-type steel sheet with minimum uncoated-steel thickness of 0.0329 inch.
 3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.
- J. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum uncoated-metal thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.
- 2.3 SUSPENSION SYSTEMS
- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.
- B. Hanger Attachments to Concrete:

1. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E 488/E 488M conducted by a qualified testing agency.
 2. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.
- C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.
- D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch and minimum 1/2-inch-wide flanges.
- E. Furring Channels (Furring Members):
1. Cold-Rolled Channels: 0.0538-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges, 3/4 inch deep.
 2. Steel Studs and Runners: ASTM C 645.
 3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.
 4. Resilient Furring Channels: 1/2-inch-deep members designed to reduce sound transmission.

2.4 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide one of the following:
1. Asphalt-Saturated Organic Felt: ASTM D 226/D 226M, Type I (No. 15 asphalt felt), nonperforated.
 2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C 841 that apply to framing installation.
 2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C 1063 that apply to framing installation.
 3. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C 844 that apply to framing installation.
 4. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.
- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.2 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
 - 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 - 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb unless otherwise indicated.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 - 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 - 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
 - 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
 - 6. Curved Partitions:
 - a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.

- b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches o.c.

E. Direct Furring:

1. Screw to wood framing.
2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

F. Z-Shaped Furring Members:

1. Erect insulation, specified in Section 072100 "Thermal Insulation," vertically and hold in place with Z-shaped furring members spaced 24 inches or as indicated o.c.
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

- G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.3 INSTALLING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

- C. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for

structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.

5. Do not attach hangers to steel roof deck.
6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
8. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Seismic Bracing: Sway-brace suspension systems with hangers used for support if required.

F. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Interior gypsum board.
 - 2. Exterior gypsum sheathing.
 - 3. Tile backing panels.
 - 4. Texture finishes.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Mock-Up Panel: For approval of texture finish.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

- A. Gypsum Board, Type X: ASTM C 1396/C 1396M.
 - 1. Thickness: 5/8 inch.
 - 2. Long Edges: Tapered.
- B. Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.

1. Core: 5/8 inch, Type X.
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.4 EXTERIOR GYPSUM SHEATHING

- A. Glass-Mat Gypsum Sheathing Board: ASTM C 1177/C 1177M, with fiberglass mat laminated to both sides and with manufacturer's standard edges.
1. 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:
 - a. CertainTeed Corporation.
 - b. National Gypsum Company.
 - c. United States Gypsum Company.
 2. Core: 5/8 inch, Type X, or as indicated in Drawings.

2.5 TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or ASTM C 1325, with manufacturer's standard edges.
1. 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:
 - a. CertainTeed Corporation.
 - b. Custom Building Products.
 - c. James Hardie Building Products, Inc.
 - d. National Gypsum Company.
 - e. United States Gypsum Company.
 2. Thickness: 5/8 inch, or as noted in Drawings.
 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.6 TRIM ACCESSORIES

- A. Trim: ASTM C 1047.
1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet.
 2. Shapes:
 - a. Cornerbead.
 - b. Bullnose bead.
 - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - d. L-Bead: L-shaped; exposed long flange receives joint compound.
 - e. U-Bead: J-shaped; exposed short flange does not receive joint compound.

- f. Expansion (control) joint.
- g. Curved-Edge Cornerbead: With notched or flexible flanges.

2.7 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
 - 1. Interior Gypsum Board: Paper.
 - 2. Glass-Mat Gypsum Sheathing Board: As recommended by panel manufacturer.
 - 3. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
 - 1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
 - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping or drying-type, all-purpose compound.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
 - 3. Fill Coat: For second coat, use setting-type, sandable topping or drying-type, all-purpose compound.
 - 4. Finish Coat: For third coat, use setting-type, sandable topping or drying-type, all-purpose compound.
 - 5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound, drying-type, all-purpose compound, or high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.
- D. Joint Compound for Tile Backing Panels:
 - 1. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.8 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
- C. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.
 - 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
 - 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

- D. Sound-Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - 1. Product standard shall be Owens Corning QuietZone unfaced batts, or equivalent product producing a sound reduction of 6dB minimum.
 - 2. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- E. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
- F. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."

2.9 TEXTURE FINISHES

- A. Primer: As recommended by textured finish manufacturer.
- B. Non-Aggregate Finish: Premixed, vinyl texture finish for spray application.
 - 1. Texture: Smooth.

PART 3 - EXECUTION

3.1 APPLYING AND FINISHING PANELS

- A. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- B. Comply with ASTM C 840.
- C. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4-wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- D. For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- E. Prefill open joints and damaged surface areas.
- F. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- G. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
 - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 - 2. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.

- a. Primer and its application to surfaces are specified in Section 099100 "Paints and Coatings."
- 3. Level 5: Where indicated on Drawings.
 - a. Primer and its application to surfaces are specified in Section 099100 "Paints and Coatings."
- H. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.
- I. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.2 APPLYING TEXTURE FINISHES

- A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.
- B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture matching approved mockup and free of starved spots or other evidence of thin application or of application patterns.

3.3 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet, moisture damaged, and mold damaged.

END OF SECTION 092900

SECTION 093013 - TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ceramic tile.
2. Metal edge strips.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples:

1. Each type and composition of tile and for each color and finish required.
2. Assembled samples, with grouted joints, for each type and composition of tile and for each color and finish required.

1.3 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

1.4 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of each type of floor tile installation.
2. Build mockup of each type of wall tile installation.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 TILE PRODUCTS

A. ANSI Ceramic Tile Standard: Provide Standard grade tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

- B. Tile Types: See Material Finish Legend in Drawings.

2.2 SETTING MATERIALS

- A. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.
- B. Dry-Set Portland Cement Mortar (Thin Set): ANSI A118.1.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Laticrete International, Inc.
 - b. MAPEI Corporation.
 - 2. For wall applications, provide nonsagging mortar.
- C. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Laticrete International, Inc.
 - b. MAPEI Corporation.
 - 2. Prepackaged, dry-mortar mix to which only water must be added.
 - 3. Prepackaged, dry-mortar mix combined with liquid-latex additive.
 - 4. For wall applications, provide nonsagging mortar.
- D. Water-Cleanable, Tile-Setting Epoxy: ANSI A118.3, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 1. to compliance with requirements, provide the following:
 - a. MAPEI Corporation.

2.3 GROUT MATERIALS

- A. Grout as indicated in drawings.

2.4 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- B. Metal Edge Strips: See Materials Legend for required Transition strips at adjoining floor materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
 - 1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.

3.2 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with adhesives with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. Blending: For tile exhibiting color variations, use factory blended tile or blend tiles at Project site before installing.
- C. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 INSTALLATION

- A. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
- E. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
- F. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:

- 1. As required by tile manufacturer - smallest joint possible.
- G. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
- H. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.

3.4 INTERIOR TILE INSTALLATION SCHEDULE

- A. See locations indicated on drawings.

END OF SECTION 093013

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes acoustical panels and exposed suspension systems for ceilings.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Evaluation reports.
- C. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
 - 2. Smoke-Developed Index: 450 or less.

2.2 ACOUSTICAL PANEL CEILINGS, GENERAL

- A. Glass-Fiber-Based Panels: Made with binder containing no urea formaldehyde.
- B. Acoustical Panel Standard: Comply with ASTM E 1264.
- C. Metal Suspension System Standard: Comply with ASTM C 635.

- D. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

2.3 ACOUSTICAL PANELS

- 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. Armstrong World Industries, Inc.
 - 2. CertainTeed Corporation.
 - 3. United States Gypsum Company.
- B. Product Standard: Armstrong Ultima 1904 Beveled Tegal or equal.
- C. Color: White.
- D. LR: 0.90.
- E. NRC: 0.70, Type E-400 mounting according to ASTM E 795.
- F. CAC: 35.
- G. Edge/Joint Detail: Beveled Tegal edge.
- H. Thickness: 3/4 inch.
- I. Modular Size: 24 by 48 inches as indicated on Drawings.

2.4 METAL SUSPENSION SYSTEM

- 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. Armstrong World Industries, Inc.
 - 2. CertainTeed Corporation.
 - 3. Chicago Metallic Corporation.
 - 4. United States Gypsum Company.
- B. Narrow-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 coating designation; with prefinished 9/16-inch-wide metal caps on flanges.
 - 1. Structural Classification: Intermediate-duty system.
 - 2. End Condition of Cross Runners: Override (stepped) or butt-edge type.
 - 3. Face Design: Flat, flush.
 - 4. Cap Material: Steel or aluminum cold-rolled sheet.
 - 5. Cap Finish: Painted white.
- C. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with

seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.

D. Edge Trim for Cloud Ceilings: Armstrong Axiom Classic AX6STR or equal.

1. Material: Extruded aluminum channel.
2. Depth: 6"
3. Color: White

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
- B. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.
 1. Arrange directionally patterned acoustical panels as indicated on reflected ceiling plans.

END OF SECTION 095113

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Resilient base.
 - 2. Resilient molding accessories.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.

PART 2 - PRODUCTS

2.1 THERMOPLASTIC-RUBBER BASE

- 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. Armstrong.
 - 2. Johnsonite.
 - 3. Roppe Corporation, USA.
- B. Product Standard: ASTM F 1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).
 - 1. Style and Location:
 - a. As scheduled in Drawings.
- C. Thickness: As scheduled.
- D. Height: As scheduled.
- E. Lengths: Coils in manufacturer's standard length.
- F. Outside Corners: Preformed.
- G. Inside Corners: Job formed or preformed.
- H. Colors: see Drawings.

2.2 RUBBER MOLDING ACCESSORY

- 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. Roppe Corporation, USA.
 - 2. VPI Corporation.
- B. Description: Rubber transition strips.
- C. Profile and Dimensions: As indicated.
- D. Locations: At transitions from carpet and resilient flooring to adjacent dissimilar floor finishes.
- E. Colors and Patterns: As selected by Architect from full range of industry colors.

2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install resilient products until they are the same temperature as the space where they are to be installed.
- D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.2 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Preformed Corners: Install preformed corners before installing straight pieces.
- H. Job-Formed Corners:
 - 1. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
 - a. Miter or cope corners to minimize open joints.

3.3 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

SECTION 096813 - TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes modular carpet tile.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show the following:
 - 1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
 - 2. Type of subfloor.
 - 3. Type of installation.
 - 4. Pattern of installation.
 - 5. Pattern type, location, and direction.
 - 6. Pile direction.
- C. Samples: For each exposed product and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.
- B. Fire-Test-Response Ratings: Where indicated, provide carpet tile identical to those of assemblies tested for fire response according to NFPA 253 by a qualified testing agency.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI 104.

1.7 FIELD CONDITIONS

- A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.

1.8 WARRANTY

- A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
 - 1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
 - 2. Failures include, but are not limited to, more than 10 percent edge raveling, snags, runs, dimensional stability, loss of face fiber, and delamination.
 - 3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE

- A. See Material Finish Legend in Drawings for scheduled products.

2.2 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.
 - 1. Adhesives shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Adhesives shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
 - 3. Adhesives shall be releasable as recommended by carpet manufacturer.
- C. Transition strips as noted on finish schedule and Materials legend.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.

- B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
- D. Preparation: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.
- E. Installation: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.
- F. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.
- G. Maintain dye lot integrity. Do not mix dye lots in same area.
- H. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.
- I. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- J. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.
- K. Install pattern parallel to walls and borders.
- L. Perform the following operations immediately after installing carpet tile:
 - 1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
 - 2. Remove yarns that protrude from carpet tile surface.
 - 3. Vacuum carpet tile using commercial machine with face-beater element.
- M. Protect installed carpet tile to comply with CRI 104, Section 16, "Protecting Indoor Installations."

END OF SECTION 096813

SECTION 097200 - WALL COVERINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vinyl wall covering.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each type of wall covering and for each color, pattern, texture, and finish specified.

1.3 INFORMATIONAL SUBMITTALS

A. Product test reports.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: As determined by testing identical wall coverings applied with identical adhesives to substrates in accordance with test method indicated below by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

- a. Flame-Spread Index: 25 or less.
- b. Smoke-Developed Index: 450 or less.

2.2 VINYL WALL COVERING

A. Description: Provide products in rolls from same production run.

B. Width: As noted in Drawings.

- C. Colors, Textures, and Patterns: As noted in the Finish Material Legend in the Drawings.

2.3 ACCESSORIES

- A. Adhesive: Mildew-resistant, nonstaining adhesive, for use with specific wall covering and substrate application indicated and as recommended in writing by wall-covering manufacturer.
- B. Primer/Sealer: Mildew resistant, as recommended in writing by primer/sealer and wall-covering manufacturers for intended substrate.
- C. Metal Primer: Interior ferrous metal primer as recommended in writing by primer and wall-covering manufacturers for intended substrate.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Comply with manufacturer's written instructions for surface preparation.
- B. Clean substrates of substances that could impair bond of wall covering, including dirt, oil, grease, mold, and mildew.
- C. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.
 - 1. Moisture Content: Maximum of 5 percent on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.
 - 2. Plaster: Allow plaster to cure for at least 90 days. Neutralize areas of high alkalinity. Apply primer/sealer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
 - 3. Metals: If not factory primed, clean and apply metal primer as recommended in writing by metal-primer manufacturer and wall-covering manufacturer.
 - 4. Gypsum Board: Apply primer/sealer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
 - 5. Painted Surfaces:
 - a. Check for pigment bleeding. Apply primer/sealer to areas susceptible to pigment bleeding as recommended in writing by primer/sealer manufacturer.
 - b. Sand gloss, semigloss, and eggshell finishes with fine sandpaper.
- D. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.
- E. Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

3.2 INSTALLATION OF WALL COVERING

- A. Comply with wall-covering manufacturers' written installation instructions applicable to products and applications indicated.

- B. Cut wall-covering strips in roll number sequence. Change the roll numbers at partition breaks and corners.
- C. Install strips in same order as cut from roll.
- D. Install wall covering without lifted or curling edges and without visible shrinkage.
- E. Match pattern as required by product installation instructions.
- F. Install seams vertical and plumb at least 6 inches from outside corners and 3 inches from inside corners unless a change of pattern or color exists at corner. Horizontal seams are not permitted.
- G. Trim edges and seams for color uniformity, pattern match, and tight closure. Butt seams without overlaps or gaps between strips.
- H. Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.
- I. Remove excess adhesive at seams, perimeter edges, and adjacent surfaces.
- J. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION 097200

SECTION 099113 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and the application of paint systems on exterior substrates.

1.2 DEFINITIONS

- A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- D. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- E. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- F. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
- B. Samples: For each type of paint system and each color and gloss of topcoat.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- 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. Benjamin Moore & Co.
 - 2. Dunn-Edwards Corporation.
 - 3. Sherwin-Williams Company (The).

2.2 PAINT, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."
- B. Material Compatibility:
 - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- C. Colors: As selected by Architect from manufacturer's full range and/or as indicated in a color schedule.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. Masonry (Clay and CMUs): 12 percent.
 - 3. Wood: 15 percent.
 - 4. Gypsum Board: 12 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- C. Surfaces: Correct defects and clean surfaces capable of affecting work of this section. Remove or repair existing coatings exhibiting surface defects.

- D. Marks: Seal with shellac those that may bleed through surface finishes.
- E. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
- F. Uncoated Steel and Iron Surfaces: 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 treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.
- G. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Prime metal items including shop primed items.
- H. Exterior Wood Scheduled to Receive Transparent Finish: Remove dust, grit, and foreign matter; seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes with tinted exterior caulking compound after sealer has been applied.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."
- B. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 CLEANING AND PROTECTION

- A. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- B. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 EXTERIOR PAINTING SCHEDULE

- A. Steel and Iron Substrates:
 - 1. Water-Based Light Industrial Coating System:
 - a. Prime Coat: Primer, rust inhibitive, water based.
 - b. Prime Coat: Shop primer specified in Section where substrate is specified.
 - c. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
 - d. Topcoat: Light industrial coating, exterior, water based, semi-gloss (MPI Gloss Level 5).
- B. Galvanized-Metal Substrates:
 - 1. Water-Based Light Industrial Coating System:

- a. Prime Coat: Primer, galvanized, water based.
- b. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
- c. Topcoat: Light industrial coating, exterior, water based, semi-gloss (MPI Gloss Level 5).

END OF SECTION 099113

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and the application of paint systems on interior substrates.

1.2 DEFINITIONS

- A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. MPI Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- D. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- E. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- F. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- G. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Samples: For each type of paint system and in each color and gloss of topcoat.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- 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. Benjamin Moore & Co.
 - 2. Dunn-Edwards Corporation.
 - 3. Sherwin-Williams Company (The).

2.2 PAINT, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."
- B. Material Compatibility:
 - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- C. Colors: As selected by Architect from manufacturer's full range and/or as indicated in a color schedule.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. Masonry (Clay and CMUs): 12 percent.
 - 3. Wood: 15 percent.
 - 4. Gypsum Board: 12 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- C. Surfaces: Correct defects and clean surfaces capable of affecting work of this section. Remove or repair existing coatings exhibiting surface defects.

- D. Marks: Seal with shellac those that may bleed through surface finishes.
- E. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
- F. Uncoated Steel and Iron Surfaces: 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 treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.
- G. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Prime metal items including shop primed items.
- H. Interior Wood Scheduled to Receive Transparent Finish: Remove dust, grit, and foreign matter; seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes with tinted exterior caulking compound after sealer has been applied.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
- B. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 CLEANING AND PROTECTION

- A. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- B. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 INTERIOR PAINTING SCHEDULE

- A. Concrete Substrates, Nontraffic Surfaces:
 - 1. High-Performance Architectural Latex System:
 - a. Prime Coat: Primer, alkali resistant, water based.
 - b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
 - c. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 2).
- B. Concrete Substrates, Traffic Surfaces:
 - 1. Water-Based Concrete Floor Sealer System:
 - a. First Coat: Sealer, water based, for concrete floors, matching topcoat.

- b. Topcoat: Sealer, water based, for concrete floors.
- C. Steel Substrates:
 - 1. High-Performance Architectural Latex System:
 - a. Prime Coat: Primer, alkyd, anti-corrosive, for metal.
 - b. Prime Coat: Shop primer specified in Section where substrate is specified.
 - c. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
 - d. Topcoat: Latex, interior, high performance architectural semi-gloss (MPI Gloss Level 5).
 - 2. Water-Based Dry-Fall System:
 - a. Prime Coat: Primer, alkyd, anti-corrosive, for metal.
 - b. Prime Coat: Shop primer specified in Section where substrate is specified.
 - c. Topcoat: Dry fall, latex, flat.
 - d. Topcoat: Dry fall, water based, for galvanized steel, flat (MPI Gloss Level 1).
- D. Galvanized-Metal Substrates:
 - 1. High-Performance Architectural Latex System:
 - a. Prime Coat: Primer, galvanized, water based.
 - b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
 - c. Topcoat: Latex, interior, high performance architectural semi-gloss (MPI Gloss Level 5).
 - 2. Water-Based Dry-Fall System:
 - a. Prime Coat: Dry fall, water based, for galvanized steel, matching topcoat.
 - b. Topcoat: Dry fall, water based, for galvanized steel, flat (MPI Gloss Level 1).
- E. Aluminum (Not Anodized or Otherwise Coated) Substrates:
 - 1. High-Performance Architectural Latex System:
 - a. Prime Coat: Primer, quick dry, for aluminum.
 - b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
 - c. Topcoat: Latex, interior, high performance architectural semi-gloss (MPI Gloss Level 5).
- F. Wood Substrates: Wood trim, Architectural woodwork and wood board paneling.
 - 1. Transparent Stain System:
 - a. Prime Coat: Stain, water based, semitransparent, matching topcoat.
 - b. Intermediate Coat: Stain, water based, semitransparent, matching topcoat.
 - c. Topcoat: Polyurethane, solvent based, transparent low sheen, fire-resistant properties to achieve a Class C rating (Flame Spread of 200 max., and Smoke Spread of 450 max.).

G. Plastic Substrates:

1. High-Performance Architectural Latex System:

- a. Prime Coat: Primer, bonding, solvent based.
- b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
- c. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 4).

H. Gypsum Board Substrates:

1. High-Performance Architectural Latex System:

- a. Prime Coat: Primer sealer, latex, interior.
- b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
- c. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 2).

END OF SECTION 099123

SECTION 099600 - HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and the application of high-performance coating systems.

1.2 DEFINITIONS

- A. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- B. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- C. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
- B. Samples: For each type of coating system and in each color and gloss of topcoat indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- 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. Benjamin Moore & Co.
 - 2. Sherwin-Williams Company (The).
 - 3. Tnemec Company, Inc.

2.2 HIGH-PERFORMANCE COATINGS, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."
- B. Material Compatibility:
 - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.

2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
 3. Products shall be of same manufacturer for each coat in a coating system.
- C. Colors: As selected by Architect from manufacturer's full range and/or as indicated in color schedule.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
1. Concrete: 12 percent.
 2. Fiber-Cement Board: 12 percent.
 3. Masonry (Clay and CMUs): 12 percent.
 4. Wood: 15 percent.
 5. Gypsum Board: 12 percent.
 6. Plaster: 12 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Proceed with coating application only after unsatisfactory conditions have been corrected.
1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and coating systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.

3.3 APPLICATION

- A. Apply high-performance coatings according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
- B. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.4 INTERIOR HIGH-PERFORMANCE COATING SCHEDULE

- A. Concrete Masonry Substrates:
 - 1. Epoxy System:
 - a. Prime Coat: Block filler.
 - b. Intermediate Coat: Epoxy, matching topcoat.
 - c. Topcoat: Epoxy, semi-gloss.
- B. Gypsum Board Substrates:
 - 1. Epoxy System:
 - a. Prime Coat: Primer sealer, latex, interior.
 - b. Intermediate Coat: Epoxy, matching topcoat.
 - c. Topcoat: Epoxy, semi-gloss.

END OF SECTION 099600

SECTION 101423 - INTERIOR SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Room-identification signs.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For panel signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
3. Show message list, typestyles, graphic elements, and layout for each sign at least half size.

C. Samples: For each exposed product and for each color and texture specified.

D. Sample warranty.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.4 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SIGNS

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. APCO Graphics, Inc.
2. ASI Sign Systems, Inc.
3. Best Sign Systems, Inc.

4. Clarke Systems.
5. Seton Identification Products.

2.2 TOILET ROOM SIGNS

- A. Raised Character Size and Style: Acrylic plastic, character adhered to base material:
 1. Edges: Square.
 2. Character Font: Helvetica.
 3. Character Case: Upper case.
 4. Include Braille characters under text.
- B. Individual Graphics, Material: acrylic plastic:
 1. Edges: Square.
 2. Character Font: Helvetica.
 3. Character Case: Upper case.
 4. Graphic Style: Handicap Type.

2.3 ACCESSORIES

- A. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 2. Install signs so they do not protrude or obstruct according to the accessibility standard.
 3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
 4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- B. Mounting Methods:
 1. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.
- C. Remove temporary protective coverings and strippable films as signs are installed.

3.2 SCHEDULE

- A. Provide Toilet Room Signs at all multi-fixture toilet rooms. Provide Men and Women designations for rooms as shown in Drawings.
- B. Provide any additional signage indicated in Drawings.

END OF SECTION 101423

SECTION 102113 - PLASTIC TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes solid-plastic toilet compartments configured as toilet enclosures and urinal screens.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For toilet compartments. Include plans, elevations, sections, details, and attachment details.
- C. Samples for each type of toilet compartment material indicated.

1.3 INFORMATIONAL SUBMITTALS

- A. Product certificates.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.5 WARRANTIES

- A. Provide manufacturer's 25 year warranty against breakage, corrosion, and delamination under normal conditions.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 450 or less.
- B. Regulatory Requirements: Comply with applicable provisions in ICC A117.1 for toilet compartments designated as accessible.

2.2 SOLID-PLASTIC TOILET COMPARTMENTS

- 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. Bradley Corporation.
 - 2. Hadrian Manufacturing Inc.
 - 3. Scranton Products.
- B. Toilet-Enclosure Style: Eclipse by Scranton Products or approved equal.
- C. Doors, Panels and Pilasters:
 - 1. High density polyethylene (HDPE), fabricated from extruded polymer resins, forming single thickness panel.
 - 2. Waterproof and nonabsorbent, with self-lubricating surface, resistant to marks by pens, pencils, markers, and other writing instruments.
 - 3. 1 inch thick with edges rounded to 1/4 inch radius.
 - 4. Color: To be selected from manufacturer's full color range.
- D. Aluminum Extrusions: ASTM B221, 6463-T5 alloy and temper.
- E. Aluminum Die Castings: ASTM B85, A380 alloy.
- F. Injection Molded Plastic: High density polyethylene.
- G. Rubber: Abrasion resistant Styrene Butadiene Rubber, 65 to 80 Shore A durometer, black.

2.3 HARDWARE AND ACCESSORIES

- A. Hinges:
 - 1. Inswing hinges:
 - a. Hidden pivot type fabricated from heavy-duty cast aluminum.
 - b. Auto-close feature, adjustable to 15 degree open position.
 - c. Mounted to doors with stainless steel Torx head screws and through bolted to metal post with tamper proof Torx head sex bolts.
 - d. Hinge pivot point: 6 to 8 inches from edge of door; maintain sufficient clearance to water closet.
 - 2. Outswing hinges:
 - a. Fabricated from extruded aluminum.
 - b. Auto-close feature, adjustable to 15 degree open position.
 - c. Surface mounted to doors with stainless steel Torx head screws and fastened to metal posts with countersunk tamper proof screws.
 - 3. Provide for field adjustment of plus or minus 0.125 inch laterally and plus or minus 0.125 inch vertically.
- B. Door Keeper:
 - 1. 3.5 inches long, fabricated from heavy duty extruded aluminum, clear anodized finish.
 - 2. Mount in gap between dividing panel and door.
- C. Latch and Housing:
 - 1. Heavy duty extruded aluminum.
 - 2. Latch housing: Clear anodized finish.
 - 3. Slide bolt and button: Black anodized finish.

- D. Coat Hook/Bumper: Combination type, chrome plated Zamak.
- E. Door Pulls [and Push Plates]:
 - 1. Heavy duty extruded aluminum, clear anodized finish.
 - 2. Single component providing door pull capability on outswing doors..

2.4 COMPONENTS

- A. Doors and Dividing Panels:
 - 1. 55 inches high, mounted 14 inches above finished floor.
 - 2. Doors: 60 degree angle on two opposite edges for enhanced privacy.
 - 3. Dividing panels: Slotted on one edge to accept wall bracket..
- B. Metal Posts: 82.75 inches high, heavy duty extruded aluminum, clear anodized finish, fastened to foot with stainless steel tamper resistant screw.
- C. Headrail Cap and Corner Cap: One-piece molded polyethylene secured to metal post with stainless steel tamper resistant screw; adjustable to level headrail to finished floor.
- D. Hidden Wall Brackets: 54 inches long, heavy duty extruded aluminum, clear anodized finish, inserted into slotted panel and fastened to panels with stainless steel tamper resistant screws.
- E. Headrail: Heavy duty extruded aluminum, designer anti-grip design, clear anodized finish, fastened to headrail bracket with stainless steel tamper resistant screw and to headrail cap or corner cap with stainless steel tamper resistant screw.
- F. Headrail Brackets: Heavy duty extruded aluminum, clear anodized finish, secured to wall with stainless steel tamper screws.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
- B. Locate bottom edge of doors and panels 14 inches above finished floor.
- C. Provide uniform, maximum 3/8 inch vertical clearance at doors.

3.2 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 102113

SECTION 10 22 39 - FOLDING GLASS PARTITIONS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes furnishing and installing a sliding-folding thermally broken, acoustically rated, aluminum-framed glass panel system that includes:
 - 1. Aluminum frame.
 - 2. Threshold.
 - 3. Aluminum framed panels.
 - 4. Sliding-folding and locking hardware.
 - 5. Sound gasketing.
 - 6. Bionic Turtle® thermal break.
 - 7. Panel Catch.
 - 8. Glass and glazing.
 - 9. Accessories as required for a complete working installation.

1.02 REFERENCES

- A. Reference Standards in accordance with Division 01 and current editions from the following:
 - 1. AAMA. American Architectural Manufacturers Association; www.aamanet.org
 - a. AAMA 205-15, In-Plant Testing Guidelines for Manufacturers and Independent Laboratories.
 - b. AAMA 502, Voluntary Specification for Field Testing of Newly Installed Fenestration Products.
 - c. AAMA 611, Voluntary Specification for Anodized Architectural Aluminum.
 - d. AAMA 920-11, Specification for Operating Cycle Performance of Side-Hinged Door System.
 - e. AAMA 1304, Voluntary Specification of Forced Entry Resistance of Side-Hinged Door Systems.
 - f. AAMA 2604, Voluntary Specifications, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
 - g. AAMA/WDMA/CSA 101/1.S.2/A440-17, NAFS, North American Fenestration Standard Specification for Windows, Doors and Skylights.
 - 2. ANSI. American National Standards Institute; www.ansi.org
 - a. ANSI Z97.1, Safety Performance Specifications and Methods of Test for Safety Glazing Material Used in Buildings.
 - 3. ASTM. ASTM International; www.astm.org
 - a. ASTM C1036, Standard Specification for Flat Glass.
 - b. ASTM C1048, Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.
 - c. ASTM E90-09, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
 - d. ASTM E413-16, Classification for Rating Sound Insulation.

- e. ASTM E2068-00 (2016), Standard Test Method for Determination of Operating Force of Sliding Windows and Doors.
- f. ASTM E987-88 (2017), Standard Test Methods for Deglazing Force of Fenestration Products.
- g. ASTM F842, Standard Test Methods for Measuring the Forced Entry Resistance of Sliding Door Assemblies, Excluding Glazing Impact.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate Folding Glass Partition system and framing R.O.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's printed product literature for each Folding Glass Partition system to be incorporated into the Work. Show performance test results and details of construction relative to materials, dimensions of individual components, profiles, and colors.
- B. Product Drawings: Indicate Folding Glass Partition system component sizes, dimensions and framing R.O., configuration, swing panels, direction of swing, stacking layout, typical head jamb, side jambs and sill details, type of glazing material, handle height and field measurements.
- C. Certificates: Submit CE Mark certificate.
- D. Manufacturers' Instructions: Submit Owner's Manual from manufacturer which includes installation instructions, operation, and maintenance data: Identify with project name, location and completion date, and type and size of unit installed.

1.05 QUALITY ASSURANCE

- A. Regulatory Requirements: Folding Glass Partition to be CE Mark certified.
- B. Manufacturer Qualifications: Manufacturer capable of providing complete, precision built, engineered, pre-fitted units with a minimum thirty (30) years' experience in the sale of folding-sliding door systems for large openings in the North American market.
 - 1. Manufacturer to have DIN EN ISO 9001: 2015 quality management system registration.
 - 2. Manufacturer to have DIN EN ISO 14001: 2015 environmental management system registration.
- C. Installer Qualifications: Installer experienced in the installation of manufacturer's products or other similar products for large openings. Installer to provide reference list of at least three (3) projects of similar scale and complexity successfully completed in the last three (3) years.
 - 1. Installer to be trained and certified by manufacturer.
- D. Single Source Responsibility: Furnish Folding Glass Partition system materials from one manufacturer for entire Project.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Comply with manufacturer's instructions and recommendations, Section 01 60 00 requirements, and as follows:

1. Deliver materials to job site in sealed, unopened cartons or crates.
 - a. Upon receipt, inspect the shipment to ensure it is complete, in good condition and meets project requirements.
2. Store material under cover in a clean and dry location, protecting units against weather and defacement or damage from construction activities, especially to the edges of panels.

1.07 FIELD CONDITIONS

- A. Field Measurements: Contractor to field verify dimensions of rough openings (R.O.) and threshold depressions to receive sill. Mark field measurements on product drawings submittal.

1.08 WARRANTY

- A. Manufacturer Warranty: Provide Folding Glass Partition system manufacturer's standard limited warranty as per manufacturer's published warranty document in force at time of purchase, subject to change, against defects in materials and workmanship.
 1. Warranty Period beginning with the earliest of 120 days from Date of Delivery or Date of Substantial Completion:
 - a. Rollers and Glass Seal Failure: Ten (10) years
 - b. All Other Components: Ten (10) years
 - 1). Exception: Five (5) years if NOT installed by manufacturer's specific system approved or certified trained installer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. NanoWall; 100 Meadowcreek Drive #250, Corte Madera, CA 94925, Ph: 800.873.5673
- B. Product: NWACOUSTICAL 645L by NanaWall Systems, INC. (www.nanawall.com)
 1. Substitution Procedures: Not allowed.

2.02 PERFORMANCE / DESIGN CRITERIA

- A. Performance Criteria: Minimal Surface Mounted Flush Sill and Flush Sill - Outward Opening
 1. Air Infiltration (ASTM E283):
 - a. 0.12 cfm/ft² (0.61 L/s/m²) at a static air pressure of 1.57 psf (75 Pa)
 - b. 0.30 cfm/ft² (1.50 L/s/m²) at a static air pressure of 6.24 psf (300 Pa)
- B. Performance Criteria:
 1. Acoustic Performance

- a. System STC (Rw) 43 (43) with 1-5/8 inch (42 mm) double IGU, 8 mm + 8 mm STC 47 enhanced laminated glass
- 2. Swing Panel - Operation / Cycling Performance (AAMA 920): 500,000 cycles
- 3. System - Life Cycle Performance (DIN EN 1191/12400): 20,000 cycles

C. Design Criteria:

1. Sizes and Configurations:

- a. Position 1: NWAcoustical645L
 - 1). Overall width: 16'-0"
 - 2). Overall height: 8'-0"
 - 3). Insulation type: double glazing
 - 4). Glass Description 15/16", 6 mm + 6mm STC 43 enhanced laminated glass
 - 5). Gap Fill: Air
 - 6). Swing Stacking Direction: Outward opening
 - 7). Total Panel Count: 5
 - 8). Stacked Layout: 01L 04R
 - 9). Mounting: Floor Supported
 - 10). Sill Type: Thermally Broken Flush (No rating against wind driven rain or surface water)
 - 11). Mullion Notes: One standard Lite
 - 12). Bottom Rail: Standard Bottom Rail
 - 13). Active Opening Side: Both
 - 14). Handle height from Bottom of Panel: 3'-5 5/16"
 - 15). Left Swing Panel Handle: Multi-point locking with latch, deadbolt, and lever handles on both sides on swing panel (does not unlock with one motion). Thumbturn on the inside and key cylinder on the outside.
 - 16). Folding Panel Handle: Flat Handle Stainless Steel
 - 17). Multipurpose Inserts: Yes
 - 18). Frame and Panel Finish Type: Powdercoat
 - 19). Frame and Panel Finish: Choose from 50 Standard Colors
 - 20). Sill Finish: Clear Anodized
 - 21). Swing Panel Handle Finish: Stainless Steel with brushed Satin Finish
 - 22). Folding Panel Handle Finish: Brushed Satin
 - 23). Assembly Finish for Hinge Roger and Pull Handle: Clear Anodized
 - 24). Glass Spacer Bar Finish: Gray

2.03 MATERIALS

- A. Model NWAcoustical 645L. Thermally Broken Aluminum Framed Folding Glass Description: Nominal frame stile width of 3-7/8 inch (99 mm) between folding panels, floor track supported system. Manufacturer's standard thermally broken frame and panel profiles, with head track, side jambs, sill and panels with dimensions as shown on Drawings.

1. System Components: Aluminum frame, threshold, panels, sliding-folding and locking hardware, weather-stripping, glass and glazing, panel catch and bionic turtle® thermal break.
 2. Panels: Single lite; standard
 3. Panel Size (W x H): As indicated above.
 - a. Rail Depth: 2-5/8 inch (67 mm)
 - b. Top Rail and Stile Width: 2-7/8 inch (73 mm)
 - c. Bottom Rail Width: 2-5/8" inch (66 mm)
 - d. Frame Depth: 2-15/16 inch (74mm)
 - e. Head Track Width: 3-7/8 inch (99mm) anti-tilt feature for unhinged SixFold panel set configurations.
 - f. Side Jamb Width: 2 inches (51mm)
 - g. Sill Finish: To be selected from manufacturer's standard finishes
 4. Aluminum Extrusion: AIMgSi0.5 alloy, 6063-T5 (F-22 – European standard)
 - a. Thickness: 0.078 inch (2.0 mm) nominal
 - b. Acoustic Break: 1-1/4 inch (32 mm) wide specially designed and patented (Patent Number: US10550625B2) glass fiber reinforced (GFR) polyamide "Bionic Turtle®" for panels.
 5. Aluminum Finish: Color to be selected from manufacturer's standard finishes.
- B. Glass and Glazing:
1. Safety Glazing: In compliance with ASTM C1036, ASTM C1048, ANSI Z97.1 and CPSC 16CFR 1201.
 2. Manufacturer's glass lites in insulated glazing units, dry glazed with glass stops on the inside.
 - a. 15/16": 6mm + 6mm STC 43 laminated glass
 - b. Glass Spacer: Silver Grey; standard
- C. Locking Hardware and Handles:
1. Main Entry Panel(s) for Models WITH a Pair of Swing Panel:
 - a. Lever Handles: On inside and outside
 - b. Rods to be concealed and not edge-mounted
 - c. Operation: After turn of key or thumb-turn, depression of handle withdraws latch. Lifting handle engages rods and turn of key or thumb-turn engages deadbolt and operates lock.
 - d. Standard lockset with lockable latch.
 - e. Multi-point locking with concealed dead bolt and rods at top and bottom on primary panel only.
 - f. Secondary Swing Panel: Provide concealed two-point, edge locking.
 - g. Lever Handle Finish: Brushed satin stainless steel
 - h. Locking: Standard profile cylinder
 2. Handle Type: Flat handle stainless steel
 3. Flat Handle Finish: Brushed satin stainless steel, standard
 4. Handle Height: 41-3/8 inch (105 cm) centered from bottom of panel.
 5. Locking rods with standard end caps at the top and bottom. Rods to have a stroke of 15/16 inch (24 mm)
 6. Additional profile cylinders to be Keyed differently.
 7. Panel Catch: panel catch to hold swing panel to adjacent folding panel to prevent incorrect

operation when moving the panel.

- D. Sliding-Folding Hardware: Provide manufacturer's standard combination sliding and folding hardware with top and bottom tracks and threshold. All running carriages to be with sealed, self-lubricating, double ball bearing multi-rollers. Surface mounted hinges and running carriages NOT acceptable.
 - 1. Lower Running Carriage Carrying Capacity: 250 lb. (120 kg). Lower running carriage provided with two vertical stainless-steel wheels with double row of ball bearings and two horizontal polyamide wheels.
 - 2. Vertical wheels with Gothic arch feature to ride on top of stainless-steel guide track covers over the full length of the sill track. Wheels riding on aluminum surfaces NOT acceptable.
 - 3. Upper guide carriage with two horizontal polyamide guiding wheels. For configurations with pairs of panels that can slide left or right, additional concealed, additional vertical tilt protection hardware.
 - 4. Rollers: Clear double ball bearing stainless-steel wheels.
 - 5. Hinges: Clear anodized aluminum with stainless steel security hinge pins and set-screws. Provide electrical raceway in hinges to accommodate low-voltage wiring.
 - 6. Optional Spring-Loaded Pull Handle: For outswing units with larger panel sizes, a spring loaded- pull handle is supplied for ease of closing the system. The pull handle is located above the flat handle. When not in use, the handle lays flat against the adjacent panel and is supplied with bumpers to avoid metal to metal contact.
 - a. Pull Handle – Brushed satin or black titanium finish.
- E. Sound Gasketing: Manufacturer's double layer EPDM between panels and EPDM gasket, Q-lon gasket, or brush seal between panel and frame, or brush seals with a two-layer fiberglass reinforced polyamide fin attached at both inner and outer edge of bottom of door panels with a recessed sill or on frame for sealing between panels and between panel and frame.
- F. Fasteners: Installation plates for connecting frame components made of stainless steel with sealing cushion to avoid thermal connectivity.

2.04 FABRICATION

- A. Folding Glass Wall: Extruded aluminum frame and panel profiles, corner connectors and hinges, sliding and folding hardware, locking hardware and handles, glass and glazing and sound gasketing.
 - 1. Each unit factory pre-assembled and shipped with complete system components and installation instructions.
 - 2. Exposed work to be carefully matched to produce continuity of line and design with all joints.
 - 3. No raw edges visible at joints.

2.05 ACCESSORIES

- A. Provide sidelights, transoms, corner posts, or single or double doors as indicated.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examination and Acceptance of Conditions per Section 01 70 00 and as follows:
 - 1. Carefully examine rough openings with Installer present, for compliance with requirements affecting Work performance.
 - a. Examine surfaces of openings and verify dimensions; verify rough openings are level, plumb, and square with no unevenness, bowing, or bumps on the floor; and other conditions as required by the manufacturer for readiness to receive Work.
 - b. Verify structural integrity of the header for deflection with live and dead loads limited to the lesser of $L/720$ of the span or 1/4 inch (6 mm). Provide structural support for lateral loads, and both wind load and eccentric load when the panels are stacked open.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. General: Install Folding Glass Partition system in accordance with the Drawings, approved submittals, manufacturer's recommendations, and installation instructions, and as follows:
 - 1. Properly seal around opening perimeter to reduce sound infiltration from surroundings.
 - 2. Securely attach anchorage devices to rigidly fit frame in place, level, straight, plumb, and square. Install frames in proper elevation, plane, and location, and in proper alignment with other work.
 - 3. Install panels, handles, lockset, gasketing and other accessories in accordance with manufacturer's recommendations and instructions.

3.03 FIELD QUALITY CONTROL

- A. Field Tests and Inspections per Section 01 40 00 of the following:
 - 1. Verify the Folding Glass Partition system operates and functions properly. Adjust hardware for proper operation.
- B. Non-Conforming Work: Repair or replace non-conforming work as directed by the Architect; see General and Supplementary Conditions, and Division 01, General Requirements.
- C. CLEANING AND PROTECTION
 - 1. Keep units closed and protect Folding Glass Partition installation against damage from construction activities.
 - 2. Remove protective coatings and use manufacturer recommended methods to clean exposed surfaces.

END OF SECTION

SECTION 102600 - WALL PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Corner guards.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each type of wall and door protection showing locations and extent.
- C. Samples: For each exposed product and for each color and texture specified, 12 inches long.

1.3 INFORMATIONAL SUBMITTALS

- A. Product certificates.
- B. Material certificates.
- C. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.5 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of wall-protection units that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 450 or less.

2.2 CORNER GUARDS

- A. Surface-Mounted, Plastic-Cover Corner Guards: Manufacturer's standard assembly consisting of resilient plastic corner guards with 1 ½" legs and self-adhesive tape backing; fabricated with 90-degree turn to match wall condition.
 - 1. 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:
 - a. Construction Specialties, Inc.
 - b. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - c. Korogard Wall Protection Systems; a division of RJF International Corporation.
 - 2. Product Standard to be CS Acrovyn Model VA-200N.
 - a. Color and Texture: As selected by Architect from manufacturer's full range. Multiple colors to be selected for project.
 - b. Height: 8' lengths for rooms with >8'-0" ceiling height, 7' lengths for rooms with 8'-0" ceiling height.

2.3 MATERIALS

- A. Plastic Materials: Chemical- and stain-resistant, high-impact-resistant plastic with integral color throughout; extruded and sheet material as required, thickness as indicated.
- B. Adhesive: As recommended by protection-product manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation Quality: Install wall and door protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
- B. Locations: Install corner guards immediately above specified wall base **at all outside corners in gypsum board walls except for column fur-outs.**

END OF SECTION 102600

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Public-use washroom accessories.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: Full size, for each exposed product and for each finish specified.

1.3 INFORMATIONAL SUBMITTALS CLOSEOUT SUBMITTALS

- A. Sample warranty.
- B. Maintenance data.

1.4 WARRANTY

- A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PUBLIC-USE WASHROOM ACCESSORIES

- A. Wall-Mounted Roll Toilet Tissue Dispenser:
 - 1. Owner furnished, Owner installed
- B. Grab Bars – 36" Back, 42" Side, and 18" Vertical:
 - 1. 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:
 - a. Bobrick Washroom Equipment, Inc.
 - b. Bradley Corporation.
 - 2. Mounting: Flanges with concealed fasteners.

3. Material: Stainless steel, 0.05 inch thick.
 - a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.
4. Outside Diameter: 1-1/4 inches.
5. Configuration and Length: As indicated on Drawings and in compliance with applicable accessibility codes.

C. Coat Hook:

1. 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:
 - a. Bobrick.
 - b. Bradley.
2. Description: Double-prong unit, Bobrick B-6727 or equal.
3. Material and Finish: Stainless steel, No. 4 finish (satin).

D. Paper Towel Dispenser

1. Owner furnished, Owner installed.

E. Wall-Mounted Soap Dispenser

1. Owner furnished, Owner installed

F. Framed Mirror Unit:

1. 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:
 - a. Bobrick Washroom Equipment, Inc.
 - b. Bradley Corporation.
2. Frame: Stainless-steel angle, 0.05 inch thick.
 - a. Corners: Welded and ground smooth.
3. Hangers: Produce rigid, tamper- and theft-resistant installation.
4. Size: As indicated on Drawings

G. Sanitary-Napkin Disposal Unit:

1. 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:
 - a. Bobrick Washroom Equipment, Inc.
 - b. Bradley Corporation.
2. Mounting: Surface mounted, Bobrick B-35139 or equal.

3. Door or Cover: Self-closing, disposal-opening cover and hinged face panel with tumbler lockset.
4. Receptacle: Removable.
5. Material and Finish: Stainless steel, No. 4 finish (satin).

H. Specimen Pass-Through

1. 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:
 - a. Bobrick.
 - b. Bradley.
2. Description: Self-closing, interlocking door pass-thru, Bobrick B505 or equal.
3. Material and Finish: Stainless Steel, 304 satin finish.
4. Size: 11 1/2" wide x 10 7/8" high.
5. Include removable steel tray.

2.2 FABRICATION

- A. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.

END OF SECTION 102800

SECTION 104400 - FIRE EXTINGUISHERS, CABINETS, AND ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fire extinguishers.
- B. Fire extinguisher cabinets.
- C. Accessories.
- D. All materials, labor, services, and incidentals necessary for the completion of this section of the work.

1.2 RELATED SECTIONS

- A. Section 061000 – Rough Carpentry: Wood Blocking and Curbing: Wood blocking and shims.
- B. Section 092900- Gypsum Board Assemblies: Metal blocking and support assemblies.

1.3 REFERENCES

- A. NFPA 10 - Standard for Portable Fire Extinguishers.
- B. UL - Fire Protection Equipment Directory.

1.4 PERFORMANCE REQUIREMENTS

- A. Conform to NFPA 10 code.
- B. Provide extinguishers classified and labeled by Underwriters Laboratories Inc. for the purpose specified and indicated.

1.5 SUBMITTALS FOR REVIEW

- A. Section 013300 - Submittals: Procedures for submittals.
- B. Shop Drawings: Indicate cabinet physical dimensions rough-in measurements for recessed cabinets, wall bracket mounted measurements, location, and height.
- C. Product Data: Provide extinguisher operational features, color and finish, and anchorage details.

1.6 SUBMITTALS FOR INFORMATION

- A. Section 013300 - Submittals: Procedures for submittals.
- B. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

- C. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.7 SUBMITTALS AT PROJECT CLOSEOUT

- A. Section 017700 - Contract Closeout: Procedures for submittals.
- B. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers:
 - 1. Larson
 - 2. J.L. Industries
 - 3. Substitutions: Refer to Section 012500 – Substitution Procedures.

2.2 FIRE EXTINGUISHERS

- A. Dry Chemical Type: Steel tank, with pressure gage; Class A:B:C, Size 10 (verify with Architect).
- B. Extinguisher Finish: Baked enamel.

2.3 FIRE EXTINGUISHER CABINETS

- A. Metal: Formed aluminum; semi recessed.
- B. Configuration: Semi-recessed type, sized to accommodate accessories.
- C. Trim Type: Returned to wall surface, with 2-3 inch projection wide face.
- D. Door: 0.036 inch thick reinforced for flatness and rigidity; latch full glass access.
- E. Door Glazing: Glass, clear, 1/8" thick tempered.
- F. Cabinet Mounting Hardware: Appropriate to cabinet.
- G. Form cabinet enclosure with right angle inside corners and seams. Form perimeter trim.
- H. Pre-drill for anchors.
- I. Hinge doors for 180 degree opening with continuous piano hinge. Provide roller type catch.

- J. Weld, fill, and grind components smooth.
- K. Glaze doors with resilient channel gasket glazing.
- L. Finishing Cabinet Exterior Trim and Door: Anodized Aluminum.
- M. Finishing Cabinet Interior: Aluminum.

2.4 ACCESSORIES

- A. Extinguisher Brackets: Formed steel, chromed.
- B. Cabinet Signage: FIRE EXTINGUISHER, silk-screened on door.

PART 3 EXECUTION

3.1 EXAMINATION

- A. See Section 013100 – Project Management and Coordination: Coordination and Meetings: Verification of existing conditions before starting work.
- B. Verify rough openings for cabinet are correctly sized and located.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Mount extinguishers and cabinets so that extinguisher handle is 48" AFF max. for accessibility.
- C. Install cabinets plumb and level in wall openings, from finished floor to inside bottom of cabinet.
- D. Secure rigidly in place.
- E. Place extinguishers in cabinets.

END OF SECTION 104400

SECTION 105100 - METAL LOCKERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Welded lockers.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For metal lockers.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Include locker identification system and numbering sequence.
- C. Samples: For each color specified.

1.3 INFORMATIONAL SUBMITTALS

- A. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.5 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.
 - 1. Warranty Period for Welded Metal Lockers: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: For lockers indicated to be accessible, comply with applicable provisions in ICC A117.1.

2.2 WELDED LOCKERS

- 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. AJW Architectural Products.
 - 2. ASI Storage Solutions; ASI Group.
 - 3. General Storage Systems Ltd.
 - 4. Penco Products, Inc.
- B. Doors: One piece; fabricated from 0.075-inch nominal-thickness steel sheet; formed into channel shape with double bend at vertical edges and with right-angle single bend at horizontal edges.
 - 1. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors more than 15 inches wide; welded to inner face of doors.
 - 2. Door Style: Vented panel as follows:
 - a. Louvered Vents: No fewer than three louver openings at top and bottom for double-tier lockers.
- C. Body: Assembled by welding body components together. Fabricate from unperforated steel sheet with thicknesses as follows:
 - 1. Tops, Bottoms, and Sides: 0.060-inch nominal thickness.
 - 2. Backs: 0.048-inch nominal thickness.
 - 3. Shelves: 0.060-inch nominal thickness, with double bend at front and single bend at sides and back.
- D. Frames: Channel formed; fabricated from 0.060-inch nominal-thickness steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral, full-height door strikes on vertical main frames.
- E. Hinges:
 - 1. Hinges: Manufacturer's standard, steel, continuous or knuckle type.
- F. Projecting Door Handle and Latch: Finger-lift latch control designed for use with either built-in combination locks or padlocks; positive automatic latching, chromium plated; pry and vandal resistant.
 - 1. Latch Hooks: Equip doors 48 inches and higher with three latch hooks and doors less than 48 inches high with two latch hooks; fabricated from 0.105-inch nominal-thickness steel sheet; welded or riveted to full-height door strikes; with resilient silencer on each latch hook.
 - 2. Latching Mechanism: Manufacturer's standard, rattle-free latching mechanism and moving components isolated to prevent metal-to-metal contact, and incorporating a prelocking device that allows locker door to be locked while door is open and then closed without unlocking or damaging lock or latching mechanism.
- G. Door Handle and Latch for Lockers: Stainless-steel strike plate with integral pull; with steel padlock loop that projects through metal locker door.
- H. Identification Plates: Manufacturer's standard, etched, embossed, or stamped aluminum plates, with numbers and letters at least 3/8 inch high.

- I. Hooks: Manufacturer's standard ball-pointed, aluminum or steel; zinc plated.
- J. Coat Rods: Manufacturer's standard.
- K. Continuous Zee Base: Fabricated from, manufacturer's standard thickness, but not less than 0.060-inch nominal-thickness steel sheet.
 - 1. Height: 4 inches.
- L. Continuous Sloping Tops: Fabricated from 0.048-inch nominal-thickness steel sheet, with a pitch of approximately 20 degrees.
 - 1. Closures: Vertical-end type.
- M. Recess Trim: Fabricated from 0.048-inch nominal-thickness steel sheet.
- N. Filler Panels: Fabricated from 0.048-inch nominal-thickness steel sheet.
- O. Boxed End Panels: Fabricated from 0.048-inch nominal-thickness steel sheet.
- P. Finished End Panels: Fabricated from 0.024-inch nominal-thickness steel sheet to cover unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.
- Q. Materials:
 - 1. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
 - 2. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with A60 zinc-iron, alloy (galvannealed) coating designation.
- R. Finish: Baked enamel or powder coat.
 - 1. Color: As selected by Architect from manufacturer's full range.

2.3 LOCKS

- A. Combination Padlock: Provided by Owner.

2.4 FABRICATION

- A. Fabricate metal lockers square, rigid, without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.
- B. Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments.
- C. Equipment: Provide each locker with an identification plate and the following equipment:
 - 1. Double-Tier Units: One double-prong ceiling hook and two single-prong wall hooks.
- D. Welded Construction: Factory preassemble metal lockers by welding all joints, seams, and connections; with no bolts, nuts, screws, or rivets used in assembly of main locker groups.

Factory weld main locker groups into one-piece structures. Grind exposed welds smooth and flush.

E. Accessible Lockers: Fabricate as follows:

1. Locate bottom shelf no lower than 15 inches above the floor.
2. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches above the floor.

F. Continuous Zee Base: Fabricated in lengths as long as practical to enclose base and base ends; finished to match lockers.

G. Continuous Sloping Tops: Fabricated in lengths as long as practical, without visible fasteners at splice locations; finished to match lockers.

H. Recess Trim: Fabricated with minimum 2-1/2-inch face width and in lengths as long as practical; finished to match lockers.

I. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip-joint filler angle formed to receive filler panel.

J. Boxed End Panels: Fabricated with 1-inch-wide edge dimension, and designed for concealing fasteners and holes at exposed ends of nonrecessed metal lockers; finished to match lockers.

K. Finished End Panels: Fabricated to conceal unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.

L. Center Dividers: Full-depth, vertical partitions between bottom and shelf; finished to match lockers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install lockers level, plumb, and true; shim as required, using concealed shims.

1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
2. Anchor single rows of metal lockers to walls near top and bottom of lockers of lockers and to floor.

B. Welded Lockers: Connect groups together with manufacturer's standard fasteners, with no exposed fasteners on face frames.

C. Trim: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.

1. Attach recess trim to recessed metal lockers with concealed clips.
2. Attach filler panels with concealed fasteners.
3. Attach sloping-top units to metal lockers, with closures at exposed ends.
4. Attach boxed end panels using concealed fasteners to conceal exposed ends of nonrecessed metal lockers.

5. Attach finished end panels using fasteners only at perimeter to conceal exposed ends of nonrecessed metal lockers.

END OF SECTION 105100

SECTION 122413 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes manually operated roller shades.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.
- B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.
- C. Samples: For each exposed product and for each color and texture specified.
- D. Roller-Shade Schedule: Use same opening designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

- A. Product certificates.
- B. Product test reports.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- 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. Draper Inc.
 - 2. Hunter Douglas Contract.
 - 3. MechoShade Systems, Inc.

2.2 ROLLER SHADES

- A. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.
 - 1. Bead Chains: Manufacturer's standard.
 - a. Loop Length: Full length of roller shade.
 - b. Limit Stops: Provide upper and lower ball stops.
 - 2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller-shade weight and lifting heavy roller shades.
 - a. Provide for shadebands that weigh more than 10 lb or for shades as recommended by manufacturer, whichever criteria are more stringent.
- B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
 - 1. Roller Mounting Configuration: Single roller.
 - 2. Roller Drive-End Location: Right side of inside face of shade.
 - 3. Direction of Shadeband Roll: Regular, from back of roller.
 - 4. Shadeband-to-Roller Attachment: Manufacturer's standard method.
- C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
- D. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers into a multiband shade that is operated by one roller drive-end assembly.
- E. Shadebands:
 - 1. Shadeband Material: Light-filtering fabric.
 - 2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
 - a. Type: Enclosed in sealed pocket of shadeband material.
 - b. Color and Finish: As selected by Architect from manufacturer's full range.
- F. Installation Accessories:
 - 1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
 - a. Shape: L-shaped.
 - b. Height: Manufacturer's standard height required to conceal roller and shadeband when shade is fully open, but not less than 3 inches.
 - 2. Exposed Headbox: Rectangular, extruded-aluminum enclosure including front fascia, top and back covers, endcaps, and removable bottom closure.
 - a. Height: Manufacturer's standard height required to enclose roller and shadeband when shade is fully open, but not less than 3 inches.

3. Endcap Covers: To cover exposed endcaps.
4. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.3 SHADEBAND MATERIALS

- A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.
 1. Source: Roller-shade manufacturer.
 2. Type: PVC-coated fiberglass or PVC-coated polyester.
 3. Weave: Mesh.
 4. Roll Width: Widest width possible to align with window mullions.
 5. Openness Factor: 5-6 percent.
 6. Color: As selected by Architect from manufacturer's full range.

2.4 ROLLER-SHADE FABRICATION

- A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.
- B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:
 1. Outside of Jamb Installation: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings
- C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible.

PART 3 - EXECUTION

3.1 ROLLER-SHADE INSTALLATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Install roller shades level, plumb, and aligned with adjacent units, according to manufacturer's written instructions.
- D. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.
- E. Clean roller-shade surfaces after installation, according to manufacturer's written instructions.

SCHEDULE

A. Provide shades at all windows in offices in remodeled portion of Building, Linemans' Lounge D101, and Meeting Room C102.

END OF SECTION 122413

SECTION 220000 - BASIC PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01, apply to this Division. Refer to these articles in the specifications for additional information.
- B. Provide all materials, equipment, labor, and transportation required to install a complete and working plumbing system. It is the intent of the drawings and specifications to provide complete installations even though each and every item necessary is not specifically mentioned or shown.
- C. Bidders shall determine the contents of a complete set of Drawings and Specifications and be aware that they may be bidding from a partial set of drawings, applicable only to the various separate contracts, subcontracts, or trades as may be issued for bidding purposes only. The submission of bids shall be deemed evidence of the review and examination of all existing conditions on site and all drawings, specifications, and addenda issued for this project as no allowances will be made because of unfamiliarity with any portion of the complete set of documents or site conditions.
- D. Perform all Division 22 work in strict accordance with the requirements and recommendations stated in the latest adopted version of all federal, state, and local codes, ordinances, and standards (NFPA, IPC, IECC, etc.) except when requirements are modified by the Authority Having Jurisdiction.
- E. Where local codes or practices exceed or conflict with the adopted plumbing code, it shall be the Contractor's responsibility to perform the work in accordance with the local code prevailing and local interpretations thereof by the Authority Having Jurisdiction. This Contractor shall bear all costs for correcting any deficiencies due to non-compliance.
- F. Plumbing Contractor is responsible for all final connections to specified plumbing fixtures and all owner furnished equipment requiring plumbing (drain, water, gas, condensate, air).
- G. This section of work comprises furnishing of all materials, equipment, tools, scaffolding, rigging, hoisting, labor, and transportation necessary for the complete installation of the plumbing systems as shown on the plans and as specified herein.
- H. Contractor, subcontractor, vendors, and suppliers are required to waive subrogation against Owner and Engineer.

1.2 REFERENCES AND STANDARDS

- A. All adopted State and Local Building Codes and Facility Standards.
- B. All requirements of the local authority having jurisdiction.
- C. ASHRAE - American Society of Heating, Refrigerating and Air Conditioning Engineers Standards.
- D. CSA - Canadian Standards Association.

- E. NEC - the abbreviation is the National Electrical Code (NFPA Ch 70). Where used, this shall mean the latest adopted version of the NEC.
- F. NEMA - National Electrical Manufacturers Association
- G. NFPA - National Fire Protection Association. Where used, this shall mean the latest adopted version of the NFPA.
- H. OSHA - Occupational Safety and Health Administration Standards
- I. UL - Underwriters' Laboratories

1.3 ABBREVIATIONS

- A. Reference Standards are listed in Division 22 using the abbreviations listed below:
 - 1. AFF - Above Finished Floor
 - 2. AFG - Above Finished Grade
 - 3. AHJ - Authority Having Jurisdiction
 - 4. AHU - Air Handling Unit
 - 5. ALT - Alternate
 - 6. CLG - Ceiling
 - 7. DFA - Down from above
 - 8. EOR - Engineer of Record
 - 9. EWC - Electric water cooler
 - 10. EXIST / EX - Existing
 - 11. NC - Normally closed
 - 12. NO - Normally open
 - 13. NTS - Not to scale
 - 14. RTU - Roof-top unit
 - 15. TYP - Typical

1.4 DEFINITIONS

- A. Owner's Representative - Indicates the entity designated or hired to represent an owner on a project. This entity could be the owner themselves, an Architect or could be another third party hired to represent the owner. Verify who will be representing the owner on this project before bidding.
- B. Contract Documents - Shall include, but not limited to Drawings, Specifications, Addenda, etc.
- C. Approval - It is understood that approval must be obtained from the Owner's Representative in writing before proceeding with the proposed work. Approval by the Owner's Representative of any changes, submitted by the Contractor, will be considered as general in nature and only to aid the Contractor in expediting his work.
- D. As required - Indicates that the contractor shall perform the work or provide the material as indicated in accordance with manufacturer's installation instructions and in accordance with the latest adopted version of applicable codes or regulations.
- E. Contractor - Where the word(s) "contractor" or "this contractor" is used herein it refers to the contractor engaged to execute the work under this division of the specifications only, even though they may be technically described as a sub-contractor.

- F. Directed - Terms such as directed, requested, authorized, selected, approved, required, and permitted mean directed by the Owner's Representative, requested by the Owner's Representative, and similar phrases.
- G. EMCS - Energy Management Control System (Building Management System / BMS), used to control mechanical systems in the building via hardware and / or software.
- H. Furnish - The term furnish means to equip with what is needed, supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- I. Indicated - The term indicated refers to graphic representations, notes, or schedules on the Drawings, or other Paragraphs or Schedules in the Specifications, and similar requirements in the Contract Documents. Terms such as shown, noted, scheduled, and specified are used to help the reader locate the reference. There is no limitation on location.
- J. Install - The term install describes operations at the Project site including setting in position, connecting or adjusting for use, the actual unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- K. Or equal - Indicates that the contractor may substitute equipment by another manufacturer if the salient features of the equipment indicated by manufacturer's name and / or described are adequate in the judgment of the Owner's Representative.
- L. Provide - Furnish and install all material and labor required for a complete installation ready for operation as required in accordance with the intent of the Contract Documents.
- M. Shall - Indicates a mandatory requirement or requirements.
- N. Unless otherwise noted, refer to IPC Chapter 2 for additional definitions used in these specifications.

1.5 COORDINATION

- A. For additional requirements, see Division 01 - General Requirements.
- B. Plumbing and mechanical services to all portions of existing buildings at the construction site not involved with the project shall remain in operation throughout construction. Provide all required temporary water, sewer, fuel gas and storm service in the base bid to all required areas to satisfy OSHA requirements.
- C. All metering and temporary service charges and / or costs of utilities shall be paid by the Contractor.
- D. The Drawings are not to be construed as shop drawings but indicate the extent, general locations, arrangement, etc., of piping systems and equipment. Plumbing drawings are diagrammatic and shall not be scaled for exact size. If the contractor has any questions regarding the layout of a particular device or equipment item, he shall contact the Owner's Representative for clarification. This Contractor shall, in laying out their work, refer to other sections of the specifications and other drawings such as air conditioning, structural, plumbing, architectural, civil, etc., to eliminate conflicts and undue delays in the progress of the work. Where items are furnished by other trades and require connections by this Contractor, they shall be held responsible for providing rough-in drawings and assistance upon request.

- E. In the event of interferences, piping or equipment requiring set grades or elevations shall have precedence over conduit, luminaires, outlet boxes, etc. Coordinate with all disciplines.
- F. Plans, specifications, and other documents have been prepared and developed with reasonable professional care and coordination. It is the intent that all documents are supportive and complimentary, one to the other; and as such what is required by one shall be considered as required and binding as if indicated by all. Work indicated shall include, regardless of whether or not specifically stated, such supportive or required items or work as consistent with what is indicated, is reasonably inferable from what is indicated, and / or is common construction procedure or knowledge with regard to what is indicated.
- G. In the event of a conflict between manufacturer's installation instructions and the drawings, the manufacturer's installation instructions shall govern.
- H. Should discrepancies be found among the Contract Documents and / or an interpretation is required, and a decision or interpretation to the contractor is not rendered by the Owner's Representative, it shall be assumed the contractor has reviewed all the documents to find the most costly method or items in question which then shall be required. One document does not take precedence over another when interpreting a discrepancy.
- I. Provide motor starters, controls, relays, all low-voltage wiring, conduit, and wiring related to plumbing and other equipment and devices to form a complete working system. See Division 26.

1.6 QUALIFICATIONS

- A. For a product or manufacturer to be considered, all products shall be submitted ONLY from manufacturers that:
 - 1. Specialize in the manufacturing of the products specified for a minimum of five (5) consecutive years.
 - 2. Has been producing this product for at least two (2) years.

1.7 QUALITY ASSURANCE

- A. Provide complete installations of all systems.
- B. Furnish all items of equipment, material, and labor to complete the Contract even though each and every item necessary is not specifically mentioned or shown.
- C. In case of any conflict between the specifications, plans, and ordinances, the ordinances shall govern.
- D. All materials furnished under this Contract shall be new, free from defects of any kind, of the quality and design hereinafter specified, and shall conform to the standards of Underwriter's Laboratories Inc., except for equipment which UL does not list or provide label service.
- E. All plumbing equipment and fixtures shall be the same brand unless scheduled differently on plans.
- F. Certification: This contractor shall be certified / licensed to install the products and equipment they are providing.
- G. Regulatory Requirements: All products provided under this division shall be manufactured and listed for the intended use and environment installed.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. For additional requirements, see Division 01 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. For additional requirements, see Division 01 - Product Requirements: Environmental conditions affecting products on site.
- C. Storage and Protection: Material shall be stored in a clean and dry location until installation.
- D. Contractor shall handle in accordance with manufacturer's recommendations to avoid damaging equipment, installed devices, and finish.
- E. This shall include the creation of all required temporary shelters to adequately protect any apparatus above the floor of the construction and the covering of apparatus in the completed building with tarpaulins or other protective covering.
- F. All apparatus shall be cribbed up from the floor or ground by the Contractor and covered with tarpaulins or other protective covering where necessary or directed.
- G. Failure to comply with the above to the satisfaction of the Owner's inspector will be sufficient cause for the rejection of the equipment in question and its complete replacement by this Contractor.

1.9 EXISTING FIELD CONDITIONS

- A. The drawings are prepared from the best information available and reflect all conditions commensurate with this information. However, the contractor should visit the site prior to submitting a proposal and should verify the locations, sizes, depths, pressures, etc., of all existing utilities and familiarize themselves with working conditions, hazards, existing grades, soil conditions, obstructions, etc. If it becomes evident that existing site conditions will impair the proper operation of the utilities, the Owner's Representative shall be notified in writing.
- B. All proposals shall take these existing conditions and any revisions required into consideration, and the lack of specific site information on the drawings shall not relieve the contractor of any responsibility.
- C. This Contractor shall familiarize themselves with working conditions to the extent that they shall be responsible for damage to concealed piping, wiring and other equipment meant to remain, and shall repair any damage caused by their negligence at no cost to the owner.

1.10 WARRANTY

- A. This Contractor shall guaranty fully all workmanship, material, equipment, systems, etc., provided by them for a period of one (1) year after substantial completion of the project, unless otherwise indicated in other specification sections. The use of building equipment for temporary service and testing does not constitute the beginning of the warranty. This guaranty means that this Contractor shall make good to the owner, at no cost, any defects that become apparent during the year following substantial completion. This guarantee is in addition to any other guaranties or warranties and is not intended to limit such other guaranties or warranties.
- B. Neither the final payment nor any provisions in the Contract Documents shall relieve this Contractor, or the Contractor, of the responsibility for faulty materials or workmanship.
- C. The Owner shall give notice of observed defects with reasonable promptness.

- D. The contractor shall remedy any defects due thereto, and pay for any damage to other work resulting there from, which shall appear.
- E. This Warranty shall not be construed to include the normal maintenance of the various components of the system covered by these specifications.

PART 2 - PRODUCTS

2.1 MANUFACTURER'S INSTRUCTIONS

- A. All equipment and devices shall be installed in accordance with these plans and specifications, manufacturer's instructions, and applicable codes.
- B. Where specifications call for installation of a product to be in accordance with manufacturer's instructions and/or where manufacturer's instructions are required for installation of a product, it shall be the Contractor's responsibility to obtain the necessary applicable manufacturer's instructions and install the product in accordance with the manufacturer's instructions.
- C. It shall be the Contractor's responsibility to install all equipment, materials, and devices shown on the plans and as called out in these specifications even if manufacturer's instructions are absolutely unattainable.

2.2 SUBSTITUTION OF PRODUCTS

- A. Substitutions: Shall meet any Division 01 requirements in addition to the substitution requirements listed here.
- B. All proposed substitutions are subject to PRIOR APPROVAL and must be received by the Engineer and / or Owner's Representative no less than ten business days prior to the schedule date for opening of bids.
- C. Items noted as "No Substitutes" or "No Alternates" shall be as specified only. No substitutions will be accepted.
- D. Substitution of products specified herein will be considered only when a complete list of proposed alternative equipment is submitted to the Engineer and / or Owner's Representative in writing, supported by adequate technical and cost data. This includes a complete description of the proposed substitution, drawings, catalog cut sheets, performance data, test data, or any other data or information necessary for proper evaluation.
- E. Manufacturers' names are listed herein and on the plans to establish a standard of quality and design. Where a manufacturer's name is mentioned, products of other manufacturers will be acceptable, if, in the opinion of the Engineer, the substitute material is of equivalent quality or better than that of the material specified.
- F. The Contractor's Bid represents that the bid price is based solely upon the materials and equipment described in the Bid Documents (including addenda, if any) and that he contemplates no substitutions or extras.
- G. Requests for substitution are understood to mean that the Contractor:
 - 1. Has personally investigated the proposed substitution and determined that it is equal or superior in all respects to that specified.
 - 2. Will provide the same guarantee for the substitution that he would for that specified.

3. Will, at no cost to the Owner, replace the substitute item with the specified product if the substitute item fails to perform satisfactorily.
- H. After Award of the Contract, substitutions will be considered only under one or more of the following circumstances:
 1. The substitution is required for compliance with subsequent interpretations of code or insurance requirements.
 2. The specified product is unavailable through no fault of the Contractor.
 3. The manufacturer refuses to warranty the specified products as required.
 4. Subsequent information that the specified product is unable to perform properly or to fit in the designated space.
 5. In the Engineer's sole judgment, the substitution would be in the Owner's best interest.
- I. Revisions to the plumbing system shall be under the supervision of the Engineer at a standard hourly rate charged by the Engineer and shall be paid by the Contractor originating the changes.

PART 3 EXECUTION

3.1 EXAMINATION

- A. For additional requirements, see Division 01 - Administrative Requirements (Coordination and verification of existing project / site conditions before starting work).
- B. Utilities, Locations, And Elevations
 1. Locations and elevations of the various utilities within the scope of this work have been obtained from the City and/or other substantially reliable sources and are offered separately from the Contract documents, as a general guide only, without guarantees as to accuracy.
 2. The Contractor shall examine the site, shall verify to his own satisfaction the locations, elevations, and availability of all utilities and services required, and shall adequately inform himself as to their relation to the work; the submission of bids shall be deemed evidence thereof.
 3. The Contractor shall coordinate all services with the Utility Companies during construction, coordinate changes made by Utility Companies to the design of project, and coordinate with the Owner, Owners Representative, and Utility the scheduling of any shutdowns or delays that may occur in providing service.
 4. The Contractor shall verify location, conduct all necessary tests, inspections, coordinate with Owner's representatives and utilities, and check for existing underground utilities and lines before ditching.
 5. The Contractor shall be responsible for repair of any cut or damaged lines or utilities he uncovers. There are lines and utilities not shown on any plans.
 6. Contractor is responsible for coordination of all existing and new utilities at site. Contractor is responsible for protecting and repairing any utilities damaged by installation of pipe. All existing and new landscaping/trees to remain and to be protected unless directed otherwise by Owners Representative.

3.2 DEMOLITION AND REMODEL

- A. It shall be the responsibility of this Contractor to see that all demolition and remodeling work involving his trade (including but not limited to plumbing piping, condensate lines, plumbing equipment, etc.) is accomplished in a manner and completeness to provide the appearance of new construction work.

- B. Abandoned plumbing fixtures shall be removed and disposed of off-site in a legal manner.
- C. Any usable equipment and/or structure damaged during demolition and remodel work shall be replaced.
- D. All abandoned and/or otherwise unused piping shall be securely capped using materials of the same composition as the original piping.
- E. No exposed piping and/or other materials will be permitted in the finished job.
- F. Any abandoned piping which penetrates the slab in an exposed area shall be sealed and securely capped below the slab.

3.3 INSTALLATION

- A. The Contractor shall obtain all permits required to commence work and, upon completion of the Work, obtain and deliver to the Owner's Representative a Certificate of Inspection by an AHJ in the project city and state. The Contractor shall pay required permit fees.
- B. All work shall be done by experienced craftsmen skilled in the applicable trade.
- C. All equipment shall be installed in strict compliance with manufacturer's installation instructions and properly torqued using a calibrated torque tool.
- D. Unprofessional and incomplete work shall be rejected and corrected at no additional expense. The judgement of professionalism and completeness of work shall be made by the Engineer and / or Owner's Representative and shall be final.
- E. Where existing utilities already exist or where renovation / addition work is to be done, maintain all utility services during construction to existing structures and / or portions of a project that are to remain in place and operational.
- F. This Contractor assumes all responsibility for the safety of their personnel on the project during construction. The Contract Documents do not include materials, procedures, components, etc., required to ensure construction safety. Refer to General Conditions for additional information.
- G. Contractor shall furnish and install all safety guards required. All belt driven equipment, projecting shafts, and other rotating parts shall be enclosed or adequately guarded.
- H. This Contractor shall be responsible for damage to the project caused by this Contractor's failure to recognize hazards associated with items such as lack of power, scheduling of work (tardiness), inexperienced workmen, excessive cutting, etc. This Contractor shall repair at no expense to the owner any such damage.
- I. Contract Documents do not show exact location and elevations of lines. Deviate from drawings as required to conform to the general construction, provide proper grading and installation.

3.4 PREPARATION

- A. Flame Spread Properties Of Materials
 - 1. All materials and adhesives used for plumbing and insulation shall conform to NFPA and UL life and flame spread properties of materials.
 - 2. The composite classifications shall not exceed 25 for a flame spread rating and 50 for a smoke developed rating as listed for the basic material, the finishes, adhesives, etc., specified for each system and shall be such when completely assembled.

- B. Asbestos
 - 1. No asbestos or asbestos containing materials shall be permitted in this project.
- C. Lead Materials
 - 1. No lead or lead containing materials shall be allowed in any domestic or potable water supply piping, valves, fixtures, components, equipment, or any other item.
- D. Refrigerants
 - 1. Chlorofluorocarbons (CFCs) shall not be allowed in any equipment on this project.
 - 2. Comply with ASHRAE Std 15 and ASHRAE Std 34.
- E. Refrigerant Recovery And Recycle
 - 1. Refrigerants shall not be released to the environment.
 - 2. Contractor shall provide recovery and recycle equipment that has been certified by the Electrical Testing Laboratories or Underwriters Laboratories.
 - 3. Contractor shall also provide properly trained and certified (in accordance with EPA) personnel for refrigerant work during installation, demolition, start-up, servicing, etc.
- F. Cutting And Patching
 - 1. All Subcontractors shall notify the General Contractor sufficiently ahead of construction of any floors, walls, ceiling, roof, etc., of any openings that will be required for his work.
 - 2. The contractor shall see that all sleeves required for their work are set at proper times so as to avoid delay of the job.
 - 3. All necessary cutting of walls, floors, partitions, ceilings, etc., as required for the proper installation of the work under this Contract shall be done at the Subcontractor's expense in a neat and workmanlike manner, and as approved by the Owners Representative.
 - 4. No joists, beams, girders, or columns shall be cut by any Contractor without first obtaining written permission of the Owners Representative.
 - 5. Patching of openings and/or alterations shall be provided by the General Contractor.
 - 6. All openings in firewalls and floors, such as thimbles, shall be completely sealed after installation for a completely airtight and watertight installation. Sealing material shall be non-combustible and UL approved. The installed sealing assembly shall not cause the fire rating of the penetrated structure to be decreased.
 - 7. All openings in exterior walls shall be sealed watertight.
- G. Access Clearance
 - 1. Proper access to all installed equipment shall be provided. This Contractor shall label all points of access immediately upon installation with a marker pen.
 - 2. A minimum of 3 feet shall be maintained in front of all access points.
 - 3. If another trade violates this space, this Contractor shall immediately notify the General Contractor to correct this condition.
 - 4. When equipment is installed above lay-in ceiling this Contractor shall coordinate with the Ceiling Contractor to provide access without removing part of T-bar ceiling.
 - 5. No speakers, lights, fire alarm equipment, etc. shall be installed in lay-in ceiling tiles where access is to be gained.
- H. Operation Prior To Completion
 - 1. When any piece of plumbing equipment is operable and the Contractor needs to operate the equipment, he may do so providing that he properly supervises the operation.
 - 2. The warranty period shall, however, not commence until such time as the equipment is operated for the beneficial use of the Owner.

3. Regardless of whether or not the equipment has or has not been operated, the Contractor shall properly clean the equipment, install clean filter media, properly adjust and complete all punch list items before final acceptance by the Owner.
4. The date of acceptance and the start of the warranty may not be the same date.

3.5 ELECTRICAL WIRING AND EQUIPMENT FOR PLUMBING SYSTEMS

- A. All wiring, conduit, boxes, equipment (controls, thermostats, relays, contactors, motor starters, heaters, switches), and any other control devices or equipment required to form a complete and properly operating system, shall be the responsibility of this Contractor.
- B. The Electrical Contractor shall only provide line voltage (including hook-up) to all plumbing equipment.
- C. All controls and devices shall be low voltage unless otherwise noted or shown on the plans. Where line voltage controls or devices are noted, the Contractor shall provide complete wiring diagrams (approved by the Engineer) to the Electrical Contractor prior to final hook-up.
- D. The Plumbing and Electrical plans are based on the equipment and devices scheduled as shown on the plans or as called for in the specifications. Should any plumbing equipment or device be changed or approved from those which are shown or noted, all electrical and/or plumbing changes shall be made at the expense of the trade or Contractor initiating the change with no expense to the Owner or their representatives.
- E. All wiring provided by this Contractor shall be installed in a workmanlike manner using tie wraps, labels, anchors and etc. Loose wiring is not acceptable.
- F. All conduit and boxes required in all walls for control purposes (thermostats, switches, etc.) shall be provided by electrical contractor.
- G. All conduit required in attic, clear spaces, or on roof shall be by electrical Contractor.

3.6 TESTING

- A. After all plumbing systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequence and operation throughout the range of operation regardless of the season the Contractor shall test all plumbing equipment.
- B. Perform a smoke test on all sanitary sewers and camera all lines and provide owner with a videotape.
- C. Perform gas piping pressure test to comply with HB 1611 and all required City or governing body tests.
- D. Make adjustments as required to ensure proper functioning of all systems.
- E. Special tests on individual systems are specified under individual sections.

3.7 AS BUILT DRAWINGS

- A. Upon substantial completion, Contractor shall submit as-built drawings showing all deviations between contract drawings and actual installed conditions.
- B. Show location of all valves in plumbing systems. Submit to Owner.

3.8 TRAINING

- A. Upon completion of the work and at a time designated by the Owner's representative, provide a formal training session for the Owner's operating personnel to include location, operation, and maintenance of all plumbing equipment and systems, some sections have further instructions.
- B. Before proceeding with instruction, prepare a typed outline in triplicate listing the subjects that will be covered. Submit the outline for review by the Owner's representative.
- C. At the conclusion of the instruction, obtain the signatures of the attendees on each copy of the outline to signify that they have a proper understanding of the operation and maintenance of the system. Submit the signed outlines to the Owner's representative and Engineer as a condition of final acceptance.

3.9 CONTRACTOR FINAL INSPECTION

- A. It shall be the duty of this Contractor to make a careful inspection trip of the entire project, assuring himself that the work on the project is ready for final acceptance before calling upon the Owners Representative to make a final inspection.
- B. To avoid delay of final acceptance of the work, the Contractor shall have all necessary bonds, warranties, receipts, affidavits, etc., called for in the various articles of these specifications, prepared and signed in advance, together with a letter of transmittal, listing each paper included, and shall deliver the same to the Owners Representative at or before the time of said final inspection. The Contractor is cautioned to check over each bond, receipt, etc., before preparing for submission to verify that the terms check with the requirements of the specifications.

END OF SECTION

SECTION 220720 - PIPING INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Fiberglass insulation
 - 1. Applications:
 - a. Above ground domestic cold water
 - b. Roof drains
 - c. Horizontal portions of waste lines above grade which receive condensate from air handling units
 - d. Condensate drain lines
 - e. Domestic hot water piping
 - f. Hot water storage tanks
 - g. Storm shelter water supply tanks
- B. Closed Cell Insulation
 - 1. Closed cell insulation for piping in concrete masonry unit walls only.

1.2 RELATED SECTIONS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions, and Division 01 Specifications, apply to this Section.
- B. Section 22 00 00 - Basic Plumbing Requirements
- C. Section 22 11 17 - Domestic Water Piping and Appurtenances
- D. Section 22 13 17 - Soil, Waste and Sanitary Drain Piping, Vent Piping and Appurtenances
- E. Section 22 13 18 - Condensate Piping
- F. Section 22 14 01 - Roof Drainage Piping and Appurtenances

1.3 SUBMITTALS

- A. Product Data:
 - 1. Provide submittal data on all equipment specified in this section in accordance with Section 22 00 00, General Conditions, and Division 01.
 - 2. Submit product data indicating typical catalog of information.
 - 3. Submit product data sheets indicating dimensions, general assembly, and ratings.
 - 4. Submit manufacturer's installation instructions and method of application.

1.4 REFERENCES

- A. ASTM E84 - Fire and Smoke Ratings
- B. ASTM C547 - Standard Specifications for Mineral Fiber Pipe Insulation
- C. ASTM C585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System)

- D. ASTM C795 - Standard Specifications for Thermal Insulation for Use in Contact with Austenitic Stainless Steel
- E. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation
- F. NFPA 255 - Surface Burning Characteristics of Building Materials
- G. UL 723 - Composite Surface Burning Characteristics

1.5 DEFINITIONS

- A. Concealed:
 - 1. Hidden from sight as in trenches, chases, furred spaces, walls, pipe shafts, or suspended ceilings.
- B. Exposed:
 - 1. Not "concealed" as defined above. Normally open and visible to building occupants.

1.6 QUALITY ASSURANCE

- A. Fire Hazard Rating:
 - 1. All insulation used on the project must have a flame spread rating not exceeding 25 and a smoke developed rating not exceeding 50 as determined by test procedures ASTM E84, NFPA 255, or UL 723. Insulation used in plenums must be listed and labeled as such.
 - 2. These ratings must be tested on the composite of insulation, jacket or facing, and adhesive.
 - 3. Components such as adhesives, mastics, and cements must meet the same individual ratings as minimum requirements.
- B. Quality Controls:
 - 1. All insulation shall be the product of reputable manufacturers.
 - 2. All insulation shall be applied by mechanics skilled in the use of various materials, and in the employ of a concern regularly engaged in the insulating business. Submit qualifications of insulator with insulation submittals.
 - 3. The materials shall be applied in accordance with the special materials as required by these specifications and by the manufacturer's standards.
 - 4. Poor workmanship or appearance will be cause for rejection.
- C. Insulations shall not contain formaldehyde, asbestos, lead, mercury, mercury compounds, or polybrominated diphenyl ether fire retardants.
- D. Fiberglass insulations shall have a minimum of 50 percent recycled glass content; certified and UL Validated.
- E. Fiberglass insulations shall have a bio-based, formaldehyde-free binder and be UL GREENGUARD Gold certified.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Pipe covering insulation shall be manufactured for the sizes required for the particular system and shall be suitable for installation on piping systems defined.

2.2 PIPE INSULATION

- A. Fiberglass Insulation Manufacturers:
 - 1. Johns Manville
 - 2. Knauf Insulation
 - 3. Owens/Corning
 - 4. Manson Insulation
- B. Thickness:
 - 1. Domestic Cold Water Piping:
 - a. 1 ¼ inch pipe diameter or smaller: ½ inch thick
 - b. 1 ½ inch pipe diameter or larger: 1 inch thick
 - 2. Condensate Lines:
 - a. 1 ¼ inch pipe diameter or smaller: ½ inch thick
 - b. 1 ½ inch pipe diameter or larger: 1 inch thick
 - 3. Waste Lines Which Receive Condensate:
 - a. 1 ¼ inch pipe diameter or smaller: ½ inch thick
 - b. 1 ½ inch pipe diameter or larger: 1 inch thick
 - 4. Roof Drain Piping: 1 inch thick
 - 5. Domestic Hot Water Piping (Up to 140°F):
 - a. 1 ¼ inch pipe diameter or smaller: 1 inch thick
 - b. 1 ½ inch pipe diameter or larger: 1 ½ inch thick
 - 6. Outdoor Piping: 2 inch
- C. Construction for fiberglass insulation (Above ground and crawlspace):
 - 1. Fiberglass preformed pipe covering insulation complying with ASTM C547, Type I (850 degrees F) or Type IV (1000 degrees F); ASTM C585, ASTM C411, ASTM C795, and UL/ULC Classified. Fiberglass bonded with a bio-based thermosetting resin.
 - 2. Provide insulation with factory applied, white ASJ SSL, vapor retarder jacket complying with ASTM C1136. Thermal conductivity ASTM C 335 (k-value) at 75 degrees F mean temperature shall be 0.23 Btu x in. /h x sq. ft. x degrees F, or less. Service temperature range of 0 degrees F minimum to 1000 degrees F maximum.
 - 3. Flame spread/Smoke-developed Rating (ASTM E84) of 25/50. Must be UL Environment GREENGUARD Gold certified and UL Validated Formaldehyde-free.
- D. Closed Cell Insulation Manufacturers (for concrete masonry wall installations only):
 - 1. Armacell Ultima
 - 2. Aeroflex Self-Seal
 - 3. K-Flex Insul-Lock DS
- E. Construction for Closed Cell Insulation (for concrete masonry wall installations only):
 - 1. Type: Closed-Cell Flexible Elastomeric Foam Pipe Insulation w/dual-tape overlap self seal lip closure
 - a. Performance Criteria: Resistant to ultraviolet and biological degradation as demonstrated by ASTM G7 and ASTM G90.
 - b. Temperature Range: -297°F to 220°F
 - c. Water Vapor Permeability (Dry Cup): Less than 0.02 per inch when measured by ASTM E96/E96M.
 - d. Thermal Conductivity: 0.24-.028 BTU-IN/HR-F2-°F at 75°F mean temperature

2.3 FLANGE, VALVE, AND FITTING INSULATION

- A. PVC Fitting Covers/Jacket Manufacturers:

PIPING INSULATION

Ozarks Electric 1st Floor Remodel
Fayetteville, AR
EMA

25300600

220720 - 3

08/21/26

Construction Documents
Engineering & Consulting

1. Proto LoSmoke PVC
 2. Zeston PVC
- B. Metal Fitting Cover/Jacket Manufacturers:
1. Johns Manville
 2. RPR Products
 3. Ideal Products
 4. Polyguard
 5. VentureClad
- C. Exposed Piping:
1. Provide molded or mitered covers with full thickness matching adjacent covering.
 2. Finish with white glass, reinforced white vapor barrier coating.
- D. 2½ Inch Diameter and Larger Concealed Piping:
1. Insulate fittings and valves with molded or mitered fitting covers.
 2. Finish with white vapor barrier coating reinforced with white 10" x 10" reinforced mesh.
- E. 2 Inch Diameter and Smaller Concealed Piping:
1. Insulate fittings and valves with mineral wool and insulating cement to a thickness equal to or greater than adjoining straight pipe.
 2. Molded or mitered fittings finished with white vapor barrier coating reinforced with reinforced mesh may be provided.
- F. Underground Piping (hot water only):
1. Provide mitered covers with full thickness matching adjacent covering.
 2. Field fabricated miter joints are not acceptable.
 3. No insulation is required on underground domestic cold water piping.
- G. Outdoor Piping:
1. Metal jacketing shall be 0.016" minimum aluminum or stainless steel with moisture barrier, secured in accordance with jacket manufacturer's recommendations.
 2. Use preformed fitting covers matching jacket used on straight pipe, with all joints sealed with metal jacketing sealant.

2.4 SEALANT, ADHESIVE, AND FINISH

- A. Sealant:
1. Manufacturers:
 - a. Foster 95-44
 - b. Childers CP-76
 - c. Vimasco Corporation
 - d. Mon-Eco Industries
 2. Usage:
 - a. Valve Covers
 - b. Anchors
 - c. Hangers
 - d. Metal Jacketing
 - e. Flashing Penetrations
- B. Adhesive:
1. Manufacturers:
 - a. Foster 85-20/85-60

- b. Childers CP-127
 - c. Vimasco Corporation
 - d. Mon-Eco Industries
 - 2. Usage:
 - a. Longitudinal laps of the vapor barrier jacket
 - b. Butt joint covers.
- C. Weather Barrier Mastic
 - 1. Manufacturers:
 - a. Foster 46-50
 - b. Childers CP-10
 - c. Vimasco Corporation
 - d. Mon-Eco Industries
 - 2. Usage:
 - a. Used on above ambient piping/duct to protect insulation from weather.
 - b. Use in conjunction with reinforcing mesh.
- D. Vapor Barrier Coating:
 - 1. Manufacturers:
 - a. Foster 30-33 Vapor Out
 - b. Childers CP-33 Chil Out
 - c. Vimasco Corporation
 - d. Mon-Eco Industries
 - 2. Usage:
 - a. Glass fabric reinforcement.
 - b. Vapor stops.
 - c. Completing factory installed vapor retarders.
- E. Reinforcing Mesh
 - 1. Manufacturers:
 - a. Foster Mast Afab
 - b. Childers Chil-glass #10
 - c. Vimasco Corporation
 - d. Mon-Eco Industries
 - 2. Usage:
 - a. Glass fabric reinforcement

2.5 INSULATION SHIELD

- A. Field-fabricated:
 - 1. Material:
 - a. High-density fiberglass insulation
 - 2. Construction:
 - a. Insulation to support the bearing area at hangers and supports with a shield of galvanized metal extending not less than 4 inches on either side of the support bearing area, covering at least half of the pipe circumference. When pipe is guided at top and bottom, metal shields should cover the whole pipe circumference. Adhere metal shield to insulation so that metal will not slide with respect to insulation.
 - 3. Schedule:
 - a. 3" and smaller pipe diameter:
 - 1) 12-inch insulated section, 18 gauge metal shield

- b. Greater than 3" pipe diameter:
 - 1) 12-inch insulated section, 16 gauge metal shield
- B. Factory-made:
 - 1. Manufacturer:
 - a. Pipe Shields, Inc. or equal.
 - 2. Type:
 - a. Proper shield for service and pipe span.
 - 3. Construction:
 - a. Extend insulation at least 1 inch beyond metal.
- C. Insulation shall not compress at hanger.

PART 3 - EXECUTION

3.1 SITE INSPECTION

- A. Before starting work under this section, carefully inspect the site and installed work of other trades and verify that such work is complete to the point where installation of materials and accessories under this section can begin.
- B. Verify that all materials and accessories can be installed in accordance with project drawings and specifications and material manufacturers' recommendations.
- C. Verify, by inspecting product labeling, submittal data, and/or certifications which may accompany the shipments, that all materials and accessories to be installed on the project comply with applicable specifications and standards and meet specified thermal and physical properties.

3.2 PROPERTIES

- A. Ensure that all pipe and fitting surfaces over which insulation is to be installed are clean and dry. Remove materials that will adversely affect insulation application.
- B. Ensure that insulation is clean, dry, and in good mechanical condition with all factory-applied vapor or weather barriers intact and undamaged. Wet, dirty, or damaged insulation shall not be acceptable for installation.
- C. Ensure that pressure testing of piping and fittings has been completed prior to installing insulation.

3.3 INSTALLATION

- A. General:
 - 1. To ensure that it will achieve its highest possible performance and serve its intended purpose, install all insulation materials and accessories in accordance with manufacturer's published instructions (latest edition) and industry practices detailed by the North American Commercial and Industrial Insulation Standards Manual (latest edition). Install insulation on piping subsequent to installation of heat tracing, painting, and acceptance tests.
 - 2. Install insulation on piping subsequent to installation of heat tracing, painting, and acceptance tests.
 - 3. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with single cut piece to complete run. Do not use cut pieces or scraps abutting each other. Butt insulation joints firmly to ensure complete, tight fit over all piping surfaces.

4. Maintain the integrity of factory-applied vapor barrier jacketing on all pipe insulation, protecting it against puncture, tears, or other damage. All staples used on cold pipe insulation shall be coated with suitable vapor barrier coating to maintain vapor barrier integrity.
5. All cold water, hot water, and condensate drains routed in concrete masonry units shall be insulated using closed cell insulation as noted in this specification.

3.4 PIPE

- A. Insulation size shall match pipe size.
- B. Insulation to be continuous through wall and ceiling penetrations.
- C. Apply insulation to clean, dry pipes.
- D. Butt insulation joints firmly together and apply butt strip. All pipe insulation terminations shall be tapered and sealed.
- E. Butt pipe insulation against hanger inserts. Seal jacketing according to type used.
- F. Seal longitudinal laps and butt strips with sealant in addition to the self-sealing laps.
- G. Seal joints with adhesive and staple at 2" O.C. with outwardly clenching staples.
- H. Seal all joints with vapor barrier coating.

3.5 VALVES, FLANGES, AND FITTINGS

- A. Insulate all valves, flanges, and fittings with covers secured with Velcro with equivalent thickness and composition installation on straight pipes.
- B. Finish with 1/4 inch layer of Foster 30-33 or Childers CP-33 reinforced with reinforcing mesh.
- C. Factory made covers equal to Proto Corporation or Zeston are acceptable.

3.6 CONTROL VALVE COVERS

- A. Fabricate special covers, complete with troweled-on vapor seal, shaped to accommodate the valve stem. Insulation thickness shall be same thickness as adjoining pipe.
- B. Seal covers to valve insulation properly with adhesive so that the seal may be broken with a knife blade without damage to either part. Arrange so that cover can be removed and replaced as necessary for operation of the valve.
- C. Finish valve cover with glass cloth and two coats of vapor barrier coating.
- D. Factory made covers are acceptable. Provide submittal.

3.7 ROOF DRAIN PIPING

- A. Seal vapor tight to prevent any moisture from entering into the insulation.
- B. Roof drains for canopies do not require insulation.
- C. Roof drains that are exposed shall be insulated as described in the paragraph on exposed piping.
- D. Insulate all roof drain bodies (primary and secondary).

- E. Primary roof drain piping, insulate all piping.
- F. Secondary roof drain piping, insulate first vertical drop and first seven feet of laterals.

3.8 WASTE LINES WHICH RECEIVE CONDENSATE

- A. Insulate from the drain receptor (i.e. floor sink, hub drain) all the way to where the drain line changes to a vertical stack.

3.9 REPAIRS AND REPLACEMENT

- A. Replace any insulation that gets wet, whether now dry or not.
- B. Repair any damage caused by condensation due to improper insulating.

3.10 ALL EXPOSED PIPING

- A. All exposed piping insulation to be pre-formed pipe insulation with white PVC jacket and white PVC fittings (no exceptions). All exposed roof drain primary and secondary downspouts, water piping, condensate piping, and any other piping that requires insulation shall be insulated down to the floor level using the pre-formed pipe insulation and PVC jackets and fittings.

3.11 OUTDOOR PIPING (DOMESTIC COLD AND HOT WATER)

- A. Metal jacket shall be applied per manufacturer's recommendations. Longitudinal joints shall be applied so they will shed water completely and be sealed completely with 1/8" bead of metal jacketing sealant under each lap. Circumferential joints shall be closed using preformed butt strips in accordance with manufacturer's recommendations.

3.12 SHIELDS

- A. Metal jacketing shall be 0.016-inch minimum aluminum or stainless steel with moisture barrier, secured in accordance with jacket manufacturer's recommendations. Use bands and seals of the same material. Use preformed fitting covers matching jacket used on straight pipe, with all joints weather sealed with 1/8" bead of metal jacketing sealant under each lap.

3.13 SADDLE AND HANGERS

- A. Piping hangers or anchors are not to be in direct contact with pipe. Hangers are to be on the outside of the insulation with pipe shields at each hanger.
- B. At the location of hangers or supports for pipes run above ground and finished with a vapor seal insulation, provide rigid sections of cork, high density fiberglass, Foamglas, calcium silicate, or high density polyurethane, the same thickness as adjacent insulating material to adequately support the pipe without compression of the insulating material and cover with a vapor seal that is bonded to the adjacent insulation as described for fittings in the lines. Wood inserts shall not be allowed. Hangers and supports for piping insulation to receive a vapor barrier shall be installed exterior to the insulation.
- C. Material Changes:
 - 1. Wherever there is a change in materials on lines that are vapor sealed, apply a suitable adhesive that is compatible with both materials, tapes, etc., as required to maintain the vapor barrier.

- D. Apply insulation around the hanger ring or anchor and pipe and carry vapor barrier upward and outward along the hanger rod or anchor members to a point not less than 12 inches from the adjacent pipe.
- E. Take care to avoid puncturing the vapor seal.
- F. Finish insulation as specified for flanges, and seal over adjacent vapor barrier jacket.

3.14 FIELD QUALITY ASSURANCE

- A. Upon completion of all insulation work covered by this specification, visually inspect the work and verify that it has been correctly installed. This may be done while work is in progress, to assure compliance with requirements herein to cover and protect insulation materials during installation.

3.15 PROTECTION

- A. Replace damaged insulation which cannot be satisfactorily repaired, including insulation with vapor barrier damage and moisture-saturated insulation.
- B. The insulation contractor shall advise the general and/or the mechanical/plumbing contractor as to requirements for protection of the insulation work during the remainder of the construction period, to avoid damage and deterioration of the finished insulation work.

END OF SECTION

SECTION 221117 - DOMESTIC WATER PIPING AND APPURTENANCES COPPER

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Domestic hot water piping.
- B. Domestic cold water piping.

1.2 RELATED SECTIONS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions, and Division 01 Specifications, apply to this Section.
- B. Section 22 00 00 - Basic Plumbing Requirements

1.3 REFERENCES

- A. ASTM 763 - Standard Specification for Copper Alloy Sand Castings for Valve Applications
- B. ASTM 61 - Standard Specification for Steam or Valve Bronze Castings
- C. ASTM C27450 - Standard Specification for Brass Rod, Bar & Shapes
- D. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges & Pipe Fittings
- E. ASTM A105/A105M - Standard Specification for Carbon Steel Forgings for Piping Applications
- F. ASTM - American Society of Testing Materials
- G. ASTM B813 - Standard Specification for Liquid & Paste Fluxes for Soldering of Copper & Copper Alloy Tube
- H. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings
- I. ASTM B88 - Standard Specification for Seamless Copper Water Tube
- J. PDI - Plumbing & Drainage Institute
- K. ANSI/NSF 61
- L. NSF 61

1.4 SUBMITTALS

- A. Provide submittal data on all items specified in this section in accordance with Specification Section 22 00 00, General Conditions, and Division 01.
- B. Submit product data sheets.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All products to comply with ANSI/NSF 61 and NSF 372.
- B. Install piping in a neat and workmanlike manner.
- C. **All piping routed through exposed public areas must be routed as high as possible.**
- D. Solder all joints when the system is not under strain.
- E. Solder Joints:
 - 1. Assemble with square cut pipe using a pipe cutter.
 - 2. Hacksaw-cut pipe ends will not be acceptable.
 - 3. Ream open pipe end to full size.
 - 4. Burnish both the pipe and fitting absolutely clean.
 - 5. Apply brazing flux to both the pipe and the fittings.
 - 6. The use of corrosive acid flux will not be permitted.
 - 7. Charge the pipe and fittings with nitrogen gas during the brazing.
- F. Install each of the piping systems to provide for expansion and contraction.
- G. Expansion Offsets:
 - 1. Copper Piping:
 - a. Use developed length Copper Tube Handbook 411-R as published by Copper Development Association, Inc.
- H. Furnish necessary spring pieces and offsets as required.
- I. Conceal all of the piping systems in chases, above ceilings, in walls, and in finished areas.
- J. Run exposed piping only in machinery spaces and unfinished areas as specified or as shown on the plans.
- K. Install all necessary fittings and offsets to hold the piping close to walls and ceilings.
- L. Where these lines run exposed, obtain a clearance from the Engineer in writing before making the installation.
- M. Install piping in the most advantageous manner possible with respect to headroom, valve access, openings, equipment clearances, and clearances for other work.
- N. Give particular attention to piping in the vicinity of equipment.
- O. Preserve the maximum access to various equipment parts for maintenance.
- P. Do not cut or weaken any structural member.
- Q. Cut all pipes accurately to measurement determined at the site.
- R. After cutting pipe, ream it to remove burrs.

- S. Install piping neatly, free from unnecessary traps and pockets. Work into place without springing or forcing.
- T. Use fittings to make all changes in direction.
- U. Field bending and mitering are prohibited.
- V. Make all connections to equipment using flanged joints or unions.
- W. Make reducing connections with reducing fittings only.
- X. Do not allow piping to pass through or over designated electrical rooms or technology spaces.
- Y. Compression fittings are not allowed.
- Z. Drainage:
 - 1. Minimum Slope:
 - a. 1/8 inch per 10 feet.
 - 2. Where constant pitch cannot be maintained for long runs, establish intermediate low points and rise to higher level.
 - 3. Slope branches to drain toward mains or risers.
 - 4. Terminate low points of risers with drain valve piped to nearest hub or floor drain unless otherwise indicated.
- AA. Water Hammer Arrestors:
 - 1. Install in accordance with PDI-WH 201.
- BB. Press fitting elbows are not acceptable for water supply elbows at location of main water stub up. Use SilFos sweated fittings on all water supply elbows larger than 2". Water supply lines smaller than 2" can be soft drawn copper with no elbow.
- CC. Plumbing contractor to provide strainers, spools (for future pressure reduction valve), associated cut-off valves, reduced pressure zone, and flood control valve at all building main water entry backflow preventer assemblies. Also, route drain from the backflow preventer (RPZ) to the exterior of the building.
- DD. Press fitting manufacturer shall provide a duplicate set of all tools required to maintain and/ or modify press fittings. Required tools are to be given to the owner. One set of tools shall be provided for each project.

3.2 SLEEVES

- A. Above Grade and/or Dry Locations:
 - 1. Walls:
 - a. Mount flush on both sides.
 - 2. Floors:
 - a. Mount 2 inches above finished floor in pipe chases.
- B. Below Grade and/or Moist Locations:
 - 1. Install suitable flange in the center of wall or floor to form a waterproof passage.
 - 2. Fill the void space around the pipe with jute twine or Oakum caulk or an asphalt based compound to ensure a waterproof penetration.
- C. Passing Through Fire-Rated Enclosure:
 - 1. Fill the void space around the pipe in accordance with NFPA requirements.

2. Do not allow the sleeve installation to lower the fire rating of the assembly.

3.3 SECURING AND SUPPORTING OF PIPE

- A. Support all pipe from the building structure by means of approved hangers and supports while maintaining required grade and pitch, preventing vibration, and providing for expansion and contraction.
- B. Secure all hangers to approved inserts wherever possible.
- C. Set hanger inserts in place when the concrete is poured.
- D. If Joists Are Used for Attachment:
 1. Must be attached to the top cord of the joists.
 2. Do not support any piping and trapeze hangers from joist bridging on roof and floor deck.
- E. If Structural Steel Framing Is Used for Attachment:
 1. Use approved beam clamps.
 2. Where required, install channels to span between framing members.
 3. Do not attach hangers to the roof deck or cross bracing.
- F. Hanger Spacing:
 1. Smaller Than 1¼":
 - a. 6'-0"
 2. 1 ½" and Larger:
 - a. 10'-0"
 3. Vertical:
 - a. 10'-0"
- G. Vertical Lines:
 1. Adequately support at their bases, either by a suitable hanger placed in the horizontal line near the riser or by a base fitting set on a pedestal or foundation.
 2. Support from each floor slab by means of an approved clamp-type support which bears on the slab or beam.
- H. Change of Direction:
 1. Install supports within two feet of change of direction.
 2. Brackets of approved type may be used along the walls.
 3. Install hangers within 2 feet of each change in vertical or horizontal direction, pipe tees, and on each side of valves, strainers, etc.
 4. Multiple horizontal pipes, smaller than 12" diameter pipe, may be supported on trapeze hangers. Space trapeze hangers in accordance with the schedule for pipe spacing based upon the smallest size pipe.
 5. Properly size the trapeze members for the piping load they are to support. The number of pipes on the trapeze must be approved by the Engineer to prevent overloading of the building structure.
 6. Where pipes are insulated, oversize the hanger accordingly to accommodate the outside diameter of the insulation. Provide half-round 16 gauge galvanized steel shields, not less than 12" long and rolled to fit the insulation diameter, between the insulation and the hanger.
 7. When pipe is guided at top and bottom, cover the entire pipe circumference with metal shields.
 8. Adhere metal shield to the insulation so that the metal will not slide with respect to the insulation.

9. Wood struts shall not be used to support piping in walls.

3.4 EQUIPMENT PLUMBING CONNECTIONS

- A. Make all final connections to all pieces of equipment which require natural gas, water, drain, waste, or vent connections.
- B. Provide all required shut-off cocks, valves, drain valves, and traps.

3.5 VALVES

- A. Install valves and stops in accessible locations.
- B. Provide where shown or as required to make system complete and readily maintained.
- C. Isolation valves shall be located:
 - 1. Restroom Gang - Above lay-in ceilings adjacent to gang restrooms. When hard ceilings are present provide 18"x18" (minimum) ceiling access panel to access valves.
 - 2. Individual (private) Restrooms - Above lay-in ceilings adjacent to restroom. When hard ceilings are present provide 18"x18" (minimum) ceiling access panel to access valve.
 - 3. Individual Fixtures - Above lay-in ceilings adjacent to restroom. When hard ceilings are present provide 18"x18" (minimum) ceiling access panel to access valve
 - 4. Isolation valves on the domestic cold water shall be provided in corridors to allow isolation of buildings wings, each level, sections, and areas.
 - 5. Provide cut-off valve on main water entry upstream of strainer and backflow preventer (if backflow preventer is inside building).
 - 6. Each exterior wall hydrant and each roof hydrant shall be provided with an accessible cut-off valve.
- D. All valves, trap primers, etc. that are located behind access doors shall be located directly behind door and within 24" of plane of door.

3.6 CONTRACTOR TESTING AND INSPECTION

- A. Perform all tests as specified in Division 22 or as required by the Engineer or by the Local, Federal, and State Bureaus having jurisdiction and under their supervision during the progress and upon completion of work.
- B. Include costs of all required tests in your bid.
- C. Provide all apparatus, temporary pipeline, and all other requirements necessary for such tests.
- D. Take all due precautions to prevent damage to the building or its contents incurred by such tests as the Contractor will be required to repay and make good any damage so caused at his own expense.
- E. Properly test water distribution systems with 150 PSI hydrostatic pressure test.
- F. Do not install trap primers, flush valves, or other pressure sensitive devices until all tests are completed.
- G. Repair all leaks in pipes, fittings, and accessories during this test period.
- H. Repeat 150 PSI hydrostatic test until no leaks are found for an entire 8-hour period.
- I. Make joints in accordance with ASTM B828.

3.7 IDENTIFICATION OF PIPING AND EQUIPMENT

- A. Mark all piping to show the service and direction of flow.
- B. Place markers at each branch of tees, at equipment connections, and change of direction and at 20-foot intervals. Minimum of one (1) marker in each room.
- C. Install valve tags on all valves.
- D. Frame under glass cover and hang a typewritten list including the valve number, type of service, and location of each valve in the boiler mechanical room.
- E. Mark all valve numbers corresponding to this system of identification on the as-built drawings which will be delivered to the Owner upon completion of the work.

3.8 STERILIZATION

- A. Solution:
 - 1. Strength:
 - a. Minimum 50 parts per million
 - 2. Agents:
 - a. Liquid Chlorine:
 - 1) Conform to U.S. Army Specification #4-1
 - b. Calcium Hydrochloride:
 - 1) Federal Specification O-C-114
 - c. Chlorinated Lime:
 - 1) Federal Specification O-C-114
- B. Procedure:
 - 1. Perform sterilization after testing has been satisfactorily completed.
 - 2. Pump solution into a 1/4 inch opening provided in the water main next to the water meter.
 - 3. Conduct the sterilization process under the direction of the local health department.
 - 4. After sterilization, flush the system with clean water until the residual chlorine content is less than 3 ppm.
 - 5. After flushing, the local health department will test and verify the cleanliness of the system.

3.9 EMCS FLOW SENSOR

- A. Plumbing contractor to provide and install ModMAG M2000 Electromagnetic Flow Meter by Badger Meter. Meter shall be inside the building downstream of the backflow preventer (RPZ) or downstream of the initial water main stub up inside the building if the backflow prevention device is located in the yard. EMCS contractor to make all necessary connections for EMCS interface. Plumbing contractor to coordinate with EMCS contractor on communication protocol and power requirements prior to ordering.

END OF SECTION

SECTION 221317 - WASTE DRAIN AND VENT PIPING, AND APPURTENANCES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Drain and vent piping within the building and underground laterals.
- B. Pea gravel embedment for schedule 40 PVC piping below slab.

1.2 REFERENCES

- A. Refer to Section 22 00 10 for complete names of references identified in this section.
 - 1. Commercial Standard CS-188-59
 - 2. ASTM D2665 - Standard Specifications for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings

1.3 SUBMITTALS

- A. Provide submittal data on all items specified in this section in accordance with Specification Section 22 00 00, General Conditions, and Division 01.
- B. Submit product data on pipe, pipe fittings, trap primers, covers, cleanouts, etc.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

- A. All proposed substitutions shall be submitted for PRIOR APPROVAL on each project. Requests must be received by the Engineer and / or Owner's Representative no less than ten business days prior to the bid date. Contractor shall list all deviations from the specified unit and furnish COMPLETE submittal data. Approval of a substitution shall be in writing and shall not relieve the Contractor from compliance with the requirements of the Contract Documents.

2.2 DRAIN PIPE AND FITTINGS

- A. Material: (Pipe material for above and below slab for ducted return mechanical system)
 - 1. Schedule 40 PVC pipe and fittings conform to ASTM D2665.
 - 2. "Foam Core PVC" not allowed.
- B. Material: (Pipe material for below slab for plenum return mechanical system)
 - 1. Schedule 40 PVC pipe and pipe fittings conform to ASTM D2665.
 - 2. "Foam Core PVC" not allowed.
- C. Material: (Pipe material for above slab for plenum return mechanical system).
 - 1. Type:
 - a. Epoxy Coated Cast Iron:
 - 1) Conform to ASTM A74, ASTM A888 and ASTM C1277.
 - 2. Joints:
 - a. Epoxy Coated Cast Iron:
 - 1) Below Slab: Bell and spigot with elastomeric seals
 - (a) Conform to ASTM C564

- 2) Above Slab: No-hub joints
 - (a) Pipe 4" and smaller - 4-Band Heavy Duty Couplings
 - (b) Pipe 6" and larger - 6-Band Heavy Duty Couplings
 - (c) Couplings must comply with ASTM C1540
 - (d) Transition Couplings must comply with ASTM C1460
 - 3. Manufacturers:
 - a. AB&I Foundary
 - b. Charlotte Pipe
 - c. NewAge Casting
 - d. Tyler Pipe
- D. Material: (Pipe material for kitchen waste and vent).
- 1. Type:
 - a. Epoxy Coated Cast Iron:
 - 1) Conform to ASTM A74, ASTM A888 and ASTM C1277.
 - b. CPVC will not be allowed.
 - 2. Joints:
 - a. Epoxy Coated Cast Iron:
 - 1) Below Slab: Bell and spigot with elastomeric seals
 - (a) Conform to ASTM C564
 - 2) Above Slab: No-hub joints
 - (a) Pipe 4" and smaller - 4-Band Heavy Duty Couplings
 - (b) Pipe 6" and larger - 6-Band Heavy Duty Couplings
 - (c) Couplings must comply with ASTM C1540
 - (d) Transition Couplings must comply with ASTM C1460
 - 3. Manufacturers:
 - a. AB&I Foundary
 - b. Charlotte Pipe
 - c. NewAge Casting
 - d. Tyler Pipe

2.3 VENT PIPE AND FITTINGS

- A. Material: (Pipe material for above and below slab for ducted return mechanical system)
 - 1. Schedule 40 PVC pipe and fittings conform to ASTM D2665.
- B. Material: (Pipe material for below slab for plenum return mechanical system)
 - 1. Schedule 40 PVC pipe and fittings conform to ASTM D2665.
- C. Material: (Pipe material for above slab for plenum return mechanical system)
 - 1. Below slab: Schedule 40 PVC pipe and pipe fittings conform to ASTM D2665.
 - 2. Above slab: 1½ Inch Diameter:
 - a. Galvanized Steel: Schedule 40 pipe with city screwed, malleable iron fittings.
 - 3. Above Slab: Larger Than 1½ Inch Diameter:
 - a. Epoxy Coated Cast Iron:
 - 1) AB&I Foundary
 - 2) Charlotte Pipe
 - 3) NewAge Casting
 - 4) Tyler Pipe
 - 4. Conform to ASTM A74, ASTM A888 and ASTM C1277.
- D. All vent penetrations for storm shelters must be storm rated.

1. Manufacturers:
 - a. Cyclone CVTR by Roof Penetration Houstings LLC.

2.4 CLEANOUTS

- A. Size:
 1. Identical with the line size up to a maximum diameter of 4 inches.
- B. Type:
 1. Compatible with the surrounding floor/wall.
- C. Manufacturers:
 1. Jay R. Smith
 2. Josam
 3. Mifab
 4. Sioux Chief
 5. Wade W-6000
 6. Zurn

2.5 PLUGS

- A. Wade 8590, Tapped brass cleanout plug only. PVC plugs not allowed.
- B. Applications:
 1. Each change in direction of soil lines
 2. End of each continuous waste line
 3. Foot of each riser within the building
 4. 100 ft. intervals in interior horizontal lines
- C. Construction: Secure covers with vandal-proof screws
- D. Finished Floors:
 1. Covers: Chromium-plated, flush mounted, cast bronze with scoriated top surface.
- E. Walls/Painted Surfaces:
 1. Covers:
 - a. Furnish stainless steel covers.
- F. Exterior Locations:
 1. Traffic Areas:
 - a. Covers: Flush mounted, cast bronze covers with scoriated top surface
 2. Non-Traffic Areas:
 - a. Encase in a 14" x 14" x 6" concrete pad
 - b. Manufacturer/Model:
 - 1) Wade W-8500 series

2.6 CLOSET FLANGE

- A. Size: 4" to match sanitary sewer piping.
- B. Type:
 1. PVC or cast iron to match sanitary sewer piping.
 2. PVC flanges to be provided with stainless steel ring for reinforcement.
 3. Offset toilet flanges are not allowed.

- C. Manufacturer:
 - 1. Oatley or equal

2.7 TRAP PRIMERS - TAILPIECE

- A. Type:
 - 1. Branch line from tailpiece adapter on an adjacent sink.
- B. Size:
 - 1. Outlet:
 - a. 1/2 inch
- C. Features:
 - 1. Activated by lavatory faucet operation
 - 2. No adjustment required
 - 3. Equipped with distribution for one trap
- D. Manufacturer:
 - 1. Sioux Chief
 - 2. Zurn

2.8 3/8 INCH PEA CLEAN PEA GRAVEL FOR SCHEDULE 40 PVC PIPING BELOW SLAB

- A. Provide 3/8" clean pea gravel aggregate as backfill for all schedule 40 PVC piping below slab. Provide a minimum of 6 inches of pea gravel cover over pipe and under pipe. Compact to 85% to 95%.

2.9 EXPOSED INDIRECT WASTE LINES IN KITCHENS AND CONCESSIONS

- A. All exposed indirect waste lines in kitchens and concessions to be DWV copper material. All joints to be soldered and turned down with elbow above floor sink or hub drain (discharge below elbow to be cut at 45-degree angle).

2.10 SLEEVES

- A. Application:
 - 1. Provide sleeves for all pipes and conduits which pass through a concrete slab, masonry wall/concrete wall, sheetrock wall (fire rated or not fire rated), roof, or other portion of the building structure.
- B. Above Grade and/or dry locations:
 - 1. Material:
 - a. 20 or 22-gauge galvanized steel.
 - 2. Size:
 - a. As necessary to allow free passage of the insulated pipe.
- C. Below Grade and/or moist locations:
 - 1. Material:
 - a. ASTM D2665 Schedule 40 PVC. When PVC not allowed by code, use schedule 40 galvanized steel.
 - b. Return Air Plenum:
 - 1) Schedule 40 galvanized steel.
- D. Passing through fire-rated enclosures:
 - 1. Material:

- a. Galvanized or black steel pipe.
 - b. Non-combustible.
 - c. PVC will not be allowed.
- E. Penetration Seal: (All Sleeved Penetration Locations- fire rated or non-fire rated)
 - 1. Seal penetration with 3M Fire Barrier Sealant CP 25WB+ or one-component ceramic fiber-based putty fill, void, or cavity material, UL rated material classified for use in through-penetration firestop systems nos. 124, 125, 150, and 151.
 - 2. Flame Spread/Smoke Contribution:
 - a. 0/0 in accordance with ASTM E84.

2.11 PIPE SUPPORTS

- A. Hangers:
 - 1. 2" and Smaller Piping:
 - a. May be split cast ring type with fastening device in walls and chases.
 - 2. All Other Above Ceiling Locations:
 - a. Adjustable clevis type. Hangers to accommodate circumference of pipe and saddles.
- B. Hanger Rods:
 - 1. Type:
 - a. Minimum 3/8 inch diameter with machine threads.
- C. Minimum Steel Hanger Rod Diameter for Individually Suspended Horizontal Pipes:
 - 1. 2" and smaller diameter pipe:
 - a. 3/8"
 - 2. 2-1/2" to 3 - 1/2" diameter pipe:
 - a. 1/2"
 - 3. 4" to 5" diameter pipe:
 - a. 5/8"
 - 4. 6" diameter pipe or larger:
 - a. 3/4"
- D. Hanger Manufacturers:
 - 1. Anvil
 - 2. Elcen
 - 3. ERICO
 - 4. F&S Manufacturing
 - 5. Fee & Mason
 - 6. PHD
 - 7. Empire Industries
- E. In wall pipe supports:
 - 1. Metal strut, manufactured pipe clamps
- F. In wall pipe support manufacturer:
 - 1. Holdrite or Equivalent

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Location:

1. Install a 12-gauge copper tracer wire on all underground sewers outside of building.
- B. Slope:
 1. Desired: 1/4 inch per foot
 2. Minimum:
 - a. 1/8 inch per foot for diameter of 3 inch and larger if approved by local authority and it is impractical to use 1/4 inch per foot.
- C. Drain Pipe and Fittings:
 1. Reduction fittings:
 - a. Use to connect two pipes of different diameter.
 2. Directional changes:
 - a. Use 45-degree wyes, long sweep quarter bends, and sixth, eighth, and sixteenth bends. Sanitary tees may be used on vertical stacks. Use long sweeps at all locations sanitary tees are used.
 - b. Embed pipe on pea gravel approximately 2 pipe diameters below (minimum 4") and at least one diameter on each side and top in trench.
 - c. No hub couplings of any type cannot be used underground.
 - d. **All piping routed through exposed public areas must be routed as high as possible.**
- D. PVC Pipe Joints:
 1. May be solvent cemented using the proper cement recommended for the particular materials.
 2. Cut all pipe square and clean both pipe and fittings of all soil, dirt, oil, and grease.
 3. Make solvent joints in accordance with the applicable ASTM Standards.
 4. Allow joints to dry before testing.
 5. Comply with requirements of the NSF Standard 14 for all solvent cements and primers and label to identify the laboratory certifying compliance for the particular cement and primer being used.
 6. Plastic pipe and fittings for sewer and water pressure lines may also be joined by use of elastomeric (O-ring gasket) joints when the respective standards for the materials so specify. No-Hub fittings are not allowed on PVC sanitary sewer and storm drain piping under slab or underground.
 7. Do not use pipes with cracked bells.
 8. PVC pipe and pipe fittings are not allowed in any return air plenum serving mechanical systems. Use cast iron piping above slab for these installations.
- E. In kitchens install schedule 40 cast iron pipe and fittings from dishwasher, braising pans, and steamer discharges to grease interceptor inlet. All fittings picking up PVC branches along the way must be schedule 40 cast iron, as well.
- F. Traps:
 1. Provide at each fixture unless a trap is built into the fixture.
 2. Place traps so that the discharge from any fixture will pass through only one trap before reaching a building drain.
 3. Place each trap as near to the fixture as possible. Do not exceed the distances stated in the governing codes up to a maximum of 8 feet.
- G. Trap Primers:
 1. Provide trap primers at all floor drains, floor sinks and hub drains on entire project.
 2. Provide unions on each side of trap primer for service.
 3. Manufacturer shall provide field start-up and review of installation on trap primers.

- H. Hub Drains:
1. Install with the top of the hub 1/2 inch above the finished floor, unless otherwise shown on the drawings.
- I. Cleanouts:
1. See table below for cleanout requirements whether shown on plans or not.
 2. Install so that they open in a direction opposite to the pipe flow or at a right angle.
 3. At all wall cleanouts, install tapped brass cleanout plug behind wall escutcheons.
 4. Install vertically above the flow line of the pipe for "wye" branch and end-of-line cleanouts.
 5. Place cleanouts above the floors in pipe chases so that they will be accessible through doors or bring through a wall and provide with flush covers.
 6. Set cleanouts flush in floor slabs.
 7. Place cleanouts in accessible locations. Exact locations of each shall be approved by the Architect before installation. Locate all cleanouts within 2-feet of access door or cover.
 8. Location of all cleanouts shall be shown on the shop drawings.

INTERIOR AND EXTERIOR CLEANOUTS		
LOCATION	DESCRIPTION	ACCESSORIES
Interior horizontal drain lines.	Every 100'-0" (O.C.)	All cleanouts in walkways and floors to have scoriated non-slip cover.
Change in direction of the building drain.	At the change in direction greater than 45 degrees. If multiple changes in direction occur in a maximum of 40 feet only one cleanout is required (at the first change in direction)	
Base of stack.	A cleanout shall be provided at the base of each waste or soil stack.	Provide with access door or escutcheon. No more than 2 inches from cleanout.
Junction of building drain and building sewer.	Provide a two-way cleanout exterior of building at junction of building drain and sewer.	Two-way cleanout to be installed per detail with concrete cover.
Concealed piping cleanouts.	Cleanouts on concealed piping or under a floor less than 24 inches in height must extend up through the finished wall or floor.	Provide with scoriated non-slip cover.

9. All cleanouts must be the same size as the piping they serve. On all lines larger than 4 inches, the cleanout shall not be less than 4 inches.
10. Cleanouts up to 4 inches in diameter must have 18-inch clearance. All cleanouts larger than 4 inches must have 36-inch clearance.
11. Access shall be provided at all cleanouts.
12. All cleanouts shall have long radius sweeps at change in direction to allow the insertion of the plumbing snake for cleaning purposes. Short radius fittings will not be allowed.

13. Provide wall cleanout after last plumbing fixture and in the ADA stall. Wall cleanout to be installed 12" above the flood rim of the ADA water closet.
 14. Provide wall cleanout for each urinal.
- J. Plugs:
1. Install temporary plugs in all open sanitary drain pipes during construction to prevent any foreign objects from entering the pipe.
 2. All floor drains to have plugs until substantial completion.
- K. Vent Piping:
1. Connections:
 - a. Connect two or more vents together and extend as one vent through the roof, where practical.
 - b. Make vent and waste connections to stacks by using 45-degree wyes, long sweep quarter bends, sixth, eighth, or sixteenth bends. Sanitary tees may be used on the vertical stacks.
 2. Flashing:
 - a. Use minimum 10-inch square, 4-pound lead flashing.
 - b. Flange the flashing to the lead sleeve.
 - c. Extend the flashing up and around the vent pipe.
 - d. Turn the flashing down inside the pipe at least 2 inches to make an absolutely watertight joint.
 - e. For single-ply rooftop systems, flash according to the roofing specifications.
 3. Location:
 - a. Do not locate any vent within 15 feet of an outside air intake.
 4. Termination:
 - a. 12 inch above roof deck or 2 inch above parapet, whichever is greater.
- L. Identification Of Piping And Equipment
1. Mark all piping to show the service and direction of flow.
 2. Place markers at each branch of tees, at equipment connections, and change of direction and at 20-foot intervals. Minimum of one (1) marker in each room.

3.2 SLEEVES

- A. Above Grade and/or Dry Locations:
1. Walls:
 - a. Mount flush on both sides.
 2. Floors:
 - a. Mount 2 inches above finished floor in pipe chases.
- B. Below Grade and/or Moist Locations:
1. Install suitable flange in the center of wall or floor to form a waterproof passage.
 2. Fill the void space around the pipe with jute twine or Oakum caulk or an asphalt based compound to insure a waterproof penetration.
- C. Passing Through Fire-Rated Enclosure:
1. Fill the void space around the pipe in accordance with NFPA requirements.
 2. Do not allow the sleeve installation to lower the fire rating of the assembly.

3.3 SECURING AND SUPPORTING OF PIPE

- A. Support all pipe from the building structure by means of approved hangers and supports while maintaining required grade and pitch, preventing vibration, and providing for expansion and contraction.
- B. Secure all hangers to approved inserts wherever possible.
- C. Set hanger inserts in place when the concrete is poured.
- D. If Joists Are Used for Attachment:
 - 1. Must be attached to the top cord of the joists.
 - 2. Do not support any piping and trapeze hangers from joist bridging on roof and floor deck.
- E. If Structural Steel Framing Is Used for Attachment:
 - 1. Use approved beam clamps.
 - 2. Where required, install channels to span between framing members.
 - 3. Do not attach hangers to the roof deck or cross bracing.
- F. Crawlspace Location:
 - 1. All pipe to be suspended from structure with hangers.
- G. Hanger Spacing:
 - 1. Schedule 40 PVC Piping:
 - a. All Sizes:
 - 1) 4'-0"
 - 2. Ferrous (Schedule 40) Piping:
 - a. 1/2" diameter pipe:
 - 1) 6'-0" or less
 - b. 3/4" diameter pipe:
 - 1) 8'-0" or less
 - c. 1-1/4" diameter pipe:
 - 1) 10'-0" or less
 - d. Vertical:
 - 1) Every Floor Level Minimum
- H. Vertical Lines:
 - 1. Adequately support at their bases, either by a suitable hanger placed in the horizontal line near the riser or by a base fitting set on a pedestal or foundation.
 - 2. Support from each floor slab by means of an approved clamp-type support which bears on the slab or beam.
- I. Change of Direction:
 - 1. Install supports within two feet of change of direction.
 - 2. Brackets of approved type may be used along the walls.
 - 3. Install hangers within 2 feet of each change in vertical or horizontal direction, pipe tees, and on each side of valves, strainers, etc.
 - 4. Multiple horizontal pipes, smaller than 12" diameter pipe, may be supported on trapeze hangers. Space trapeze hangers in accordance with the schedule for pipe spacing based upon the smallest size pipe.
 - 5. Properly size the trapeze members for the piping load they are to support. The number of pipes on the trapeze must be approved by the Engineer to prevent overloading of the building structure.

6. Where pipes are insulated, oversize the hanger accordingly to accommodate the outside diameter of the insulation. Provide half-round 16 gauge galvanized steel shields, not less than 12" long and rolled to fit the insulation diameter, between the insulation and the hanger.
7. When pipe is guided at top and bottom, cover the entire pipe circumference with metal shields.
8. Adhere metal shield to the insulation so that the metal will not slide with respect to the insulation.
9. Wood struts shall not be used to support piping in walls.

J. P-traps within Ceiling Spaces

1. Provide double clevis hangers to hold p-traps in place/position.

3.4 EXCAVATION AND BACKFILLING

A. Excavation:

1. Call utility companies before digging.
2. Call Notifications Center before digging.
3. Excavate trenches for underground piping to the required depths with bell holes being provided as necessary to ensure uniform bearing. Dig all bell holes after the trench has been graded.
4. Refill excavation below the required grade of piping with fine granular material to the pipe grade.
5. Where rock is encountered, excavate to a grade 3 inches below the lowermost part of the rock and refill with fine granular materials to trench grade. Not to be confused with pipe embedment material. Refer to section 2 of this spec for embedment.
6. Sheath, brace, pump or bail the trenches as required to protect workmen and structures and to permit execution of the work. A trench greater than 5 feet deep will not be permitted unless the sides are cut back at 45 degrees to 5 feet or less. If this cannot be accomplished, hire a Registered Engineer to design shoring.
7. Install all underground piping below the frost line and in no case less than 18 inches below the surface.

3.5 TESTING

- A. Temporarily plug sanitary drain piping.
- B. Fill the pipes with water.
- C. Test the system in sections so that no section has a pressure less than 10 feet of water.
- D. If the level of water has been decreased by leakage after a 24-hour period, then locate and repair all leaks.
- E. Repeat the test until there is no perceptible decrease in the water level over a 24-hour period.
- F. Sewer Pressurization Test:
 1. Provide smoke pressure test after plumbing top out/before sheetrock is installed and again at substantial completion.
 2. All smoke test on the sanitary sewer system is to be performed before ceiling tiles are installed, no exception.
 3. After all water tests are complete, perform smoke test to ensure there are no air leaks in building. Fill all p-traps with water and temporarily cap all vents prior to testing.
 4. Procedure for Plumbing Sewer Pressurization Test Using a Visual Smoke Indicator:

- a. Contact your local city water department, some cities may provide and supervise a smoke test for your facility.
 - b. Prior to the test, notify the local fire and police departments that you are conducting a smoke test of the facility.
 - c. Prior to the test, turn off the fire alarms. The smoke will activate the alarm. After the test is complete the building will have to be ventilated to clear smoke and then the alarm can be reactivated.
 - d. You are required to have a blower with adjustable pressure control and liquid smoke or white smoke bombs.
 - e. Inflatable ball stops are required to block off the sewer line at the building manhole that connects to the city sewer main line.
 - f. All sewer vents on the facility have to be sealed to properly conduct the test. (Duct tape over the openings is acceptable.)
 - g. Ladders, portable lights, two-way radio communication, and standard hand tools are required for access above ceilings, floor drains, etc.
 - h. A minimum of three helpers are required to conduct the test.
 - i. Prior to the test, identify rooms or problem areas that should be observed first. Plumbing drawings are required to identify the locations of vents, traps, restrooms, etc.
 - j. This test will pressurize the sewer piping (approximately 1.25" S.P.) and identify any deficiencies.
 - k. If there are questions, contact EMA Engineering & Consulting: Phone 903-581-2677.
 - 5. Provide TV video of all main sanitary sewers in building and to city main. Notify Owner's Representative when video is to be made 48 hours prior to work.
- G. Job Photographs:
- 1. Contractor is to provide digital photographs of all pipe showing embedment prior to covering trenches.

END OF SECTION

SECTION 221601 - FUEL GAS PIPING AND APPURTENANCES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Natural gas piping

1.2 REFERENCES

- A. ASTM A53/A53M - Pipe, steel, black and hot-dipped, zinc coated, welded, and seamless
- B. ASTM A240/A240M - Standard specification for chromium and chromium-nickel stainless steel plate, sheet, and strip for pressure vessels and for general applications
- C. ASTM D2774 - Underground installation of thermoplastic pressure piping
- D. ASTM E84 - Standard test method for surface burning characteristics of building materials
- E. ASTM F-1668 - Construction procedures for buried plastic pipe
- F. UL 181BM - Procedures for HVAC system design and installation
- G. NFPA 54 - National Fuel Gas Code
- H. AWS - American Welding Society
- I. ASTM D2513 - Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings
- J. ASME B16.44 - Manually operated metallic gas valves for use in gas piping systems up to 5 psi.
- K. ANSI Z21.15 - Manually operated gas valves for appliances, appliance connector valves, and hose end valves.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Provide submittal data on all equipment specified in this section in accordance with Section 22 00 00, General Conditions, and Division 01.
- B. Submittals shall include:
 - 1. Pipe
 - 2. Pipe Supports
 - 3. Fittings
 - 4. Regulators
 - 5. Sleeving Materials
 - 6. All accessories
- C. Submit product data indicating typical catalog of information including arrangements.
- D. Submit product data sheets indicating dimensions, general assembly, and materials used in fabrication.

1.4 COORDINATION

- A. Coordinate installation of the gas piping with the Authority Having Jurisdiction.
- B. Obtain approval from the Authority Having Jurisdiction of all pipe sizes before installing any piping.
- C. Call gas company and Notification Center before digging.

1.5 QUALITY ASSURANCE

- A. All welders shall be certified by AWS or other accredited program.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

- A. All proposed substitutions shall be submitted for PRIOR APPROVAL on each project. Requests must be received by the Engineer and / or Owner's Representative no less than ten business days prior to the bid date. Contractor shall list all deviations from the specified unit and furnish COMPLETE submittal data. Approval of a substitution shall be in writing and shall not relieve the Contractor from compliance with the requirements of the Contract Documents.

2.2 PIPING AND FITTINGS

- A. Outside the building above grade and on roof:
 - 1. Viega MegaPressG Carbon Steel Press-Connect Fittings
 - a. Approved for underground applications in accordance with local codes and authorities having jurisdiction.
 - b. Approved for swing-joint applications.
 - c. Shall be listed to CSA 6.32 / ANSI LC-4.
 - d. Carbon steel alloy fitting with corrosion-resistant zinc/nickel coating.
 - e. 1/2" to 4" Iron Pipe Size.
 - f. Sealing Element: HNBR elastomeric sealing element rated to 125 psi (max) with a temperature range of -40 to 180 degrees (F). Sealing element shall be uniform in size/thickness and shall be free from manufactured deformities or indentations.
 - g. 420 stainless steel grip ring.
 - h. 304 stainless steel separator ring for 1/2" to 2", graphite separator ring for 2-1/2" to 4".
 - i. Press Connect fitting shall have Smart Connect Technology to detect unpressed fittings during the testing process.
 - j. Color-coded markings on exterior of fitting for readily identifying/inspecting sealing element type.
 - 2. Single source manufacturer. Technology and installation instructions vary between manufacturers.
 - 3. Approved manufacturer: Viega LLC
- B. Above the slab, within the interior of the building, and on roof:
 - 1. Standard weight, Schedule 40 black steel pipe with malleable iron fittings. Conform to ASTM A53/A53M.
 - a. Threaded on all gas piping on roof 2 inches in diameter and smaller, butt joint welded on roof on all 2-1/2" diameter and larger.
 - b. Socket welded fittings on ALL fittings and joints inside the building.
 - 1) Manufacturer:

(a) Anvil

- C. Outside of the building below grade:
 - 1. Polyethylene gas pressure pipe and fittings with fused joints.
- D. Transition Service Riser:
 - 1. Manufacturer/Model:
 - a. Central Plastics Co. (Shawnee, OK) 610-0111
 - 2. Use for the underground riser leading into the building.

2.3 GAS COCKS

- A. Type:
 - 1. Brass with tee or square head for wrench operation.

2.4 UNIONS

- A. Type:
 - 1. Malleable iron, insulating type.

2.5 PIPE FLANGED FITTINGS

- A. Type
 - 1. Per ANSI B16.5 Class 150 flanges.

2.6 VALVES

- A. Provide an approved design which does not allow locking in the open position.
- B. Larger than 2 inches:
 - 1. Provide with a lubricated stop.

2.7 GAS PIPE SLEEVING

- A. Pipe:
 - 1. Schedule 40 PVC for ducted return mechanical systems.
 - 2. Sleeving material in accordance with Local Authority having jurisdiction and per mechanical system type
- B. Prior to installation, verify with City all approved methods of gas pipe sleeving.

2.8 PIPE SUPPORTS

- A. Hangers:
 - 1. 2" and Smaller Piping:
 - a. May be split cast ring type with fastening device in walls and chases.
 - 2. Copper Piping:
 - a. Copper plated ferrous hangers.
 - 3. All Other Above Ceiling Locations:
 - a. Adjustable clevis type. Hangers to accommodate circumference of pipe and saddles.
- B. Hanger Rods:
 - 1. Type:
 - a. Minimum 3/8 inch diameter with machine threads.
 - 2. Minimum Steel Hanger Rod Diameter for Individually Suspended Horizontal Pipes:

- a. 2" and smaller diameter pipe:
 - 1) 3/8"
 - b. 2-1/2" to 3 - 1/2" diameter pipe:
 - 1) 1/2"
 - c. 4" to 5" diameter pipe:
 - 1) 5/8"
 - d. 6" diameter pipe or larger:
 - 1) 3/4"
- C. In wall pipe supports:
 - 1. Metal strut, manufactured pipe clamps
- D. Approved Manufacturers:
 - 1. Hangers:
 - a. Anvil
 - b. Elcen
 - c. ERICO
 - d. F&S Manufacturing
 - e. Fee & Mason
 - f. PHD
 - g. Empire Industries
 - h. George Strut
 - 2. In wall pipe support manufacturer:
 - a. Holdrite or Equivalent

2.9 ROOF PIPE SUPPORTS

- A. Manufacturers:
 - 1. MAPA MS-5
 - 2. Miro Industries Model 3 RAH (3-inch or less)
 - 3. Pipe Hangers and Devices (PHP) Model PP10
 - 4. Portable Pipe Hangers (PHP) Model PP10
 - 5. ERICO RPS 360407
 - 6. C-Port CXM20 Series / CREW Series
- B. Manufacturer to select correct size for size and weight of pipes.
- C. Pipe models listed above are for 3-inch or smaller gas pipe.
- D. All roof supports to be equal to MAPA Products Model MS-5, adjustable height, select size designed for size of pipe supported. MS-5 for 4" and smaller. For pipe sizes 6" and larger provide trapeze style roof supports MAPA Master Base series or equal.
 - 1. Install 1/2" rubber walk pad under each pipe support.
- E. MAPA MWP 1/2" thick rubber walk pad.
 - 1. Coordinate exact locations of supports with roofing contractor.
- F. Roof supports to support all gas piping a minimum of 6" above roof.
 - 1. Coordinate exact locations of supports with roofing contractor.
 - 2. Install 1/2" rubber walk pad under each pipe support.
 - 3. Spacing of Supports (Horizontal):
 - a. 1/2" 6 feet or less
 - b. 3/4" or 1" 8 feet or less

- c. 1¼" or larger 10 feet or less
- d. Install supports within 2 feet of every change of direction.
- 4. Spacing of Supports (Vertical):
 - a. ½" 6 feet or less
 - b. ¾" or 1" 8 feet or less
 - c. 1¼" or larger 10 feet or less
 - d. Install supports within 2 feet of every change of direction.
 - e. At least every floor level install supports within 2 feet of every direction.

2.10 MEDIUM PRESSURE REGULATORS

- A. Manufacturers:
 - 1. Itron B42 Series or as shown on drawings.
 - 2. Fisher or equivalent

2.11 GAS METERS

- A. Make all arrangements with local gas utility company to obtain gas service. Coordinate exact location of meter, correct size, and pressure with gas utility company as indicated on plans.

PART 3 - EXECUTION

3.1 POLYETHYLENE PIPING

- A. Install a minimum of 18 inches deep.
- B. Attach a number 18 copper tracer wire to the piping and terminate above grade at both ends.
- C. Do not bend the piping to a radius of less than 20 times the nominal diameter of the pipe.
- D. Installed piping with enough slack to ensure that it will not be subjected to thermally induced strain which could damage the piping system.
- E. Fusion joints according to manufacturer's instruction.

3.2 BLACK STEEL PIPING

- A. **All piping routed through exposed public areas must be routed as high as possible.**
- B. Make all joints above grade and on roof gas piping 2-1/2" and larger by welding.
- C. Do not install steel piping underground, except at risers.
- D. Protect all underground black steel piping, (including underground riser to a point at least 6 inches above grade) where exposed on the exterior against corrosion by means of yellow "polyken" wrapping, 3M #51 "Scotchwrap", or Republic Steel's "X-Tru-Coat". Gas pipe protective coatings shall be approved types, machine applied conforming to recognized standards.
- E. Field wrapping shall provide equivalent protection and is restricted to those short sections and fittings necessarily stripped for threading or welding.
- F. Provide a #17 anode, insulating fittings, etc., for cathodic protection at the meter and each entry underground.

3.3 GAS COCKS

- A. Provide all final connections with gas cocks.
- B. Mount gas cocks in vertical pipes only on all rooftop gas-fired equipment.

3.4 GAS TURRETS

- A. Plumbing contractor to provide low-pressure gas piping routed behind casework or in wall to each and every gas turret. Coordinate all turret locations with the architect's laboratory casework plan.

3.5 VALVES

- A. Provide all outlets at individual sites and any building supplied by the system with a readily accessible approved valve.
- B. Install valves in the gas piping within 3 feet of each appliance and ahead of the union connection.

3.6 MEDIUM PRESSURE REGULATORS

- A. All regulators shall be located in mechanical rooms, or on roofs as shown on plans.
- B. Each regulator shall have a separate vent to the outside.
- C. Each regulator shall be installed with an approved gas valve upstream of each regulator.
- D. Gas regulators to be installed no closer than 10'-0" to any outside air intake.

3.7 GAS PIPE SLEEVING LOCATIONS

- A. Sleeve all gas piping routed in concrete masonry walls and extend vent up through gooseneck roof termination. Gas piping routed down ICF or tilt wall panels shall not be routed in these walls. Route down along these wall types in chase wall.
- B. Vent all science/biology/chemistry valve enclosures up thru roof and terminate on roof with a gooseneck. Coordinate all valve enclosures with electrical contractor. Furnished by the electrical contractor and installed by the plumbing contractor.
- C. Sleeve all gas pipe roof penetrations from the hooded roof penetration thru the roof decking. Penetration at decking to be cut neatly and shall match the perimeter of pipe to allow fire putty application.
- D. At the main gas line building entry up to roof, sleeve gas piping from the point of entry up to the hooded roof penetration.
- E. All gas lines serving science/biology/chemistry demonstration desk will be sleeved in schedule 40 PVC pipe and fittings. Pipe and fittings to be glued and tested for leaks before backfilling. Sleeve ends to extend no less than 6" above slab.
- F. Sleeve all gas piping routed down in walls that are fire rated or are sound walls that have sheetrock extending up to the bottom side of the roof decking. Sleeve to terminate on room side of entry point and exit point of gas piping.

3.8 PRESSURE-CONNECT FITTINGS FOR STEEL PIPING

- A. Join carbon steel piping and press-connect fittings with tools recommended by fitting manufacturer.
- B. The manufacturer's installation instructions shall be strictly adhered to.
- C. All connections shall bear full insertion marks on the pipe.
- D. Special attention shall be given to the required two step pressure test.
 - 1. Initial test for unpressed fitting detection shall be in accordance with manufacturer's installation manual.
 - 2. Following a successful Smart Connect test, inspection, testing and purging of the fuel gas system shall be in accordance with local codes or, in the absence of local codes, in accordance with the International Fuel Gas Code, NFPA 54/National
 - 3. Fuel Gas Code z223.1, the Uniform Plumbing Code, NFPA 58, or CSA B 149.1 as applicable.
- E. The installers shall be credentialed by Viega.
- F. Press fitting manufacturer shall provide a duplicate set of all tools required to maintain and/ or modify press fittings. Required tools are to be given to the owner. One set of tools shall be provided for each project.

3.9 SOCKET WELD FITTING LOCATIONS

- A. All interior gas piping in all locations to be installed using socket weld fittings. Install per manufacturer's recommendations.

3.10 UNIONS

- A. Install a union at each gas regulator as noted on detail, at each rooftop unit tie-in per detail, and just downstream of cut-off valve on gas lines that penetrate roof.

3.11 PIPE FLANGED FITTINGS

- A. Install pipe flanged fittings on medium pressure gas piping at locations to allow future relocation for reroofing of building (approximately 50 foot lengths).

3.12 CONNECTIONS TO EQUIPMENT

- A. Connect the gas piping with pipe fittings.
- B. Provide for thermal expansion for straight runs of pipe over 100 feet.
- C. Flexible connectors will not be allowed on any equipment. Connect with black steel pipe and unions.

3.13 GAS METER

- A. Coordinate with gas utility.

3.14 SLOPE

- A. Slope all pipe a minimum of 1/4 inch per 15 feet to prevent traps. All horizontal lines shall slope to the risers and slope from the risers to the meter or to a service regulator when a meter is not provided.
- B. If a trap is unavoidable, a drip leg shall be installed. Drip legs shall be installed at the meter and at all appliances. Drip leg to be a minimum of 4" from tee turn down to cap.

3.15 PAINTING

- A. Paint in accordance with architectural specifications and color selected by Architect. Color to be flat black on roof and to match wall color on vertical riser to roof if color not otherwise instructed.

3.16 INSPECTION

- A. Do not enclose or cover any work until it has been inspected, tested, and accepted by local authority having jurisdiction.

3.17 TESTING

- A. Procedure:
 - 1. Subject gas piping systems to a pneumatic pressure test of 60 pounds per square inch for 30 minutes.
 - a. While the systems are subject to this air pressure, apply a soapy water solution to all welded joints for the purpose of detecting minute, as well as larger leaks.
 - b. If leaks are found in welded lines, repair by chipping and rewelding operations.
 - c. Repeat alternate testing and rewelding operations until the gas piping systems are absolutely tight.
 - d. If leaks occur at threaded joints, eliminate such leaks by replacing the fittings or properly tightening them.
 - e. Finally, subject the entire gas piping system to a pneumatic pressure test of 50 psi for a period of 24 hours and demonstrate that the piping system is absolutely tight.
- B. Perform any other tests as required by the City or other governing bodies.

END OF SECTION

SECTION 230000 - BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Basic mechanical requirements necessary to provide complete installation of all Division 23 work.

1.2 WORK INCLUDED

- A. This section of work comprises furnishing of all materials, equipment, tools, scaffolding, rigging, hoisting, labor, and transportation necessary for the complete installation of the mechanical systems as shown on the plans and as specified herein.
- B. Bidders shall determine the contents of a complete set of drawings and specifications and be aware that they may be bidding from a partial set of drawings, applicable only to the various separate contracts, subcontracts, or trades as may be issued for bidding purposes only. The contract documents and the complete scope of work for the project are illustrated on the combined Architectural, Structural, Plumbing, Heating, Ventilating, Air Conditioning, and Electrical, and each Bidder shall thoroughly acquaint himself with all the details of the complete set of drawings and specifications before submitting his bid. All drawings and specifications form a part of the contract documents for each separate contract and shall be considered as bound therewith in the event partial sets of plans and specifications are issued for bidding only. The submission of bids shall be deemed evidence of the review and examination of all drawings, specifications, and addenda issued for this project as no allowances will be made because of unfamiliarity with any portion of the complete set of documents.

1.3 CODES AND REFERENCE STANDARDS

- A. General:
 - 1. Perform all Division 23 work in strict accordance with the requirements and recommendations stated in all the latest editions of the applicable state codes, national building codes and local ordinances.
 - 2. Nothing in the Contract Documents shall be construed to permit work not conforming to these codes.
 - 3. When two or more codes or standards are applicable to the same work, then the stricter code or standard shall govern.
 - 4. The date of the code or standard that is in effect on the date of issue of the contract documents except when a particular publication date is specified.
 - 5. The Contractor shall be held responsible for verifying all local codes and ordinances that may alter any part of the plans or specifications. The Contractor shall bear all costs for correcting the deficiencies.
 - 6. Where local codes and ordinances are not in writing or on record, but a local precedence has been set, the Owner shall pay for any additional cost incurred.
- B. Applicable Codes and Standards for All Division 23 Work:
 - 1. International Building Code
 - 2. International Gas Code
 - 3. International Plumbing Code
 - 4. International Mechanical Code
 - 5. International Energy Conservation Code

6. National Electrical Code
7. American Society of Heating, Refrigerating and Air Conditioning Engineers Standards.
8. Occupational Safety and Health Administration Standards:
 - a. OSHA Standard 2207 - Construction Industry Standards
 - b. OSHA 29 CFR 1926 - Regulation of Excavation
 - c. All other applicable standards
9. National Fire Protection Association:
 - a. NFPA 90A - Installation of Air Conditioning and Ventilating Systems
10. Clean Air Act and Clean Air Act Amendments
11. State Codes:
 - a. All other applicable codes
12. Local Municipal Codes and Ordinances

1.4 SCHEDULE OF ABBREVIATIONS

- A. Reference Standards are listed in Section 23 using abbreviations listed below:
1. AABC (NSTSB) - Associated Air Balance Council
 2. AASHTO - American Association of State Highway and Transportation Officials
 3. ADA - Americans with Disabilities Act
 4. ADC - Air Diffusion Council
 5. A/E - Architect/ Engineer
 6. AGA - American Gas Association
 7. AMCA (DIR) - Air Moving and Conditioning Association
 8. ANSI - American National Standards Institute
 9. AHRI - Air-Conditioning and Refrigeration Institute
 10. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers
 11. ASME - American Society of Mechanical Engineers
 12. ASPE - American Society of Plumbing Engineers
 13. ASTM - American Society for Testing and Materials
 14. AWE - American Welding Society
 15. AWWA - American Water Works Association
 16. CGA - Compressed Gas Association
 17. CISPI - Cast Iron Soil Pipe Institute
 18. CS - Commercial Standard
 19. CSA - Canadian Standards Association
 20. DIPRA - Ductile Iron Pipe Research Association
 21. DOT - Department of Transportation
 22. DOC - Department of Commerce
 23. FCC - Federal Communications Commission
 24. FM - Factory Mutual
 25. FS - Federal Specification
 26. GSHPA - Ground Source Heat Pump Association
 27. IBC - International Building Code
 28. ITL - Independent Testing Laboratories
 29. NEC - National Electric Code
 30. NFPA - National Fire Protection Association
 31. NSF - National Sanitation Foundation
 32. OSHA - Occupational Safety and Health Administration
 33. PDI - Plumbing and Drainage Institute
 34. SMACNA - Sheet Metal and Air Conditioning National Association
 35. UBC - Uniform Building Code
 36. UL - Underwriters Laboratories

1.5 QUALITY ASSURANCE

- A. Provide complete installations of all systems.
- B. Furnish all items of equipment, material, and labor to complete the Contract even though each and every item necessary is not specifically mentioned or shown.
- C. In case of any conflict between the specifications, plans, and ordinances, the ordinances shall govern.
- D. All materials furnished under this Contract shall be new, free from defects of any kind, of the quality and design hereinafter specified, and shall conform to the standards of Underwriter's Laboratories Inc., except for equipment which U.L. does not list or provide label service.
- E. All mechanical equipment and fixtures shall be the same brand unless scheduled differently on plans.
- F. Contractor's Responsibility:
 - 1. Contractor assumes all responsibility regarding the safety of his personnel on the project during construction.
 - 2. Erect barricades, protective fencing, and signs to prevent injury to personnel on site.
 - 3. Make permanent connection to utilities or existing lines. Determine depth and location, and bid accordingly.
 - 4. Relocate and repair any existing lines cut by general construction work.
 - 5. Pay all costs in connection with metering devices.
 - 6. Plans do not show exact location and elevations of lines, nor do they show all offsets required.
 - 7. Deviate from plans as required to conform to the general construction and provide proper grading.
 - 8. Maintain all utility services during construction to existing portions of job that remain.
 - 9. Procure and pay for all necessary permits or licenses to carry out the work.
 - 10. Obtain and pay for all the necessary certificates of approval which must be delivered to the Architect/Engineer before final acceptance of the work.
 - 11. Periodically remove rubbish, clean or repair all surfaces marred by the work required under this contract.
 - 12. Protect work from damage by other trades.
 - 13. Make all tests required by law; pay all costs in connection with the testing.
 - 14. Where job conditions require changes in indicated locations and arrangement, make such changes without extra cost to Owner.
 - 15. Provide motor starters, controls, relays, all low-voltage wiring, conduit and wiring related to HVAC and other equipment and devices to form a complete working system.

1.6 DEFINITIONS

- A. Approval:
 - 1. It is understood that approval must be obtained from the Architect/Engineer in writing before proceeding with the proposed work.
 - 2. Approval by the Architect/Engineer of any changes, submitted by the Contractor will be considered as general only to aid the Contractor in expediting his work.
- B. Contractor:
 - 1. The Contractor engaged to execute the work included in a particular section only, even though he may be technically described as a Subcontractor to the General Contractor.

2. If the Contractor engaged to execute said work employs Sub-Contractors to perform various portions of the work included under this Section, he shall be held responsible for the execution of same, in full conformity with Contract Document requirements.
 3. The Contractor shall cooperate at all times and shall be responsible for the satisfactory cooperation of his Subcontractors with the other Contractors on the job so that all of the various phases of the work may be properly coordinated without unnecessary delays or damage to any parts of the work of any Contractor.
- C. Provide:
1. Defined as requiring the furnishing and installing of the item or facility indicated, complete in all respects, and ready for operation unless otherwise specifically noted.
- D. As Required:
1. Indicates that the Contractor shall perform the work or provide the material as indicated in accordance with manufacturer's installation instructions; and in accordance with applicable codes or regulations; and in a workmanlike manner as defined by good local practice.
- E. Or Equal:
1. Indicates that the Contractor may substitute equipment by another manufacturer if the salient features of the equipment indicated by manufacturer's name and/or described are, in the judgment of the Architect/Engineer, adequate. Submittals for review are required where indicated.
- F. Intent of Contract Documents:
1. The specific intent of these documents is to provide to the Owner, in a thoroughly functional condition, all the various systems, equipment, etc., indicated herein. Final authority over interpretation of the "intent" shall rest with the Architect/Engineer.

1.7 WARRANTY

- A. The Contractor shall warranty his work against defective materials and workmanship for a period of one year from the date of acceptance of the job.
- B. Neither the final payment nor any provisions in Contract Documents shall relieve the Contractor of the responsibility for faulty materials or workmanship.
- C. He shall remedy any defects due thereto, and pay for any damage to other work resulting therefrom, which shall appear within a period of one year from date of substantial completion.
- D. The Owner shall give notice of observed defects with reasonable promptness.
- E. This Guarantee shall not be construed to include the normal maintenance of the various components of the system covered by these specifications.

1.8 SITE VISIT

- A. Before submitting his proposal, each bidder shall examine all plans and specifications relating to the work, shall visit the site of the project and become fully informed of the extent and character of the work required.
- B. No consideration will be granted for any alleged misunderstanding of the materials to be furnished or the amount of work to be done, it being fully understood that the tender of a proposal carries with it the agreement to all items and conditions referred to herein, or indicated on the accompanying plans or required by nature of the site of which may be fairly implied as essential to the execution and completion of any and all parts of the work.

1.9 PROJECT RECORD DOCUMENTS

- A. The Contractor shall keep a set of plans on the job, noting daily all changes made in connection with the final installation including exact dimensioned locations of all new and uncovered existing utility piping outside the building.
- B. Upon submitting his request for final payment, he shall turn over to the Architect/Engi, for subsequent transmittal to the Owner, a clean, neatly marked set of reproducible plans showing "as installed" work and an electronic file with changes of materials.
- C. In addition to the above, the Contractor shall accumulate during the job's progress the following data, in duplication (2 each), prepared in 3 ring binders of sufficient size, black in color, neat in appearance, and turned over to the Architect/Engineer for checking and subsequent delivery to the Owner. Electronic copies of the following are also acceptable, but they must be saved to a single flash drive or external hard drive:
 - 1. All warranties, guarantees, and manufacturer's directions on equipment and material covered by the Contract.
 - 2. Approved fixture brochures.
 - 3. Copies of reviewed shop drawings.
 - 4. Set of operating instructions. Operating instructions shall also include recommended maintenance and seasonal changeover procedures.
 - 5. Any and all other data and/or plans required during construction.
 - 6. Repair parts lists of all major items and equipment including name, address, and telephone number of local supplier or agent.
- D. The first page, or pages, shall have the names, addresses, and telephone numbers of the following:
 - 1. General Contractor and all sub-contractors.
 - 2. Major Equipment Suppliers.

1.10 TRAINING

- A. Upon completion of the work and at a time designated by the Owner's representative, provide a formal training session for the Owner's operating personnel to include location, operation, and maintenance of all mechanical equipment and systems, some sections have further instructions.
- B. Before proceeding with instruction, prepare a typed outline in triplicate listing the subjects that will be covered. Submit the outline for review by the Owner's representative.
- C. At the conclusion of the instruction, obtain the signatures of the attendees on each copy of the outline to signify that they have a proper understanding of the operation and maintenance of the system. Submit the signed outlines to the Owner's representative and Engineer as a condition of final acceptance.

1.11 PLANS AND SPECIFICATIONS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions, and Division 01 Specifications apply to all of Division 23.
- B. The plans show diagrammatically the locations of the various lines, ducts, conduits, fixtures, and equipment and the method of connecting and controlling them.
- C. It is not intended to show every connection in detail and all fittings required for a complete system.
- D. The systems shall include but are not limited to the items shown on the plans.

- E. Exact locations of these items shall be determined by reference to the general plans and measurements of the building and in cooperation with other contractors, and in all cases, shall be subject to the approval of the Architect/Engineer.
- F. The Architect/Engineer reserves the right to make any reasonable change in the location of any part of this work without additional cost to the Owner.
- G. Contractor, subcontractor, vendors, and suppliers are required to waive subrogation against Owner and Engineer.

1.12 UTILITIES, LOCATIONS, AND ELEVATIONS

- A. Locations and elevations of the various utilities within the scope of this work have been obtained from the City and/or other substantially reliable sources and are offered separately from the Contract documents, as a general guide only, without guarantees as to accuracy.
- B. The Contractor shall examine the site, shall verify to his own satisfaction the locations, elevations and availability of all utilities and services required, and shall adequately inform himself as to their relation to the work; the submission of bids shall be deemed evidence thereof.
- C. The Contractor shall coordinate all services with the Utility Companies during construction, coordinate changes made by Utility Companies to the design of project, and coordinate with the Owner, Architect/E, and Utility the scheduling of any shutdowns or delays that may occur in providing service.
- D. The Contractor shall verify location, conduct all necessary tests, inspections, coordinate with Owner's representatives and utilities, and check for existing underground utilities and lines before ditching.
- E. The Contractor shall be responsible for repair of any cut or damaged lines or utilities he uncovers. There are lines and utilities not shown on any plans.

1.13 SUBSTITUTION OF PRODUCTS

- A. Substitution of products specified herein will be considered only when a complete list of proposed alternative equipment is submitted to the Engineer in writing, supported by adequate technical and cost data. This includes a complete description of the proposed substitution, drawings, catalog cuts, performance data, test data, or any other data or information necessary for evaluation.
- B. All proposed substitutions and data must be received by the Engineer no less than seven working days prior to the scheduled date for opening of bids.
- C. The Engineer will consider all such submittals and the Architect/Engineer will issue an addendum listing items which the Engineer considers acceptable. Only such items as specified or approved as acceptable will be installed on this project.
- D. Manufacturers' names are listed herein and on the plans to establish a standard of quality and design. Where a manufacturer's name is mentioned, products of other manufacturers will be acceptable, if, in the opinion of the Engineer, the substitute material is of equivalent quality or better than that of the material specified.
- E. The Contractor's Bid represents that the bid price is based solely upon the materials and equipment described in the Bid Documents (including addenda, if any) and that he contemplates no substitutions or extras.

- F. Requests for substitution are understood to mean that the Contractor:
1. Has personally investigated the proposed substitution and determined that it is equal or superior in all respects to that specified.
 2. Will provide the same guarantee for the substitution that he would for that specified.
 3. Will, at no cost to the Owner, replace the substitute item with the specified product if the substitute item fails to perform satisfactorily.
 4. After Award of the Contract, substitutions will be considered only under one or more of the following circumstances:
 - a. The substitution is required for compliance with subsequent interpretations of code or insurance requirements.
 - b. The specified product is unavailable through no fault of the Contractor.
 - c. The manufacturer refuses to warranty the specified products as required.
 - d. Subsequent information that the specified product is unable to perform properly or to fit in the designated space.
 - e. In the Engineer's sole judgment, the substitution would be in the Owner's best interest.
 5. Revisions to the mechanical system shall be under the supervision of the Engineer at a standard hourly rate charged by the Engineer and shall be paid by the Contractor originating the changes.

1.14 PROTECTION OF EQUIPMENT AND MATERIALS

- A. Contractor shall continuously maintain adequate protection of both stored and installed materials and equipment. Fixtures and equipment, whether located inside or outside, shall be tightly covered with sheet polyethylene or waterproof tarpaulin as protection against dirt, rust, moisture and abuse from other trades. Adequate air circulation shall be provided under any protective sheet to prevent condensate build up. Materials and equipment shall not be stored directly on the ground, floor or roof deck. Ductwork, piping and equipment shall not be used by other trades as supports for scaffolds or personnel. At the completion of the work, equipment, fixtures, exposed supports and piping shall be cleaned of dirt, construction debris, overspray, etc., to the satisfaction of the Architect/Engineer. Repairs made necessary by damage shall be paid for by the Contractor.
- B. Contractor in performing his work shall take particular care not to damage the structure. All finished floors and step treads shall be covered to prevent any damage by workmen or their tools and equipment during the construction of the building. In addition, each Contractor shall protect any materials on the job site whether a part of this contract or the property of another Contractor.
- C. Contractor shall be responsible for damage to project caused by this Contractor's failure to recognize hazards associated with items such as leaks, scheduling of work, inexperienced workmen, excessive cutting, etc.
- D. Contractor shall familiarize himself with working conditions to the extent that he shall be responsible for damage to concealed piping, wiring and other equipment to remain and shall repair any damage caused by his negligence at no cost to the Owner.
- E. The Contractor shall take such precautions as may be necessary to properly protect his apparatus from damage.
- F. This shall include the creation of all required temporary shelters to adequately protect any apparatus above the floor of the construction and the covering of apparatus in the completed building with tarpaulins or other protective covering.

- G. Failure to comply with the above to the satisfaction of the Owner's inspector will be sufficient cause for the rejection of the equipment in question and its complete replacement by this Contractor.
- H. All apparatus shall be cribbed up from the floor or ground by the Contractor and covered with tarpaulins or other protective covering where necessary or directed.
- I. Each contractor shall provide space for storage of materials, equipment or tools at ground level. Any storage contemplated within the building will be allowed only upon specific approval of the Architect/Engineer.

1.15 FINAL INSPECTION

- A. It shall be the duty of this Contractor to make a careful inspection trip of the entire project, assuring himself that the work on the project is ready for final acceptance before calling upon the Architect/Engineer to make a final inspection.
- B. To avoid delay of final acceptance of the work, the Contractor shall have all necessary bonds, warranties, receipts, affidavits, etc., called for in the various articles of these specifications, prepared and signed in advance, together with a letter of transmittal, listing each paper included, and shall deliver the same to the Architect/Engineer at or before the time of said final inspection. The Contractor is cautioned to check over each bond, receipt, etc., before preparing for submission to verify that the terms check with the requirements of the specifications.

1.16 ASBESTOS

- A. No asbestos or asbestos containing materials shall be permitted in this project.

1.17 CUTTING AND PATCHING

- A. All Subcontractors shall notify the General Contractor sufficiently ahead of construction of any floors, walls, ceiling, roof, etc., of any openings that will be required for his work.
- B. He shall see that all sleeves required for his work are set at proper times so as to avoid delay of the job.
- C. All necessary cutting of walls, floors, partitions, ceilings, etc., as required for the proper installation of the work under this Contract shall be done at the Subcontractor's expense in a neat and workmanlike manner, and as approved by the Architect/Engineer.
- D. No joists, beams, girders, or columns shall be cut by any Contractor without first obtaining written permission of the Architect/Engineer.
- E. Patching of openings and/or alterations shall be provided by the General Contractor.
- F. All openings in firewalls and floors shall be completely sealed after installation for a completely airtight installation. Sealing material shall be non-combustible and UL approved. The installed sealing assembly shall not cause the fire rating of the penetrated structure to be decreased.
- G. All openings in exterior walls shall be sealed watertight.

1.18 MANUFACTURER'S INSTRUCTIONS

- A. All equipment and devices shall be stored, protected and installed in accordance with these plans and specifications, manufacturer's instructions, and applicable codes.

- B. Where specifications call for installation of a product to be in accordance with manufacturer's instructions and/or where manufacturer's instructions are required for installation of a product, it shall be the contractor's responsibility to obtain the necessary applicable manufacturer's instructions and install the product in accordance with the manufacturer's instructions.
- C. It shall be the Contractor's responsibility to install all equipment, materials, and devices shown on the plans and as called out in these specifications even if manufacturer's instructions are absolutely unattainable.
- D. Any such work performed that does not comply with the manufacturers' directions shall have deficiencies corrected at no cost to the Owner.

1.19 RELATED WORK

- A. Whether specifically identified or not, it is the responsibility of the Mechanical Contractor to coordinate all mechanical work with all related trades.

1.20 ELECTRICAL WIRING AND EQUIPMENT FOR MECHANICAL SYSTEMS

- A. All wiring, conduit, boxes, equipment (controls, thermostats, relays, contactors, motor starters, heaters, switches), and any other control devices or equipment required to form a complete and properly operating system, shall be the responsibility of the Mechanical Contractor.
- B. The Electrical Contractor shall only provide line voltage (including hook-up) to all mechanical equipment.
- C. All mechanical controls and devices shall be low voltage unless otherwise noted or shown on the plans. Where line voltage controls or devices are noted, the Contractor shall provide complete wiring diagrams (approved by the Engineer) to the Electrical Contractor prior to final hook-up.
- D. All electrical resistance heating elements which are scheduled to be served by three-phase electrical power shall impose an equal electrical load on all phases. Electrical resistance elements which are not balanced over all three phases are not acceptable.
- E. The Mechanical and Electrical plans are based on the equipment and devices scheduled as shown on the plans or as called for in the specifications. Should any mechanical equipment or device be changed or approved from those which are shown or noted, all electrical and/or mechanical changes shall be made at the expense of the trade or contractor initiating the change with no expense to the Owner, Architect, Engineer or their representatives.
- F. All wiring provided by this Contractor shall be installed in a workmanlike manner using tie wraps, labels, anchors and etc. Loose wiring is not acceptable.
- G. All conduit in all areas plus conduit and boxes required in all walls for control purposes (thermostats, etc.) shall be provided by electrical contractor.

1.21 DEMOLITION AND REMODEL

- A. It shall be the responsibility of this Contractor to see that all demolition and remodeling work involving his trade (including but not limited to chilled and hot water piping used for space cooling and heating, condensate lines, air handlers, mechanical equipment, etc.) is accomplished in a manner and completeness to provide the appearance of new construction work.
- B. Abandoned air conditioning units shall be removed and disposed of off-site in a legal manner.

- C. Any usable equipment and/or structure damaged during demolition and remodel work shall be replaced.
- D. All abandoned and/or otherwise unused piping shall be securely capped using materials of the same composition as the original piping.
- E. No exposed piping and/or other materials will be permitted in the finished job.
- F. Any abandoned piping which penetrates the slab in an exposed area shall be securely capped below the slab.

1.22 OPERATION PRIOR TO COMPLETION

- A. When any piece of mechanical or electrical equipment is operable and the Contractor needs to operate the equipment, he may do so providing that he properly supervises the operation.
- B. The warranty period shall, however, not commence until such time as the equipment is operated for the beneficial use of the Owner.
- C. Regardless of whether or not the equipment has or has not been operated, the Contractor shall properly clean the equipment, install clean filter media, properly adjust and complete all punch list items before final acceptance by the Owner.
- D. The date of acceptance and the start of the warranty may not be the same date.

1.23 SAFETY GUARDS

- A. Contractor shall furnish and install all safety guards required. All belt driven equipment, projecting shafts, and other rotating parts shall be enclosed or adequately guarded.

1.24 FLAME SPREAD PROPERTIES OF MATERIALS

- A. All materials and adhesives used for air conditioning filters, acoustical lining, and insulation shall conform to NFPA and UL life and flame spread properties of materials.
- B. The composite classifications shall not exceed the flame spread rating and the smoke development rating as outlined by NFPA 255/ ASTM E-84 for the basic material, the finishes, adhesives, etc., specified for each system, and shall be such when completely assembled.

1.25 FILTER ASSEMBLIES

- A. All filter housings and assemblies shall be factory built and supplied with the unit. A separate filter rack may be required and is the responsibility of the mechanical contractor to provide.
- B. Access doors (panels) must be opened to change the air filters shall be labeled "Filter Access" and the number and size of required filters shall be identified.
- C. No piping conduit etc. shall be installed in front of this access door.
- D. Install clean filters prior to substantial completion.
- E. All air handlers shall have filters installed upstream of all coils.

1.26 LEAD MATERIALS

- A. No lead or lead containing materials shall be allowed in any domestic or potable water supply piping, valves, fixtures, components, equipment, or any other item.

1.27 REFRIGERANTS

- A. Chlorofluorocarbons (CFCs) and Hydrochlorofluorocarbons (HCFCs) shall not be allowed in any equipment on this project.
- B. Comply with ASHRAE Standards 15 and 34.

1.28 REFRIGERANT RECOVERY AND RECYCLE

- A. Refrigerants shall not be released to the environment.
- B. Contractor shall provide recovery and recycle equipment that has been certified by the Electrical Testing Laboratories or Underwriters Laboratories.
- C. Contractor shall also provide properly trained and certified (in accordance with EPA) personnel for refrigerant work during installation, demolition, start-up, servicing, etc.

1.29 ACCESS CLEARANCE

- A. Proper access to all installed equipment shall be provided. The Mechanical Contractor shall label all points of access immediately upon installation with a marker pen.
- B. A minimum of 3 feet shall be maintained in front of all access points.
- C. If another trade violates this space, the Mechanical Contractor shall immediately notify the General Contractor to correct this condition.
- D. When equipment is installed above lay-in ceiling the Mechanical Contractor shall coordinate with the Ceiling Contractor to provide access without removing part of T-bar ceiling.
- E. No speakers, lights, fire alarm equipment, etc. shall be installed in lay-in ceiling tiles where access is to be gained.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. All materials shall be new and free from defects at the time of installation. Materials or equipment damaged in shipment or otherwise damaged prior to installation shall not be repaired at the job site, but shall be replaced with new.

2.2 MANUFACTURERS REQUIREMENTS

- A. When a manufacturer's name appears in these specifications, it is not to be construed that the manufacturer does not have to meet the full requirements of the specifications or that his standard cataloged item will be acceptable.

PART 3 - EXECUTION

3.1 CONFLICTS, INTERFERENCES AND COORDINATION BETWEEN TRADES

- A. Drawings are not to be construed as shop drawings, but indicate the extent, general location, arrangement, etc., of piping systems and equipment. This Contractor shall refer to other sections of the specifications and other drawings such as electrical, structural, architectural, etc., in order to eliminate conflicts and undue delays in the progress of the work. Where other

Contractors furnish items requiring piping connections by this Contractor, they will be held responsible for providing roughing-in drawings and assistance upon request.

- B. Each trade shall so harmonize its work with that of the other trades so that the work may be done in the most direct and workmanlike manner without hindering the other trades. Piping interference shall be handled by giving precedence to pipelines which require a stated grade for proper operation.

3.2 TESTING

- A. After all mechanical systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequence and operation throughout the range of operation regardless of the season the contractor shall test all HVAC equipment in both heating and cooling modes.
- B. Each and every phase of the new air conditioning, heating, and ventilating systems shall be operated separately, or in conjunction with the other, for a period of time, to demonstrate to the satisfaction of the Architect/Engineer the ability of the equipment to meet the capacity and performance requirements while maintaining design conditions in accordance with the true intent and purpose of these specifications.
- C. Previous to such performance tests, the Contractor shall have set all valves, dampers, motors, controllers, thermostats, etc., and shall have the system operating and maintaining design temperatures, humidity, and air circulation throughout all areas of the building.
- D. Make adjustments as required to ensure proper functioning of all systems.
- E. Special tests on individual systems are specified under individual sections.
- F. See Section 23 05 93 for Testing, Adjusting, and Balancing for HVAC.

END OF SECTION

SECTION 230090 - HVAC SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This section supplements Division 01 Submittal Procedures and contains additional requirements applicable to Division 23 submittals.

1.2 SECTION INCLUDES

- A. This section includes, but is not limited to:
 - 1. HVAC submittal procedures
 - 2. This section applies only to the Division 23 specifications. Submittals required by other specification divisions are not included here, even though the same subcontractor may be providing work under other divisions.

1.3 DEFINITIONS

- A. Product Data: Illustrations, standard schedules, performance charts, instructions, and brochures furnished by the contractor, subcontractor, manufacturer, or supplier to illustrate materials or equipment or to illustrate some portion of the work. Provide a summary of scheduled items with all data in schedules.
- B. Shop Drawings: Drawings, diagrams, schedules, and other data specifically prepared for the work by the contractor, subcontractor, manufacturer, or supplier to illustrate some portion of the work.
- C. Equipment/Material Submittal Package: A compilation of the product data, shop drawings, and other items as required by the specifications, submitted near the start of the work. Typically, the specifications require the initial submittal package to be submitted within a certain number of days after the work starts.
- D. Quality Assurance Submittal: Items submitted before and during the execution of a particular portion of the work for the purpose of guarding against defects and deficiencies.
- E. Quality Control Submittal: Items submitted at the completion of a particular portion of the work for the purpose of evaluating completed activities and elements of the work for conformance with contract requirements (e.g. start-up reports).
- F. Closeout Submittals: Items submitted at or near the completion of the contract.

1.4 SUBMITTALS

- A. The materials, workmanship, design, and arrangement of all work installed under this contract shall be subject to the review of the architect, engineer, and owner. Review of shop drawings and/or submittal data shall not relieve the Contractor of responsibility for deviations from the contract drawings or specifications.
- B. Manufacturers: Manufacturers submitted shall be as per the acceptable manufacturers listed in each specification section or referenced schedule.

- C. Required Submittals: All material, components and equipment that fall under Division 23 shall be submitted.
- D. Contractor's Coordination Submittals: The contractor may require his subcontractors to provide drawings, setting diagrams, and similar information to help coordinate the project, but such data shall remain between the contractor and his subcontractors and will not be reviewed by the engineer.
- E. Electronic Submittals: E-mail or other electronic forms of submittals from the contractor are required. The procedures described in this section shall be as follows:
 - 1. The contractor shall supply one electronic copy of the submittal.
 - 2. The electronic files will either be e-mailed to the architect or posted to a project management and information exchange website, depending on the architect's requirements. The architect and contractor can distribute copies of the files as desired.
 - 3. The engineer will retain an electronic copy of the submittal and all responses.
- F. Coordination Correspondence: The contractor may desire to verify the acceptability of a particular item prior to assembling the initial submittal package. The contractor may send material directly to the engineer for comments and feedback. This communication will be treated as normal coordination correspondence and will not be tracked or documented as a formal submittal. The engineer may or may not respond to such correspondence. If the engineer agrees, in writing, to the use of a particular item, then that same material shall be included in the initial submittal package along with a copy of the correspondence.
- G. Unapproved Products: If materials or equipment are installed before being reviewed by the engineer, the contractor shall be liable for the removal and replacement of such unapproved materials and equipment, at no additional expense to the owner. Additionally, if the removal and replacement of rejected materials or equipment necessitates the removal and replacement of other related materials or equipment, then the contractor shall be liable for the removal and replacement of the related materials and equipment at no additional expense to the owner.
- H. Product Data: Where the content of manufacturer submittal literature includes data not pertinent to the submittal, clearly indicate which portions of the contents are being submitted for review. Catalogs, pamphlets, or other documents submitted to describe items on which review is being requested shall be specific and identifications in catalogs, pamphlets, etc., of items submitted shall be clearly made in a contrasting ink or highlighting. Data of a general nature shall not be acceptable.
- I. Shop Drawings:
 - 1. Contractor shall submit shop drawings showing all piping, ductwork and equipment shown by drawings and specification. Submit drawings on all mechanical rooms and congested areas. The drawings shall be coordinated with structural, electrical and fire sprinkler drawings. Submit prior to construction of work.
 - 2. Scale and measurements: Make shop drawings accurately to a scale sufficiently large to show all pertinent aspects of the item.
 - 3. Electronic shop drawing submittals are required.

PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 SUBMITTALS

- A. Make submittals of product data, shop drawings, samples, quality assurance submittals, quality control submittals, and other items in accordance with the requirements of this section, applicable sections in Division 23, and additional requirements of each individual Division 23 specification section.
- B. Grouping of Submittals:
 - 1. The submittal package shall be coordinated and included in a single submission. Multiple submissions are not acceptable except where prior written approval has been obtained from the engineer. Partial submittals may be rejected, without being reviewed, as not complying with the provisions of the contract.
 - 2. In the case that multiple submissions are approved, it is the responsibility of the contractor to maintain and update a submittal checklist. The contractor shall ensure that all applicable submittal sections are submitted to the Engineer. If a submittal section is not submitted, it will be considered rejected until reviewed by the Engineer.
 - 3. If submittal sections are submitted as individual submittal files, the submittal sections will be grouped and returned as one file with one set of submittal responses.
- C. Electronic Submittal Organization:
 - 1. Electronic submittals are to be submitted as a single PDF file. Within the PDF file, each section shall be bookmarked.
 - 2. Provide an electronic submittal cover sheet that lists at least the following:
 - a. Project name
 - b. Date
 - c. Name and address of architect
 - d. Name and address of engineer
 - e. Name, address, and telephone number of prime contractor
 - f. Name, address, and telephone number of HVAC contractor
 - g. Name, address, and telephone number of HVAC supplier
 - 3. Provide an electronic index sheet listing all items submitted.
 - 4. The contractor shall call to the attention of the engineer, clouded in the submittal and noted after the index sheet, any instance in which the submittals are known to differ from the requirements of the contract documents.
 - 5. Organize all required items by specification section. The material for each specification section shall be organized as follows:
 - a. Provide an electronic section cover sheet that lists the same information as the submittal cover sheet, plus the specification number and title and the name, address, and telephone number of the vendor or vendor's representative, if applicable.
 - b. Refer to the individual Division 23 specification sections for any required organization of the submittal material within each submittal section.
 - c. Bookmarked sections shall be arranged by specification section number in numerical order.
 - d. Submit in accordance with these procedures and procedures described in Division 01 Submittal Procedures.

- e. Submittals not organized as described here may be rejected, without being reviewed, as not complying with the provisions of the contract.
- D. Response to engineer's review:
- 1. Review comments: Review comments of the engineer will either be shown on the returned sets to the contractor or shown on a document attached to the sets. If the comments are on an attached document, then the engineer will place a note on the submittal referring to the attached comments. In such cases, the engineer's signature will appear only on the attached document. If the attached, signed document becomes physically separated from the submittal, then the submittal will no longer be considered as being a reviewed submittal.
 - 2. Complete rejection: If the submittal is not complete or does not meet the requirements of this specification section, then the engineer may reject the entire submittal and return the submittal without further review or comment. In such cases, the entire submittal shall be completely revised and resubmitted. The resubmittal shall be given a new submittal number and shall be documented and processed as a separate submittal from the original.
 - 3. Held for completion: If the submittal is not complete, but is only missing some minor item, the engineer may, at the engineer's sole discretion, hold the submittal rather than rejecting and returning the submittal. In such cases, the engineer will notify the architect and contractor that the submittal is being held for completion. The contractor will be given a predetermined amount of time to provide the missing item. Upon receipt of the missing item, the engineer will insert the missing item into the submittal package and proceed with the review process.
 - 4. Partial rejection: The engineer may reject only certain portions of the submittal. In such cases, only those rejected portions or items need to be revised and resubmitted.
 - 5. Provide as noted and corrected: The engineer may note a required change to a submitted item, but may not consider the change serious enough to require a resubmittal. In such cases, the engineer will note that the item is to be provided as noted or corrected. In such cases, the contractor may proceed to provide the item. However, if subsequent observations reveal that the noted change was not made, then the contractor shall be liable for removal and replacement of the item at no additional cost to the owner.
 - 6. Reviewed without comment: The contractor may proceed to provide all materials and equipment as submitted.
- E. Close-out Submittals:
- 1. Provide close-out submittals and O&M's at or near completion of the contract.

END OF SECTION

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Isolation pads
- B. Concrete bases
- C. Expansion joints
- D. Other supports

1.2 RELATED SECTIONS

- A. Section 23 00 00 - Basic Mechanical Requirements
- B. Section 23 00 90 – HVAC Submittal Procedures

1.3 SUBMITTALS

- A. Product Data:
 - 1. Provide submittal data on all items specified in this section in accordance with Section 23 00 90, General Conditions, and Division 1.
 - 2. Submit shop drawings and catalog data with locations of use.

1.4 REFERENCES

- A. Refer to Section 23 00 00 for complete names of references identified in this section.
- B. SMACNA Standards
- C. ASHRAE - American Society of Heating, Refrigeration and Air Conditioning Engineers

1.5 QUALITY ASSURANCE

- A. Isolation devices must be provided by a company whose sole business is to provide isolation equipment.
- B. All equipment and materials to be installed in workmanlike manner by experienced mechanics and as recommended by the manufacturers.
- C. Design Data: Complete design of isolation equipment including confirmation that no noise will be transmitted to structure of building.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Provide isolation and support devices as required for all mechanical equipment.

2.2 FLEXIBLE DUCT CONNECTIONS

- A. Use "Ventglas" fabric, fireproof, waterproof, and mildew resistant, approximately 30 ounces per square yard.
- B. Comply with SMACNA standards.

2.3 HVAC PIPE SUPPORTS

- A. Hangers:
 - 1. All Copper Piping
 - a. Copper plated ferrous hangers.
 - 2. 2" and smaller piping in walls:
 - a. May be split cast ring type with fastening device in walls and chases.
 - 3. Trapeze Hangers for Multiple Pipes
 - a. Steel channels with welded spacers and hanging rods
 - 4. All Other Above Ceiling Locations:
 - a. Adjustable clevis type. Hangers to accommodate circumference of pipe and saddles.
- B. Vertical Supports:
 - 1. Wall support for 3" or smaller diameter pipe:
 - a. Cast iron hooks
 - 2. Wall support for 4" or larger diameter pipe:
 - a. Welded steel bracket and wrought steel clamp
- C. Floor Supports:
 - 1. Cast iron adjustable pipe saddle, lock, nut, nipple, floor flange, concrete pier or steel support
- D. Hanger Rods:
 - 1. Type:
 - a. Sized per load and a minimum of 3/8 inch diameter with machine threads.
- E. Minimum Steel Hanger Rod Diameter for Individually Suspended Horizontal Pipes:
 - 1. 2" and smaller diameter pipe:
 - a. 3/8"
 - 2. 2-1/2" to 3-1/2" diameter pipe:
 - a. 1/2"
 - 3. 4" diameter pipe:
 - a. 5/8"
 - 4. 5" to 6" diameter pipe:
 - a. 3/4"
 - 5. 8" to 12" diameter pipe or larger:
 - a. 7/8"
 - 6. 14" to 18" diameter pipe or larger:
 - a. 1"
 - 7. 20" to 30" diameter pipe or larger:
 - a. 1 1/4"

2.4 SLEEVES

- A. Application:
 - 1. Provide sleeves for all pipes and conduits which pass through a concrete slab, masonry wall/concrete wall, roof, or other portion of the building structure. Each pipe and duct,

- regardless of material, which passes through a concrete slab, masonry wall, roof or other portion of the building structure shall be free from the structure and shall pass through a sleeve.
2. After installation of pipe and duct through sleeves, all sleeves shall be sealed with materials suitable for maintaining thermal resistance, acoustic properties, and weatherproofing of walls, roofs, etc.
- B. Above Grade and/or dry locations:
1. Material:
 - a. 18 gauge galvanized steel.
 2. Size:
 - a. As necessary to allow free passage of the insulated pipe.
- C. Passing through fire-rated enclosures:
1. Material:
 - a. Fire stopped using approved materials to maintain the fire rating of the structure
 - b. Galvanized or black steel pipe.
 - c. Non-combustible.
 - d. PVC will not be allowed.

PART 3 - EXECUTION

3.1 ISOLATION DEVICES AND PAD INSTALLATION

- A. Install isolation pads between floor and equipment pads according to manufacturer's recommendations and approved shop drawings.
- B. Install flexible duct connections where ducts connect to fans or air handling units.
- C. All joints to be airtight.
- D. Provide a minimum of 1/2" slack in connections, and a minimum of 2½" distance between the edges of ducts.
- E. Comply with recommendations of ASHRAE for the selection and application of vibration materials and units.

3.2 SECURING AND SUPPORTING OF HVAC PIPING

- A. Support all pipe from the building structure by means of approved hangers and supports while maintaining required grade and pitch, preventing vibration and providing for expansion and contraction.
- B. Secure all hangers to approved inserts wherever possible.
- C. Set hanger inserts in place when the concrete is poured.
- D. If Joists Are Used for Attachment:
 1. 2" diameter or smaller:
 - a. May be attached to the bottom of joists.
 2. Greater than 2" diameter:
 - a. Must be attached to the top cord of the joists.
 3. Do not support any piping and trapeze hangers from joist bridging on roof and floor deck.

- E. If Structural Steel Framing Is Used for Attachment:
 - 1. Use approved beam clamps.
 - 2. Where required, install channels to span between framing members.
 - 3. Do not attach hangers to the roof deck or cross bracing.
- F. Hanger Spacing:
 - 1. Schedule 40 Black Steel Piping:
 - a. 1" diameter pipe or less → 6'-0" or less
 - b. 1-1/4" diameter pipe and larger → 8'-0" or less
 - 2. Copper Piping:
 - a. Smaller Than 1 1/4" → 6'-0" or less
 - b. 1 1/2" and Larger → 8'-0" or less
 - 3. HDPE or Plastic Pipe:
 - a. All pipe → 5'-0" or less
 - 4. All Vertical Spacing:
 - a. 8'-0" or less
 - b. Every Floor Level Minimum
 - c. Adequately support at their bases, either by a suitable hanger placed in the horizontal line near the riser, or by a base fitting set on a pedestal or foundation.
 - d. Support from each floor slab by means of an approved clamp-type support which bears on the slab or beam.
- G. Change of Direction:
 - 1. Install supports within two feet of change of direction.
 - 2. Brackets of approved type may be used along the walls.
 - 3. Install hangers within 2 feet of each change in vertical or horizontal direction, pipe tees and on each side of valves, strainers, etc.
 - 4. Multiple horizontal pipes, smaller than 12" diameter pipe, may be supported on trapeze hangers. Space trapeze hangers in accordance with the schedule for pipe spacing based upon the smallest size pipe.
 - 5. Properly size the trapeze members for the piping load they are to support. The number of pipes on the trapeze must be approved by the Engineer to prevent overloading of the building structure.
 - 6. Where pipes are insulated, oversize the hanger accordingly to accommodate the outside diameter of the insulation. Provide half-round 16 gauge galvanized steel shields, not less than 12" long and rolled to fit the insulation diameter, between the insulation and the hanger.
 - 7. When pipe is guided at top and bottom, cover the entire pipe circumference with metal shields.
 - 8. Adhere metal shield to the insulation so that the metal will not slide with respect to the insulation.
 - 9. Wood struts shall not be used to support piping in walls.

3.3 SLEEVES

- A. Above Grade and/or Dry Locations:
 - 1. Walls:
 - a. Mount flush on both sides.
 - 2. Floors:
 - a. Mount 2 inches above finished floor in pipe chases.
- B. Passing Through Fire-Rated Enclosure:

1. Fill the void space around the pipe in accordance with NFPA requirements.
2. Do not allow the sleeve installation to lower the fire rating of the assembly.

END OF SECTION

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Testing and balancing services for the heating, ventilating, and air conditioning (HVAC) systems of this project.
- B. The testing and balancing agency will be responsible for the satisfactory execution of testing and balancing of the HVAC systems.

1.2 RELATED SECTIONS

- A. Section 23 00 00 - Basic Mechanical Requirements
- B. Section 23 00 90 – HVAC Submittal Procedures

1.3 STANDARDS

- A. The balancing agency shall perform the services specified herein in accordance with the Associated Air Balance Council's National Standards, including revisions, to the date of the contract.
- B. All terms in this specification shall have their meaning defined as stated in the National Standards.
- C. If these specifications set forth more stringent requirements than the AABC National Standards, these specifications shall prevail.

1.4 QUALIFICATIONS OF THE BALANCING AGENCY

- A. The balancing agency/firm shall be a registered member of the Associated Air Balance Council (AABC) and/or certified by the National Environmental Balancing Bureau (NEBB).
- B. To perform required professional services, the balancing agency shall have a minimum of one "Test and Balance Engineer" certified by the Associated Air Balance Council and/or the National Environmental Balancing Bureau (NEBB).
- C. This certified "Test and Balance Engineer" shall be responsible for supervision and certification for the total work herein specified.
- D. The balancing agency shall submit records of experience in the field of air and hydronic system balancing or any other data as requested by the Owner/Engineer. The supervisory personnel for the firm shall have at least five (5) years' experience, and be a full-time employee for a minimum of six (6) months prior to the project. All employees used in this project shall be qualified technicians in this specific field.
- E. The balancing agency shall furnish all necessary calibrated instrumentation to adequately perform the specified services. An inventory of all instruments and devices in possession of the balancing agency may be required by the Owner to determine the balancing agency's performance capability.
- F. The balancing agency shall have operated for a minimum of five (5) years under its current name.

1.5 DOCUMENTS

- A. The General Contractor will provide the balancing agency one copy of the following documents:
 - 1. Project drawings (mechanical sepia's if requested) and specifications.
 - 2. Reviewed construction revisions pertaining to the HVAC systems.
 - 3. Reviewed submittal data on HVAC equipment and systems to be installed by the Mechanical Subcontractor.
 - 4. Reviewed HVAC shop drawings.
 - 5. Reviewed HVAC wiring diagrams, control diagrams, and equipment brochures, as appropriate.

1.6 COORDINATION

- A. It will be necessary for the balancing agency to perform its services in close coordination with the Mechanical Subcontractor.
- B. The plans and specifications indicate meters, valves, dampers, and other devices for the purpose of adjusting the system to obtain optimum operating conditions. It will be the responsibility of the Mechanical Subcontractor to install these devices in a manner that will leave them accessible, readily adjustable, and complete. The balancing agency shall provide guidance if there is a questionable arrangement of a control or balancing device.
- C. The General Contractor, Mechanical Contractor, Temperature Controls Subcontractor, and the suppliers of the HVAC equipment shall all cooperate with the balancing agency to provide all necessary data on the design and proper application of the system components. In addition, they shall furnish all labor and materials required to eliminate any system deficiencies.

1.7 RESPONSIBILITIES OF THE MECHANICAL CONTRACTOR

- A. The Mechanical Contractor shall complete the installation and start all HVAC systems to ensure they are working properly and shall perform all other items as described hereinafter to assist the balancing agency in performing the testing and balancing of the HVAC systems.
- B. Air Distribution Systems:
 - 1. Verify installation for conformity to design.
 - 2. Terminate all supply, return, and exhaust ducts, and pressure test them, for leakage, as required by specification.
 - 3. Ensure that all splitters, extractors, and volume and fire dampers are properly located and functional. Dampers serving requirements of minimum and maximum outside, return, relief, and exhaust air shall provide tight closure and full opening, with a smooth and free operation.
 - 4. Verify that all supply, return, exhaust, and transfer grilles; registers; diffusers; and high-pressure terminal units are installed and operational.
 - 5. Ensure that air-handling systems, units, and associated apparatus, such as heating and cooling coils, filter sections, access doors, etc., are blanked and/or sealed to eliminate excessive bypass or leakage of air.
 - 6. Ensure that all fans (supply, return, relief, and exhaust) are operating and free of vibration. All fans and drives shall be checked for proper fan rotation and belt tension. Overload protection shall be of proper size and rating. A record of motor current and voltage shall be made to verify that the motors do not exceed nameplate rating.
 - 7. Make any necessary changes to the sheaves, belts, and dampers, as required by the balancing agency, at no additional cost to the Owner.
 - 8. Install clean filters.

1.8 RESPONSIBILITIES OF THE TEMPERATURE CONTROLS CONTRACTOR

- A. The Temperature-Controls Contractor shall allow sufficient time in the project to provide assistance and instruction to the balancing agency in the proper use and setting of control components such as, but not limited to, computers, static pressure controllers, or any other device that may need set points changed so that the testing and balancing work can be performed.
- B. Furnish to the balancing agency any software and cables required to make adjustments to controls. Any unique micro-processor required to set controls shall be furnished by Temperature Controls Contractor.
- C. The Temperature Controls Contractor shall complete the installation of the temperature control system, and operate and test all control systems to ensure they are functioning properly as designed. The Temperature Controls Contractor shall assist the balancing agency in testing and balancing the HVAC systems, as described hereinafter.
 - 1. Verify that all control components are installed in accordance with project requirements and are functional, including all electrical interlocks, damper sequences, air, and water reset, and fire and freeze stats.
 - 2. Verify that all controlling instruments are calibrated and set for design operating conditions.
 - 3. Calibrate room thermostats/sensors after installation, and before the thermostat control verification tests are performed. The balancing agency shall prove the accuracy of final settings by taking temperature readings. The readings shall be in a typical conditioned space for each separately controlled zone.

1.9 PRE-BALANCING CONFERENCE

- A. Prior to beginning of the testing, adjusting, and balancing procedures, schedule and conduct a conference with the Architect/Engineer, General Contractor, Mechanical Contractor, Electrical Contractor, and Temperature Controls Contractor. The objective of the conference is final coordination and verification of system operation and readiness for testing, adjusting, and balancing.

1.10 NOTIFICATION FOR TESTING AND BALANCING WORK TO BEGIN

- A. The general contractor shall notify the balancing agency in writing when all heating, ventilating, and air conditioning systems are complete and ready for testing and balancing. The Mechanical Contractor shall attest that he has completed all items as described in "RESPONSIBILITIES OF THE MECHANICAL CONTRACTOR" Section of these specifications.
- B. If upon commencing the work, the balancing agency finds that the systems are not ready, or if a dispute occurs as to the readiness of the systems, the balancing agency shall request an inspection to be made by the Mechanical Engineer. This inspection shall establish to the satisfaction of the represented parties whether or not the systems meet the basic requirements for testing and balancing. Should the inspection reveal the notification to have been premature, the balancing agency shall be reimbursed for all costs for the inspection and work previously accomplished. Furthermore, such items that are not ready for testing and balancing shall be completed and placed in operational readiness before testing and balancing services shall again be requested.

PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 SCOPE

- A. In accordance with Project Drawings and Specifications and as specified herein, the balancing agency shall provide all supervision, personnel, instruments, calibration equipment, and all other materials and services necessary to perform all testing and balancing of the heating, ventilating, and air conditioning systems. All test data including all pertinent calculations shall be reported on appropriate forms.

3.2 GENERAL

- A. The testing and balancing of the heating, ventilating, and air conditioning systems shall be performed by an independent balancing agency approved by the Engineer. The balancing agency shall have a minimum of five years specialized experience in air and hydronic system balancing, possess calibrated instruments, certified "Test and Balance Engineers", and skilled technicians to perform all required tests. The balancing agency shall be a certified member of the Associated Air Balance Council and/or the National Environmental Balancing Bureau (NEBB).
- B. The tests shall demonstrate the specified capacities and operation of all equipment and materials comprising the systems. The balancing agency shall then make available to the Owner's representative such instruments and technicians as are required for spot checks of the system.
- C. The balancing agency shall not instruct or direct the Mechanical Contractor in any of the work. Any proposed changes or revisions in the work shall be submitted to the Architect and General Contractor in writing.
- D. Document Review:
 - 1. The Test and Balance Firm shall be responsible for reviewing the HVAC plans and specifications relating to the test and balance services for proper arrangement and adequate provisions of devices for testing, adjusting, and balancing.
 - 2. Test and Balance Firm shall review HVAC manufacturers' submittals data relative to balanceability.
 - 3. Test and Balance Firm shall review submitted HVAC automatic temperature control sequences for conformity to the specifications.

3.3 SERVICES

- A. During construction, the balancing agency shall inspect the installation of pipe systems, sheet metal work, temperature controls, and other component parts of the heating, ventilating, and air conditioning systems.
- B. The inspections shall be performed periodically as the work progresses. A minimum of two inspections are required as follows: (1) when 60 percent of the ductwork is installed; (2) when 90 percent of the equipment is installed. The balancing agency shall submit a brief written report of each inspection to the General Contractor and Engineer.

- C. Upon completion of the installation and start-up of the mechanical equipment by the Mechanical Contractor, the balancing agency shall test and balance the system components to obtain optimum conditions in each conditioned space in the building.

3.4 DEFICIENCIES

- A. If in the process of performing the TAB work, any deficiencies encountered shall be brought to the attention of the contractor responsible through defined procedures and entered in the punch list of deficiencies on the next daily Status Report. If correction of the deficiency is urgent, the matter shall be brought to the attention of all involved parties for quick resolution. The General Contractor shall provide and coordinate services of qualified responsible subcontractors, suppliers, and personnel as required to correct, repair, or replace any and all deficient items or conditions during the testing, adjusting, and balancing period.
- B. The notification may be for single or multiple deficiencies. The work necessary to correct items on the listing shall be performed and verified in writing by the affected trade.
- C. All deficiencies that prevent proper TAB work from being completed shall be corrected prior to submittal of the Final TAB Report, unless the correction of such deficiencies cannot be accomplished in a reasonable period of time, in which case the Mechanical Engineer may grant permission to submit the Final TAB Report with the deficiencies detailed in the report.

3.5 AIR SYSTEM PROCEDURES

- A. The balancing agency shall perform the following testing and balancing functions in accordance with the Associated Air Balance Council's National Standards:
 - 1. Fan Speeds:
 - a. For all two stage units, low and high fan speeds must be individually set. For all multistage units, every fan speed step must be individually set. When controls contractor are directly controlling fan speed, the balancing agency shall provide the fan speeds needed to control units at every stage.
 - b. Test and adjust fan RPM to achieve design CFM requirements.
 - 2. Current and Voltage:
 - a. Measure and record motor current and voltage.
 - 3. Pitot-tube Traverse:
 - a. Perform a Pitot-tube traverse of main supply and return ducts to obtain total CFM. If a Pitot-tube traverse is not practical, the summation of the outlets or inlets may be used. An explanation of why a traverse was not made must appear on the appropriate datasheet.
 - 4. Outside Air:
 - a. Test and adjust system minimum outside air by Pitot-tube traverse. If a Pitot-tube traverse is not practical, the percentage of outside air may be determined by calculations from the return air, outside air, and mixed air temperatures. Make allowances for heat of compression and motor heat where applicable.
 - 5. Static Pressure:
 - a. Test and record system static pressures, including suction and discharge static pressure of each fan.
 - 6. Air Temperature:
 - a. Take wet-bulb and dry-bulb air temperatures on the entering and leaving side of each cooling coil. Dry-bulb temperature shall be taken on the entering and leaving side of each heating coil.
 - 7. Zone Ducts:

- a. Adjust zone ducts to within design CFM requirements. At least one zone balancing damper shall be completely open.
8. Main Ducts:
 - a. Adjust main ducts to within design CFM requirements and traverse for total CFM quantities.
9. Branch Ducts:
 - a. Adjust branch ducts to within design CFM requirements. Multi-diffuser branch ducts shall have at least one outlet or inlet volume damper completely open.
10. Tolerances:
 - a. Test and balance each diffuser, grille, and register to within 10 percent of design requirements.
11. Identification:
 - a. Identify the location and area of each grille, diffuser, register, and terminal box. This information shall be recorded on air outlet data sheets.
12. Description:
 - a. Record the size, type, and manufacturer of each diffuser, grille, and register on air outlet data sheets.
13. Terminal Boxes:
 - a. Set volume regulators on all terminal boxes to meet design maximum and minimum CFM requirements. All associated temperature controls shall be checked for proper operation and calibration. If the terminal boxes have separate settings for heating and cooling CFM, the CFM quantities for each shall be recorded on air outlet data sheets. All diffusers connected to the terminal box shall be read in the heating and cooling modes and their readings recorded on air outlet data sheets.
14. Minimizing Drafts:
 - a. Adjust all diffusers, grilles, and registers to minimize drafts in all areas.

3.6 VERIFICATION OF TEMPERATURE CONTROL

- A. The balancing agency shall be assisted by the Temperature Controls Contractor in verifying the operation and calibration of all temperature control systems. The following tests shall be conducted:
 1. Verify that all control components are installed in accordance with project requirements and are functional, including all electrical interlocks, damper sequences, air and water reset, and fire and freeze stats.
 2. Verify that all controlling instruments are calibrated and set for design operating conditions.
 3. Verify the accuracy of the final settings by taking temperature readings. The readings shall be in a typical conditioned space for each separately controlled zone.
- B. In the process of performing the TAB work, the balancing agency firm shall:
 1. Verify that all dampers, valves, and other controlled devices are operated by the intended controller.
 2. Verify that all dampers and valves are in the position indicated by the controller (open, closed, or modulating).
 3. Verify the integrity of valves and dampers in terms of tightness of close-off and of full-open position. This includes dampers in VAV terminals.
 4. Check that all valves are properly installed in the piping system in relation to direction of flow and location.
 5. Verify the proper application of all normally open and normally closed valves.
 6. Check the locations of all thermostats and humidistats for potential erratic operation from outside influences such as sunlight, drafts, or cold/hot walls.

7. Check the locations of all sensors to determine whether their position will allow them to sense only the intended temperatures or pressures of the media.
 8. Check the sequence of operation for any control mode to ensure that it is in accordance with the Contract Documents.
- C. Verify that all controller set points meet the design intent. Record observations of systems under DDC control. Record all default set points if different from operating set points.
 - D. Check all dampers for free and full operation, and record any obstructions.
 - E. Verify the operation of all interlock systems.
 - F. Perform all system verifications to assure the safety of the system and its components.
 - G. Verify that the changeover from heating to cooling mode occurs as specified.

3.7 TEST AND BALANCE REPORT

- A. The test and balance report shall be complete with logs, data, and records as required herein. All logs, data, and records shall be typed on white bond paper and bound and submitted in a single PDF file. The report shall be certified, accurate and complete by the balancing agency's certified Test and Balance Engineer.
- B. The report shall contain the following general data in a format selected by the balancing agency:
 1. Project number
 2. Contract number
 3. Project title
 4. Project location
 5. Project Architect
 6. Project Mechanical Engineer
 7. Test & Balance agency
 8. Test & Balance Engineer
 9. General Contractor
 10. Mechanical Subcontractor
 11. Dates tests were performed
 12. Certification
- C. The test and balance report shall be recorded on report forms conforming to the recommended forms in the AABC National Standards. At a minimum, the report shall include:
 1. Preface:
 - a. A general discussion of the system, any abnormalities, and problems encountered.
 - b. A deficiency log detailing system abnormalities that do not meet these specifications.
 - c. The list of instruments including type, model, manufacturer, serial number, and calibration dates.
 2. System Data:
 - a. All test and balance data indicating design conditions, and actual conditions of operation for each device and/or piece of HVAC equipment.
 - b. Outside Air Temperatures, dry bulb, and wet bulb.
 - c. Entering Air Temperatures, dry bulb, and wet bulb.
 - d. Discharge Air Temperatures, dry bulb, and wet bulb.
 - e. Suction and discharge static pressures across each fan.
 - f. Verification of valve positioning and static pressures across valves
 - g. Entering and Leaving water temperatures across all coils.

- h. Static pressure drops across all coils and equipment (ahus, chillers, pumps, boilers, cooling towers, etc.)
- 3. System Identification:
 - a. In each report, the zones, supply, return, exhaust openings, and traverse points shall be numbered and/or lettered on mechanical drawings corresponding to the numbers and letters used on the report data sheets.
- 4. Controls:
 - a. Document verification of controls.
- 5. Occupancy Inspection:
 - a. Make a total of three (3) inspections within ninety (90) days after occupancy of the building, and make adjustments if required, to ensure that satisfactory conditions are being maintained throughout. Inspections to be coordinated with Architect/Engineer and Owner and shall be documented with a supplemental report containing data and information as required.
- 6. Instructions to Operating Personnel:
 - a. Test and Balance Firm shall instruct the operating personnel regarding the following:
 - 1) Systems Operation
 - 2) Unusual Operating Conditions.
 - 3) System Troubleshooting Procedures.

3.8 REPORT SUBMITTAL

- A. The test and balance report are required and shall be submitted to the General Contractor for distribution to the Owner, Architect, and Mechanical Engineer. The test and balance report shall be submitted in a single, fully bound PDF file.

3.9 FINAL ACCEPTANCE

- A. At the time of final inspection, the balancing agency shall recheck, in the presence of the Owner's representative, specific and random selections of data recorded in the certified test and balance report.
- B. Points and areas for recheck shall be selected by the Owner's representative.
- C. Measurements and test procedures shall be the same as the original test and balance.
- D. Selections for recheck, specific plus random, shall not normally exceed 15 percent of the total number tabulated in the report, except where special air systems require a complete recheck for safety reasons.
- E. If random tests demonstrate a measured flow deviation of 10 percent or more from that recorded in the certified test and balance report, the report shall automatically be rejected. In the event the report is rejected, all systems shall be readjusted and tested, new data recorded, a new certified test and balance report submitted, and a new inspection test made, all at no additional cost to the Owner.

3.10 OPPOSITE SEASON TEST

- A. Opposite season test and balance work shall be required for systems that cannot be tested and balanced due to climate or seasonal conditions. An example would be Chiller operation in the winter season, or Boiler operation in the summer season. In such case, the balancing agency shall perform an inspection of the buildings HVAC system during the opposite season from that in which the initial adjustments were made. The balancing agency shall make any necessary modifications to the initial adjustments to produce optimum system operation in compliance with

the contract documents. The TAB agency shall contact the Owner's Commissioning Agent, to coordinate such work, no less than 14 calendar days prior to any Opposite Season Testing.

- B. Opposite Season Testing is not required if the Owner's Commissioning Agent can simulate off season conditions via the building automated controls system.

END OF SECTION

SECTION 230713 - DUCT AND GRILLE INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. External duct insulation
- B. Internal duct liner
- C. Exterior ductwork

1.2 RELATED SECTIONS

- A. Section 23 00 00 - Basic Mechanical Requirements
- B. Section 23 00 90 - HVAC Submittal Procedures
- C. Section 23 31 13 - Metal Ductwork
- D. Section 23 37 13 - Diffusers, Registers, and Grilles

1.3 SUBMITTALS

- A. Product Data:
 - 1. Provide submittal data on all equipment specified in this section in accordance with Section 23 00 90, General Conditions, and Division 01.
 - 2. Submit product data indicating typical catalog of information.
 - 3. Submit product data sheets indicating dimensions, general assembly, and ratings.
 - 4. Submit manufacturer's installation instructions.

1.4 REFERENCES

- A. Refer to Section 23 00 00 for complete names of references identified in this section.
 - 1. ASTM E84 - Standard test for surface burning characteristics of building materials.
 - 2. NFPA 221 - Fire walls and fire barrier walls.
 - 3. NFPA 255 - Surface burning characteristics of building materials.
 - 4. NFPA 96 - Ventilation control and fire protection of commercial cooking operations.
 - 5. UL 723 - Test for surface burning characteristics of building materials.
 - 6. UL 1978 - First Edition Standard for Grease Ducts
 - 7. ASTM C553 - Standard specification for mineral fiber blanket thermal insulation for commercial and industrial applications.
 - 8. ASTM C1071 - Fibrous glass duct lining insulation (thermal and sound).
 - 9. IECC - International Energy Conservation Code
 - 10. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials
 - 11. ASTM C916-85(2001)e1 - Standard Specification for Adhesives for Duct Thermal Insulation
 - 12. ASTM C1136-02 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation
 - 13. ASTM A635/A635M-02 - Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Carbon, Commercial Steel, Drawing Steel, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability, Hot-Rolled, General Requirements
 - 14. ASTM A924 - Hot Dip Galvanized Coils & Sheets - Tolerances

1.5 QUALITY ASSURANCE

- A. Fire Hazard Rating:
 - 1. All insulation used on the project must have a flame spread rating not exceeding 25 and a smoke developed rating not exceeding 50 as determined by test procedures ASTM E84, NFPA 255 and UL 723. Bear UL label.
 - 2. These ratings must be as tested on the composite of insulation, jacket or facing, and adhesive.
 - 3. Components such as adhesives, mastics and cements must meet the same individual ratings as minimum requirements.
 - 4. Install in accordance with SMACNA standards.
- B. Insulations shall not contain formaldehyde, asbestos, lead, mercury, mercury compounds, or poly-brominated diphenyl ether fire retardants.
- C. Fiberglass insulations shall have a minimum of 50 percent recycled glass content; certified and UL Validated.
- D. Fiberglass insulations shall have a bio-based, formaldehyde-free binder and be UL GREENGUARD Gold certified.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original sealed containers or unopened packages, and clearly labeled with manufacturer's name, product identification, and lot numbers.
- B. Store materials out of weather and in an enclosed shelter.

PART 2 - PRODUCTS

2.1 APPLICATIONS

- A. Supply ducts
- B. Return ducts
- C. Outside air ducts
- D. Duct Silencers
- E. Supply and return diffusers
- F. Grilles
- G. Registers with exposed surfaces in unconditioned areas
- H. General exhaust ducts do not receive insulation

2.2 MANUFACTURERS

- A. Owens Corning
- B. Knauf Insulation
- C. Manson Insulation

D. Johns Manville

2.3 EXTERNAL DUCT WRAP AND GRILLE INSULATION

A. Minimum Thickness and Density:

1. Minimum 2" thick at 1 pound per cubic foot, Minimum Value of R-6.0

B. Material:

1. Fiberglass insulation with factory-applied FSK vapor retarding facing complying with ASTM C 1136. Fiberglass bonded with a bio-based thermosetting binder.
2. Flexible Blanket Duct Wrap insulation, complying with ASTM C 553, Type I, II, and III; ASTM C 1136 Type II; and ASTM C 1290, Type III. UL/ULC Classified per UL 723 for FSK; NFPA 90A and 90B.
3. Thermal conductivity (k-value) at 75 degrees F mean temperature is 0.27 Btu x in. /h x sq. ft. x degrees F, or less. Maximum service temperature of 250 degrees F with FSK facing, 350 degrees F for un-faced material.
4. Flame spread/Smoke-developed rating (ASTM E84) of 25/50.
5. Must be UL Environment GREENGUARD Gold certified and UL Validated Formaldehyde-free.

2.4 INTERNAL DUCT LINER

A. Use only where specifically noted, or with written approval of Engineer.

B. Install internal duct liner that extends no more than 2'-0" below roof deck at each rooftop unit.

C. Thickness:

1. Minimum 1½ inch thick, Minimum Value R-6.0

D. Material:

1. Rigid Plenum and Duct Liner
 - a. Fiberglass complying with ASTM C 1071 Type II, ASTM 1338, ASTM G21, NFPA 90A and 90B, ASTM C 1104, and NAIMA AH124, "Fibrous Glass Duct Liner Standard". Fiberglass bonded with a bio-based thermosetting binder, having a bonded, black mat-faced airstream surface and factory-applied edge coating.
 - b. Thermal conductivity (k-value) at 75 degrees F mean temperature is 0.23 Btu x in. /h x sq. ft. x deg. F., or less. Maximum service temperature of 250 degrees F. UL/ULC Classified per UL 723.
 - c. Flame spread/Smoke-developed rating (ASTM E84) of 25/50.
 - d. Must be UL Environment GREENGUARD Gold certified and UL Validated Formaldehyde-free.
2. Flexible Duct Liner
 - a. Fiberglass complying with ASTM C1071 Type I, ASTM C 1338, NFPA 90A and 90B, and NAIMA AH124, "Fibrous Glass Duct Liner Standard". Rotary glass fibers bonded with bio-based thermosetting binder, having a bonded, black mat-faced airstream surface and factory-applied edge coating.
 - b. Must be UL Environment certified GREENGUARD Gold and UL Validated Formaldehyde-free.
 - c. Surface Burning Characteristics: ASTM E84, UL 723 – Flame spread less than 25 and Smoke developed less than 50.
 - d. Maximum Rated Air Velocity: ASTM C 1071 – 6,000 ft. /min. (30.5 m/sec.).
 - e. Maximum Thermal Conductivity: ASTM C 177, C518, C1114 - 0.24 Btu / (ft² x hr. x °F) @ 75°F mean temperature.

- f. Water Vapor Sorption: ASTM C 1104 – Not exceeding 3 percent by weight.
- g. Antimicrobial Agent: Compound shall be tested for efficacy by an NRTL, and registered by the EPA for use in HVAC systems. Mold & Mildew Growth/Fungi Resistance: ASTM C 1338, ASTM G21/G22 – Pass.
- h. Corrosiveness/Corrosion: ASTM C 665 / C 1617 - Does Not Accelerate / Pass.
- i. Required Markings: EI rating, UL label, duct liner thickness, and other markings required by UL 181 on each full roll of duct liner.
- j. Duct liner adhesive shall be applied to the sheet metal with a minimum coverage of 90%. Adhesive shall meet the requirements of ASTM C916.
- k. Noise Reduction Coefficient (NRC): ASTM C 423, Type "A" Mounting
 - 1) 1.5 PCF Density: 1"=.70, 1-1/2"=.80, 2"=.95
 - 2) 2.0 PCF Density: 1/2"=.50, 1"=.70, 1-1/2"=.85

2.5 EXTERIOR DUCTWORK

- A. Thickness:
 - 1. Minimum 2-inch thick with a minimum R-value of R-8.
- B. Material:
 - 1. Rigid Board fiberglass insulation with factory-applied white ASJ+ facing complying with ASTM C 1136 and ASTM C 612, Type IA or Type IB. Fiberglass bonded with a bio-based thermosetting binder.
 - 2. UL/ULC Classified per UL 723 for unfaced; ASJ+. Thermal conductivity (k-value) at 75 degrees F mean temperature shall be 0.24 Btu x in. /h x sq. ft. x deg. F., or less. Maximum service temperature of 450 degrees F.
 - 3. Flame spread/Smoke-developed rating (ASTM E84) of 25/50.
 - 4. Must be UL Environment GREENGUARD Gold certified and UL Validated Formaldehyde-free.
- C. All exterior ductwork to be protected and sealed with a weather-proofing, protective finishing system such as Alumaguard All Weather, Venture Clad System, or equivalent. Both insulation and protective finish cover system shall be pitched in order to shed water. Level or flat covers will not be accepted.

PART 3 - EXECUTION

3.1 DUCT WRAP INSTALLATION

- A. To ensure that it will achieve its highest possible performance and serve its intended purpose, install all insulation materials and accessories in accordance with manufacturer's published instructions (latest edition) and industry practices detailed by the North American Commercial and Industrial Insulation Standards (latest edition).
- B. Wrap insulation on the ductwork with all circumferential joints butted and longitudinal joints overlapped a minimum of 3 inches. Do not over stretch, or compress more than 25%, during installation process.
- C. On circumferential joints, secure the 2-inch flange of the facing and tape with a minimum of 3 inch wide foil-scrim-Kraft tape (FSK).
- D. On longitudinal joints, secure the overlap using 1/2 inch outward clinch staples applied 6 inches on centers and taped with minimum 3 inch wide foil-scrim-Kraft tape (FSK).

- E. Tape all pin penetrations or punctures in facing.
- F. The duct wrap insulation on all rectangular/square ducts 24-inch or wider shall be additionally secured to the bottom of the duct with mechanical fasteners such as pins and speed clip washers. Spacing at 18-inch on center each direction to prevent sagging.
- G. Duct wrap should be attached and sealed to grilles, registers and diffusers in the same manner as used for duct.
- H. Extend insulation 1 inch beyond each outer surface of diffuser, grille, and register.

3.2 INTERNAL DUCT LINER

- A. Provide internal duct liner as indicated on the plans.
- B. Install internal duct liner on rooftop unit supply and return ducts no more than 2'-0" below roof deck.
- C. To ensure that it will achieve its highest possible performance and serve its intended purpose, install Duct Liner insulation and all accessories in accordance with manufacturer's published instructions (latest edition) and industry practices detailed by the NAIMA FGDLS (North American Insulation Manufacturers Association, Publication AH-124 Fibrous Glass Duct Liner Standard) or SMACNA HVAC DCS (Sheet Metal and Air Conditioning Contractors' National Association, Publication HVAC Duct Construction Standards – Metal & Flexible).
- D. Apply the liner to the inside of the duct with anti-microbial, biocide-treated, black mat finish to the duct with adhesive Insul-Coustic No. 225 or equal meeting ASTM C916, providing a minimum of 90% coverage of clean sheet metal.
- E. Do not use duct liner in kitchen or other areas that may have excess moisture present.
- F. Mechanical fasteners shall be used to secure the duct liner to the sheet metal, spaced in accordance with NAIMA FGDLS or SMACNA HVAC DCS. Fasteners may be either impact-driven, weld-secured, or adhesively secured.
- G. Accurately cut the liner and thoroughly coat the ends with adhesive to make a firmly butted and tightly sealed joint.
- H. Where ducts are lined, exterior insulation will not be needed except as otherwise specified.

END OF SECTION

SECTION 230923 - ENERGY MANAGEMENT CONTROL SYSTEM (BACNET IP/TRIDIUM NIAGARA)

PART 1 GENERAL

1.1 SUMMARY

- A. System protocol shall be BACnet IP with Cat 6 cabling. Cabling outer jacketing color shall be coordinated and determined by Owner. If owner has no preference, color shall be purple.
- B. LonWorks or proprietary protocol/software is not allowed. BACnet MS/TP and Modbus only acceptable for third party devices that are provided by others and being interfaced with.
- C. It is the intent of this specification to describe the basic architecture and performance requirements of the Energy Management Control System (EMCS). The turn-key EMCS shall include all software including operator software, programming tools, graphics editor, all other available software programs, modules, or plug-ins offered by the DDC manufacturers, hardware, Control Units, Distributed Controllers, Unitary Controllers, Local Area Networks (LANs), sensors, modems, wiring, connectors, control devices, actuators, installation and calibration, supervision, adjustments and fine tuning necessary for a complete and fully operational system.
- D. All systems shall be complete true stand-alone systems.
- E. Everything shall be reprogrammed through software without change of any hardware. The owner shall have all the tools necessary to reprogram without any additional costs.
- F. EMCS shall have backward and forward compatibility.
- G. Systems shall be furnished and installed complete in all respects, including any and all equipment, controls, wiring, instrumentation, enclosures, labor, engineering, training, commissioning, programming, supervision, calibration, coordination with other trades, etc. No information given in (or omitted from) these specifications shall relieve the contractor of this absolute requirement. Include all associated electrical work except as noted. Work includes furnishing of all labor, superintendence, materials, tools, equipment and sources necessary for the complete installation or modification of the following systems as herein specified. It is the intent of these specifications that the Contractor shall furnish and install the systems complete in every respect and ready to operate. All equipment, miscellaneous items and accessories required for such installation and for the correct and convenient operation of the entire installation whether or not each such item or accessory is shown on the plans or mentioned in these specifications shall be furnished and installed.
- H. Should discrepancies or ambiguities arise within these specifications, the most stringent condition with regard to cost shall govern the bid. Obtain clarification from the Engineer prior to purchasing equipment and proceeding with the work.
- I. Where drawings are provided as part of or supplement to these specifications, such drawings are inherently schematic only and not intended to convey all controls, wiring, installation, details, etc. It shall be the responsibility of the EMCS contractor to verify that control approaches presented are appropriate for the HVAC systems involved, and that bids include all work described, specified, or otherwise necessary for a complete and functioning system.

- J. Equipment and Software Updates/Upgrades:
1. Equipment: All equipment, components, parts, materials, etc. provided throughout the period of Work (as governed in the Agreement) shall be fully compatible with all other equipment, etc. provided at any other time throughout the period of Work. Should updated versions of equipment be provided which are not fully compatible with earlier equipment provided, Contractor shall replace earlier equipment with the later version at no cost to Owner.
 2. Software: All software upgrades applicable to system and offered by the manufacturer/contractor for this system shall be provided at no cost to the Owner throughout the period of work. This no cost upgrade shall include installation, programming, modifications to field equipment, data base revisions, training, etc. as appropriate.
- K. The Engineer shall reserve all authority regarding approval, conditional approval, or rejection of systems not fully complying with these specifications.

1.2 WORK INCLUDED

- A. Existing control system is (Trane Tracer Summit) controls by (Trane). All new equipment to be connected to the existing EMCS. All programming, software upgrades, controllers, etc. necessary to connect new equipment to existing control system shall be verified and provided by (Trane).
- B. Additions and Renovations work where existing controls components are to remain in selected areas of building: New additions shall be provided with new JACE. All new and existing equipment receiving new controls shall be BACnet IP. Contractor shall provide a new home run to serve the new addition's JACE, and/or provide a new home run to all new and existing equipment receiving new controls. Contractor shall provide all hardware, wiring, components, etc. required.
- C. Contractor is responsible for taking screenshots of existing controls system to document condition of existing system before additional work is performed.
- D. The EMCS shall be a totally Native BACnet IP based system, based on a distributed control system in accordance with this specification. All building controllers, application controllers, and all input/output devices shall communicate using the protocols and network standards as defined by the latest ANSI/ASHRAE Standard 135, BACnet. In other words, all controllers, including unitary controllers, shall be Native BACnet IP devices. No gateways shall be used for communication to controllers installed under this section. Gateways may be used for communication to existing systems or to systems installed under other sections.
- E. Unless specified by the owner's IT team, the EMCS network should be separate from the owner's IT infrastructure, except for a single connection point for remote access (internet access provided by the owner). The EMCS contractor is responsible for providing all necessary ethernet switches and communication backbones to ensure a fully operational system.
- F. The owner will provide reserved DHCP addresses and any other network configuration information necessary to each control contractor for the purpose of configuring each JACE on the owner network. The controls contractor shall coordinate the IP addressed for each JACE. It shall be the responsibility of each control contractor to coordinate with the owner for network connectivity.

- G. The controls contactors shall supply, install, configure and program at least one JACE for each building. It shall be the control contractor's responsibility to determine how many JACE controllers will be required to limit congestion and to maintain system reliability and stability. No JACE shall be overloaded past 80% memory, CPU and/or space. Contractor to provide an additional JACE and rework communication trunks as needed to unload JACE. The JACE or JACEs will be the primary operator interface for the building. All JACEs must be supplied with open licenses and be configured to work with any other Niagara JACE or N4 Supervisor. Configure each JACE with all User Interface, Connectivity, and Embedded Workbench tools and licenses to allow for standalone operation as well as integration into a future enterprise system. All JACEs shall also be supplied with UPS, battery backup or with SRAM Data Recovery Service with provisions for automatic restart and database backup in case of power failure. Additionally, all drivers necessary and required to function with the installed control components within the scope of work for each building shall be the responsibility of the control contractor.
- H. The Energy Management Control System (EMCS) application program shall be written to communicate specifically utilizing BACnet IP protocols. Software shall include password protection, alarming, logging of historical data, full graphics including animation, full suite of field engineering tools including graphical programming and applications. Systems using operating systems other than that described above are strictly prohibited.
- I. This system is to control all mechanical equipment, including all unitary equipment such as VAV boxes, heat pumps, fan-coils, AC units, etc. and all air handlers, boilers, chillers, and any other listed equipment. All application controllers for every terminal unit (VAV, HP, UV, etc.) air handler, all central plant equipment, and any other piece of controlled equipment shall be fully programmable.
- J. Incorporate and integrate all new JACEs, controllers, graphics and software into Owner's supervisory system and dashboard.
- K. Implement the detailed design for all analog and binary objects, system databases, graphic displays, logs, and management reports based on control descriptions, logic drawings, configuration data, and bid documents.
- L. Design, provide, and install all equipment cabinets, panels, data communication network cables needed, and all associated hardware.
- M. Provide and install all interconnecting cables between supplied cabinets, application controllers, and input/output devices.
- N. Provide as-built documentation, operator's terminal software, diagrams, and all other associated project operational documentation (such as technical manuals) on approved media, the sum total of which accurately represents the final system.
- O. Provide new sensors, dampers, valves, and install only new electronic actuators. No used components shall be used as any part or piece of installed system.
- P. Unless otherwise specified, all products shall be of single manufacturer where possible with substitutions approved by Engineer/Owner.
- Q. Provide all indicating devices, interface equipment, and other apparatus required to operate mechanical system and to perform functions specified and to operate other items specified.
- R. Workmanship:

1. Contractor shall use only thoroughly trained and experienced workmen completely familiar with the items required and with the manufacturers recommended methods of installation. In all respects, the workmanship shall be of the highest grade, and all construction shall be done according to the best practice of the trade. Unless otherwise noted, conduit shall be concealed and installed square to the building lines. Any work not meeting these requirements shall be replaced or rebuilt without extra expense to the Owner.
2. Bidder shall perform sufficient site investigations to include all requirements described in the construction documents. Bids shall include, at Bidder's discretion, costs related to site verifications for renovation projects. No additional costs shall be allowed for such items.

1.3 N4 SUPERVISOR STRUCTURE

- A. The N4 Supervisor shall be utilized for aggregation of the campuses within this contract and in the future for further campuses.
- B. The Campus Wide N4 Supervisor shall be responsible for the following services:
 1. Campus Wide Login information such as Users, Navigation
 2. Graphics Files necessary for central login and navigation
 3. Graphics files necessary for aggregation of information from the entire system.
 4. Critical alarm console for display of critical alarms from the system.
 5. Uploaded histories, data storage and retrieval
 6. Automatic back-up of each Site N4 Supervisor or JACE.
- C. For campuses where multiple JACE controllers are needed, a Site N4 Supervisor or a JACE configured as a Supervisor for the subordinate JACE controllers shall be provided at each campus.
- D. The Site N4 Supervisor shall be responsible for the following services:
 1. Site Login information such as Users, Navigation
 2. Campus-specific graphics files and user interface graphics.
 3. Local alarm console for display of campus specific alarms.
 4. Uploaded histories, data storage and retrieval of campus specific trends.
 5. Email service for alarm notification of critical alarms.
 6. Automatic back-up of each JACE at the campus.
 7. Scheduling of equipment at the campus.
- E. For campuses where multiple JACE controllers are needed, the JACEs shall be responsible for the following services:
 1. Generation of alarms
 2. Generation of data history on monitored points.
 3. All DDC logic. Field controllers would still contain their associated logic.
- F. For campuses where a single JACE controller is needed, the JACE shall be responsible for the following services:
 1. Site Login information such as Users, Navigation
 2. Campus-specific graphics files and user interface graphics.
 3. Local alarm console for display of campus specific alarms.
 4. Uploaded histories, data storage and retrieval of campus specific trends.
 5. Email service for alarm notification of critical alarms.
 6. Scheduling of equipment at the campus.

1.4 SUBMITTALS

- A. Drawings
 - 1. The system supplier shall submit detailed complete, engineered drawings, control sequence, and bill of materials for approval.
 - 2. Complete sets (copies) of submittal drawings shall be provided.
 - 3. Drawings shall be available on CD, flash drive and digital copy.
- B. System Documentation
 - 1. Include the following in submittal package:
 - a. Data sheets for all pieces of equipment.
 - b. System configuration diagrams in simplified block format.
 - c. All input/output object listings and an alarm point summary listing.
 - d. Electrical drawings that show all system internal and external connection points, terminal block layouts, and terminal identification.
 - e. Complete bill of materials, valve schedule and damper schedule.
 - f. Manufacturer's instructions and drawings for installation, maintenance, and operation of all purchased items.
 - g. Overall system operation and maintenance instructions including preventive maintenance and troubleshooting instructions.
- C. For all system elements - operator's workstation(s), building controller(s), application controllers, routers, and repeaters, provide BACnet Protocol Implementation Conformance Statements (PICS).
- D. Provide complete description and documentation of any proprietary (non-BACnet) services and/or objects used in the system.
- E. Drawings and Manuals:
 - 1. Upon completion of the work, the Contractor shall provide the Owner with "record" layouts for the system. Layouts shall indicate all equipment and the function of each item shall be indicated.
 - 2. Operating instructions and as-built system flow diagrams and drawings shall be prepared, bound and delivered to the Owner. Each sensor, relay, switch, motor, controller, indicator (when inside panel), and item of equipment, etc., shall be identified with a number or mark identical to one which shall be tagged on each item. Large items of equipment may be identified by a suitable symbol listed in a legend on the control diagram.

1.5 EMCS CONTRACTOR QUALIFICATION REQUIREMENTS

- A. The Energy Management Control System Manufacturer/Contractor, to be acceptable to this project, must have had an established engineering and service office serving the Owner's area for a minimum of five years prior to bid date of this project and be the authorized installing contractor for the manufacturer of the BACnet components. This office shall have a staff of factory trained technicians fully capable of rendering training, instruction, calibration procedures and routine and emergency maintenance service on all system components furnished.
- B. Installers shall have not less than five years' experience with electronic and pneumatic controls.
- C. The entire system shall be provided by a qualified and approved Controls Manufacturer/Contractor. It shall be designed by engineers and installed by competent technicians, all of which are regularly employed by the manufacturer of the control equipment.

The Manufacturer/Contractor shall maintain permanent local facilities for engineering, installation, and 24 hour maintenance and service. Submit required Qualifications Form as specified. The manufacturer shall provide evidence of the ability to support and service the work in the Owner's facilities.

- D. The Bidder/Contractor shall be certified by the manufacturer of the equipment and have factory trained installers
- E. Equipment and performance are intended as a standard of quality, but not as a means of excluding other approved Manufacturers/Control Contractors.

1.6 GRAPHICS

- A. EMCS contractor is responsible for coordinating with owner and setting up the correct graphic templates for each building and piece of equipment. If contractor fails to do so, contractor shall make all changes needed to meet graphic template at no extra cost to owner
- B. All graphical interfaces shall use standard Tridium devices that are available with the JACE. No proprietary graphics shall be utilized on these projects.
- C. The graphics provided shall be part of the Control Contractor's proposal. The purchase of additional licenses or graphics shall not be required for a complete and working graphical interface including dashboard or control panels, trends, alarms, etc.

1.7 WARRANTY

- A. The temperature control contractor shall guarantee all workmanship and material in the installed temperature regulation system for a period of one (1) year, such guarantee dating from the date of final acceptance of the entire air conditioning system by the Architect/Engineer.
- B. This warranty shall cover the repair or replacement without additional costs to the Owner of any defective materials, parts, etc. of facility workmanship.
- C. During the warranty period, the temperature controls contractor shall respond to calls for warranty service within eight (8) working hours. Emergency service shall be obtainable within four (4) hours of notification by the Owner. Emergency service shall be obtainable on a 24 hour basis, seven (7) days per week.
- D. The temperature control contractor's office shall be within a 150-mile radius of the job site.
- E. Warranty Access:
 - 1. The Owner shall grant to the Contractor, reasonable access to the EMCS system during the warranty period. The owner shall provide, at no cost to the contractor, remote software access to an on-site computer or VPN access for the following functions:
 - a. Access to the entire facility control system by the contractor to provide service and diagnostic support.
- F. Service:
 - 1. All service of the system shall be furnished by the Contractor, at no cost to the Owner, for a period of one (1) year, concurrent with the warranty period specified above.

PART 2 PRODUCTS

2.1 MATERIALS

- A. General: All materials and equipment used shall be standard components, of regular manufacture for this application. All systems and components shall have been thoroughly tested and proven in actual use.
- B. Exceptions to the specification will qualify bid as unacceptable.

2.2 OPERATOR'S SERVER AND WORKSTATION

- A. The new units, controllers, graphics, hardware and software shall be fully integrated to the owners front end system, supervisor and workstation. Floor plan and interactive color graphics shall be provided for the building with each zone providing color indication of the zone comfort level. In addition to the floor plan graphic, each piece of controlled equipment shall be represented by a graphic that is accessible by clicking on the zone or indicated piece of equipment. All points shall be available on the graphic.
- B. Software:
 - 1. EMS software shall be provided as an all-inclusive package. Software package shall allow the owner to have all the software modules/software tools that the controls contractor has for installation. The owner shall have the software tools to be 100% self-sufficient when it comes to programming the systems, modifying DDC and graphics, creating reports and trends, etc. Provisions to provide software at each building at no additional charge in the future must be included as a part of this bid.
- C. Software shall include the following, but not be limited to:
 - 1. DDC Programming tool
 - 2. All points binding and interoperability software to make the system truly open
 - 3. Graphic editing tools
 - 4. Energy management tools
 - 5. Trending tools
- D. Graphics:
 - 1. Graphics pages shall consist of the following graphics at a minimum:
 - 2. Campus and/or District Map
 - 3. Floor plans (typical of every building for both space temperature and humidity)
 - 4. Animated Unit Summary Pages (one per piece of HVAC equipment)
 - 5. Text Summary Pages (one per piece HVAC equipment)
 - 6. Time Schedule Pages
 - 7. Run times Page
 - 8. Graphics Editing Mode
 - 9. Trendlog Page
- E. General structure of workstation interaction shall be a standard client/server relationship. Server shall be used to archive data and store system database. Clients shall access server for all archived data. Each client shall include flexibility to access graphics from server or local drive.
- F. Displays:
 - 1. Operator's workstation shall display all data associated with project as called out on drawings and/or object type list supplied. Graphic files shall be created using digital, full color photographs of system installation, drawing files of field installation drawings and

- wiring diagrams from as-built drawings. Operator's workstation shall display all data using three-dimensional graphic representations of all mechanical equipment. System shall be capable of displaying graphic file, text, and dynamic object data together on each display and shall include animation. Information shall be labeled with descriptors and shall be shown with the appropriate engineering units.
2. All displays and programming shall be generated and customized by the local EMCS supplier and installer. Systems requiring factory programming for graphics or DDC logic are specifically prohibited.
 3. Analog objects may also be assigned to an area of a system graphic, where the color of the defined area changes based on the analog object's value. For example, an area of a floor-plan graphic served by a single control zone would change color with respect to the temperature of the zone or its deviation from setpoint.
- G. Password Protection:
1. Provide security system that prevents unauthorized use unless operator is logged on. Access shall be limited to operator's assigned functions when user is logged on. This includes displays as outlined above.
 2. Each operator's terminal shall provide security for 200 users minimum. Each user shall have an individual User ID, User Name and Password.
- H. Operator Activity Log:
1. Operator Activity Log shall be included with system that tracks all operator changes and activities. System shall track what is changed in the system, who performed this change, date and time of system activity and value of the change before and after operator activity. Operator shall be able to display all activity, sort the changes by user and also by operation.
- I. Scheduling:
1. Operator's workstation shall show all information in easy-to-read daily format including calendar of this month and next. All schedules shall show actual ON/OFF times for day based on scheduling priority. Priority for scheduling shall be events, holidays and daily with events being the highest.
- J. Alarm Indication and Handling:
1. Operator's workstation shall provide audible, visual, and printed means of alarm indication. The alarm dialog box shall always become the top dialog box regardless of the application(s), currently running.
- K. Trendlog Information:
1. System server shall periodically gather historically recorded data stored in the building controllers and field controllers and archive the information. Archived files shall be appended with new sample data, allowing samples to be accumulated. Systems that write over archived data shall not be allowed, unless limited file size is specified. Samples may be viewed at the operator's workstation. Operator shall be able to scroll through all trended data. All trendlog information shall be displayed in standard engineering units.
 2. Operator shall be able to change trend log setup information. This includes the information to be logged as well as the interval at which it is to be logged. All input, output, and value object types in the system may be logged.
- L. Field Engineering Tools:
1. Operator's workstation software shall include field-engineering tools for programming all controllers supplied. All controllers shall be programmed using graphical tools that allow

the user to connect function blocks on screen that provide sequencing of all control logic. Function blocks shall be represented by graphical displays that are easily identified and distinct from other types of blocks. Graphical programming that uses simple rectangles and squares is not acceptable.

2.3 NETWORK AREA CONTROLLER (NAC)

- A. Network Area Controller (NAC) shall be equal to a Tridium Niagara N4 JACE 9000 or greater. The NAC shall be provided with the necessary BACnet hardware and software for complete integration and functionality.
- B. The Network Area Controller (NAC) shall provide the interface between the WAN and the field control devices, and provide global supervisory control functions over the control devices connected to the NAC. It shall be capable of executing application control programs to provide:
 - 1. Calendar functions
 - 2. Scheduling
 - 3. Trending
 - 4. Alarm monitoring and routing
 - 5. Time synchronization
 - 6. Integration of BACnet controller data
 - 7. Network Management functions for all BACnet based devices
- C. In addition the NAC must provide or be provided with the following hardware features as a minimum:
 - 1. Battery Backup or UPS
 - 2. Flash memory for long term data backup (If battery backup or flash memory is not supplied, the controller must contain a hard disk with at least 1 gigabyte storage capacity)
 - 3. The NAC must be capable of operation over a temperature range of 0 to 55°C
 - 4. The NAC must be capable of withstanding storage temperatures of between 0 and 70°C
 - 5. The NAC must be capable of operating over a humidity range of 5 to 95% RH, non-condensing
- D. Event Alarm Notification Actions
 - 1. The NAC shall provide alarm recognition, storage; routing, management, and analysis to supplement distributed capabilities of equipment or application specific controllers.
 - 2. The NAC shall be able to route any alarm condition to any defined user location whether connected to a local network or remote via dial-up telephone connection, or wide-area network.
 - 3. Provide for the creation of a minimum of eight of alarm classes for the purpose of routing types and or classes of alarms, i.e.: Critical, HVAC, Energy, etc.
 - 4. Provide timed (schedule) routing of alarms by class, object, group, or node.
 - 5. Provide alarm generation from binary object "runtime" and /or event counts for equipment maintenance. The user shall be able to reset runtime or event count values with appropriate password control.
- E. The EMCS contractor shall coordinate with owner and setup alarms for each HVAC system type.
- F. Control equipment and network failures shall be treated as alarms and annunciated.
- G. Alarms shall be annunciated in any of the following manners as defined by the user:
 - 1. Screen message text
 - 2. Email of the complete alarm message to multiple recipients. Provide the ability to route and email alarms based on:

- a. Day of week
- b. Time of day
- c. Recipient
- 3. Graphic with flashing alarm object(s)

- H. Alarm actions may be initiated by user defined programmable objects created for that purpose.
- I. Defined users shall be given proper access to acknowledge any alarm, or specific types or classes of alarms defined by the user.

2.4 SOFTWARE LICENSE AGREEMENT

- A. The controls contractor shall sign a copy of the manufacturer's standard software and firmware licensing agreement as a condition of this contract. Such license shall grant use of all programs and application software as defined by the manufacturer's license agreement, but shall protect the manufacturer's rights to disclosure of trade secrets contained within such software.
- B. The open license must contain the following statements:
 - 1. accept.station.in="**"
 - 2. accept.station.out="**"
 - 3. accept.wb.in="**"
 - 4. accept.wb.out="**"
- C. Provide a printed copy of the license agreement as part of the submittal package.

2.5 WEB BROWSER CLIENTS

- A. The system shall be capable of supporting an unlimited number of clients using a standard Web browser such as Internet Explorer™ or Mozilla Firefox™. Systems requiring additional software (to enable a standard Web browser) to be resident on the client machine, or manufacture-specific browsers shall not be acceptable.
- B. The Web browser software shall run on any operating system and system configuration that is supported by the Web browser. Systems that require specific machine requirements in terms of processor speed, memory, etc., in order to allow the Web browser to function with the EMCS, shall not be acceptable.
- C. The Web browser shall provide the same view of the system, in terms of graphics, schedules, calendars, logs, etc., and provide the same interface methodology as is provided by the Graphical User Interface. Systems that require different views or that require different means of interacting with objects such as schedules, or logs, shall not be permitted.

2.6 SYSTEM PROGRAMMING

- A. The Graphical User Interface software (GUI) shall provide the ability to perform system programming and graphic display engineering as part of a complete software package. Access to the programming functions and features of the GUI shall be through password access as assigned by the system administrator.
- B. Programming Methods
 - 1. Provide the capability to copy objects from the supplied libraries, or from a user-defined library to the user's application. Objects shall be linked by a graphical linking scheme by dragging a link from one object to another. Object links will support one-to-one, many-to-one, or one-to-many relationships. Linked objects shall maintain their connections to other

objects regardless of where they are positioned on the page and shall show link identification for links to objects on other pages for easy identification. Links will vary in color depending on the type of link, i.e., internal, external, hardware, etc.

2. Configuration of each object will be done through the object's property sheet using fill-in the blank fields, list boxes, and selection buttons. Use of custom programming, scripting language, or a manufacturer-specific procedural language for configuration will not be accepted.
3. The software shall provide the ability to view the logic in a monitor mode. When on-line, the monitor mode shall provide the ability to view the logic in real time for easy diagnosis of the logic execution. When off-line (debug), the monitor mode shall allow the user to set values to inputs and monitor the logic for diagnosing execution before it is applied to the system.
4. All programming shall be done in real-time. Systems requiring the uploading, editing, and downloading of database objects shall not be allowed.
5. The system shall support object duplication within a customer's database. An application, once configured, can be copied and pasted for easy re-use and duplication. All links, other than to the hardware, shall be maintained during duplication.

2.7 TERMINAL UNIT APPLICATION CONTROLLERS (ROOFTOPS, HEAT PUMPS, AC UNITS, FAN COILS)

A. General:

1. Provide one Native BACnet application controller for each piece of unitary mechanical equipment that adequately covers all objects listed in object list for unit. All controllers shall interface to building controller via BACnet IP protocol. No gateways shall be used. Controllers shall include input, output and self-contained logic program as needed for complete control of unit.

2.8 VAV BOX CONTROLLERS

A. General:

1. Provide one Native BACnet application controller for each VAV box that adequately covers all objects listed in object list for unit. All controllers shall interface to building controller via BACnet IP protocol. No gateways shall be used. Controllers shall include on board CFM flow sensor, inputs, outputs and programmable, self-contained logic program as needed for control of units.

2.9 ELECTRONIC DAMPERS AND ACTUATORS

A. General:

1. Shall be Electric unless otherwise specified.
2. **Shall be manufactured by Belimo. Equal substitutions allowed with written approval by owner prior to bid.**
3. Five-year manufacturer's warranty. Two-year unconditional and three-year product defect from date of installation.
4. Furnish a Freeze-stat and install "Hard Wire" interlock to disconnect the mechanical spring return actuator power circuit for fail-safe operation. Use of the control signal to drive the actuators closed is not acceptable.
5. Damper actuation shall be Floating type or Analog (2-10vdc) and provide to VAV box manufactured for factory installation.
6. Mechanical spring shall be provided when specified. Capacitors or other non-mechanical forms of fail-safe are not acceptable.

7. Position indicator device shall be installed and made visible to the exposed side of the Actuator. For damper short shaft mounting, a separate indicator shall be provided to the exposed side of the Actuator.
 8. Overload Protection: Actuators shall provide protection against actuator burnout by using an internal current limiting circuit or digital motor rotation sensing circuit. Circuit shall insure that actuators cannot burn out due to stalled damper or mechanical and electrical paralleling.
 9. A push button gearbox release shall be provided for all non-spring actuators.
 10. Modulating actuators shall be 24VAC and consume 10VA power or less.
 11. Conduit connectors are required when specified and when code requires it.
- B. Damper Actuators:
1. Electronic damper actuators shall be direct-coupled rotary type, suitable for mounting directly on the damper end shaft. Electronic damper actuators shall be properly sized to provide sufficient torque to position the damper throughout its operating range. Damper actuators used on economizer and/or outside air dampers shall be spring return.
 2. Terminal unit damper actuators shall be electric, low voltage, utilizing floating control.
 3. Outside Air and Exhaust Air Damper Actuators shall be Mechanical Spring Return. Capacitors or other non-mechanical forms of fail-safe are not acceptable. The actuator mounting arrangement and spring return feature shall permit normally open or normally closed positions of the damper as required.
 4. Outside Air or Economizer Actuators shall be provided and installed by EMCS contractor. Actuators shall utilize Analog control 2-10 VDC and shall give position feedback for FDD monitoring. Floating control is not acceptable. Actuators shall be Mechanical Spring Return. Equal to Belimo LF-24-SR or equal.
 5. Electric damper actuators (including VAV box actuators) shall be direct shaft mounted and use a V-bolt and toothed V-clamp causing a cold weld effect for positive gripping. Single bolt or setscrew type fasteners are not acceptable.
 6. One electronic actuator shall be direct shaft mounted per damper section. No connecting rods or jackshafts shall be needed. Small outside air and return air economizer dampers may be mechanically linked together if one actuator has sufficient torque to drive both and damper drive shafts are both horizontal installed.
 7. Multi-section dampers with electric actuators shall be arranged so that each damper section operates individually. One electronic actuator shall be direct shaft mounted per damper section.
- C. Control Dampers:
1. Control Air dampers shall be parallel blade for two-position control and opposed blade for modulating control applications. Dampers shall be galvanized with nylon bearings. Blade edge and tip seals shall be included for all dampers. Leakage through the damper shall not exceed 4 CFM per square foot at 1" w.c. Blades shall be 16-gauge minimum and 10" wide maximum and frame shall be of welded channel iron. Dampers over 48" wide shall be equipped with a jackshaft to provide sufficient force throughout the intended operating range.
 2. All dampers used for modulating service shall be opposed blade type arrange for normally open or normally closed operation as required. The damper is to be sized so that when wide open the pressure drop is a sufficient amount of its close-off pressure drop for effective throttling.
 3. All dampers used for two-position or open-close control shall be parallel blade type arranged for normally open or closed operation as required.

4. Damper linkage hardware shall be constructed of aluminum or corrosion resistant zinc and nickel-plated steel and furnished as follows:
 - a. Bearing support bracket and drive blade pin extension shall be provided for each damper section. Sheet metal contractor shall install bearing support bracket and drive blade pin extension. Sheet metal contractor shall provide permanent indication of blade position by scratching or marking the visible end of the drive blade pin extension.
 - b. Drive pin may be round only if V-bolt and toothed V-clamp is used to cause a cold weld effect for positive gripping. For single bolt or set-screw type actuator fasteners, round damper pin shafts must be milled with at least one side flat to avoid slippage.
- D. Multiple Section Dampers:
1. Size damper sections based on actuator manufacturers specific recommendations for face velocity, differential pressure and damper type. In general:
 - a. Damper section shall not exceed 24 ft-sq. with face velocity of 1500 FPM.
 - b. Damper section shall not exceed 18 ft-sq. with face velocity of 2500 FPM.
 - c. Damper section shall not exceed 13 ft-sq. with face velocity of 3000 FPM.
 2. Damper manufacturer shall supply alignment plates for all multi-section dampers.
 3. Multiple section dampers of two or more shall be arranged to allow actuators to be direct shaft mounted on the outside of the duct.
 4. Multiple section dampers of three or more sections wide shall be arranged with a 3-sided vertical channel (8" wide by 6" deep) within the duct or fan housing and between adjacent damper sections. Vertical channel shall be anchored at the top and bottom to the fan housing or building structure for support. The sides of each damper frame shall be connected to the channels. Holes in the channel shall allow damper drive blade shafts to pass through channel for direct shaft mounting of actuators. Open side of channel shall be faced down stream of the airflow, except for exhaust air dampers.
 5. Multiple section dampers to be mounted flush within a wall or housing opening shall receive either vertical channel supports as described above or sheet metal standout collars. Sheet metal collars (12" minimum) shall bring each damper section out of the wall to allow direct shaft mounting of the actuator on the side of the collar.
- E. Actuator mounting for damper and valve arrangements shall comply to the following:
1. Damper Actuators: Shall not be installed in the air stream
 2. A weather shield shall be used if actuators are located outside. For Damper Actuators use clear plastic enclosure.
 3. Damper or valve actuator ambient temperature shall not exceed 122F through any combination of medium temperature or surrounding air. Appropriate air gaps, thermal isolation washers or spacers, standoff legs, or insulation shall be provided as necessary.
 4. Actuator cords or conduit shall incorporate a drip leg if condensation is possible. Water shall not be allowed to contact actuator or internal parts. Location of conduits in temperatures dropping below dew point shall be avoided to prevent water from condensing in conduit and running into actuator.
 5. Damper mounting arrangements shall comply to the following:
 6. The ventilation subcontractor shall furnish and install damper channel supports and sheet metal collars.
 7. No jack shafting of damper sections shall be allowed.
 8. Multi-section dampers shall be arranged so that each damper section operates individually. One electronic actuator shall be direct shaft mounted per section.

2.10 ENCLOSURES

- A. NEMA 2 rated enclosures for inside mounting, provide with weather shield for outside mounting.
- B. All controllers, power supplies and relays shall be mounted in enclosures.
- C. Enclosures may be NEMA 1 when located in a clean, dry, indoor environment. Indoor enclosures shall be NEMA 12 when installed in other than a clean environment.
- D. Enclosures shall have hinged, locking doors.
- E. Provide laminated plastic nameplates for all enclosures in any mechanical room or electrical room. Include location and unit served on nameplate. Laminated plastic shall be 1/8" thick sized appropriately to make label easy to read.
- F. All direct digital controllers located indoors shall be installed in NEMA 1 enclosures. All direct digital controllers located outdoors shall be installed in NEMA 3R enclosures. Enclosures shall be of suitable size to accommodate all power supplies, relays and accessories required for the application. Each enclosure shall include a perforated subpanel for direct mounting of the enclosed devices. Include matched key locks for all enclosures provided.

2.11 SENSORS, SWITCHES, CONTROLLERS, TRANSDUCERS, AND MISCELLANEOUS DEVICES

- A. Temperature Sensors:
 - 1. All temperature sensors to be solid state electronic, factory-calibrated to within 0.5°F, totally interchangeable with housing appropriate for application. Wall sensors to be installed as indicated on drawings. Mount 48 inches above finished floor. Duct sensors to be installed such that the sensing element is in the main air stream. Immersion sensors to be installed in wells by control contractor, but installed by mechanical contractor. Immersion wells shall be filled with thermal compound before installation of immersion sensors. Outside air sensors shall be installed away from exhaust or relief vents, not in an outside air intake and in a location that is in the shade most of the day.
- B. Wall Temperature Sensor
 - 1. Temperature sensors shall have LCD screen with occupancy override and setpoint adjustment.
 - 2. Areas such as Administration, Gyms, Auditoriums, Cafeterias, Kitchens, Choir, Dance, Band and Corridors sensors shall have tamper proof protective covers.
- C. Differential Pressure Switches (Air):
 - 1. Provide differential pressure switches across fans and filters for status indication. Differential pressure switches shall have an adjustable setpoint from 0.05" w.c. to 2" w.c. with a switch differential that progressively increases from 0.02" w.c. at minimum to 0.8" w.c. at maximum. Switch shall be SPDT rated for 15A (non-inductive) at 277VAC.
- D. Differential Pressure Switches (Liquid):
 - 1. Provide differential pressure switches across pumps and chillers to prove flow. Differential pressure switches shall have a 0-150 psig working differential pressure and have an adjustable setpoint from 4" w.c. to 43.5" w.c. on a fall and 5.5" w.c. to 45" w.c. on a rise. Liquid differential pressure switch enclosure shall carry a NEMA 4 rating. Switch shall be SPDT rated for 5A (inductive) at 125VAC.
- E. Mixed Air Low Limit Controllers (Freezestats):

1. Mixed air low limit controllers shall be manual reset, adjustable setpoint with 20-foot element serpentine across the entering air face of center cooling coil. Control shall be responsive only to the lowest temperature along the element.
- F. Static High Limit Controllers:
 1. Discharge static high limit controllers shall be provided on all VAV AHU systems. When discharge static pressure exceeds setpoint, the supply fan shall be de-energized. Manual reset shall be required.
- G. Static Pressure Transducers (Air):
 1. Provide static pressure transducers for monitoring supply duct static pressure. Static pressure transducers shall be 100% solid state and shall include glass on silicon, ultra-stable capacitance sensors. Each static pressure transducer shall incorporate short circuit and reverse polarity protection. Transmitter output shall be either 0-10VDC or 4-20mA. Static pressure transducers are to be provided in an enclosure that is suitable for duct mounting. The desired setpoint is to be in the top 50% of the transmitter's operating range.
- H. Differential Pressure Transducers (Air):
 1. Provide differential pressure transducers for monitoring air system and airflow measuring station differential pressures. Differential pressure transducers shall be 100% solid state and shall include glass on silicon, ultra-stable capacitance sensors. Each differential pressure transducer shall incorporate short circuit and reverse polarity protection. Transducer output shall be either 0-10VDC or 4-20mA. Differential pressure transducers are to be provided in an enclosure that is suitable for duct mounting. The desired setpoint is to be in the top 50% of the transducer's operating range.
- I. Line Pressure Transducers (Liquid):
 1. Provide Rosemount 3051 line pressure transducers for monitoring hydronic system line pressure. Pressure transducers shall be 100% solid state with accuracy of +/- 1% of calibration range. Factory calibrated and have zero and span trimmers for field calibration. Range shall be selected to match the medium being monitored. Transducer output shall be either 0-10VDC or 4-20mA. Differential pressure transducers are to be provided in a field mounted enclosure and all wetted parts shall be constructed from materials that are suitable for operation in the measured medium. LCD display.
- J. Differential Pressure Transducers (Liquid):
 1. Provide Rosemount 3051 pressure differential transducers for monitoring hydronic system differential pressure. Differential pressure transducers shall be 100% solid state with accuracy of +/- 1% of calibration range and shall include dual silicon water type sensors. Factory calibrated and have zero and span trimmers for field calibration. Pressure snubbers to protect from pressure pulses and a 3-way bypass / valve assembly to protect the transducer from overpressure damage during start-up. Range shall be selected to match the medium being monitored. Transducer output shall be either 0-10VDC or 4-20mA. Differential pressure transducers are to be provided in a field mounted enclosure and all wetted parts shall be constructed from materials that are suitable for operation in the measured medium. LCD display.
- K. Liquid Flow Meters:
 1. Provide insertion type flow meters for monitoring system hydronic system flow. Flow meters shall be provided with "hot tap" isolation valves and all accessories for bi-directional flow.

Flow meter transmitter supply voltage to be 24VAC unregulated. Flow meter output shall have either a 4-20mA or pulse output that is linear with the flow rate.

- L. Current Sensing Relays:
 - 1. Provide current switches for indication of equipment status. Amperage ratings shall be adjustable with the desired setpoint to be in the top 50% of the current relay's operating range. Current sensing relays shall incorporate trip indication LED's and shall be sized for proper operation with the equipment served.
- M. Relative Humidity Sensors:
 - 1. Relative humidity sensors shall have an accuracy of +/-3% from 5 to 95% RH. Output signal shall be either be 0-10VDC or 4-20mA. Humidity transmitters shall be factory calibrated and require no field setting.
- N. CO2 Sensors:
 - 1. CO2 sensors shall be space or duct mounted carbon dioxide sensors as required by the application. Space CO2 sensors shall be mounted next to space temperature sensors. The sensor shall have a range of 0-2000 ppm with an accuracy of $\pm 5\%$. The response time for the sensor shall be less than one minute. The sensor shall be capable of providing an analog signal proportional to the CO2 level sensed. The signal shall be either 0-10VDC or 4-20mA.
- O. Duct/Well Sensors:
 - 1. Sensors for duct and water temperature sensing shall incorporate either RTD or Thermistor sensing devices. Sensing element accuracy shall be 0.1% over the sensor span or better. Where the element is being used for sensing mixed air or coil discharge temperatures and/or the duct cross sectional area is in excess of 14 square feet, the element shall be of the averaging type. Averaging duct sensors shall utilize a 6, 12 or 24 foot sensing element. Immersion sensors shall use matched 316 stainless steel bulb wells. All duct and immersion sensors shall be provided with conduit connection housings. Sensors shall be provided with adequate standoffs for insulation installation.
- P. Selector Switches:
 - 1. Selector switches shall be 2 or 3-position, knob or key type as required by the sequence of operation. Selector switches shall feature oil tight construction and be fitted with snap-fit contact blocks rated for 10A, 600VAC/DC operation. Labels shall be provided indicating switch position.
- Q. Pushbutton Switches:
 - 1. Pushbutton switches shall be either maintained or momentary as required by the sequence of operation. Pushbutton switches shall feature oil tight construction and be fitted with snap-fit contact blocks rated for 10A, 600VAC/DC operation. Labels shall be provided indicating switch function.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence.

- B. Notify the owners' representative in writing of conditions detrimental to the proper and timely completion of the work.
- C. Do not begin work until all unsatisfactory conditions are resolved.
- D. Each bid must include all costs associated with providing wiring, conduit, concrete trenching, and earth trenching.

3.2 INSTALLATION

- A. General:
 - 1. Install in accordance with manufacturer's instructions.
 - 2. Provide all miscellaneous devices, hardware, software, interconnections installation and programming required to ensure a complete operating system in accordance with the sequences of operation and point schedules.
 - 3. Provide a complete and operational temperature control and building automation system based on the following points and sequence of operation. The system shall be complete as to sequences and standard control practices. The determined point list is the minimum amount of points that are to be provided. If additional points are required to meet the sequence of operation, they will be provided.
- B. Location and Installation of Components:
 - 1. Locate and install components for easy accessibility; in general, mount 48 inches above floor with minimum 3'-0" clear access space in front of units. Obtain approval on locations from owner's representative prior to installation.
 - 2. Enclosures and hardware or wiring shall not block or limit accessibility to service compartments of any other equipment.
 - 3. The work shall be coordinated fully, as it pertains to the fire protection system, fire alarm system, and electrical power system. All items shall be terminated in the DDC controllers in a predetermined order as indicated in the submittal drawings.
 - 4. All instruments, switches, transmitters, etc., shall be suitably wired and mounted to protect them from vibration, moisture and high or low temperatures.
 - 5. Identify all equipment and panels. Provide permanently mounted tags for all panels.
 - 6. Provide stainless steel or brass thermowells suitable for respective application and for installation under other sections - sized to suit pipe diameter without restricting flow.
- C. Interlocking and Control Wiring:
 - 1. Provide all interlock and control wiring. All wiring shall be installed neatly and professionally, in accordance with Specification Division 16 and all national, state and local electrical codes.
 - 2. Provide wiring as required by functions as specified and as recommended by equipment manufacturers, to serve specified control functions. Provide shielded low capacitance wire for all communications trunks. Communication shall be per manufacturer's specifications.
 - 3. Control wiring shall not be installed in power circuit raceways. Magnetic starters and disconnect switches shall not be used as junction boxes. Provide auxiliary junction boxes as required. Coordinate location and arrangement of all control equipment with the owner's representative prior to rough-in.
 - 4. Provide auxiliary pilot duty relays on motor starters as required for control function.
 - 5. Provide power for all control components from nearest electrical control panel or as indicated on the electrical drawings. Coordinate with electrical contractor.
 - 6. All control wiring in the mechanical, electrical, telephone and boiler rooms to be installed in conduit. All other wiring to be installed neatly and inconspicuously per local code

requirements. If local code allows, control wiring above accessible ceiling spaces may be run with plenum rated cable (without conduit).

D. Installation Requirements:

1. Any panels associated with the control system shall be furnished and installed under this section of the work. Panel wiring shall be terminated by connecting to numbered terminals strips. Wire nut connections shall not be allowed. All wiring shall be color coded and shall be tagged for future identification.
2. Unless otherwise specified, all devices, panels, etc., furnished and/or installed by the Contractor shall be located where they can be calibrated and maintained from the floor without use of a ladder. These items shall be identified by means of plates made of plastic suitably engraved, embossed or punched, plastic tape will not be acceptable. At completion of job, the Contractor shall submit record drawings of any changes made during construction. This submittal shall be a condition of final payment.
3. Any conduit on roof shall be absolute minimum and shall have prior written approval.
4. All conduit used indoor and outdoor shall be metal and shall be of type and fittings to minimize corrosion and moisture entry.

E. Cable Installation and Attachments:

1. Control System wiring and equipment installation shall be in accordance with good engineering practices as established by the TIA/EIA and the NEC. Wiring shall meet all state and local electrical codes. All wiring shall test free from all grounds and shorts. All cable shall be supported from the building structure and bundled.
2. The support system shall provide a protective pathway to eliminate stress that could damage the cabling. The cable shall not be crushed, deformed, skinned, crimped, twisted, or formed into tight radius bends that could compromise the integrity of the cabling. Controls cables shall not be run loose on ceiling grid or ceiling tiles. Support shall be provided by mounting appropriate fasteners which may be loaded with multiple cables. Provided that the weight load is carried by the support rod or wire, the support assembly may attach to the ceiling grid for lateral stabilization. The required support wires for the ceiling grid or light fixtures shall not be utilized. Any fastener attached to the ceiling grid shall not interfere with inserting or removing ceiling tiles. All cabling and supports must be positioned at least 12 inches above the ceiling grid.
3. Controls cables shall be run in bundles above accessible ceilings and supported from building structure. Cabling shall be loosely bundled with wire wraps randomly spaced at 30 to 48 inches on center, wire wraps shall not be tight enough to deform cabling and shall not be used to support the cabling.
4. Attachments for cabling support shall be spaced at 48 to 60 inches on center. The cable bundle shall not be allowed to sag more than 12 inches mid-span between attachments. Attachments shall be sized as follows:
 - a. 2" bridle ring, Caddy #4BRT32 or equivalent
 - b. 3/4" J-Hook, Caddy #CAT12 or equivalent
 - c. 1-5/16" J-Hook, Caddy #CAT21 or equivalent
 - 1) 2" J-Hook, Caddy #CAT21 or equivalent
 - 2) Split bundles greater than 2" dia. or provide cable tray.
5. Do not mix different signal strength cables on the same J-Hook (i.e. fire alarm, 25 volt speaker cable). Multiple J-Hooks can be on the same attachment point up to the rated weight of the attachment device.
6. Controls cables shall be run in conduit stubs, where stubs are provided, from wall mounted devices to above accessible ceilings. Conduit shall be required only within walls and concealed spaces to provide access. Provide a plastic snap bushing or sleeve on the end

of each conduit stub such as Thomas & Betts Catalog no. 443 - 3/4", 424 - 1", 425 - 1 1/4", 427 - 2" or equivalent.

7. Conduit, duct or track shall be used for controls cable in exposed areas.
8. All conduit, ducts, track and raceways shall be supported from the structure at industry standard intervals for the size specified, utilizing proper anchoring devices and techniques for each type of cable used.
9. All penetrations through fire rated walls or floors shall feature a short length of metal conduit. The hole shall be neatly cut, not oversize or irregular. Seal the interior of the conduit sleeve around the cables and around the outside of the sleeve on each side of the penetration with fire-stop caulk or putty, such as Minnesota Mining & Mfg. Co. (3M) - CP 25WB+ caulk, MPS-2+ putty, or equivalent. Install according to the manufacturers' instructions.
10. All cable shall have a label on both ends utilizing self-laminating, flexible vinyl film and non-smear nylon marking pens. Utilize Tyton Corporation Part No. RO175 Rite-On labels and Part No. FTP1 nylon marking pens or equivalent.
11. Each cable run shall include a three foot service loop with wire tie located in the ceiling above the control unit panel. This is to allow for future re-termination or repair.
12. No terminations or splices shall be installed in or above ceilings. Cable shall be continuous from one device termination to the next.
13. Mount all equipment firmly in place. Route cable in a professional, neat and orderly installation.
14. All cabling shall be placed with regard to the environment, EMI/RFI (interference) and its effect on communication signal transmission.
15. Do not route any controls cable within two feet of any light fixture, HVAC unit service access area, electric panel, or any device containing a motor or transformer.
16. Low voltage controls cable will not be installed in the same conduit, duct or track with line voltage electrical cable.
17. Maximum pulling tension should not exceed 25 lb/ft. or manufactures recommendation, whichever is less.
18. Any pulling compounds utilized must be approved by the cable manufacturer and shall not degrade the strength or electrical characteristics of the cable.
19. Cable bends shall not exceed the manufacturers' suggested bend radius.
20. Provide for adequate ventilation in all equipment panels.
21. Provide wire mold where wiring must run exposed. Obtain advance approval from Architect and Owner before running exposed. Coordinate with Owner and Architect.
22. For all wiring, provide numbering on all terminations (both ends).
23. Label all panels, cans, enclosures, controllers and correlate with air conditioning units served. Labeling shall relate to shop drawings and equipment served. Provide wiring diagram inside each enclosure.
24. Provide a rain-tight enclosure for each rooftop unit controller.
25. Locate outdoor air sensors shielded and on northern exposure.

F. Termination practices:

1. Strip back only as much cable jacket as required to terminate.
2. Preserve wire twists as closely as possible to point of termination (0.5" maximum) to keep signal impairment to a minimum.
3. Avoid twisting cable during installation.
4. Electrical Interlocks:
 - a. All electrical interlocks shall be provided as specified. All electrical interlocks shall be made by means of motor starters or shall be accomplished by separate relays. No motor power lead shall be utilized in an interlock circuit.

3.3 SERVICES

- A. Field Services:
 - 1. Prepare and start logic control system under provisions of this section.
 - 2. Start-up and commission systems. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation.
 - 3. Provide the capability for off-site monitoring at control contractor's local or main office. At a minimum, off-site facility shall be capable of system diagnostics and software download. Owner shall provide remote access via Internet for this service for 1 year or as specified.
 - 4. Provide Owner's Representative with spare parts list. Identify equipment critical to maintaining the integrity of the operating system.
 - 5. Provide all interface devices and computer cards required.
 - 6. Contractor responsible for verifying all quantities of air conditioning units, etc. on existing and new construction.
 - 7. Provide Owner with CD or flash drive with graphic diagrams and drawings. Include map of Campus with buildings located and floor plan of each building with equipment located.
- B. HVAC Training:
 - 1. Provide application engineer to instruct owner in operation of systems and equipment.
 - 2. Provide system operator's training to include (but not limited to) such items as the following: modification of data displays, alarm and status descriptors, requesting data, execution of commands and request of logs.
 - 3. Provide on-site training above as required, up to 16 hours as part of this contract.
- C. Demonstration:
 - 1. Demonstrate complete operating system to owner's representative.
 - 2. Provide certificate stating that control system has been tested and adjusted for proper operation.
- D. Programming:
 - 1. Prior to completion of the control installation, schedule time with Owner's designated representatives to evaluate and select programming options and requirements. Contractor shall provide engineer for such meetings and consultations on an as-needed basis. Preparation time for the conference shall be in addition to the "in conference" time, and shall be provided on an as-needed basis without additional cost to the Owner.
 - 2. The Contractor shall also provide additional coordination as needed with the Owner's representative and Engineer to formulate and determine functions, reports, graphics, and alarms most desirable and suitable for the owner and writing the software capability. Programming of these items shall be provided. The Contractor shall program the system using coordinated Owner provided schedules for time of day and holidays.
 - 3. No hardware change shall be required for program changes.
- E. Documentation:
 - 1. The Contractor shall provide a complete documentation package to the owner which shall include floor plans indicating location of EMCS equipment, wiring diagrams, bill of materials, data base information, and sequences of operation. The sequences of operation shall be submitted and approved by the owner in writing prior to installation and programming.
- F. Coordination:
 - 1. For construction project installations where electrical and mechanical contractors are responsible for their respective trade, the electrical contractor is to provide line voltage to

required equipment and the mechanical contractor is to install any devices that are to be included in piping systems. It is the controls contractor responsibility to provide all devices with diagrams for location and coordinate with mechanical contractor prior to mechanical contractor starting installations. For installations where controls only, work is provided, all necessary work shall be performed by the controls contractor. Controls contractor shall coordinate and provide all required work and wiring for duct mounted smoke detectors, control relays for unit shutdown, and interface with any fire alarm system. For installations where controls only work is provided, all necessary work shall be performed by the controls contractor.

PART 4 SEQUENCE OF OPERATION

4.1 SEQUENCE OF OPERATION

- A. The sequences of operations which will be accomplished by the EMCS. Coordinate with Owner in operating equipment to maximize comfort and economy. All points required to accomplish the sequences will be provided and connected to the EMCS.
- B. All chillers, boilers, pumps, AHU's, supply/exhaust fans and lighting circuits shall be supplied with a RIB relay with manual HOA switches. This is to allow owner to turn on and run equipment locally. The activation of the switch shall notify the Building Automation System (BAS) that the unit is in manual override. The equipment on the BAS graphic shall change color to red to alert that that equipment has been locally manually overridden.
- C. Areas such as, but not limited to, Administration, Gyms, Auditoriums, Cafeterias, Kitchens, Choir, Dance, Band and Corridors sensors shall have tamper proof protective covers provided and installed.

END OF SECTION

SECTION 233113 - METAL DUCTWORK

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Furnishing and installation of all ductwork as shown on the construction documents. Acoustical and thermal linings and wrappings; flexible ductwork and connections; combination smoke and fire dampers, smoke dampers, and fire dampers; duct access doors; air diffusers, grilles, and registers; air volume control devices; hangers and supports; plenums and casings; turning vanes; air filters; installation of temperature control dampers, and other appurtenances necessary for a complete and operational system.
- B. All work shall be preceded by taking measurements at the job site, fully coordinating all work with other disciplines, verifying available spaces for ductwork, and developing shop drawings.

1.2 RELATED SECTIONS

- A. Section 23 00 00 - Basic Mechanical Requirements
- B. Section 23 00 90 - HVAC Submittal Procedures
- C. Section 23 05 93 - Testing, Adjusting and Balancing for HVAC
- D. Section 23 07 13 - Duct and Grille Insulation
- E. Section 23 33 33 - Access Doors
- F. Section 23 37 13 - Diffusers, Registers, and Grilles

1.3 REFERENCES

- A. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters
- B. AMCA 511 - Certified Ratings Program for Air Control Devices
- C. ASTM A653/A653M - Sheet Metal, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot-Dip Process
- D. ASTM A924/A924M - Hot Dip Galvanized Coils & Sheets - Tolerances
- E. ASTM A463/A463M - Steel Sheet Aluminum Coated by the Hot-Dip Process
- F. NFPA 90A - National Fire Protection Association - Installation of Air Conditioning and Ventilation Systems
- G. NFPA 92 - Smoke Control Systems
- H. SMACNA - Sheet Metal and Air Conditioning Contractors Association
- I. SMACNA HVAC Duct Construction Standards, Latest Edition, for Metal and Flexible Ducts
- J. UL - Underwriter's Laboratories
- K. UL 555 - Standard for Safety; Fire Dampers

METAL DUCTWORK

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- L. UL 555S - Standard for Safety; Leakage Rated Dampers for Use in Smoke Control Systems

1.4 SYSTEM DESCRIPTION

- A. Design static pressure:
 - 1. 1-inch w.g. minimum for all low-pressure ductwork applications.
 - 2. 3-inch w.g. minimum for all medium pressure ductwork applications.

1.5 SUBMITTALS

- A. Product Data:
 - 1. Provide submittal data on all equipment specified in this section in accordance with Section 23 00 90, General Conditions, and Division 01.
 - 2. Submit product data indicating typical catalog of information including arrangements.
 - 3. Submit product data sheets indicating dimensions, general assembly, and materials used in fabrication.
 - 4. Indicate mechanical and electrical service locations and requirements of equipment.
 - 5. Submit manufacturer's installation instructions.
- B. Shop Drawings:
 - 1. Submit 1/4" per foot shop drawing(s) showing all ducts, piping, and equipment shown by plans and specifications. Submit drawings on all mechanical rooms. Before starting shop drawings or fabrication of any ductwork, the Contractor must be coordinated with structural and electrical and have an approved reflected ceiling plan with which he can coordinate location of air outlets, lights, tile patterns, etc. Provide sections for all congested areas and mechanical rooms. Submit prior to construction of ductwork.

1.6 QUALITY ASSURANCE

- A. All equipment and materials shall be new and of the quality as specified herein. All work shall comply with the Local Building Code, Mechanical Code, Fire Code, and all other applicable State and Local Codes or ordinances.
- B. All equipment and materials shall be installed in a workmanlike manner by trained and experienced sheet metal technicians and mechanics as recommended by the manufacturers of the products installed.
- C. All ductwork to be manufactured, constructed, installed, sealed, joined, reinforced, supported, tested and conform in accordance with the latest SMACNA standards.
- D. Where the standards and requirements of this specification exceed those of SMACNA, the requirements herein shall govern.

1.7 WARRANTY

- A. Warranty all ductwork and dampers for 1 year from the date of final acceptance. The warranty will cover workmanship, noise, chatter, whistling, and vibration. Ductwork must be free from pulsation under all conditions of operation.

PART 2 PRODUCTS

2.1 RECTANGULAR AND ROUND RIGID DUCTS

- A. Material:
 - 1. New, prime grade sheet or coil steel

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- B. Gauge:
 - 1. Select gauge in accordance with latest SMACNA Duct Construction Standards Tables
- C. Coating:
 - 1. Type:
 - a. Continuous, hot-dip, galvanized coating
- D. Application:
 - 1. 1-1/4 ounces per 1 square foot, two-sided sheet
 - 2. Comply with ASTM A653/A653M
- E. Identification:
 - 1. Sheet steel:
 - a. Stencil each sheet with manufacturer's name and gauge.
- F. Elbows:
 - 1. Elbows shall be mitered with double thickness turning vanes or smooth radius long sweep elbows.
- G. Coil steel:
 - 1. Stencil coils on 10-foot centers with manufacturer's name and gauge.
- H. Construction:
 - 1. Manufacture in accordance with latest SMACNA Round Duct Standards Tables
 - 2. Pre-manufactured round duct may be used if approved by the Architect/Engineer.

2.2 ACCESS DOORS

- A. Install access doors to facilitate cleaning as required by code.
- B. Install access doors as required for access to fire protection devices.

2.3 EXHAUST DUCT FOR DOMESTIC WATER HEATERS

- A. Zero clearance concentric flue with all necessary tees, adapters, elbows, flashing, thimbles, plates, supports, condensate traps and termination kits. Install per local codes and per manufacturer recommendations.

2.4 EXHAUST DUCTS FOR SHOWER ROOMS

- A. Aluminum:
 - 1. Gauge in accordance with the latest SMACNA Standards.

2.5 DOUBLE-WALL INSULATED SPIRAL/RECTANGULAR DUCTWORK

- A. Types:
 - 1. Round
 - 2. Flat Oval
 - 3. Rectangular
- B. Materials:
 - 1. Duct: Sheet metal, select gauge in accordance with the latest SMACNA Standards.
 - 2. Solid Liner: Galvanized steel
 - 3. Insulation liner:
 - a. 1-inch fiberglass with R-value greater than 6.0 for conditioned areas (gyms)

- b. 2-inch fiberglass with R-value greater than 6.0 inside building unconditioned space.
 - c. 3-inch fiberglass with R-value greater than 8.0 for exterior duct.
 - C. Conform to ASTM A653/A653M and ASTM A924/A924M.
 - D. Conform to ASTM 463 for aluminized ductwork
 - E. Construction:
 - 1. Double wall insulated
 - 2. Spiral with lockseams
 - 3. "Paint grip" finish on outer shell for exposed ductwork
 - 4. Conform to ASTM A653/A653M
 - 5. Fittings:
 - a. Spot welded and bonded construction
 - 6. Outer joints:
 - a. Use flanged couplings that will withstand the maximum design pressure with no leakage.
 - 7. Inner Liner Joints:
 - a. Use a separate slip coupling to connect the inner liner sections at duct to duct joints to allow for expansion/contraction.
 - b. Do not mechanically fix or seal inner lining couplings.
 - F. Flanged Joints:
 - 1. Seal with a duct sealant that has a synthetic elastomeric base.
 - 2. Sealant:
 - a. Formulated to withstand temperatures from -20 to 150 degrees F.
 - b. Formulated so that no surface preparation or solvent cleaning is necessary.
 - c. UL classified.
 - G. Control Dampers:
 - 1. Construct with a 2-inch insulation layer and a solid inner liner.
 - 2. Press stainless steel bearing sleeves into the frame of the outer shell to support the damper axle.
 - 3. Extend the axle 6 inches from the outer shell body.
 - 4. Attach a 1½ inch x 1½ inch reinforcement to the damper.
 - H. Elbow Radius:
 - 1. 90-degree: 1-1/2 times duct diameter with 5 gores
 - 2. 45-degree: 1-1/2 times duct diameter with 3 gores
 - I. Manufacturer/Model:
 - 1. United McGill Corporation
 - 2. Lewis & Lambert, LLP
 - 3. Linx Industries
 - 4. Precision Spiral Pipe
 - 5. Spiral Pipe of Texas Corporation, Inc.
- 2.6 SINGLE-WALL, ROUND AND FLAT OVAL DUCT AND FITTINGS (FOR MEDIUM PRESSURE APPLICATION)
- A. Medium Pressure (3-inch w.g.)
 - B. Material:
 - 1. New, prime grade sheet or coil steel.

- a. Select gauge in accordance with latest SMACNA Duct Construction Standards.
- C. Fittings:
 - 1. By Duct Manufacturer
- D. Coatings:
 - 1. Type:
 - a. Continuous, hot-dip galvanized coating.
- E. Application:
 - 1. 1-1/4 ounces per 1 square foot, two-sided sheet.
 - 2. Comply with ASTM A653/A653M.
- F. Identification:
 - 1. Sheet Steel
 - 2. Stencil each sheet with manufacturer's name and gauge.
- G. Construction:
 - 1. Manufacture in accordance with the latest SMACNA Standards.
- H. Approved Manufacturers:
 - 1. United McGill Corporation
 - 2. Lewis & Lambert, LLP
 - 3. Linx Industries
 - 4. Precision Spiral Pipe
 - 5. Spiral Pipe of Texas Corporation, Inc.

2.7 FLEXIBLE DUCTS

- A. Material: In accordance with the latest SMACNA Metal and Flexible Duct Standards,
- B. Construction:
 - 1. Factory insulate with high-density fiberglass to a minimum R-value of 6.
 - 2. Provide a positive interior air seal permanently bonded to a carbon steel spring helix.
 - 3. Sheath seal in a Class 1 vapor barrier and factory seal at both ends.
 - 4. Conform to UL 181, NFPA 90A
- C. Manufacturer/Model:
 - 1. ATCO 30 Series or equal

2.8 VOLUME CONTROL DAMPERS

- A. Manufacturer:
 - 1. Nailor Industries Series 1020, 1021, or equal.
- B. Type:
 - 1. Manually operated single-blade or multi-blade
 - 2. Conform to the latest SMACNA Duct Standards (Metal & Flexible)
- C. Application:
 - 1. Provide in all branches, splits, and taps whether indicated on plans or not.
- D. Construction:
 - 1. Provide an indicating device with lock to hold damper in proper position.

2. All manual dampers installed above hard ceilings or at other inaccessible areas shall be supplied with a cable operated damper equal to Young Regulator Model 830A-CC. Damper(s) to be opposed blade type constructed of .050 minimum heavy duty extruded aluminum frames and blades. All necessary hardware to ensure compatibility with remote cable control system shall be included. Damper blades to include individual blade bushings for smooth and quiet operation. Damper blades shall rotate between a matched pair of formed and punched 306 stainless steel connecting slide rails which facilitate smooth blade movement and ensure alignment.

2.9 TURNING VANES

- A. Provide in all rectangular supply elbows.
- B. Conform to the latest SMACNA Duct Standards

2.10 DUCT SEALANT

- A. Equal to Glenkote "Seal-Flex" duct sealer, Hardcast "Irongrip 601", Foster 32-19" or "Childers CP-146"

2.11 FIRE DAMPERS

- A. Manufacturer/Model:
 1. Fire Dampers - Pottorff, Ruskin, Greenheck, National Controlled Air or Nailor
- B. Type:
 1. 212°F fusible link fire damper.
 2. Fire protection rating: 1.5 hours
 3. Conform to UL 555 and be UL labeled
 4. Tested in accordance with AMCA 500.
- C. Application:
 1. Provide where required by Local and State ordinances and at locations shown on plans.
 2. Multi-blade airfoil style for medium pressure duct.
 3. Curtain style blade for low pressure duct.
 4. Rectangle duct transitions or round blade type for round duct.
- D. Features:
 1. Vertical or horizontal installation
 2. Radiation blanket
 3. Wall Sleeve and retaining angle collar

2.12 FIRE SAFETY FUNCTIONS - DUCT MOUNTED SMOKE DETECTORS, CONTROL RELAYS, AND SMOKE FIRE DAMPER CONTROL

- A. At minimum, duct mounted smoke detectors required on all air handlers, fan coil units, fan powered boxes, and packaged rooftop units rated at 2000 CFM or more. Control relays required on all air handlers, fan coil units, fan powered boxes, and packaged rooftop units feeding any path of egress or corridors.
- B. The Fire Alarm Contractor shall provide the Duct Mounted Smoke Detectors, Control Modules, Power Relays, and Control Relay devices and perform the final low-voltage hook-up to the fire alarm system.

- C. Duct-mounted smoke detector housings and sample tubes shall be furnished by the Fire Alarm Contractor and mounted by the Mechanical Contractor.
- D. Line voltage hook-up shall be by the Electrical Contractor.
- E. Fire Alarm Safety Control Functions, which may include the operation of fire alarm Control Relays CR associated with duct mounted smoke detector D/air handler shut down, high volume low speed (HVLS) fan shut down, fire door hold-back and release, smoke fire damper motor control, et cetera, shall be initiated via Control Relays which shall be de-energized under fire alarm conditions. These Control Relays shall be provided and mounted by the Fire Alarm Contractor and located within three feet of the unit. These Control Relays shall be controlled by a fail-safe Fire Safety Control Function circuit. For each controlled device, the contractor providing the device shall wire it internally for fail-safe shut-down and provide a labeled 3' coil of cable outside the unit to allow the fire alarm contractor to make final connection to the Common and N.O. or N.C. dry contacts on the fire alarm SPDT Control Relay. Each Fire Safety Control Function circuit controlled device shall be configured such that when the fire alarm system safety control circuit is re-energized, by the fire alarm control panel, the device shall return to normal operation (e.g. be ready to re-start) without a need for manual or environmental control system intervention.

2.13 FIRE SAFETY FUNCTIONS - DUCT MOUNTED SMOKE DETECTORS, CONTROL RELAYS, AND SMOKE FIRE DAMPER CONTROL

- A. At minimum, duct mounted smoke detectors required on all air handlers, fan coil units, fan powered boxes, and packaged rooftop units rated at 2000 CFM or more. Control relays required on all air handlers, fan coil units, fan powered boxes, and packaged rooftop units feeding any path of egress or corridors.
- B. The Mechanical Contractor shall employ a Fire Alarm sub-contractor that is licensed by the State of Texas Fire Marshal and a factory authorized distributor for the brand of existing fire alarm system to provide the devices and perform the final low-voltage hook-up. Duct mounted smoke detector housings and sample tubes shall be furnished by the Fire Alarm sub-contractor and mounted by the Mechanical Contractor. Line voltage hook-up shall be by the Electrical Contractor.
- C. Fire Alarm Safety Control Functions, which may include the operation of fire alarm Control Relays CR associated with duct mounted smoke detector D/air handler shut down, high volume low speed (HVLS) fan shut down, fire door hold-back and release, smoke fire damper motor control, et cetera, shall be initiated via Control Relays which shall be de-energized under fire alarm conditions. These Control Relays shall be provided and mounted by the Fire Alarm Contractor and located within three feet of the unit. These Control Relays shall be controlled by a fail-safe Fire Safety Control Function circuit. For each controlled device, the contractor providing the device shall wire it internally for fail-safe shut-down and provide a labeled 3' coil of cable outside the unit to allow the fire alarm contractor to make final connection to the Common and N.O. or N.C. dry contacts on the fire alarm SPDT Control Relay. Each Fire Safety Control Function circuit controlled device shall be configured such that when the fire alarm system safety control circuit is re-energized, by the fire alarm control panel, the device shall return to normal operation (e.g. be ready to re-start) without a need for manual or environmental control system intervention.
- D. Duct mounted smoke detector housings with addressable or conventional photoelectric detector heads (to match the existing fire alarm system) shall be provided where shown on the drawings, or as required. Detectors shall operate by the photoelectric light-scattering principle using an LED light source to measure smoke density and shall, on command from the control panel, send

data to the panel representing the analog level of smoke density. The detector shall operate in air velocities of 300 to 4,000 ft./min. without a shift in sensitivity. Each detector shall be resettable from the FACP.

- E. The unit shall include a 16-gauge steel or Noryl molded plastic enclosure with molded integral conduit knockouts. The unit shall be provided with gasket seals to provide proper sealing of housing to mechanical ductwork and to ensure proper airflow into the detector sampling chamber. Duct housing shall be designed for mounting to rectangular or round ducts.
- F. Each duct mounted detector housing shall be labeled in a visible area with its device hardware address or zone utilizing self-laminating, flexible vinyl film, non-smear, machine printed labels.
- G. The Duct Detector Unit shall be UL listed to the most current UL 268A standard and be cross-listed for use with the fire alarm control panel. Each duct unit shall be equipped with sampling tubes protruding into the associated ductwork. For ducts up to 3' wide, the supply tube shall be 1" shorter than the duct width. For ducts 3' to 8' wide the sampling tube to be 1" longer than the duct width and protrude through the opposite side of the duct for support. Duct widths greater than 8' will require internal bracing. Sampling tubes shall be configured to provide adequate airflow through the detector housing and fitted with an integral porosity filter system to aid in reducing detector contamination. Detectors shall be installed per NFPA 90A and the manufacturer's instructions.
- H. When smoke is detected by a duct mounted smoke detector, it shall activate a supervisory fire alarm condition at the fire alarm control panel. Duct mounted smoke detectors shall indicate a supervisory alarm unless otherwise directed, duct mounted smoke detectors are not a substitute for area detection. In either case, the activation of any duct mounted smoke detector shall actuate all related fire alarm safety control functions.
- I. Each smoke detector shall be attached to a SLC and set to a distinct address and internal identification code, which the control panel shall use to identify the location, status, and type of device. Duct detectors must be powered from the fire alarm system.
- J. Each detector shall be provided with a remote power/status LED. The remote LED indicator shall be located in the nearest corridor ceiling unless otherwise directed. The status LED shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control panel. The LED shall be placed into steady illumination when a supervisory condition has been detected.
- K. Each remote LED faceplate shall have an engraved plastic nameplate permanently attached indicating the HVAC unit number, type, and device identification number as programmed in panel. Labels shall be 1/16" thick two-ply black/white acrylic sheet engraving stock with all sides beveled.
- L. Each HVAC unit for which a Duct mounted Smoke detector is installed shall also have a blower shutdown relay as listed below.
- M. Provide housing with base and photoelectric detector head, sampling tube, and remote LED.
- N. Fire Safety Function HVAC Unit Blower Shut-Down and Smoke Fire Damper Operation:
 - 1. Provide a power relay for each fire safety control circuit as required to operate smoke fire dampers, control relays for shut-down of each air handler, et cetera, as indicated on plans.
- O. Fire Safety Function Control Module:

1. Addressable Control/Relay Modules shall be provided where required to provide NAC interface or relay controlled fire alarm functions. The control module will mount in a standard 4-inch electrical box. The control module shall provide a dry contact (form C) relay with SPDT dry contacts rated at 2.0 amps @ 24 VDC and 0.5 Amps @ 120 VAC (pilot duty).
- P. Power to operate the relay actuation shall be provided by the SLC. Each control module shall be operated by events as programmed in the control panel (i.e. operate on alarm condition). Control modules shall feature status LEDs to indicate the module is operational and when the relay is energized.
- Q. Each control module shall be set to a distinct address and internal identification code on the SLC, which the control panel shall use to identify the location, status, and type of device.
- R. Each control module shall have an engraved plastic nameplate permanently attached indicating the devices function and control panel device identification number. Labels shall be 1/16" thick two-ply black/white acrylic sheet engraving stock with all sides beveled.
- S. Fire Safety Function Power Relay:
 1. Power Relays shall be provided as required to control each fire safety control functions circuit, one or two circuits may be controlled by each relay. Each relay shall be operated by a 120 VAC coil and feature DPDT dry contacts rated 30 Amps @ 120 VAC. Each relay shall be mounted in a surface mount metal enclosure with conduit knockouts. Relays shall be UL recognized and rated for ten million mechanical operations.
 2. Air Products & Controls model MR-199X-14/C, 120 VAC coil, heavy-duty power relay with metal enclosure or approved equivalent.
- T. Fire Safety Function Control Relays:
 1. Control Relays shall be provided where a relay control interface is required to perform fire safety control functions; air handler shut-down, fire door control, et cetera. Each relay shall be operated by a multi-voltage coil (24 VDC, 24 VAC, or 120 VAC), feature SPDT dry contacts rated 10 Amps @ 120 VAC, and a status LED to indicate the relay is energized. Each relay shall be mounted in a surface mount metal enclosure with a status LED viewing hole and conduit knockouts. Relays shall be UL recognized and rated for ten million mechanical operations.
 2. Air Products & Controls model MR-101/C, multi-voltage coil, control relay with metal enclosure or approved equivalent.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Erect all ductwork in the general locations shown.
- B. Conform to all structural and finish conditions of the building.
- C. Ductwork shall not be allowed to pass through or over designated electrical rooms.
- D. Before fabricating any ductwork, check the physical conditions at the job site and make all necessary changes in cross sections, offsets, and similar items, whether they are specifically indicated or not.
- E. Where ductwork is shown to be lined on the inside with duct liner, the sizes shown on the plans are the inside dimensions. Therefore, sheet metal dimensions shall be increased accordingly.

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- F. Seal all joints both transverse and longitudinal seams, with duct sealant.
- G. Install 1" roll type filter media on all return duct openings prior to starting blowers. Leave in place and change as necessary during construction.
- H. Before installing grilles, operate air conditioning unit fans and remove all debris or foreign matter.
- I. Rectangular ductwork:
 - 1. Construct in accordance with the latest SMACNA, Duct Construction Standards for the specific duct pressure classification involved. Do not use radius ells with square throats.
- J. Round ductwork:
 - 1. Connect with slip type joints using a minimum of three sheet metal screws per joint and in accordance with the latest SMACNA Duct Construction Standards.
- K. Flexible ductwork:
 - 1. All flexible ducts shall be demountable and individual lengths shall not be in excess of five feet. Flexible ducts are not allowed to substitute rigid return air ductwork unless approved by engineer.
 - 2. Use only factory-made connectors.
 - 3. Flexible ducts should be installed fully extended, free of sags and kinks.
- L. Shower Room Exhaust Ductwork:
 - 1. Provide shower room with aluminum or stainless steel exhaust ductwork as specified for standard duct construction for sheet metal ductwork.
 - 2. Make all joints in the bottom of horizontal runs watertight.
 - 3. Slope horizontal runs to exhaust grille.
 - 4. Use unlined duct in all shower room installations.
- M. Double-wall insulated spiral/rectangular ductwork:
 - 1. Install without exposed insulation in all exposed ceiling areas.
 - 2. Provide ductwork installation that is high quality, very neat, and aesthetically pleasing.
 - 3. The final appearance of the ductwork shall be approved by the Architect/Engineer.
- N. Exterior Ductwork:
 - 1. Exterior ductwork shall use a Ductmate Industries connection and sealing system. Install per manufacturers recommendations.
 - 2. All exterior ductwork to be protected and sealed with a weather-proofing, protective finishing system such as Alumaguard All Weather, Venture Clad System, or equivalent. Both insulation and protective finish cover system shall be pitched in order to shed water. Level or flat covers will not be accepted.
- O. Reinforcement:
 - 1. Reinforce all ducts to prevent buckling, breathing, vibration, or unnecessary noise.
 - 2. Reinforcing shall be in accordance with the latest SMACNA Duct Construction Standards (Metal and Flexible), plus any additional reinforcing to meet job conditions.
 - 3. All ducts shall be supported in accordance with the latest SMACNA Duct Construction Standards (Metal and Flexible).
- P. Flexible Connections:
 - 1. Where ducts connect to fans or air handling units, make flexible airtight connections using "Ventglas" fabric.
 - 2. The fabric must be fire-resistant, waterproof, and mildew resistant with a weight of approximately 30 ounces per square yard.

3. Provide a minimum of 1/2 inch slack in the connections, and a minimum of 2-1/2 inches distance between the edges of the ducts.
 4. Provide a minimum of 1-inch slack for each inch of static pressure on the fan system.
 5. Securely fasten fabric to apparatus and to adjacent ductwork by means of galvanized flats or draw bands.
 6. Do not install outdoors, except where detailed on plans.
 7. Where connections are made in outdoor locations, seal fabric to metal with mastic.
- Q. Access Doors:
1. Install ductwork access doors in structural angle frames and provide with sash locks and hinges arranged for convenient access.
 2. Construct doors which occur in insulated ducts with an insulation filler.
 3. All access doors shall be appropriately labeled.
- R. Flashing and Opening Sealing:
1. Ducts passing through roofs or exterior walls:
 - a. Provide suitable flashing to prevent rain or air currents from entering the building as detailed on plans.
 - b. The flashing shall be minimum No. 24 gauge galvanized steel.
- S. Ducts passing through mezzanine walls:
1. Completely seal the penetration with acoustic sealant and fill all gaps between the ductwork and the wall materials.
 2. Sealant must be capable of preventing sound from exiting the mechanical rooms through these openings.
- T. Ducts penetrating the floor:
1. Make the entire penetration watertight by installing appropriate flashing and/or application of G.E. silicone sealant.
 2. The penetration must be capable of maintaining standing water in the mechanical area without allowing any water through the opening.
- U. Duct Leakage:
1. Seal ductwork in accordance with the latest SMACNA HVAC Duct Construction Standards - Metal and Flexible.
 2. Minimal leakage is expected for ductwork constructed to these standards but in no case shall the total leakage exceed 1% of designed CFM.
 3. All joints to be sealed with duct sealant.
- V. Fire and Smoke Dampers:
1. Install fire and smoke dampers at locations shown on plans, and where required by local and state ordinances.
 2. Do not compress or stretch SFD, FD frame into duct or opening.
 3. Install dampers square and free from racking with blade running horizontally.
 4. Handle damper using sleeve or frame. Do not lift damper using blades actuator, or jackshaft.
 5. Install bracing for multiple section assemblies to support assembly weight and to hold against system pressure. Install bracing as needed.
 6. Provide access doors in attached ductwork for inspection.
 7. Stencil each door "Fire Damper Access" per UL 555 Standard.
 8. Install fire dampers in openings utilizing steel angles, sleeves, and other materials, and practices required to provide an installation equivalent that used by manufacturer when dampers were tested at UL.

9. Install in accordance with damper manufacturer's published recommendations and instructions and NFPA 90A.

3.2 BALANCING DAMPERS

- A. Volume Control Dampers:
 1. Install manually operated volume control dampers in all branch ducts, splits, or taps whether indicated on the drawings or not. Install a minimum of 5'-0" from grille/diffuser.
 2. Provide indicating device with lock to hold damper in position.
- B. Cable Operated Dampers:
 1. Install a minimum of 5'-0" from grille/diffuser.
 2. Install to facilitate smooth blade movement and ensure alignment.
- C. Back Draft Dampers:
 1. Install back draft dampers as shown on plans.
 2. Manufacturer: Nailor Industries Series 1300 or equal.
- D. Air Intake Ducts:
 1. Insulate all outside air intake ducts.

3.3 DAMPER IDENTIFICATION

- A. Provide a securely attached red band and a label reading "Damper Location" at the location of all concealed manual dampers.
- B. All manual dampers which are not readily visible after duct insulation installation shall be identified in this manner.

3.4 DUCTWORK SUPPORT

- A. All ducting must be supported from building structure.
- B. Duct straps are not allowed to be screwed to roof decks, support from cross bridging, or supported from bottom chord of joists.
- C. Do not support from roof or floor deck joist bridging.
- D. Support sizes and spacing shall conform to the latest SMACNA Standards.

END OF SECTION

SECTION 233713 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Grilles
- B. Diffusers
- C. Registers
- D. Louvers (Including Storm Rated FEMA Louvers)

1.2 RELATED SECTIONS

- A. Section 23 00 00 - Basic Mechanical Requirements
- B. Section 23 00 90 - HVAC Submittal Procedures
- C. Section 23 31 13 - Metal Ductwork

1.3 REFERENCES

- A. ARI Standard 890-94 - Rating of Air Diffusers and Air Assemblies.

1.4 SUBMITTALS

- A. Provide submittal data on all items specified in this section in accordance with Specification Section 23 00 90, General Conditions, and Division 01.
- B. Product data for review prior to placement of purchase order:
 - 1. Outlets
 - 2. Grilles
 - 3. Registers
 - 4. Control devices
 - 5. Diffusers
 - 6. Louvers
 - 7. Similar equipment
- C. Product data shall be submitted for each device specified. Data shall be arranged to match grille schedule.
- D. If a manufacturer other than the one scheduled on the plan is used, the sizes shown on the plans shall be checked for performance, noise level, face velocity, throw, pressure drop, etc., before the submittal is made.
- E. Selections shall meet the manufacturer's own published data for the above performance criteria.
- F. If grilles other than those scheduled by name are furnished, manufacturer shall be prepared to demonstrate compliance with noise criteria at Engineer's request and to Engineer's satisfaction.

1.5 COORDINATION

- A. Coordinate this work with work under Division 26 to ensure that intended functions of lighting and air systems are achieved.
- B. Locations of outlets on plans are approximate and shall be coordinated with other trades to make symmetrical patterns.
- C. Locations shall be governed by the established pattern of the lighting fixtures or architectural reflected ceiling plan.
- D. The Contractor shall move any grille, register, or outlet up to four feet in any direction as directed by the Engineer at no additional cost.

PART 2 PRODUCTS

2.1 GENERAL

- A. All air distribution devices shall be 100% aluminum construction.
- B. Provide grilles, registers, and diffusers as shown or scheduled on the plans. Conform to ARI 890-94.
- C. All air distribution devices for 1-hour structures (walls or ceilings) shall be steel construction conforming to all codes and standards.

2.2 MANUFACTURERS

- A. Greenheck / Metalaire
- B. Titus / Krueger
- C. Nailor
- D. Price
- E. Pottorff
- F. Ruskin
- G. United Enertech

2.3 PERFORMANCE CRITERIA

- A. Throw: Velocity at the end of the throw, in the 5'-0" occupancy zone, will be between 25 to 50 FPM.
- B. Noise levels (NC Curve):
 - 1. Not to exceed those scheduled below.
 - a. Classrooms, Libraries, and Offices - 25 N.C.
 - b. Cafeterias - 30 N.C.
 - c. Gymnasiums - 40 N.C.
- C. All devices shall be tested per Air Diffusion Council and labeled as such.

2.4 FINISHES

- A. Paint exposed devices with factory standard prime coat or factory finish coat. Architect/Engineer to determine final color of grille.

2.5 AIR INTAKE AND EXHAUST LOUVERS

- A. Designed to meet local wind speed and rain rating

PART 3 EXECUTION

3.1 INSTALLATION

- A. Where called for on the schedules, the grilles, registers, and ceiling outlets shall be provided with deflecting devices and manual dampers. These shall be the standard product of the manufacturer, subject to review by the Engineer.
- B. All ceiling devices shall be furnished to be compatible with the ceilings in which they are installed.

END OF SECTION

SECTION 237416 - PACKAGED LARGE CAPACITY ROOFTOP HVAC UNITS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Design, controls, and installation of packaged large capacity rooftop HVAC units.

1.2 RELATED SECTIONS

- A. Section 23 00 00 - Basic Mechanical Requirements
- B. Section 23 00 90 - HVAC Submittal Procedures
- C. Section 23 05 32 - Roof Curbs

1.3 REFERENCES

- A. ARI Standard 410 and 430 66
- B. AMCA 210, 310, 410, and 500.
- C. NFPA 90A - Installation of Air Conditioning and Ventilation Systems.
- D. UL 181 - Factory-Made Air Ducts & Air Connectors
- E. ASTM E84 - Fire and Smoke Rating
- F. NEMA
- G. ASHRAE Std 15 - Safety Standard for Mechanical Refrigeration

1.4 QUALITY ASSURANCE

- A. Unit will conform to AMCA 210 for fan performance ratings.
- B. Unit will conform to E.T.L. standards. Unit will be ETL listed.
- C. Unit sound ratings will be reported in accordance with AHRI 260 for inlet and discharge sound power levels.
- D. Unit casing radiated sound ratings will be reported in accordance with ISO 9614 parts 1 and 2, and ANSI S12.12.
- E. Unit will conform to AHRI 410 for capacities, pressure drops, and selection procedures of air coils.
- F. Unit will conform to ANSI/AHRI 430 for all fabrication procedures of air handling units.
- G. Damper performance will comply with AMCA 500
- H. Air handling unit will be ISO 9001 certified.
- I. Air handling unit will be manufactured in an ISO 9002 certified facility.

1.5 SUBMITTALS

- A. Provide submittal data on all items specified in this section in accordance with Specification Section 23 00 90, General Conditions, and Division 1.
- B. Submit unit performance including capacity, nominal and operating performance, and fan curves with fan operating point clearly marked.
- C. Submit Mechanical Specifications for unit and accessories describing construction, components, and options.
- D. Submit shop drawings indicating overall dimensions as well as installation, operation, and service clearances. Indicate lift points and recommendations. Indicate unit shipping, installation, and operating weights including dimensions.
- E. Submit data on electrical requirements and connection points. Include recommended wire and fuse sizes or MCA, sequence of operation, safety, and start-up instructions.
- F. The contractor shall provide a 1/4" scale drawing of the mechanical equipment rooms where all air handling units will be located. The drawing shall show all piping, equipment, and required maintenance clearances for the equipment. This drawing shall be furnished prior to commencement of work.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under provisions of the contract documents. Units shall ship fully assembled up to practical shipping and rigging limitations. Units not shipped fully assembled shall have tags and airflow arrows on each section to indicate location and orientation in direction of airflow. Each section shall have lifting lugs or shipping skid to allow for field rigging and final placement of section.
- B. Deliver units to site with fan motors, sheaves, and belts completely assembled and mounted in units. Mount motors as specified in these contract documents.
- C. Store and protect products under provisions of the contract documents.
- D. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish. The contractor shall be responsible for the repair of the units if any damage occurs due to improper storage and handling. The contractor shall protect the units with tarpaulins, not plastic covering.

1.7 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data.
- B. Include manufacturer's descriptive literature, operating instructions, installation instructions, and maintenance and repair data.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

1.9 STRUCTURAL REQUIREMENTS

- A. Provide factory assembled units, in sections sized to meet existing site restrictions. Refer to equipment schedule on drawings for dimensional data.
- B. Furnish units with sealing and fastening hardware supplied by the manufacturer. Include written instructions needed to complete field assembly of the components.
- C. Provide units designed and constructed so that coils, panels, fan housing, and fans can be removed without affecting the structural integrity of the unit. All units shall come complete with a welded structural steel base around the entire perimeter. Provide de-mounts as required to meet site restrictions. All units shall be suitable for Class II design conditions.

1.10 WARRANTY

- A. Unit manufacturer shall warrant unit and factory packaged controls for eighteen (18) months from date of shipments or twelve (12) months from manufacturer supervised on-site start-up.
- B. Compressor(s) shall have 5 year warranty.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURER

- A. Aeon
- B. Daikin
- C. Valent
- D. Manufacturer must clearly define any exceptions made to Plans and Specifications. Mechanical Contractor is responsible for expenses that occur due to exceptions made.

2.2 UNIT GENERAL DESCRIPTION

- A. Units shall be specifically designed for outdoor rooftop installation on a roof curb and be completely factory assembled and tested, piped, internally wired, fully charged with compressor oil and shipped in one, two or three-pieces for field reassembly into a single unit. Single piece units shall be fully charged.
- B. Units shall be available for direct expansion cooling only, or direct expansion cooling with natural gas, electric, hot water or steam heating. Filters, outside air system, relief air system, optional non-fused disconnect switches and all operating and safety controls shall be furnished factory installed.
- C. Unit shall have a draw-through supply fan configuration and discharge air horizontally or vertically based on plans.
- D. Unit shall be factory assembled and tested including leak testing of the coils and run testing of the supply fans and factory wired electrical system.
- E. Unit shall have decals and tags to indicate lifting and rigging, service areas, and caution areas for safety and to assist service personnel.

- F. Unit components shall be labeled, including pipe stub outs, refrigeration system components, and electrical and controls components.
- G. Installation, Operation, and Maintenance manual shall be supplied within the unit.
- H. Laminated color-coded wiring diagram shall match factory-installed wiring and shall be affixed to the interior of the control compartment's access door.
- I. Unit nameplate shall be provided in two locations on the unit, affixed to the exterior of the unit and affixed to the interior of the control compartment's access door.

2.3 UNIT CASING CONSTRUCTION

- A. Unit physical dimensions are shown accurately on drawings. Any deviation from dimensions shown is the responsibility of the contractor to verify all maintenance clearance requirements are met.
- B. Refrigeration components and compressor shall be accessible through removable louvered panels as standard. Unit section shall be laminated double-wall construction with polyurethane foam core injected between sheet metal panels and liners. Insulation value shall be minimum of R8. All interior surfaces shall be suitable for cleaning per ASHRAE 62. All access doors and panels shall have neoprene gaskets. Unit base shall be watertight with heavy gauge formed load bearing members and curb overhang. Unit lifting lugs shall accept chains or cables for rigging. Lifting lugs shall also serve as unit tie down points
- C. All cabinet walls and access doors shall be fabricated of double wall, impact resistant, rigid polyurethane foam panels.
- D. Unit shall be designed to reduce air leakage and infiltration through the cabinet. Sealing shall be included between panels and between access doors and openings to reduce air leakage. Refrigerant piping and electrical conduit through cabinet panels shall include sealing to reduce air leakage.
- E. Access doors shall be hinged with a single, exterior mounted, height and tension adjustable, handle to provide positive latching at three points. Access doors shall provide a door stop mechanism to latch the door in the open position to prevent unsafe door closure by wind.
- F. Doors of laminated double wall construction with a polyurethane foam core between the exterior sheet metal pane and the interior liner, with an insulating value of R8 shall be provided on the air handlers serviceable compartments such as return/relief fan, filters, evaporator coil, and blank sections. Two single wall doors shall be provided for access to the control panel
- G. Drain pan shall be 304 stainless steel, double sloped, and located under the evaporator coil in order to promote runoff of standing water from condensation inside the unit as well as provide protection in corrosive environments. Two drain pipes shall be installed through the base channel on each side of the unit
- H. Cooling coils shall be mechanically supported above the drain pan by multiple supports that allow drain pan cleaning and coil removal.
- I. Exterior paint finish shall be capable of withstanding at least 2,000 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B117-95 test procedure.

2.4 CONDENSING UNIT CONSTRUCTION

- A. Condensing unit shall include compressors, air-cooled condenser coils, condenser fans, suction and liquid connection valves, and unit controls. Unit shall be factory assembled and tested including leak testing of the coil and run testing of the completed unit. Run test report shall be supplied with the unit in the controls compartment's literature pocket.
- B. Unit shall be completely factory assembled, piped, wired, and shipped in one section.
- C. Unit shall be specifically designed for outdoor application.
- D. Condenser coils shall have all-aluminum, Microchannel coils. All coils shall be leak tested at the factory to ensure pressure integrity. The condenser coil shall be pressure tested to 650 psig. Subcooling circuit(s) shall be provided as standard.
- E. Coils shall be designed for a minimum of 10°F of refrigerant sub-cooling.
- F. Condenser coils shall be mechanically protected from physical damage by painted galvanized steel louvers (wire grille) covering the full area of the coil.
- G. Access to condenser coils, condenser fans, compressors, and electrical and controls components shall be through hinged access doors with quarter turn, zinc cast, and lockable handles.
- H. Unit shall include a forkliftable base.
- I. Unit shall be provided with standard power block for connecting power to the unit.
- J. All condenser fans shall be vertical discharge, direct drive fans, statically balanced, with steel blades and zinc plated steel hubs. Condenser fan motors shall be totally enclosed three-phase motors with permanently lubricated ball bearings, built-in current and thermal overload protection and weather tight slingers over motor bearings.
- K. Variable speed condenser motors shall be provided to allow the unit to operate down to 0°F

2.5 UNIT FANS AND SECTION

- A. Fans shall be direct-driven. Entire assembly shall be completely isolated from unit and fan board by 2" deflection spring isolation. Fan shall not require routine maintenance such as fan bearing lubrication, belt tensioning and replacement, sheave alignment, and setscrew torque
- B. Supply, relief and return motors shall be totally enclosed fan cooled (TEFC). Motors with internal haft grounding rings can be selected for use with VFD applications and shall provide a conductive discharge path away from the motor bearings to ground.
- C. Variable frequency drive shall be factory wired and mounted in the control compartment. Fan motor shall be premium efficiency.
- D. Fans shall have bypass control provides airflow in the event of drive failure.

2.6 UNIT COOLING COILS

- A. Direct expansion (DX) coils, and steam coils shall have capacity and pressure drop performance certified in accordance with AHRI 410.
- B. Maximum face velocity across coils shall be 490 fpm.

- C. DX Coils:
1. Coil shall be designed for use with refrigerant and constructed of copper tubes with aluminum fins mechanically bonded to the tubes and galvanized steel end casings. Fin design shall be sine wave rippled.
 2. Clearly label suction and discharge headers on outside of unit.
 3. Coils shall be proof tested to 450 psig and leak tested under water to 300 psig air pressure.
 4. Suction headers shall be constructed of copper tubing with connections penetrating unit casing to permit sweat connections to refrigerant lines.
 5. Construct tubes of 1/2 inch O.D. minimum 0.016-inch thick copper and construct fins of aluminum.
 6. If two or more coils are stacked in unit, install intermediate drain channels between coils to drain condensate to main drain pans without flooding lower coils or passing condensate through airstream.
 7. Coil shall be furnished with a factory-installed thermostatic expansion valve. The sensing bulbs shall be field installed on the suction line immediately outside the cabinet.

2.7 UNIT HEATING SYSTEM

- A. Modulating Gas Fired Heating
1. Modulating gas heaters shall be made from of stainless steel.
 2. All gas-fired units shall be completely assembled, have a wired, gas-fired heating system integral within unit, and fire tested prior to shipment.
 3. All gas heaters shall have minimum 81% steady state efficiency. Gas-fired heating system control shall be fully integrated with the unit controls. Gas safety controls shall include electronic flame sensing capability, which proves combustion air prior to ignition sequence and during operation. The ignition sequence shall include a pre-purge cycle. Direct spark ignition shall be provided to the pilot line on all heat exchangers.
 4. All gas piping shall be threaded connection with a pipe cap provided. Gas supply connection shall be provided through the side or bottom of unit. Heat exchanger shall be factory pressure and leak tested.
- B. Modulating Electric Heating
1. All electric heat models shall be completely assembled and have wired electric heating system integral within the rooftop unit. Modulating electric heat provides improved control over the amount of heat being generated by varying the time the heat is energized. The cycling of the heating elements adjusts the level of heat output. The heater is capable of fully modulating the capacity from 0 to 100 percent. Heavy duty nickel chromium elements internally wired shall be provided. Automatic reset high limit control shall operate through heater backup contactors.

2.8 FILTER SECTION

- A. Filters shall mount integral within the unit and be accessible by a hinged access door with a single point latching device.
- B. Filters to be provided as two-inch nominal thickness, high efficiency pleated media filters. Filters shall be provided mounted in a galvanized steel filter rack.
- C. Provide two (2) sets of unit filters. One set, minimum, shall be utilized during the construction phase of the project. During the construction phase of the project the contractor shall maintain clean filters in the unit. The construction filters shall be replaced at time of owner occupancy with clean unused filters.

2.9 ELECTRICAL

- A. Unit shall be completely factory wired with necessary control and contactor pressure lugs or terminal block for power wiring.
- B. A 65,000 Amp rating shall be applied to the unit enclosure using a non-fused circuit breaker for disconnect switch purposes.
- C. A 15A, 115V Ground Fault Interrupter convenience outlet shall be factory installed and wired and powered from a factory mounted transformer.
- D. Compressor Protection Modules shall be included in the junction box to protect compressors against reverse rotation.

2.10 CONTROL OPTIONS

- A. Unit shall have low voltage terminal strip for external control by 3rd party controls contractor.

2.11 OUTSIDE AIR SECTION

- A. The outside air shall be 0-100 percent fully modulating outside air damper. Unit shall be provided with a 100% outdoor air hood. The 100% outdoor air hood shall allow outdoor air to enter from the back of the unit, at the draw-through filter section. The outdoor air hood shall be factory installed and constructed from galvanized steel finished with the same durable paint finish as the main unit. The hood shall include a bird screen to prevent infiltration of foreign materials and a rain lip to drain water away from the entering air stream.
- B. Automatically modulated return and OA dampers maintains proper temperature in the conditioned space. An outdoor temperature sensor for comparing the outdoor dry bulb temperature to a locally adjustable temperature setpoint. The setpoint is programmed at the user interface, or remote user interface, to determine if outdoor air temperature is suitable for economizer operation. Economizer is equipped with an automatic lockout when the outdoor high ambient temperature is too high for proper cooling.
- C. Minimum position control is standard and adjustable at the user interface or with a remote potentiometer or through the building management system. A spring return motor ensures closure of OA dampers during unit shutdown or power interruption.
- D. Dampers to be ultra low leak and will have added sealing under the jam seals and in the frame. The ultra low leak dampers have a leakage rate of 4 CFM/ft² (AMCA Class 1) at 1.0 in W.C. pressure difference.
- E. Barometric dampers shall open to relieve positive pressure in the return air section of the rooftop. Barometric relief dampers shall relieve building over pressurization, when that over pressurization is great enough to overcome the return duct pressure drops.

2.12 RETURN AIR FAN

- A. The modulating return fan shall be modulated in conjunction with the supply fan.
- B. The return fan VFD shall modulate and track in response to the supply fan.. Bypass to be be factory installed to provide full nominal airflow in the event of a drive failure

2.13 AIRFLOW MEASUREMENT STATION

- A. A factory mounted airflow measurement station is provided in the outside air opening to measure airflow. The airflow measurement station is AMCA certified (+/- 5.0%) from 300fpm to 2500fpm. The airflow measurement station adjusts for temperature variations.

2.14 SYSTEM ACCESSORIES

- A. Modulating hot gas reheat shall be provided on the lead refrigeration circuit. Refrigeration circuit shall be provided with (interlaced) hot gas reheat coil, modulating valves, electronic controller, supply air temperature sensor and a dehumidification control signal terminal which allow the unit to have a dehumidification mode of operation, which includes supply air temperature control to prevent supply air temperature swings and overcooling of the space. Modulating reheat valves shall be factory installed. Reheat line connections shall be labeled, extend beyond the unit casing, and be located near the suction and liquid line connections for ease of field connection. Connections shall be factory sealed with a grommet on the exterior of the unit casing to minimize air leakage.
- B. Lead refrigerant circuit shall be provided with external hot gas bypass to protect against evaporator frosting at low suction pressure and to prevent excessive compressor cycling. Hot gas bypass line connections shall be labeled, extend beyond the unit casing and be located near the suction and liquid line connections for ease of field connection. Connections shall be factory sealed with a grommet on the exterior of the unit casing to minimize air leakage.
- C. Lead compressors shall be modulating/variable capacity scroll type compressors with thermal overload protection. Compressors shall be capable of modulation from 10-100% of the system's capacity.
- D. Compressors shall be direct-drive, hermetic, scroll-type compressors with centrifugal-type oil pumps. Each compressor has a crankcase heater to minimize the amount of liquid refrigerant present in the oil sump during off cycles. Discharge line service valves shall be standard on each refrigerant circuit, as well as liquid moisture indicator/sight glass..
- E. Compressors shall be isolated from the base pan with the compressor manufacturer's recommended rubber vibration isolators, to reduce any transmission of noise from the compressors into the building area.
- F. Each refrigeration circuit shall be equipped with automatic reset low-pressure and manual reset high-pressure refrigerant safety controls, Schrader type service fittings on both the high-pressure and low-pressure sides, and service valves for liquid and suction connections. Liquid line filter driers shall be factory provided. Finished field installed refrigerant circuits shall include the low side cooling components, refrigerant, thermal expansion valve, liquid line insulated hot gas bypass line, insulated hot gas line, and insulated suction line.
- G. Unit shall include a factory holding charge and oil.
- H. Each compressor shall be equipped with a 5-minute off, delay timer to prevent compressor short cycling.
- I. A2L Refrigerant with factory installed leakage detection system and sensors

PART 3 - EXECUTION

3.1 INSTALLATION AND OPERATION

- A. Installation, Operation, and Maintenance manual shall be supplied with the unit.
- B. Installing contractor shall install unit, including field installed components, in accordance with Installation, Operation, and Maintenance manual instructions. Contractor shall provide final refrigerant line set installation diagram for approval by equipment manufacturer.
- C. Start-up and maintenance requirements shall be complied with to ensure safe and correct operation of the unit.
- D. Manufacturer shall provide start-up services for all equipment. This work shall not be done by the installing mechanical contractor (no exceptions).

END OF SECTION

SECTION 260000 - ELECTRICAL

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Provide all materials, equipment, labor, and transportation required to install a complete and working electrical system. It is the intent of the drawings and specifications to provide complete installations even though each and every item necessary is not specifically mentioned or shown.
- B. Perform all Division 26 work in strict accordance with the requirements and recommendations stated in the latest adopted version of all federal, state, and local codes, ordinances, and standards (NFPA, NEC, IECC, etc.) except when requirements are modified by the Authority Having Jurisdiction.
- C. Where local codes or practices exceed or conflict with the NEC, it shall be the Contractor's responsibility to perform the work in accordance with the local code prevailing and local interpretations thereof by the Authority Having Jurisdiction. This Contractor shall bear all costs for correcting any deficiencies due to non-compliance.

1.2 REFERENCES AND STANDARDS

- A. All adopted State and Local Building Codes and Facility Standards.
- B. All requirements of the local authority having jurisdiction.

1.3 DEFINITIONS

- A. Owner's Representative - Indicates the entity designated or hired to represent an owner on a project. This entity could be the owner themselves, an Architect or could be another third party hired to represent the owner. Verify who will be representing the owner on this project before bidding.
- B. EMCS - Energy Management Control System (Building Management System / BMS), used to control mechanical systems in the building via hardware and / or software.
- C. Or equal - Indicates that the contractor may substitute equipment by another manufacturer if the salient features of the equipment indicated by manufacturer's name and / or described are adequate in the judgment of the Owner's Representative.
- D. Provide - Furnish and install all material and labor required for a complete installation ready for operation as required in accordance with the intent of the Contract Documents.
- E. Shall - Indicates a mandatory requirement or requirements.
- F. Unless otherwise noted, refer to NEC 100 for additional definitions used in these specifications.

1.4 COORDINATION

- A. Electrical service to all portions of existing buildings at the construction site not involved with the project shall remain in operation throughout construction. Provide all required temporary electrical service in the base bid to all required areas to satisfy OSHA requirements.

- B. All metering and temporary electrical service charges and / or costs of utilities shall be paid by the Contractor.
- C. The Drawings are not to be construed as shop drawings but indicate the extent, general locations, arrangement, etc., of conduit systems and equipment. Electrical drawings are diagrammatic and shall not be scaled for exact size. If the contractor has any questions regarding the layout of a particular device or equipment item, he shall contact the Owner's Representative for clarification. This Contractor shall, in laying out their work, refer to other sections of the specifications and other drawings such as air conditioning, structural, plumbing, architectural, civil, etc., to eliminate conflicts and undue delays in the progress of the work. Where items are furnished by other trades require connections by this Contractor, they shall be held responsible for providing rough-in drawings and assistance upon request.
- D. Plans, specifications, and other documents have been prepared and developed with reasonable professional care and coordination. It is the intent that all documents are supportive and complimentary, one to the other; and as such what is required by one shall be considered as required and binding as if indicated by all. Work indicated shall include, regardless of whether or not specifically stated, such supportive or required items or work as consistent with what is indicated, is reasonably inferable from what is indicated, and / or is common construction procedure or knowledge with regard to what is indicated.

1.5 SUBMITTALS

- A. The submittals required in this Division shall conform to and be submitted in accordance with the General Conditions, Instructions to Bidders, Division 1 and requirements listed in all sections of Division 26.
- B. Shop drawings, manufacturer's data materials lists, etc., are required for all equipment and material where submittals are required.
- C. Each submittal shall contain data relevant to the particular equipment (including options). The data shall be identified by "highlighting", arrows, underlining, etc. Do not submit pages of non-relevant information. Broad general data is not acceptable. If equipment submitted is not as specified in the Contract Documents, then the submittal shall contain specific details prominently identifying any differences in form, fit or function. If the equipment submitted is not as specified, then the Contractor shall be responsible for any additional costs necessary to install and connect the equipment. This includes, but is not limited to, increased panelboard size, circuit breaker size, disconnect size or circuit size.
- D. Submit warranty information on all equipment specified in this division. Warranty shall start at the time of substantial completion, unless otherwise indicated in subsequent sections.
- E. Submit dimensional layout of all electrical equipment locations, drawn to scale, with equipment locations shown. Clearances shall be in accordance with NEC and local codes. Panelboard and switchgear submittals will be rejected without dimensioned room or equipment location layouts.
- F. Some products require that a color selection be coordinated with the Owner's Representative. Information regarding such products shall be submitted to the Owner's Representative for review.
- G. If materials or equipment are installed before being reviewed without comment by the engineer, the contractor shall be liable for the removal and replacement of such unapproved materials and equipment, at no additional expense to the owner. Additionally, if the removal and replacement

of unapproved materials or equipment necessitates the removal and replacement of other related materials or equipment, then the contractor shall be liable for the removal and replacement of the related materials and equipment at no additional expense to the owner.

H. Partial submittals for review will not be accepted.

1.6 CLOSEOUT SUBMITTALS

- A. This Contractor shall accumulate during the job's progress the below list of data and shall keep it updated during construction as a set of Record Documents:
1. Exact dimensioned locations of all new and existing switchgear, devices, luminaires, controls, all other equipment and new or existing site utilities.
 2. All warranties, as described in this section and in each subsequent specification section.
 3. All shop drawings, as-built drawings, submittals, operating manuals, maintenance manuals, repair parts lists, etc.
 4. Factory start-up and testing documentation, commissioning documentation, etc.
- B. Training Documentation: Provide a letter in the closeout submittals documenting that the end user (determined by the Owner) received training as required in any section in this division. Documentation to include name of person, date, duration, and content of training.

1.7 QUALITY ASSURANCE

- A. This contractor shall be certified / licensed to install the provided products and equipment.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Contractor shall store and handle in accordance with manufacturer's recommendations to avoid damaging equipment, installed devices, and finish.

1.9 EXISTING FIELD CONDITIONS

- A. All proposals shall take these existing conditions and any revisions required into consideration, and the lack of specific site information on the drawings shall not relieve the contractor of any responsibility.

1.10 WARRANTY

- A. This Contractor shall guaranty fully all workmanship, material, equipment, systems, etc., provided by them for a period of one (1) year after substantial completion of the project, unless otherwise modified in other specification sections. The use of building equipment for temporary service and testing does not constitute the beginning of the warranty. This guaranty means that this Contractor shall make good to the owner, at no cost, any defects that become apparent during the year following substantial completion. This guaranty is in addition to any other guaranties or warranties and is not intended to limit such other guaranties or warranties.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Unless otherwise noted, products shall be only from manufacturers that have been in business for at least five (5) consecutive years and have been manufacturing proposed products for at least two (2) consecutive years.

2.2 SUBSTITUTION OF PRODUCTS

- A. All proposed substitutions are subject to PRIOR APPROVAL and must be received by the Engineer and / or Owner's Representative no less than ten business days prior to the schedule date for opening of bids.
- B. Items noted as "No Substitutes" or "No Alternates" shall be as specified only. No substitutions will be accepted.

2.3 PERFORMANCE REQUIREMENTS

- A. All materials, components, products, assemblies, equipment, etc. shall be new, free from defects, listed (by an NEC accepted listing agency), and approved / rated for the application, environment and purpose. No Exceptions.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All equipment shall be installed in strict compliance with manufacturer's installation instructions and properly torqued using a calibrated torque tool.
- B. All panels, enclosures, devices, equipment and associated conduits, whether provided by this Contractor or any other, shall be flush-mounted and cleanly recessed in all finished spaces unless otherwise noted on the Drawings.
- C. Unprofessional and incomplete work shall be rejected and corrected at no additional expense. The judgement of professionalism and completeness of work shall be made by the Engineer and / or Owner's Representative and shall be final.
- D. All electrical connections shall be made per NEC 110.14 and torqued per manufacturer's instructions.
- E. Where existing utilities already exist or where renovation / addition work is to be done, maintain all utility services during construction to existing structures and / or portions of a project that are to remain in place and operational.
- F. This Contractor shall be responsible for damage to the project caused by this Contractor's failure to recognize hazards associated with items such as lack of power, scheduling of work (tardiness), inexperienced workmen, excessive cutting, etc. This Contractor shall repair at no expense to the owner any such damage.

3.2 INTERFACE WITH OTHER WORK

- A. The Electrical Contractor shall coordinate the installation of the electrical system and all associated electrical connections with the General Contractor, as well as the Mechanical, Plumbing, and Communications Contractors, to ensure proper wire sizes, OCPD sizes, and a complete working system for the Owner.
- B. Cooperation with trades of adjacent, related or affected materials or operations, and / or trades performing continuations of this work under subsequent contracts is considered a part of this work in order to affect timely and accurate placing of work and to bring together, in proper and correct sequence, the work of such trades, including under the general contractor Division 1 and Division 23.

- C. The Electrical plans are based on equipment schedules shown. Should any mechanical equipment or device be submitted with different electrical properties from those properties shown, all electrical and / or mechanical changes shall be made at the expense of the trade or contractor initiating the change with no expense to the Owner's Representative, Engineer, etc.
- D. Make permanent connection to new utilities or existing lines. Determine depth and location, and bid accordingly. Relocate and repair any existing lines cut by general construction work.

3.3 CONTRACTOR COORDINATION - ELECTRICAL / MECHANICAL (DIV 23)

- A. Electrical Contractor to provide the following:
 - 1. All line voltage wiring, conduits, back boxes and hook-up to all HVAC equipment including required fused or non-fused safety switches.
 - 2. All boxes and conduit into accessible attic space for all thermostats and sensors. Coordinate with Mechanical Drawings for exact locations and requirements.
 - 3. All contactors and relays shown on the Electrical Drawings only.
 - 4. All conduit and back boxes for control wiring in all mechanical spaces to protect control wiring from damage. Conduit and back boxes to be required from 6" above each piece of equipment or control to a common 12" square NEMA 1 enclosure provided by Electrical Contractor and mounted directly above the EMCS / BMS controls in that space. Coordinate all required conduit paths with mechanical contractor before bidding and again before installing. Mechanical contractor to provide Electrical Contractor with conduit paths required for controls wiring on a drawing with adequate dimensions for bidding.
- B. All other equipment and materials, including but not limited to, contactors and relays for mechanical equipment, motor starters (with heaters as required) / VFDs, thermostats, controls and wiring, etc. shall be provided by mechanical contractor.

3.4 CONTRACTOR COORDINATION - ELECTRICAL / PLUMBING (DIV 22)

- A. Electrical Contractor to provide the following:
 - 1. All line voltage wiring, conduits, back boxes and hook-up to all plumbing equipment including required fused or non-fused safety switches.
- B. All other equipment and materials, including but not limited to, contactors, relays, and switches required to control plumbing equipment, etc. shall be provided by plumbing contractor.

3.5 CONTRACTOR COORDINATION - ELECTRICAL / CONTROLS (DIV 23, 25)

- A. Electrical Contractor to provide the following:
 - 1. All junction boxes (standard one or multi-gang) required for controls contractor. Coordinate with controls contractor for exact locations.
 - 2. Various relays, devices, wiring and other equipment for control equipment as indicated or required per details on Electrical Drawings.
- B. All other equipment and materials, including but not limited to, relays, hardware, software, sensors, and control wiring, etc. shall be provided by controls contractor.

3.6 CONTRACTOR COORDINATION - ELECTRICAL / COMMUNICATIONS (DIV 27)

- A. Electrical Contractor to provide the following:
 - 1. All receptacles and direct connection to all communications systems and equipment as shown and as required.

2. All ground conductors and bonding to the building grounding system for all communications equipment panels and racks. See Section 26 05 26 - Grounding and Bonding, notes and details on Drawings for more information.
 3. All required standard back boxes as required for wall-mounted devices furnished by Communications Contractor.
 4. All raceway / conduit as required for accessibility of all communications systems cabling as listed below and as indicated on the rawings and details (whether furnished under a Division 01 allowance, by the Owner, Division 26 and / or Division 27).
 - a. Provide raceway / conduit for cabling in above-ceiling spaces at the following locations:
 - 1) All wall penetrations.
 - 2) All HVAC duct penetrations (Per NEC 800).
 - 3) All cabling traveling through a plenum or other environmental air space (Per NEC 800).
 - b. Provide raceway / conduit for all cabling from wall-mounted back boxes to accessible spaces per Communications Device Backboxes detail. Coordinate exact size and locations with communications contractor before installation.
 - c. Provide full raceway / conduit for all cabling in exposed ceilings or when cabling is to be exposed on walls. Coordinate exact size and locations with communications contractor before installation.
 5. Installation of all special boxes and equipment cabinets furnished by Owner or Communications, Security, and Safety Contractor(s).
- B. Communications Contractor to provide the following:
1. All communications systems complete with equipment, cabling, special backboxes, hardware, and all other required devices.
 2. Furnish all special boxes in timely manner to the electrical contractor for installation as required.
 3. All attachments for all communications cable above accessible ceilings to be supported from the building structure and bundled.

3.7 CONTRACTOR COORDINATION - ELECTRICAL / ELECTRONIC SAFETY & SECURITY (DIV 28)

- A. Electrical Contractor to provide the following:
1. All receptacles and direct connection to all security and safety equipment as shown and as required.
 2. All ground conductors and bonding to the building grounding system for all security and safety equipment panels. See Section 26 05 26 - Grounding and Bonding and details for more information.
 3. All required standard back boxes as required for wall-mounted devices furnished by security and safety contractors.
 4. All raceway / conduit as required for accessibility of all security and safety systems cabling (whether furnished under a Division 01 allowance, by the Owner, Division 26 and / or Division 28) as listed below and as indicated on the Drawings and details.
 - a. Provide raceway / conduit for all cabling in above-ceiling spaces at the following locations:
 - 1) All wall penetrations.
 - 2) All HVAC duct penetrations (Per NEC 800).
 - 3) All cabling travelling through a plenum or other environmental air space (Per NEC 800).
 - b. Provide raceway / conduit for all cabling from wall-mounted back boxes to accessible spaces per Communications Device Backboxes detail. Coordinate exact size and locations with security and safety contractor before installation.

- c. Provide full raceway / conduit for all cabling in exposed ceilings and when cabling is to be exposed on walls. Coordinate exact size and locations with security and safety contractor before installation.
- 5. A dedicated circuit for the Fire Alarm Control Panel (FACP). Provide power to all Fire Safety Control Function devices as shown on the drawings. Each circuit breaker shall be labelled as "FIRE ALARM CIRCUIT" in the panel directory and labelled "FIRE ALARM" at the lockout clip on the circuit breaker.

3.8 CONTRACTOR COORDINATION - ELECTRICAL / OTHER

- A. Electrical Contractor shall provide required hook-up to line voltage at all electromagnetic door holder / release, fire / smoke dampers, smoke dampers, etc. Provide required relays and wiring to fire alarm panels and coordinate with other specified work.

3.9 INSTALLATION - OTHER WORK

- A. Cutting and Patching:
 - 1. All cutting required for the installation of sleeves, conduit, equipment, etc., shall be coordinated with the General Contractor, but performed by this Contractor. Patching shall be by General Contractor. This Contractor shall not cut any structural element or any finished work without written permission from the Owner's Representative.
- B. Concrete Work:
 - 1. This Contractor shall provide all forming, reinforcing and concrete as indicated or required for equipment bases, transformer pads, etc. Work shall conform to the applicable portion of Division 03 - Concrete.
- C. Trenching and Backfill:
 - 1. This Contractor shall perform all trenching, excavation, shoring, pumping and backfill required in the installation of their work. All trenches shall be maintained dry until all circuits have been satisfactorily tested and then filled in tamped 6" layers immediately after approval of tests by the Owner's Representative. All backfill shall be free of construction debris and any other foreign material which might damage any circuit runs. Stability of backfilled soil shall match adjacent undisturbed soil.
- D. Flashing and Waterproofing:
 - 1. All building penetrations to the outside shall be flashed and counter-flashed as required to eliminate leaks. Provide link-seal fitting on all below grade conduit penetrations greater than 2".

3.10 SYSTEM STARTUP

- A. All circuit and operational tests of the electrical systems shall be made by this Contractor and repeated until equipment meets or exceeds testing requirements and all electrical systems are operating properly.

END OF SECTION

SECTION 260519 - LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. This section includes conductors for power circuits, including terminations and connectors.

1.2 SUBMITTALS

- A. Submittals required in this section shall conform to and be submitted in accordance with the General Conditions, Division 01, and Division 26.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Conductors shall be manufactured in the United States. Acceptable manufacturers are:
 - 1. Alan Wire, Cerrowire, Encore Wire, General Cable, Republic Wire, and Southwire

2.2 MATERIALS

- A. All feeders to be soft-drawn annealed copper.
- B. All branch circuit conductors shall be soft-drawn annealed copper.
- C. Aluminum is permissible ONLY where specifically indicated on the Drawings. Aluminum used shall be AA-8xxx rated and compact stranding is preferred.

2.3 MANUFACTURED UNITS

- A. Manufactured Power Circuit Conductors:
 - 1. Conductors for shall be rated for at least 600 volts and 90°C. No exceptions.
 - 2. Conductor insulation shall be type THHN / THWN-2 or XHHW-2.
 - 3. All conductors shall be #12 AWG or larger.
 - 4. Conductors that are #8 AWG and larger shall be stranded. Conductors that are #12 AWG and #10 AWG may be stranded if crimp on fork terminals are used for device terminations. Otherwise, #12 AWG and #10 AWG shall be solid conductors. Never place bare stranded conductors directly under device screws.
- B. MC Cable: Unless otherwise noted on the Drawings, MC cable is allowed ONLY for luminaire whips. Total length not to exceed six (6) feet. MC cable must meet all requirements listed in this section including (but not limited to) separate full-size neutrals, conductor material, isolated ground, installation per NEC, etc.
 - 1. Conductor Insulation: The insulation over the conductors shall be type THHN 90°C dry with an extruded polypropylene protective covering.
 - 2. Armor: A zinc coated galvanized steel armor shall be applied over the cabled wire assembly with an interlock in compliance with UL 1569 Section 13. Armor shall be colored to identify the voltage and number of conductors.
 - 3. Fittings: Fittings shall be listed and identified as MCI-A for such use with metal clad interlocking armor ground. Connectors shall be of steel or malleable iron and shall have saddle clamp to insure a tight termination of MC or MCI-A cable to box.

- C. Manufactured Conductor Terminations and Connectors:
 - 1. All accessory materials such as connectors, splice and tap fittings, and terminations shall be of a type designed or intended and suitable for the use. They shall be compatible with the conductor material. Both compression (crimp) and mechanical (screw set) connections are acceptable. Installation, compression, and torque settings shall be per manufacturer's recommendations.
 - 2. Only connection devices that require the complete removal of the conductor jacket or insulation and result in a connection to the complete conductor surface area are suitable for use. Insulation piercing type connectors, press in type connectors or Wago style connectors shall NOT be used.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. More than one conductor shall not be installed in any termination unless the termination is marked as suitable for more than one conductor.
- B. Wire Sizing: Provide conductors sized as indicated on Drawings. Where sizing is unclear or has been omitted, provide conductors with an ampacity at least as large as the ampacity of the load and provide an overcurrent protection device sized as large as the ampacity of the conductors. In such cases, notify the Engineer before installation for size verification.
- C. Voltage Drop: The intent of the drawings is to limit the voltage drop from the service entrance conductors to each branch circuit to less than 5%. The electrician is responsible to ensure proper voltage drop values are maintained as mentioned here and mentioned in the NEC.
- D. Neutral Conductors: Provide a separate neutral conductor for each feeder or branch circuit. Multiple circuits shall not share a common neutral. Neutral conductors shall be sized as large as the phase conductors. Neutral conductors shall not be of a reduced size.
- E. Equipment Grounding Conductors: Provide equipment grounding conductors in accordance with Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- F. Number of Current Carrying Conductors (CCC) per conduit:
 - 1. #12 Wire - no more than six (6) CCCs in a single conduit.
 - 2. #10 Wire - no more than nine (9) CCCs in a single conduit.
 - 3. ELSE - no more than three (3) CCCs in a single conduit.
 - 4. Regarding #12 and #10 wire above (ONLY #1 and #2 above), when more than three (3) CCCs are in a single conduit, the electrician is responsible for derating the available ampacity of the current carrying conductors per NEC and provide calculations to the Engineer, when requested. If any derating results in a conductor ampacity lower than the load for the circuit, all conductors must be removed and repulled in separate conduits to eliminate the derating. No exceptions.
- G. Installation in Raceways:
 - 1. All conductors shall be installed in a raceway.
- H. Terminations:
 - 1. Use compression (crimp) or mechanical (screw set) type lugs or connectors for all terminations or splices of stranded conductors. See 26 05 26 Grounding and Bonding where thermal welding may be used.
 - 2. Use ring tongue type terminators on all control wiring.

3. Conductive antioxidant shall be applied on all connections per manufacturer's instructions, regardless of conductor material.
- I. Splices:
 1. Where splices are required, they shall be in a box or enclosure. Splices within a conduit run are not acceptable.
 - J. Color Coding:
 1. Provide factory colored insulated conductors for #6 AWG and smaller.
 2. If existing wiring in renovation or addition work has a consistent color coding, then match the existing and note in record documents. Otherwise, colors shall be as follows:

Line	208/120V	240/208V 1ph	240/120V	480/277V
A	Black	Black	Black	BROWN
B	Red	n/a	Orange	ORANGE
C	Blue	Red	Blue	Yellow
Neutral	White	White	White	Gray
Ground	Green	Green	Green	Green
Isol Grnd	Green +Yellow	Green + Yellow	Green + Yellow	Green + Yellow
 - K. Identification: All conductors in a panelboard shall be identified by means of tags or tape.
 - L. MC Cable: Where allowed, install MC cable to meet all NEC requirements.
 1. Support: All MC cable shall be supported by dedicated J-cable hangers or cable tray. Where suspended from the ceiling or roof structure, use split-ring hangers or wrought-iron hanger rods.

3.2 SITE TESTS

- A. Perform in accordance with manufacturer's printed testing procedures, applicable industry standards, ANSI standards, IEEE standards, and NEMA standards. Provide calibrated testing equipment in good working order and which complies with the above requirements. The below test shall be performed after the conductors have been pulled into the conduit and after terminations have been added, but before final connections are made. Document all readings and testing and make documentation available to Owner upon request.
- B. Feeder Insulation Test: The insulation of new service entrance conductors and each new feeder run shall be tested using a megger. Readings must indicate not less than one (1) megohm to be acceptable.
- C. Branch Circuit Insulation Test: The insulation of each new branch circuit shall be tested using an ohm meter. Readings must indicate not less than one (1) megohm to be acceptable.

END OF SECTION

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Grounding and bonding shall include the solid grounding of the various electrical systems and equipment and the proper bonding of all electrical system components and equipment to meet NEC 250 and all other applicable NEC sections, codes, and ordinances. These systems shall be provided for the proper protection of life, equipment, circuits, and systems.
- B. Permanently ground entire lighting and power systems in accordance with the latest adopted version of the NEC, including service equipment, distribution, panelboards, switch and starter enclosures, motor frames, devices, transformers, grounding type receptacles, and other exposed non-current carrying metal parts of electrical equipment.
- C. Grounding and bonding requirements specified in this section may be supplemented in other sections of these Specifications.

1.2 COORDINATION

- A. On all additions and new construction, complete grounding and bonding of concrete encased electrode system (building reinforcing steel /rebar) to the satisfaction of the local AHJ prior to concrete placement.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Apache Grounding, Copperweld, Inc., ILSCO Corporation, nVENT (Cadweld, Critec, Erico), Thermoweld, and Thomas & Betts (T&B)

2.2 PERFORMANCE REQUIREMENTS

- A. General:
 - 1. All grounding and bonding shall be in strict accordance with NEC 250, 517, etc.
 - 2. Grounding electrode system shall have a resistance to earth of five (5) ohms or less. Where this cannot be met, provide two additional ground rods to form a "triple ground rod" installation. Under no conditions shall the system have a resistance greater than twenty-five (25) ohms to ground, per NEC 250, at any location in the system.
- B. Ground Rods:
 - 1. Copper cladding permanently bonded to a high-strength steel core.
 - 2. 3/4 inch by 10 feet (19mm by 3m) straight, conform to UL 467.
- C. Conductors:
 - 1. Grounding Conductor: Copper, insulated (green) where required or uninsulated where allowed in the Specifications or by code, sized per Drawings or NEC Table 250.66.
 - 2. Bonding Jumpers - Insulated conductor, sized to be minimum cross-sectional area greater than or equal to that of the equivalent grounding conductor as determined from NEC Table 250.102.
 - 3. Grounding Ring around a building - #2 AWG uninsulated copper, otherwise sized per NEC.

4. Grounding Ring around a utility transformer - #2 AWG uninsulated copper (unless sized per drawings), otherwise sized per NEC or by utility requirements.
- D. Connections:
1. General: All connectors shall be listed and labeled as grounding connectors for the materials used.
 2. Welded Bond - Exothermic welded connection or bond such as "Cadweld". No phosphorous or any other caustic, toxic or explosive substance may be used.
 - a. Provide exothermic materials, accessories, and tools for preparing and making permanent field connections between grounding system components.
 3. Clamps - Listed bronze connectors, suitable for grounding and bonding applications, in configurations required for a particular installation.
- E. Buss Bars:
1. Bare annealed copper bars, 1/4" x 4" x 20" unless otherwise noted on the Drawings.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Unless otherwise indicated, the below list of connection styles shall be followed.
- B. Outdoor Below Grade Grounding Connections:
1. Welded bond only, no exception.
- C. Outdoor Above Grade Grounding Connections:
1. Clamps may be used. Use welded bond where clamping is not accessible or practical.
- D. Indoor Grounding and Power Connections:
1. Clamps may be used. Use low-smoke/low emission welded bond where clamping is not accessible or practical.

3.2 INSTALLATION

- A. General:
1. Where the Drawings or Specifications exceed NEC requirements, then follow the Drawings or Specifications.
 2. Bond all ground electrodes together to form the grounding electrode system including metal underground water pipe, metal frame of the building or structure, concrete encased electrodes, ground ring, rod and pipe electrodes and plate electrodes.
 3. At all electrical system components, assemblies, circuits, etc. that are over 120v to ground, provide locknuts and / or listed fittings per NEC 250.97 for bonding of metal raceways. In case of oversized, concentric or eccentric knockouts, comply with NEC 250.92(B). The use of snap-in, wedge-type, or pivot-type connectors is prohibited.
 4. Refer to Drawings for additional special grounding systems or grounding requirements not mentioned here.
- B. Concrete Encased Electrode:
1. Fabricate with twenty (20) feet (6m) of conductor laid lengthwise in excavation for foundation or footings. Install such that conductor is within two (2) inches (50mm) of the bottom of the concrete. Where base of foundation is less than twenty (20) feet (6m) in length, coil excess conductor at base of foundation. Bond conductor to reinforcing steel at four (4) locations, minimum. Extend conductor below grade and connect to building grounding electrode.

- C. Main Electrode:
1. Provide a building ground rod and bond it to the grounding electrode system. Where ohmic values exceed 5 ohms to ground, the building ground rod shall consist of three ground rods, arranged in an equilateral triangular pattern located at least five (5) feet outside an exterior building wall or as otherwise directed. Space fifteen (15) feet apart and drive into the earth to a point two (2) feet below finished grade to top of rods. Grounding electrode conductor shall form a continuous loop around rods, and conductor shall be properly bonded to each rod by a fusion weld similar to "Cadweld".
 2. Extend grounding electrode conductor from ground rod(s) to the grounded service conductor (neutral) in the main switchboard at an accessible point on the ground bus per NEC 250.24.
- D. Main Bonding Jumper: Shall be sized in accordance with NEC 250.102, if not indicated on the Drawings, and installed within the same enclosure as the point of bonding of the system neutral service entrance.
- E. Water Pipe Electrode: A ten (10) foot minimum length of electrically-continuous underground metal water pipe. Bond around insulating joints or sections, insulating pipe, and water meters to make pipe electrically continuous.
- F. Fuel Gas Piping:
1. Each above ground portion of a gas piping system upstream from the equipment shutoff valve shall be made electrical continuous and bonded to the building grounding electrode system, as required in NFPA 54.
 2. Gas piping shall not be used as a grounding electrode.
- G. Transformers: Ground as a separately derived source.
1. Where transformer secondary includes a neutral, the neutral shall be bonded to the equipment enclosure and connected to the system ground conductor.
 2. Size system bonding jumper per NEC Table 250.102.
 3. Grounding conductor shall be in raceway and shall be bonded to nearest available point of the building grounding electrode system.
- H. Equipment Grounding Conductor (EGC):
1. Comply with NEC 250 for sizes and quantities of equipment grounding conductors, except where larger sizes or more conductors are indicated.
 2. All power circuits shall be provided with a separate copper insulated EGC run in the raceway with the power conductors. The conduit shall not be used as the sole means of grounding. The insulation of the EGC shall be green.
 3. Bonding to the EGC shall be provided at each end of metallic conduit runs and at all boxes and enclosures.
 4. Connect wiring device grounding terminal to outlet box with bonding jumper and branch circuit equipment grounding conductor.
- I. Isolated Ground (IG) Equipment Grounding Conductor:
1. All branch circuits and feeders that require an IG equipment grounding conductor shall be provided with a separate copper insulated IG equipment grounding conductor run in the raceway with the power conductors. The IG equipment grounding conductor shall be provided in addition to the normal EGC. The insulation of the IG equipment grounding conductor shall be green with a yellow stripe.
 2. Conduits and boxes of IG circuits shall be bonded to the normal EGC as stated above. At outlet locations, the IG equipment grounding conductor shall connect only to the isolated ground terminal of an isolated ground outlet. There shall be no connection, either directly

- or indirectly, between the normal EGC and the IG equipment grounding conductor at any point other than at the source of a separately derived system (transformer) or at the service entrance.
3. The following circuits shall be provided with an IG equipment grounding conductor:
 - a. Feeders providing power to panels equipped with an IG buss.
 - b. All branch circuits originating at a panel with an IG buss.
- J. Grounding Busses:
1. Provide a copper buss bar where indicated on Drawings or in rooms containing any of the below list.
 - a. Provide a #2 AWG insulated grounding electrode conductor from the grounding electrode system to each grounding buss.
 - b. Provide in each IDF and MDF room.
 - c. Provide at each CATV / MATV head-end mounting board.
 - d. Provide at each building communications rack.
 - e. Provide at each sound reinforcement equipment rack.
- K. Communications Systems:
1. Bond each server, patch panel, data and other communications equipment ground (buss type or grounding conductor type) at each piece of equipment and each equipment rack back to the copper grounding buss installed in the room with a bare #6 AWG ground wire.
- L. Engine Generator Neutral:
1. Ground the generator neutral as a separately derived system per NEC 250.30, unless noted otherwise on Drawings.
- M. Lightning Protection System:
1. Bond grounding conductors or grounding conductor conduits to lightning protection down conductors or grounding conductors in compliance with NFPA 780.
 2. Bond electric power system ground directly to lightning protection system grounding conductor at closest point to electric service grounding electrode. Use bonding conductor sized same as system ground conductor and installed in conduit.
- N. Other Grounding Systems:
1. Other buildings served from common service:
 - a. The main building service is the source for electric service.
 - b. Bond grounding conductor of building main feeder to grounding electrode system.

3.3 CONNECTIONS

- A. General:
1. Make connections in such a manner as to minimize possibility of galvanic action or electrolysis. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
 2. Aluminum to steel connections shall be with stainless steel separators and mechanical clamps. Aluminum to galvanized steel connections shall be with tin-plated copper jumpers and mechanical clamps.
 3. Coat and seal connections involving dissimilar metals with inert material such as red lead paint to prevent future penetration of moisture to contact surfaces.
- B. Exothermic Welded Connections:
1. Use for connections to structural steel and for underground connections except those at test wells. Install at connections to ground rods and plate electrodes. Comply with

manufacturer's written recommendations. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

2. Terminate insulated EGCs for feeders and branch circuits with pressure-type grounding lugs. Where metallic raceways terminate at metallic housings without mechanical and electrical connection to the housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to the ground buss in the housing. Bond electrically noncontinuous conduits at both entrances and exits with grounding bushing and bare grounding conductors.

C. Compression Type Connections:

1. Use hydraulic compression tools to provide the correct circumferential pressure for compression connectors. Use tools and dies recommended by the manufacturer of the connectors. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on the ground conductor.

D. Moisture Protection:

1. Where insulated ground conductors are connected to ground rods or ground busses, insulate the entire area of the connection and seal against moisture penetration of the insulation and cable.

3.4 SITE TESTING

A. Testing:

1. Test the electrical system after installation is complete. Inspect and test for stray currents, unintended ground shorts, and proper physical condition of grounding system. Correct any deficiencies and re-test to verify satisfactory installation.
2. Document all readings and testing and make documentation available to Owner upon request.
3. Perform ground resistance and continuity testing in accordance with IEEE 142.

END OF SECTION

SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Provide all raceway and conduits, outlet boxes, pull and splice boxes, floor boxes, poke-thru boxes, wireways, gutters, and associated fittings as indicated on the Drawings and as required for feeders, branch circuits, splices, taps, equipment connections, and for compliance with regulatory requirements. All locations shown on the Drawings are approximate unless dimensioned.
- B. Provide complete, separate conduit systems for all electrical systems on this project to include, but not limited to service entrance, feeders, branch circuit, control wiring furnished by this contractor, emergency and standby power and lighting circuits, critical power, communication systems, and other electrical systems as required.
- C. Provide outlet wiring boxes of the type, shape and size, including depth of box, to suit each respective location and installation; constructed with knockouts or threaded hubs in back and sides, and with threaded holes with screws for securing box covers or wiring devices. Provide outlets as shown and as required per NEC.

1.2 DESIGN REQUIREMENTS

- A. Boxes and fittings shall be made of the same material as the conduit material they are installed with, unless modified below or otherwise noted on the Drawings.

1.3 SUBMITTALS

- A. Submit on all conduit, raceways, pull boxes, back boxes, hand holes, cover plates, extension rings, fittings, labeling, and supports for conduits inside and on roof.

1.4 COORDINATION

- A. Coordinate mounting heights, orientation and locations of back boxes for outlets mounted above counters, benches, back splashes, etc.
- B. Conduit systems shall not be covered or otherwise concealed until review has been made and approvals obtained from the AHJ.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Raceways, Wireways, Gutters and Conduits: ABB, Aflex, Atkore (AFC, Allied, FRE, Power Strut, TJ Cope), American Conduit, Calbond, Cantex, Champion, Hoffman, Hubbell, KorKap, Nepco, Nucor, Omega, Plasti-Bond, Perma-Cote, Pittsburgh, Prime Conduit, Sedco, Spang, Square-D, Thomas & Betts (T&B), Western Tube and Wheatland, Walker and Wiremold.
- B. Surface-mount Raceways: Hubbell, Mono-Systems, Panduit, Tehalit and Wiremold.

- C. Boxes and Fittings: Appleton, Atkore (AFC, Allied, Power Strut, TJ Cope), Cantex, Eaton, ECN Korns, Hoffman, Hubbell, Keystone, Lew, Madison, nVent Caddy, Orbit Industries, Quazite, Raco, Regal, Stahlin, Steel City, Thomas & Betts (T&B) and Walker.
- D. Others: Where specifically listed on Drawings.

2.2 GENERAL PERFORMANCE REQUIREMENTS

- A. Minimum conduit / raceway size shall be 1/2" for all circuits.
- B. Fittings may be set-screw or compression style fittings.
- C. All fittings shall have an insulated throat bushing, no exceptions.
- D. See Section 26 05 19 - Low Voltage Conductors for information on where MC cable is allowed.
- E. Aluminum conduit shall not be installed in direct contact with concrete or masonry construction.

2.3 RIGID METAL CONDUIT - STEEL (RMC)(IMC) - PER ANSI C80

- A. Steel: Hot-dipped galvanized rigid steel (GRC) and galvanized intermediate metallic conduit (IMC) with zinc-coated threads and an outer coating of zinc chromate.
- B. Fittings: Per NEMA FB 1.
 - 1. Malleable iron, either cadmium plated or hot-dipped galvanized. Die cast zinc.
 - 2. Use deflection and expansion couplings with bonding jumpers at all expansion joints where required.

2.4 RIGID METAL CONDUIT - ALUMINUM (RAC) - PER ANSI C80

- A. Aluminum: Rigid aluminum conduit shall be threaded only.
- B. Fittings: Per NEMA FB 1
 - 1. Aluminum fittings required.
 - 2. Use deflection and expansion couplings with bonding jumpers at all expansion joints where required.

2.5 PVC COATED RIGID METAL CONDUIT - NEMA RN 1

- A. Steel: Galvanized rigid steel conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6 and ETL PVC-001.
- B. Fittings: Per NEMA FB 1.
 - 1. Malleable iron or steel, PVC coated (40 mils) exterior, urethane coated (2 mils) interior.
 - 2. Use fittings listed and labeled as complying with UL 514B.
- C. Conditions: The installer shall be certified by a manufacturer to install coated conduit.

2.6 ELECTRICAL METALLIC TUBING (EMT) - ANSI C80.3

- A. Galvanized thin wall steel or aluminum tubing.
- B. Fittings: Per NEMA FB 1.
 - 1. Die cast zinc, pressure cast, malleable iron or steel. Clamps shall be steel. Where aluminum tubing is allowed, aluminum fittings are required unless otherwise noted.

2.7 RIGID NONMETALLIC CONDUIT (RNC)

- A. PVC: Schedule 40 PVC, NEMA TC 2, high impact resistant.
- B. RTRC: Fiberglass, NEMA TC 14, standard wall.
- C. Fittings: Per NEMA TC 3 & 14, solvent weld socket type.
- D. Conditions: Do NOT use PVC for elbows in sizes 1-1/2" and larger.

2.8 FLEXIBLE METAL CONDUIT (FMC)

- A. Steel: Spiral-wound, square interlocked, hot-dipped galvanized steel.
- B. Aluminum: Spiral-wound, square interlocked aluminum.
- C. Fittings: Per NEMA FB 1.
 - 1. Cadmium plated two-screw, double-clamp malleable iron. Hot-dipped galvanized two-screw, double-clamp malleable iron. Pressure cast. Steel cast. Zinc coated, aluminum.

2.9 LIQUID-TIGHT FLEXIBLE METAL CONDUIT (LFC)

- A. Steel: Spiral-wound, square interlocked, hot-dipped galvanized steel strip with a bonded outer jacket of PVC.
- B. Fittings: Per NEMA FB 1.
 - 1. Cadmium plated, compression type, malleable iron. Hot-dipped galvanized, compression type, malleable iron. Terminations shall be insulated throat type.
 - 2. Aluminum: Copper free (1% or less).

2.10 WIREWAYS / GUTTERS

- A. Steel: Not less than 16-gauge sheet steel. Size and length shall be as indicated on drawings. Otherwise, provide dimensions per NEC 366 and NEC 376, but never smaller than four (4) inches by four (4) inches. Construction shall be oil-tight, dust-tight and rain-tight with hinged fully gasketed cover. Finish shall be ANSI gray epoxy paint over rust-inhibiting prime coat.

2.11 SURFACE RACEWAYS - SINGLE CHANNEL

- A. Steel: Not less than 0.04" thickness sheet steel. One piece for up to seven (7) - #12 AWG wire capacity. Two (2) piece for eight (8) or more - #12 AWG wire capacity. In unfinished spaces, finish shall be enamel over rust-inhibiting prime coat, not less than 0.25 square inch cross section.
- B. PVC: Rigid PVC, not less than 0.20 square inch cross section. Two (2) piece construction, minimum five (5) - #12 AWG wire capacity.
- C. Finish: In all spaces, coordinate color with Owner's Representative.
- D. Fittings: Provide all required manufacturer's standard accessories and fittings for a complete installation.

2.12 SURFACE RACEWAYS - DUAL CHANNEL

- A. Aluminum: Two compartment, with receptacles and data devices as noted on electrical and technology drawings.

- B. PVC: Wiremold 4320, Panduit T-70 non-metallic raceway or similar, two compartment, with receptacles and data devices as noted on electrical and technology drawings.
- C. Finish: In all spaces, coordinate color with Owner's Representative.
- D. Fittings: Provide all required manufacturer's standard accessories and fittings for a complete installation.

2.13 GENERAL OUTLET / BACK BOX / JUNCTION BOX

- A. All boxes shall meet NEMA OS 1 (metallic) and NEMA OS 2 (nonmetallic).
- B. Cast Boxes: NEMA FB 1, Type FS or FD malleable iron or aluminum. Furnish gasketed cover by box manufacturer and provide threaded hubs.
- C. Floor-mounted Back Boxes: Shall be adjustable and gasketed.
- D. Outlet and Pull Boxes: Single or ganged back boxes.
 - 1. Interior: Standard box shall be 2-1/8" deep or better. Use 3-1/2" deep boxes as needed and 1-1/2" shallow boxes as required for wall depth.
 - 2. Exterior: Standard box shall be 3-1/2" deep NEMA 3R or better.
 - 3. In Ground or Concrete: NEMA 4 cast iron box with external recessed flanged cover. Depth as required.
- E. Box Ganging: Gang type boxes shall be used where multiple devices are located adjacent to one another, including ceiling, wall and cast in floor boxes.
- F. Box Barriers: In boxes with multiple switches, where the voltage between adjacent switches exceeds 150 volts to ground, provide an enclosure equipped with identified, securely installed barriers between adjacent devices.

2.14 PULL / SPLICE BOXES AND HAND HOLES

- A. Surface Mounted Cast Metal Box: NEMA 250, Cast aluminum with ground flange, neoprene gasket and stainless steel cover screws.
- B. In-Ground Cast Box: NEMA 250, Type 6, cast aluminum, concrete or fiberglass with flanged (smooth/nonskid) cover, recessed cover box for flush mounting.
- C. Handholes: Fiberglass with weatherproof nonskid cover with pre-cut 6 inch x 6 inch (150 mm x 150 mm) cable entrance at center bottom of each side.

2.15 POWER AND COMMUNICATIONS FLOOR BOXES AND POKE-THRUS:

- A. Shallow Floor Boxes: Lid to be square, color to be per Owner's Representative.
 - 1. Provide 2-gang and 4-gang: RFBA series by Walker, CFB series by Hubbell.
- B. Standard Floor Boxes: Lid to be square, color to be per Owner's Representative.
 - 1. Provide 2-gang, 4-gang, 6-gang, and 10-gang: RFBx by Walker, CFBx by Hubbell.

2.16 ROOFTOP CONDUIT SUPPORTS

- A. Supports shall be adjustable height. Metal parts to be stainless steel or galvanized steel.
- B. Approved Products:
 - 1. Miro Industries model #24-R-AH, 48-R-AH, 24AH and 48AH.

2. PHP Systems model #PP10.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Place conduit sleeves in the cavities of walls and floor slabs for the free passage of conduits.
- B. Apply caulking for all conduit sleeves through floors and through exterior walls.

3.2 GENERAL INSTALLATION

- A. The Drawings indicate an approximate location of boxes for switches, lighting outlets, power outlets, raceways, etc. The Drawings may not give complete and accurate information in regard to locations of such items. The exact locations shall be determined by reference to the Drawings and by actual measurements during construction of the building, subject to approval by the Owner's Representative.
- B. The Owner's Representative reserves the right to adjust locations of raceway and boxes up to six (6) feet in any direction prior to rough-in to accommodate intended purpose at no additional cost.
- C. All installations shall meet NEC requirements for acceptable fill ratings and conductor derating. NO exceptions. Listed partitions are acceptable in gutters or similar for proper partitioning.

3.3 CONDUIT, RACEWAY, FITTING AND BOX APPLICATION

- A. General Application:
 1. Conduit Sleeves: Provide RMC sleeves at all locations where conduits pass through beams, outside walls, fire rated walls, or structural members. The size of these sleeves shall be such as to permit readily the subsequent insertion of conduit of the proper size with adequate clearance for movement due to expansion and contraction. Where conduits pass through outside walls, the inside diameter of each pipe sleeve shall be at least 1/2" greater than the outside diameter of the service pipe. After the conduits are installed, fill the annular space between the conduit and its sleeve with a mastic or caulk. Use packing as required to accomplish this. At fire rated wall penetrations, use fire barrier.
 2. Surface-mount Raceway: Not permitted except as noted on the Drawings or in locations where concealing conduit is not possible.
 3. Branch Circuits: Shall not be installed in or under the ground floor slab unless specifically required on the Drawings or pre-approved by the EOR. No exceptions.
- B. Underground / In-ground:
 1. Acceptable Conduit: RMC, PVC, and Fiberglass.
 2. Fittings: All elbows shall be long sweep galvanized steel or fiberglass, no PVC. Other fittings shall match the conduit material.
 3. Boxes: Shall be cast metal, concrete or fiberglass. Shall be ANSI 77 traffic rated for the location.
 - a. Street / Drive: Vehicle Tier 22 rated.
 - b. Sidewalk: Personnel or vehicle Tier 8 rated.
 - c. Grass: Personnel Light Duty rated.
 4. Conditions: Conduit risers from elbow to above grade shall be RMC.
- C. Imbedded in / Passing through concrete:
 1. Acceptable Conduit: RMC, PVC, and Fiberglass.

2. Fittings: All elbows shall be long sweep galvanized steel or fiberglass, no PVC. Other fittings shall match the conduit material.
 3. Masonry Boxes: Galvanized steel masonry rated box.
 4. Conditions:
 - a. PVC allowed in concrete filled storm shelter walls or where required by utility provider.
 - b. Where allowed, conduit imbedded in concrete shall not be larger than 3/4". Verify with project Structural Engineer prior to placing.
- D. Wet and Damp Locations:
1. Acceptable Conduit: RMC.
 2. Fittings: Shall be rated for the space and shall match the material of the conduit they are installed with.
 3. Boxes: Recessed shall match conduit material. Surface-mount shall be stainless steel.
- E. Concealed / Exposed Dry Locations:
1. Acceptable Conduit - EMT.
 2. Fittings: Shall match the conduit material.
 3. Boxes: Malleable iron or cast aluminum (type FS / FD), with threaded hubs and gasketed covers.
 4. Conditions: Do not use aluminum in cinder-fill walls.
- F. Existing Walls:
1. Acceptable Conduit:
 - a. Concealed: FMC and EMT.
 - b. Surface-Mount: Surface-Mount Raceway and EMT.
 2. Fittings: Shall match the conduit material.
 3. Conditions: Surface-mount raceway shall be used in finished spaces. EMT may be used only in unfinished spaces, unless otherwise directed on the Drawings.
- G. Indoor Equipment Connections:
1. Acceptable Conduit: FMC and LFC (Liquid-Tight FMC).
 2. Fittings: Shall match the conduit material.
 3. Boxes: Shall match the conduit material.
 4. Conditions:
 - a. Where FMC or FNC are used, total length not to exceed 72" above ceiling, 48" exposed below ceiling.
 - b. In kitchen or similar spaces, use LFC unless otherwise directed on the Drawings.
 - c. Install flexible conduit to all recessed luminaires in accessible ceilings. Do not use more than four (4) flexible metal conduits per junction box to supply luminaires in a location. Do not supply a luminaire from another with any raceway or FMC. Suspend junction boxes and conduits from high roofs with hangers and trapeze.
- H. Outdoor Above Grade:
1. Acceptable Conduit: RMC.
 2. Fittings: Shall match the conduit material.
 3. Boxes: Weatherproof cast steel or cast aluminum.
 4. Conditions: Conduits may be used on a roof ONLY where indicated on the Drawings and shall be supported per the Specifications.
- I. Outdoor Equipment Connections:
1. Acceptable Conduit: LFC (Liquid-Tight FMC).
 2. Fittings: Shall be rated for the space or environment.
 3. Boxes: Shall be rated for the space or environment.

4. Conditions: Flexible conduit types shall not exceed 72" in length.

J. Corrosive Environments:

1. Acceptable Conduit: PVC and LFNC.
2. Fittings & Boxes: Shall be rated for the space or environment.
3. Conditions: Flexible conduit for equipment connections only unless otherwise noted on the Drawings.

K. Passing Through a Firewall:

1. Acceptable Conduit: EMT and RMC.
2. Conditions: Provide fire caulking at all penetrations.

3.4 CONDUIT, RACEWAY, FITTING AND BOX APPLICATION

A. General:

1. Unless otherwise indicated on the Drawings, conduits shall be concealed in walls, partitions and above the ceiling. In rooms where ceilings are not present or scheduled, orient conduit parallel or perpendicular to structure.
2. Conduits shall be continuous between enclosures such as outlet, junction and pull boxes, panels, cabinets, motor control centers, etc. The conduit must enter and be secured to enclosures so that each system is electrically continuous throughout. Where knockouts are used, provide double locknuts, one on each side. At conduit terminations, provide insulated throat fittings. Where conduits terminate in equipment having a ground buss, such as in switchgear, and panelboards, provide conduit with an insulated grounding bushing.
3. Capping
 - a. Cap open ends of raceways until conductors are installed to prevent ingress of dirt and moisture.
 - b. Cap or close ends and unused openings in wireways and gutters.
4. Sealing
 - a. Seal both ends of all conduits that serve as a passageway for control wiring, data, etc. through a rated wall to prevent air / gasses / contaminants from moving from one space to another.
 - b. Seal both ends of underground conduits as required to prevent ingress of water and other contaminants from outside.
 - c. All Sealant shall be fire caulk, putty packs, etc. to maintain the rating of the wall.
5. Provide insulated ground wire in all PVC conduit and extend to ground buss.
6. Moisture traps: Provide junction box with drain fitting at low points in conduit system to avoid moisture traps.
7. Use expansion-deflection fittings on conduits two (2) inches and larger crossing structural expansion joints and on exposed conduit runs where necessary. Provide bonding jumpers across fittings in metal raceway systems. Provide fittings to accommodate expansion and deflection where raceway crosses seismic, control and expansion joints.

B. Support:

1. Install conduits parallel and supported on unistrut or equal trapezes and anchored with split ring hangers, conduit straps or other devices specifically designed for the purpose. Wire ties are not permitted. Do not attach raceway to ceiling support wires or other piping systems.
2. Securely fasten and support all conduit runs. Provide required clamps, straps, clips, hangers and brackets. Raceways installed in joists shall be secured to joists with clamps at 20'-0" maximum spacing. Raceways installed parallel to joists shall be supported by caddy clips (1 inch or smaller) or in unistrut / threaded rods / beam clamps

trapeze at 15'-0" centers. Raceways installed perpendicular to bottom of joists shall be secured with individual conduit hangers at 10'-0" maximum spacing or unistrut / threaded rods / beam clamps at 15'-0" maximum centers. Raceways supported by straps at walls shall be supported per NEC. Support all raceways within one (1) foot of each box, cabinet, disconnect, bend or other raceway termination.

3. Raceways shall be supported with 2-hole straps. Single hole straps are not acceptable.
 4. Support raceway using coated steel or malleable iron straps, clevis hangers, and split hangers.
 5. Do not support raceway with wire or perforated pipe straps. Remove wire used for temporary supports.
- C. Raceway Spacing:
1. Maintain twelve (12) inch (300 mm) clearance between raceway and surfaces with temperatures exceeding 104°F (40°C). (Excluding roof mounted conduits.)
- D. Raceway Bends:
1. Make bends with standard ells or conduit bent in accordance with the NEC.
- E. Concealed Locations:
1. Install concealed conduit as directly and with the largest radius bends as possible. Conceal conduit in finished areas.
- F. Pull String:
1. Provide a Greenlee #431 or equal (240 lbs.) nylon pulling line in all conduits that are to be used as spares and all conduits used by other divisions, such as controls, communications, and similar systems. Identify both ends of the line by means of labels or tags reading "Pulling Line".
- G. Fire Rated Walls:
1. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping to comply with the latest applicable edition of the UL Fire Resistance Directory, Volumes I and II.
- H. Rooftop Installation:
1. RMC installed on the roof shall be securely fastened in place and supported on approved supports at least every ten (10) feet. Additionally, conduit shall be securely fastened and supported within three (3) feet of each outlet box, junction box, device box, cabinet, conduit body, or other conduit termination.
 2. LFC on the roof shall be securely fastened in place by an approved means within twelve (12) inches of each box, cabinet, conduit body, or other conduit termination, and shall be supported and secured at intervals not to exceed 4.5 feet. Flexible conduit shall not lay on roof.
- I. Raceway Assemblies:
1. Bring conduit to shoulder of fittings; fasten securely.
 2. Provide conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.
- J. Surface Raceway:
1. Provide flat-head screws, clips, and straps to fasten raceway channel to surfaces. Mount plumb and level.
 2. Provide insulating bushings and inserts at connections to outlets and corner fittings.
 3. Serve surface-mount raceways from flush outlet boxes mounted behind raceway where possible and as directed.

3.5 WIREWAY AND GUTTER INSTALLATION

- A. Install wireways and surface raceways where noted or as required. Field apply a 90% grey zinc paint coating over cuts or scratches before any other finish is applied.

3.6 COMMUNICATION SYSTEMS CONDUIT INSTALLATION

- A. This Contractor shall provide all raceways and conduits for all communication systems shown and / or required per Specifications and as shown on the Electrical and Communications Drawings. Communication systems may include but are not limited to fire alarms, intercoms, data, security, antenna and media management.
- B. This contractor shall provide a conduit pathway (minimum 12" long) above ceiling for fire alarm, data, AV systems, etc. between all spaces and the corridor, where walls go to deck. Coordinate exact conduit sizes and quantities (range from one (1x) 1" to two (2x) 4" conduits) with low voltage Contractors and Installers.

3.7 BACK BOXES, OUTLETS AND FITTINGS APPLICATION

- A. Back Boxes: Sizes and configuration shall be as required for the intended service and shall conform to and be applied in accordance with NEC Table 314.16(A). Provide extension rings, expandable bars sets, supports, gaskets for weatherproof type etc., where required.
- B. Ceiling-mounted Boxes: Provide supports and attachments to properly support ceiling and bracket-type devices or luminaires. Where the box shall support the device, the box shall be rated for the weight of the device / luminaire supported.
- C. Voice & Data Outlet: Provide back boxes at each voice and data outlet. Communications wiring, device and plate to be provided by communications Contractor. See Divisions 27 and 28 for additional requirements.

3.8 BACK BOXES, OUTLETS AND FITTINGS INSTALLATION

- A. Do not connect or install outlet boxes back-to-back.
- B. Unless otherwise shown or specified, install boxes for switches at 44" and receptacles at 18" AFF. Verify door swings with Drawings and schedules and locate switches and pull stations on the strike side of the door unless otherwise noted.
- C. Where back boxes are required for switches, receptacles, data jacks, thermostats, CO₂ sensors, etc. and are shown next to each other, all devices shall be installed at the same height and, where possible, provide a gang back box and cover them with a multi-gang cover plate.
- D. Protect boxes in such a manner as to prevent foreign material, such as plaster, from entering boxes. Boxes shall be thoroughly cleaned of foreign materials before pulling conductors.
- E. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- F. Accessible Ceilings: Install outlet and junction boxes no more than six (6) inches (150 mm) from ceiling access panel or from removable recessed luminaire. Provide suitable access doors for all boxes mounted above gypsum / hard or otherwise inaccessible ceilings.
- G. Do not fasten boxes to ceiling support wires or other piping systems.
- H. Support boxes independently of conduit.

- I. Install gang box where more than one device is mounted together. Do not use sectional box.
- J. Provide plaster rings for all boxes in plastered walls and ceilings.
- K. At all ceiling-mounted receptacle and luminaire locations (exit light, pendants, linear direct / indirect, etc.), provide a heavy-duty dual bar hanger with ceiling ties to support the back box. Provide Cooper Industries BA50F or approved equal with appropriate back box for the application.
- L. All outlet boxes shall be supported by both adjacent joists / studs using a mounting bracket that stretches the entire length between the joists / studs and is mechanically fastened to joists / studs at both ends. An outlet box fastened to a stud must be supported by both ends as mentioned above, OR a CV style back box shall be used IF it is fastened with at least two mechanical fasteners and IF it has far-side box supports (Morris 18350, Orbit ABS-6, Caddy 766A or approved equal). No other style back box mounting styles shall be used.
- M. Plates shall cover any cracks between box and tile. Use oversize plates where necessary.

3.9 FLUSH BOXES

- A. Mount all outlet boxes such that finished installation with mud ring is within 1/4 inch of the finished wall or ceiling line unless otherwise indicated. Provide knockout closures to cap unused knock out holes where knock out holes have been removed. Install outlets flush with finish walls or ceiling surfaces for concealed wiring.
- B. Provide galvanized steel extension rings where required to extend the box forward in conformance to NEC requirements. Attach ring with at least two machine screws. Install electrical boxes and fittings in compliance with NEC requirements and in accordance with the manufacturer's written instructions and with recognized industry practices to ensure that the boxes and fittings serve the intended purposes. Under no circumstances shall a conduit enter/exit an extension ring. Conduits shall enter / exit the electrical box only.
- C. Locate boxes and conduit bodies to ensure accessibility of electrical wiring. Install blank cover plates, painted to match surrounding, at pull boxes, junction boxes and all others to which no luminaire or device is to be attached.

3.10 POWER AND COMMUNICATIONS FLOOR BOXES AND POKE-THRU DEVICES

- A. Provide and install all wiring, devices, back boxes, covers, plates, conduit and hardware as required for a complete installation. Do not daisy-chain floor boxes or poke-thru devices with conduits unless otherwise noted on the Drawings. See Section 26 27 26 - Wiring Devices for wiring devices to go in floor boxes.
- B. Provide duplex receptacles and associated wiring per table below unless otherwise noted on the Drawings. Provide circuits as shown on the Drawings. If powered by an isolated ground circuit, all receptacles shall be isolated ground. Provide conduits indicated in the table below from each box to nearest wall and then up to accessible attic space for power, data, A/V and other wiring.

SIZE	Recept. Qty.	Power Conduit	Data Conduits
2-gang	1x duplex	1x - 1"	1x - 1-1/4"
4-gang	2x duplex	*1x - 1"	2x - 1-1/4"
6-gang	3x duplex	*2x - 1"	3x - 1-1/4"
8-gang	4x duplex	*2x - 1"	See Plans

10-gang	5x duplex	*2x - 1"	See Plans

* or as required.

3.11 INTERFACE WITH OTHER PRODUCTS

- A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods in accordance with Section 07 84 00 - Firestopping.
- B. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket. Coordinate location with roofing installation.

3.12 ADJUSTING

- A. Adjust flush-mounting outlets to make front flush with finished wall material.
- B. Install knockout closures in unused openings in boxes.

END OF SECTION

SECTION 262000 - LOW VOLTAGE ELECTRICAL DISTRIBUTION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Electrical service including underground primary requirements, transformer and secondary enclosure requirements, overhead and underground service entrance requirements, metering, and final connections.
- B. Provide and install all components of the low voltage distribution system(s) including all switchboards, panelboards, transformers, fuses, circuit breakers, disconnects, MCCs, etc. as shown on the Drawings and as required for a complete and working system. All equipment shall be sized to meet the latest adopted version of NEC 220 requirements as a minimum.

1.2 COORDINATION

- A. Prior to ordering disconnects and fuses or fuse holders, coordinate fuse ratings with the Mechanical Contractor to verify that fuses for all mechanical equipment matches the Maximum Over-Current Protection (MOCP) values of the mechanical equipment being provided. This Contractor to adjust upstream breaker sizes, branch circuit conductor sizes, whip sizes and disconnect sizes to accommodate the fuse (Over-Current Protection Device, OCPD) requirements for the supplied equipment.

1.3 SUBMITTALS

- A. Provide scaled shop drawings for each electrical equipment room showing the placement of all panelboards, transformers, and other equipment such as mechanical equipment, drawn to scale and dimensioned. Such shop drawings will be reviewed for compliance with the intent of the Drawings and the spaces available for all electrical equipment.
- B. Clearly indicate on the submittals whether equipment is fully-rated or series-rated and arrange the submittals in order the panelboards appear on the Drawings.
- C. Include the following parameters as applicable in the submittal: equipment name, description, voltage, phase, ampacity, kVA rating, K-rating, control voltage, impedance, etc.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. All panelboards, switchboards, disconnects, OCPDs, etc. shall be from the same manufacturer to ensure proper breaker coordination.
- B. All equipment on this project shall be new. Refurbished or used equipment will not be acceptable.
- C. Approved Manufacturers: Eaton (Cutler Hammer) and Square-D.
- D. All other manufacturers shall require pre-approval in accordance with Section 26 00 00 - Electrical.

2.2 GENERAL REQUIREMENTS

- A. Unless specifically noted otherwise on the Drawings, all equipment in these Specifications shall meet the requirements outlined below.
- B. Conductor material for switchboards, panelboards, disconnects, etc. shall be copper.
- C. Transformer coils shall be continuous wound and conductor material shall be copper.
- D. Unless otherwise indicated on the Drawings, provide the following enclosures for all panelboards, switchboards, switchgear, disconnects, transformers, etc.:
 - 1. NEMA 1 - All equipment located in interior dry locations.
 - 2. NEMA 3R - All equipment located in damp, wet or exterior locations.
 - 3. NEMA 4X - All equipment located in corrosive environments.
- E. All panelboards, switchboards, disconnects, etc. shall have weatherproof threaded hubs for top / bottom / side conduit entries.
- F. All equipment shall have a factory applied gray finish applied over a rust inhibiting treatment. Any items which have the finish marred shall be touched up or refinished to like new condition before final acceptance. This shall include, but shall not be limited to, sanding and properly removing rust or other contaminants and completely repainting equipment if damage is extensive. Overall acceptance is subject to approval of the Owner's Representative.
- G. Provide all labeling / identification per Section 26 05 53 - Identification of Electrical Systems.
- H. Provide, at each main switchboard and all downstream distribution, a complete (time-current) coordination study and an arc flash study with all required labels. Contractor may use the equipment manufacturer to provide both the required studies and the required labels. Contractor to adjust all settings for electronic-trip circuit breakers. See Section 26 05 73 - Power System Studies for more details.

2.3 PANELBOARD / SWITCHBOARD COMMON REQUIREMENTS

- A. Construction: NEMA PB 1, UL 67, interiors shall be completely factory assembled. See General Requirements above for NEMA enclosure rating requirements.
- B. Enclosure Properties: Door in door construction, standard conduit knockouts in ends and sides of cabinet. Provide flush type combination catch and key door locks on all panelboards and load centers. Key all locks alike, provide two keys with each panelboard.
- C. Bus Information:
 - 1. Ground Bus: Full length, 25% phase rated, bonded to each bus, additional isolated bus in computer and communication panels.
 - 2. Neutral Bus: Full length
 - a. 200% of phase rated for all non-linear, computer or isolated ground (IG) panels.
 - b. 100% of phase rated for all lighting and power panels.
- D. OCPDs: Provide bolt-on circuit breakers unless otherwise indicated on the Drawings.
- E. Fault Withstandability: Suitable for operation and able to withstand the symmetrical short circuit current as indicated on the Drawings or available at the location, whichever is larger.
- F. Spaces: Install all allotted or indicated spaces so that future OCPDs can be added without additional machining, drilling, tapping or bus extensions.

- G. Circuit Identification:
 - 1. Frame-mounted directory with a heat-resistant transparent face for identifying circuits. Mount inside the panelboard door. Use equipment names as reflected by panelboard schedules on the Drawings. Use room names and numbers selected by the Owner's Representative, which may differ from those shown on Drawings.
 - 2. Provide on all new and revised existing panelboards per Division 26 with new information. See Section 26 05 53 - Identification for Electrical Systems for more information.
- H. Features and Accessories:
 - 1. Provide metering and instrumentation per Section 26 09 13 - Electrical Power Monitoring and per Division 23 Energy Management Control System requirements.
 - 2. Provide GFCI and GFPE protection as indicated here, as shown on the Drawings and where required per NEC.
 - 3. Provide SPDs at each main switchgear per Section 26 43 00 - Surge Protective Devices.

2.4 PANELBOARDS

- A. Construction:
 - 1. Flush-mounted panelboards: Trims shall fasten to permit both horizontal and vertical adjustment. Provide barriers per NEC 215.15.
 - 2. Surface-mounted panelboards: Trims shall fasten to insure no overhang.

2.5 SWITCHBOARDS (> 1200A AMPS)

- A. Construction:
 - 1. Provide the required number of sections of the required size to fit in the space provided.
 - 2. Connect sections with busing. Cabled connections are not allowed.
 - 3. Switchboards rated 2,000 amps or greater shall have a minimum depth of 30 inches.
- B. Overcurrent Protection Devices:
 - 1. Circuit breakers: Shall be capable of field-installable shunt trip, all shall be capable of being locked in the OFF position.
 - 2. Fused switches: Provide fused switches and fuses as indicated on the Drawings.
 - 3. Clearly indicate size of breaker or fused switch and ON / OFF positions for all OCPDs.

2.6 SAFETY SWITCHES AND ENCLOSED CIRCUIT BREAKERS

- A. Product Description:
 - 1. Provide single-throw, horsepower rated, 100% load break and make rated, designed for locking in "ON" or "OFF" position, steel cabinets, as required by the application and required per the NEC.
 - 2. Provide equipment rated for the required voltage and with the number of poles required, dependent on the equipment requirements.
 - 3. Provide SPDs at equipment in accordance with Section 26 43 00 - Surge Protection Devices.
- B. Construction:
 - 1. All safety switches and enclosed circuit breakers shall be Heavy Duty (HD) type and built per NEMA KS 1 and UL 98.
- C. Disconnect / Safety Switches:
 - 1. Safety switches shall be fused, unless indicated as non-fused on the Drawings.
 - 2. All disconnects / safety switches shall be lockable in the OFF position.
 - 3. Use fuse clips which are rejecting type to accept Class RK or L fuses only.

- 4. Size fused safety switches and upstream conductors serving motor loads at 175% of motor nameplate or per NEC values, whichever is larger, and round to the next standard size.
- D. Enclosed Circuit Breakers: Provide where indicated on Drawings, otherwise provide a disconnect / safety switch.

2.7 CIRCUIT BREAKERS

- A. Product Description: Bolt-on, quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers; listed and labeled as complying with UL 489; ratings, configurations, and features as indicated on the Drawings.
- B. Interrupting Ratings: Provide size (ampacity) and withstand (AIC) rating as indicated on the Drawings. Series rated panels are NOT allowed. All panels shall be FULLY RATED.
- C. Thermal Magnetic Circuit Breaker: Bi-metallic overload elements, magnetic trip, common trip type so that an overload or fault on one pole will trip all poles simultaneously. Handle ties are not acceptable.
- D. Electronic-Trip Circuit Breaker: Solid-state, microprocessor-based, true RMS sensing trip units with the following field-adjustable trip response settings:
 - 1. Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
 - 2. Long time delay.
 - 3. Short time pickup and delay.
 - 4. Instantaneous pickup.
- E. Features and Accessories: Provide as required by NEC, as indicated in the Specifications and as shown on the Drawings.
 - 1. AFCI: Arc fault sensing where arc fault protection is indicated or required.
 - 2. GFCI / GFPE: Ground fault pickup and delay where ground fault protection is indicated or required by NEC.
 - 3. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
 - 4. Lock-Out Provision: For locking the circuit breaker in the off position.
- F. Provide number of poles indicated for the specified equipment or service, with common trip handle for all poles.
- G. Independently mount so that a single unit can be removed from the front of the panelboard without disturbing or removing main bus, other units or other branch circuit connections.
- H. All circuit breakers that have an overcurrent trip setting fixed or adjustable at 1200a or higher shall have an Energy-Reducing Maintenance Switch or similar approved method for arc energy reduction and shall meet all requirements of NEC 240.67 and NEC 240.87. No exceptions.

2.8 FUSES

- A. Performance Requirements:
 - 1. All fuses shall be from the same manufacturer.
 - 2. Provide ampacity rating as indicated on the Drawings or required by NEC.
 - 3. Unless otherwise indicated on the Drawings, size fuses serving all motor loads at 175% of motor nameplate FLA or NEC motor table ampacity, whichever is larger.
- B. 600-amp and less: UL Class RK-1 dual element, time delay.
- C. 601-amp and larger: UL Class L time delay.

2.9 GROUND FAULT PROTECTION

- A. Ground Fault Protection System:
 - 1. Ground sensor relay (GSR) system with ground break components, solid state construction, adjustable current pick-up and time delay settings.
 - 2. Coordinate ground sensor (CT) with integral test winding of sufficient size to encircle all phase and neutral conductors, for zero-sequence monitoring and a solid-state relay to operate the trip circuit on the main switches.
 - 3. Provide required transformer to supply power for tripping switches and connect phase to phase.
- B. Accessories Included:
 - 1. Ground fault relaying system for main switches to be zero-sequence type.
 - 2. Ground fault current-detection range to be 100a to 1,200a.
 - 3. Time delay range to be instantaneous to 60 cycles.
 - 4. Derive tripping and control power from control power transformers in switchboard.
 - 5. Components shall include static ground fault sensor, current monitor, and test panel.
- C. Where ground fault protection is required per NEC or indicated in the Specifications or the Drawings, coordinate with the equipment manufacturer to provide all proper GFCI / GFPE requirements for personnel (5ma) and equipment (30ma).

2.10 FRACTIONAL HORSEPOWER MOTOR-RATED SWITCH

- A. Product Description: NEMA WD-1 & WD-6, motor-rated toggle switch. For use when switch-mounted thermal overload relays are not required.
- B. See Specifications section 26 27 26 - Wiring Devices for additional requirements.

2.11 CONTACTORS AND RELAYS

- A. General:
 - 1. NEMA ICS 2, magnetically operated contactor with poles and contacts to match the circuit function and load. All contactors used for lighting shall be "lighting-rated".
 - 2. Coordinate coil voltage with controls system. 120v preferred. Provide fused control circuit transformers as required.
 - 3. Provide an enclosure to house all contactors and relays. See General Requirements above for NEMA enclosure rating requirements.
 - 4. All contactors to be rated for the load type, voltage and continuously rated current.
 - 5. Provide sufficient contactors and/or poles to accommodate quantity of circuits required to be switched plus an additional 25% for future growth.
 - 6. Mechanically-held contactors are required except where electrically-held contactors are specifically noted in the Drawings or Specifications.
- B. Mechanically-Held Contactors:
 - 1. Mechanism electrically operated by solenoids and mechanically latched.
 - 2. Coil clearing contacts to de-energized coils when device is held closed.
 - 3. Required remote control relay and controls for proper latching and unlatching.
- C. Electrically-Held Contactors:
 - 1. Mechanism electrically-held by a solenoid.
 - 2. Required relays and controls for proper operation.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify mounting supports are properly sized and located including concealed bracing in walls.

3.2 PREPARATION

- A. Coordinate with the power utility company to obtain information regarding the available short circuit current at the service point. Provide this information to the electrical gear manufacturer for use in the overcurrent protective device coordination study required by Section 26 05 73 - Power System Studies.
- B. Coordinate all requirements with the power utility company and include in the base bid, including but not limited to the following:
 - 1. Whether the service will be overhead or underground.
 - 2. The extent of any underground primary.
 - 3. The need for a secondary enclosure. Provide in bid if required.
 - 4. Any charges from the power utility company for providing service.
 - 5. The need for a transocket for utility metering.

3.3 APPLICATION

- A. Panelboards and Switchboards: Provide a complete isolated ground system including isolated ground panelboard with 200% neutral, SPD and separate isolated ground bus where indicated on the Drawings.
- B. Transformers:
 - 1. Provide K-1 transformers when serving panelboards, unless altered by below items.
 - 2. Provide K-13 transformers when serving isolated ground panelboards.
 - 3. Provide K-20 transformers when serving panelboards in network operations centers (NOC).
- C. Circuit Breakers:
 - 1. Provide ground fault circuit breakers (GFCI) where indicated on the Drawings, panelboard schedules and / or as required by NEC 210.8(B), 422.5, etc. For example, provide protection at all EWCs, hand dryers, kitchen equipment, concessions equipment, etc. Pull separate neutrals with each circuit to ensure correct GFCI operation.
 - 2. Provide combination AFCI / GFCI circuit breakers where AFCI protection is required per NEC and as indicated on the Drawings.
- D. GFCI Protection:
 - 1. Provide ground fault protection at all service entrance equipment in accordance with NEC 230.95.
 - 2. Provide ground fault sensing and indication on emergency systems in accordance with NEC 700.27.
 - 3. Provide ground fault protection at any additional locations indicated on the Drawings.
- E. Motor Disconnecting Means:
 - 1. Provide a motor-rated switch as a disconnecting means at all motors powered by 120v, 277v and 208v 1ph 20A circuits, unless otherwise indicated on the Drawings.
 - 2. Provide a fused disconnect at all motors not listed above, unless otherwise indicated on the Drawings.

3.4 INSTALLATION

A. General:

1. Set all equipment plumb, straight and level.
2. Provide and install all equipment, including electrical connections, in accordance with the manufacturer's written instructions, the applicable requirements of NEC and the NECA "Standard of Installation", and in accordance with recognized industry practices to ensure that products serve the intended function.

B. Electrical Service:

1. Underground primary: Unless otherwise noted on the Drawings, provide two 4" conduits from the power utility company service point to pad-mounted transformers. Primary conductors will be provided by the power utility company. Coordinate exact location of service point with the power utility company.
2. Pad-mounted transformer: Construct the transformer pad in accordance with the power utility company specifications. Coordinate with the power utility company before installation of concrete for exact size, location and all requirements. The transformer will be provided by the power utility company, unless otherwise noted.
3. Secondary enclosure: Coordinate with the power utility company and provide a secondary enclosure where required to transition from the transformer output to the service entrance feeder. Provide the pad for the secondary enclosure. Provide all conduit, wire, and terminations between the transformer and the secondary enclosure.
4. Underground service entrance: Provide all trenching, conduit, conductors and electrical equipment from the secondary terminals of the transformer / secondary enclosure to the main service disconnects.
5. Overhead service entrance: Provide all conduit, conductors, supports, weatherheads, and sleeving from the electric service point to the main service disconnects.
6. Metering: Provide conduits, conductors, cabinets, racks, transocket, and supports as required by the power utility company for service metering. All utility metering equipment will be provided by the power utility company.
7. Final connection: Coordinate final connection with the power utility company.

C. Panelboards and Switchboards:

1. Install in the locations as shown and as recommended in NEMA PB1.1. Mount the panelboards such that the top of the switch or circuit breaker in the highest position will not be more than 6-1/2 feet above the floor or working platform. Space all panelboards and switchboards to meet the requirements of NEC 110 and 408. Anchor enclosures firmly to walls and structural surfaces, ensuring that they are permanently and mechanically secured.
2. Provide required SPD breaker for each panelboard/ switchboard as indicated on the Drawings.
3. Coordinate installation of panelboards and enclosures with other trades, including Mechanical and Plumbing to avoid clearance issues with dedicated equipment space and working clearances.
4. Place all free standing or floor mounted equipment on four (4) inch housekeeping pads.

D. Transformers:

1. Mount transformers on additional vibration isolators and / or on neoprene and spring isolators at floor or other mounting points to meet sound ratings. Install per manufacturer's recommendations.
2. Exterior weatherproof transformers: Mount on six (6) inch thick minimum steel reinforced concrete slab. Extend slab one (1) foot beyond transformer on each side. Provide weather shields from the manufacturer.

3. Use flexible conduit, six (6) feet maximum length, for connections to transformer. Make conduit connections to side panelboard of enclosure.
 4. Check for damage and tight connections prior to energizing transformer. Measure primary and secondary voltages and make appropriate tap adjustments.
 5. At all floor-mounted transformers, installation shall be level and equipment shall be bolted to a raised four (4) inch concrete pad.
 6. Mount wall-mounted transformers using integral flanges or accessory brackets furnished by the manufacturer.
- E. Fuses:
1. Check fasteners on fuse clips for tightness when installing fuses.
 2. Install fuses so label is in an upright, readable position. Fuses without labels are not acceptable.
 3. Do not install fuses until equipment is ready to be energized.
- F. Safety Switches and Enclosed Circuit Breakers:
1. Mount switches within six (6) feet of the equipment served, so that operating handle is easily accessible. Align tops of switches when grouped together.
 2. Provide a four (4) inch housekeeping pad for all free standing / floor mounted safety switches whether they are mounted inside or outside.
 3. Mount vertically on required separate support system hardware with switch easily accessible (door to open 90 degrees minimum).
 4. Permanently mount safety switches from inside with plated or stainless bolts, toggle bolts or anchors. Exposed mounting bolts, screws, etc. are not acceptable.
 5. Permanently install fusible switches with Class R fuse kits so that fuses are readable when looking at open switch.
 6. Do not mount switches / disconnects to access panels or on nameplate data on equipment per NEC.
 7. Installation of conductors: Switches shall not be used as "junction boxes" between HVAC units (splicing or "pig tailing" is not permitted). The maximum number of conductors allowed per termination is determined by the manufacturer's approved rating for each terminal or lug.
- G. Contactors and Relays:
1. Unless otherwise indicated on the Drawings, mount contactors in electrical enclosures in the electrical room, mechanical room or designated area on Drawings in accordance with manufacturer's instructions and recommendations.
 2. Provide an override toggle switch for maintenance and testing located beside each contactor used for lighting.
 - a. Provide relay with integral override switch per Exterior Lighting Controls details on the Drawings.

3.5 ELECTRICAL SERVICE AND METERING PROVISIONS

- A. The Contractor shall provide all materials and labor shown on the Drawings and / or required for the complete installation except as specifically indicated to be by the serving power utility company. The Contractor shall meet all requirements as directed by the serving power utility company at the cost to the Contractor.

3.6 ADJUSTING

- A. Electrical Load Balancing: Balance panelboards by checking each phase of all panels under full load and arrange so that all phases carry the same load as near as possible by moving individual

branch circuits. After load balancing is complete, correct panelboard schedule directories to reflect all breakers and loads correctly.

- B. Transformer Voltage Adjustments: Measure primary and secondary voltages and make appropriate tap adjustments.
- C. GFCI Protection: Initial adjustments at service entrance equipment:
 - 1. Initial settings: At the time of installation, adjust the settings of the ground fault protection device as follows:
 - a. Time delay: Adjust the time delay to 0.3 seconds.
 - b. Pick-up: In no case can the setting exceed 1,200a. Observing this absolute maximum, adjust the ground fault trip setting to the greater of the following two options:
 - 1) 15% of the trip rating of the main breaker in the service entrance equipment.
 - 2) At least as large as the trip rating of the largest downstream overcurrent device that serves a single piece of equipment.

END OF SECTION

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Provide factory fabricated wiring devices of the type and electrical rating for the service indicated. Provide proper selection to fulfill the wiring requirements. All wiring devices and associated wall plates shall be colored to match each other, unless indicated otherwise on the Drawings or changed by owner requirements, code requirements or these specifications.
- B. Provide switch, receptacle, outlet, conduit, and special purpose wall plates for wiring devices, with ganging and cutouts as indicated, provided with metal screws for securing plates to devices with screw heads colored to match finish of plate.
- C. Provide a compatible receptacle for the cap or plug and cord of all other equipment installed in this project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by one of the following, unless specific manufacturers are listed or restricted elsewhere in this specification section:

2.2 GENERAL REQUIREMENTS

- A. Unless otherwise specified herein or indicated on the Drawings, all devices shall be specification grade, heavy duty, 20a rated (at equipment rated voltage with the required number of poles), back and side-wired with grounding terminals. Screw terminals or plugtail (P&S PTx series or similar) devices only, no push-in terminals. These devices shall comply with NEMA WD 1 and WD 6 Standards and shall all be listed.
- B. Color:
 - 1. Device color shall be coordinated with Owner's Representative and shall reasonably match across all divisions. Emergency devices and plates shall be red.
 - 2. Device plate material shall be as follows: In all finished spaces use Stainless Steel device plates and covers.
- C. All devices shall be properly labelled and identified per NEC, NFPA and IECC requirements. Additionally, all emergency device coverplates shall be labelled with the panelboard name and circuit number.

2.3 AC / TOGGLE SWITCHES

- A. Unless otherwise specified herein or indicated on the Drawings, all switches to be quiet-type, complying with UL 20 and Federal Specification WC 896.
- B. Wall Switches:

	<u>Single Pole</u>	<u>Double Pole</u>	<u>Three-Way</u>	<u>Four-Way</u>	<u>Pilot Light</u>
Eaton / Arrow	AH1221	AH1222	AH1223	AH1224	equal

Leviton	1221-2	1222-2	1223-2	1224-2	1221-PLR
Hubbell	HBL1221	HBL1222	HBL1223	HBL1224	HBL1221-PL
P & S	PS20AC1	PS20AC2	PS20AC3	PS20AC4	PS20AC1-RPL

2.4 RECEPTACLES

- A. Unless otherwise specified herein or indicated on the Drawings, all receptacles to be NEMA 5-20R duplex, complying with NEMA WD 6 Standards, UL 498 and UL 943, Federal Specification WC 596F and WC 596.
- B. Isolated Ground (IG) Receptacles: All IG receptacles to be four wire with self-ground strap. Place these receptacles at all computer and communications / technology locations if IG panelboards are provided.
- C. GFCI Receptacles: GFCI receptacles to be NEMA 5-20R duplex, self-test, auto monitoring, complying with UL 498 and UL 943.
- D. SPD Receptacles: NEMA 5-20R duplex, Type 3 SPD, >200 Joules, >6kA Surge, 3-mode, with indicator light.

- E. Specification Grade, Heavy Duty Receptacles:

	<u>20A Duplex</u>	<u>20A GFCI</u>	<u>20A IG</u>	<u>20A SPD</u>	<u>20A Tamper</u>
Eaton / Arr	5362	GF20	IG5362	5362S	TR5362
Leviton	5362	GFNT2	5362-IG	7380	5362-SG
Hubbell	5362	GFRST20	IG5352	HBL5362-SA	5362TR
P & S	5362	P2097	IG5362	5362-SP	TR5362

- F. Weatherproof Receptacles:
 - 1. All weatherproof receptacles shall have GFCI protection at the device or at the breaker.

2.5 DEVICE PLATES

- A. Both standard and oversized (jumbo / mid-size) device plates are allowed.
- B. All device plates shall be attached with screws. No screwless device plates are allowed.
- C. Weatherproof Cover Plates:
 - 1. Provide cast metal weatherproof device plates with hinged cover with self-closing lid for all exterior receptacles and where noted on the Drawings. Leviton WM1D series or equivalent by Eaton, Hubbell or P & S.
 - 2. When any outdoor receptacle is permanently in use (heat tape, etc.) provide a cover listed as "While In Use". Leviton IUM1x series or equivalent by Eaton, Hubbell or P & S.

PART 3 - EXECUTION

3.1 APPLICATION

- A. All devices shall have GFCI and AFCI protection where required per NEC 210.
- B. All receptacles shall meet tamper-resistant requirements where required per NEC 406 for the location installed.

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3.2 INSTALLATION

- A. All Devices:
 - 1. Install devices plumb and level and mount all devices per ADA.
 - 2. Install switches with OFF position down.
 - 3. The Owner's Representative can move any device, before installation, up to six (6) feet in any direction at no additional cost to the Owner.
 - 4. Install 302 / 304 stainless steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.
 - 5. Do not install behind markerboards, millwork, permanent mounted equipment, etc. Verify on Architectural drawings before installation. Where installed in unsuitable location, the Contractor will move as directed at no cost to the Owner.
- B. GFCI Receptacles:
 - 1. Install separate GFCI device at each location. Do not use feed through feature for any GFCI receptacle unless specifically noted on the Drawings.
- C. Device Plates:
 - 1. Use a single one-piece device plate for ganged devices (switches & receptacle).
 - 2. Device plates shall be flush, level and completely cover all openings per NEC. Provide oversized plates where required. Where oversized plates are used, all plates in the space shall be oversized for consistency.

3.3 QUALITY CONTROL

- A. Verify outlet boxes are installed at proper height and covers properly attached.
- B. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
- C. Operate each wall switch with circuit energized and verify proper operation.
- D. Verify each receptacle device is energized and test each for proper polarity.
- E. Test each GFCI receptacle device for proper operation.

END OF SECTION

SECTION 265000 - LIGHTING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Interior and exterior lighting systems including, but not limited to, luminaires, drivers, emergency drivers, emergency lighting, power transfer devices, poles and pole bases, etc.

1.2 COORDINATION

- A. Coordinate the location, mounting height and mounting style of luminaires with architectural RCP, mechanical (HVAC duct work, grilles, etc.), plumbing (exposed piping, sprinkler heads, etc.), technology (A/V, projectors, etc.) and other trades, as required, before installation.
- B. In any space with a ceiling other than gypsum, T-grid or exposed, the Contractor shall install 3-4 luminaires and make the installation available for review by the Owner's Representative before installing the remaining luminaires in the space.
- C. Coordinate placement of poles and associated foundations with utilities, curbs, sidewalks, trees, walls, fences, striping, etc. installed under other sections or by others. Coordinate elevation to obtain specified foundation height.

1.3 SUBMITTALS

- A. Submit luminaires shown on the Luminaire Schedule on the Drawings and those noted on the Drawings but not on the schedule.
- B. Product Data: In addition to the above requirements, submit complete product information for the following:
 - 1. Luminaires - complete manufacturer part number, delivered lumens, L70 rating, LM-80 testing hours, CCT (Correlated Color Temperature), CRI (Color Rendering Index), input wattage, finish, EPA (Effective Projected Area).
 - 2. Drivers - controls / dimming, power factor, THD (Total Harmonic Distortion).
 - 3. Emergency LED drivers - run time, battery chemistry, wattage.
 - 4. Power transfer devices for emergency lighting - manufacturer part number, wiring diagram.
- C. Indicate if DLC (DesignLights® Consortium) listing applies only to certain color temperatures, beam spreads, or other luminaire options. Indicate if any luminaire options void the DLC listing.

1.4 SAMPLES

- A. Submit non-returnable samples of luminaires upon request. Include all components necessary for a working product.

1.5 WARRANTY

- A. Provide a five (5) year manufacturer's warranty for all luminaires and emergency LED drivers. The warranty shall include all luminaire components including, but not limited to, LED arrays, drivers, luminaire body and hardware. LED arrays will be considered defective if a total of 15% or more of the individual diodes fail to illuminate.

- B. The warranty period shall cover the cost of equipment, materials, mobilization and labor for repair and replacement.

1.6 ADDITIONAL MATERIALS

- A. Additional materials to be a dollar cost in the base bid. At the end of the project, the Contractor shall generate a dollar amount credited back to the Owner for any unused items.
- B. Include in the base bid for additional materials:
 - 1. All costs to provide two (2) additional lighting circuits, all required branch circuit breakers, wiring, conduit, labor and devices as specified and directed by the Owner's Representative. Each circuit (wiring, conduit, OCPD, labor, etc.) to be priced with a rating of 20 amps and at a distance of 100 feet to furthestmost device. Each circuit to include fifteen (15) luminaires equal in value to luminaire type "B5".

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Only those manufacturers of luminaires and poles listed on the Luminaire Schedule are acceptable.

2.2 PERFORMANCE / DESIGN CRITERIA

- A. All luminaires shall be compatible with lighting controls shown on the Drawings or specified in Section 26 09 16 - Electrical Control Components and / or Section 26 09 23 - Lighting Control Devices.
- B. Exterior lighting shall meet all current city ordinances for light levels, light trespass and specific shielding requirements.

2.3 LUMINAIRES

- A. All luminaires shall have the following listings based on usage:
 - 1. LED luminaires shall comply with UL 8750 and UL 1598 requirements.
 - 2. Emergency luminaires, including exit signs, shall be UL 924 listed.
 - 3. Luminaires in hazardous locations shall comply with UL 844 requirements and be suitable for the environment.
- B. See the Luminaire Schedule for CCT, THD, CRI, lumen output tolerance, wattage tolerance, L70 rating. When these values are not listed on the schedule, use the following values:
 - 1. CCT - 4000K, minimum 80 CRI (interior) and 70 CRI (exterior), THD 10% max, life expectancy - L70 at 50,000 hours per LM-80 test data using TM-21 procedures.
 - 2. Tolerance for Lumen Output shall be + / - 8% and Wattage (VA) shall be +5% / -10%.
- C. CCT: Color Temperature shall be within a 3-step Standard Deviation Color Matching (SCDM) or MacAdam ellipse in accordance with ANSI C78.377.
- D. Expected Life: The estimated L70 of LED luminaires shall be derived from LM-80 test data in accordance with TM-21 procedures. LM-80 test data shall be measured in accordance with LM-79 procedures.
- E. Efficacy: All general purpose LED luminaires shall have a minimum efficacy of 90 lumens / watt.
- F. Finishes: Unless otherwise noted, consult Owner's Representative for factory luminaire finish.

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2.4 INTERIOR LUMINAIRES

- A. All luminaires in gyms, play areas, multipurpose spaces, etc. shall have a hinged wire guard and retainer latches for tool-less maintenance.

2.5 EMERGENCY LIGHTING AND EXIT SIGNS

- A. All emergency lighting and exit signs shall be provided with status indicator lamp and test switch. Integral test switch is preferred.
- B. See Emergency LED Drivers part below for emergency driver information.

2.6 LED DRIVERS

- A. Shall be factory installed, unless otherwise indicated on the Drawings or prior approval is given by the Engineer.
- B. Drivers shall comply with UL 8750, be UL Type TL or UL Class P listed and bear such labels.
- C. Voltage: Drivers shall be 60hz, universal input voltage (120v thru 277v) + / - 10% unless otherwise indicated on the Luminaire Schedule. Drivers shall demonstrate no visible change in light output with a variation of + / - 10% change in line voltage input.
- D. Remote Drivers: Unless otherwise dictated on the Drawings, remote drivers shall have remote wiring capability of fifty (50) feet minimum.
- E. Sensor Compatibility: Drivers shall be compatible with and not cause interference with the operation of motion sensors or other infrared control systems.
- F. Performance: Drivers shall have a power factor of 0.9 or greater, have an efficiency of 85% or greater and have an audible noise rating of 27dB Class A or less.
- G. Case Temperature: Interior drivers shall have a maximum case temperature rating of 75°C. Exterior drivers shall have a maximum case temperature rating of 85°C.
- H. Operating Ambient Temperature Range: Drivers shall be rated for a temperature range of 32°F - 122°F when mounted inside and rated to 0°F when outside or above an outside ceiling.
- I. Electromagnetic Compliance: Drivers shall comply with CFR Title 47 Part 15 Class A.

2.7 EMERGENCY LED DRIVERS

- A. In addition to the above driver requirements, Emergency drivers shall also meet the following:
 - 1. Shall be rated for at least ninety (90) minutes at full light output (120 minutes in storm shelters) unless otherwise noted on the Drawings.
 - 2. Shall operate with constant output power to maintain the output wattage to the LED array even as the system voltage diminishes.
 - 3. Shall be maintenance-free, nickel-cadmium battery technology.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide all luminaires of the types indicated, in accordance with NEMA standards, manufacturer's recommendations, and NEC requirements.

- B. Install indoor lighting systems in accordance with NECA / IESNA 500 and all exterior lighting systems in accordance with NECA / IESNA 501.
- C. Install all interior and exterior luminaires as shown on the Drawings. Where the layout needs to be altered, coordinate with the Owner's Representative for direction before installing luminaires to ensure even illumination and proper light levels.
- D. Provide support for all interior luminaires by means of bar hangers extended across the main ceiling support members. See lighting details on the Drawings for more information.
- E. All interior luminaires shall be independently supported from the building structure.
- F. Provide luminaires complete with LED arrays, LED drivers, and other accessories necessary for proper installation in the building construction and listed for fire rated ceilings where required by code or shown on the Drawings.
- G. Lighting Control: Provide switches with matching technology (line voltage dimming, 0-10V dimming, etc.) for dimming drivers in the locations shown on the Drawings. Provide lighting controls in accordance with Section 26 09 16 - Electrical Control Components, Section 26 09 23 - Lighting Control Devices and / or Section 26 55 61 - Theatrical Lighting.
- H. Emergency Lighting: Provide an emergency LED driver, power transfer switch, internal wiring etc. in each luminaire that is indicated on the Drawings as an emergency luminaire or night light.
- I. Emergency Lighting Power: For all emergency lighting powered by a generator or UPS, provide an emergency power circuit to every power transfer device.
- J. Mount recessed luminaires in the center of a ceiling tile or as shown on the Drawings.
- K. Provide luminaire whips (flex conduit / metal clad cable) from a junction box to each luminaire (not to exceed four luminaires per junction box) access plate. Luminaire whips between luminaires will not be accepted. Refer to luminaire installation details on the Drawings for more information.
- L. Locate all remote LED drivers and / or emergency LED drivers as noted on the Drawings. Otherwise, install above the ceiling above each luminaire or in an adjacent room with a low ceiling for easy access. Provide a permanent label on the ceiling t-grid to identify locations of all remote drivers. Mount drivers on rubber insulators.
- M. All exit signs and night lights shall not be switched. Provide a constant hot tied back to the panelboard serving the lighting in the space.

3.2 SITE QUALITY CONTROL

- A. Prior to final inspection, check all luminaires for damage during construction and replace damaged luminaires at no additional expense to the Owner. Test all emergency luminaires for proper operation, including exercising all transfer switching, emergency LED drivers, generator, etc. All luminaires shall be cleaned and completely operational at the time of final acceptance of the building.
- B. Where specific light levels are mentioned on the Drawings and the luminaire type, quantity, locations or lumen output is changed, the Contractor shall ensure light levels are met. Re-aim or add lighting as necessary.

- C. The design intent shown on the Drawings meets the city ordinances for outdoor lighting trespass and minimum light level requirements. It is the responsibility of this Contractor to ensure that the lighting is installed to meet the design intent and city ordinances. Where required, re-aim or add shields to meet these requirements.

3.3 ADJUSTING

- A. The Contractor shall move any luminaire up to six feet in any direction as directed at no additional cost.

END OF SECTION

SECTION 313116 - TERMITE CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Soil treatment.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include the EPA-Registered Label for termiticide products.

1.3 INFORMATIONAL SUBMITTALS

- A. Product certificates.

- B. Soil Treatment Application Report: Include the following:

1. Date and time of application.
2. Moisture content of soil before application.
3. Termiticide brand name and manufacturer.
4. Quantity of undiluted termiticide used.
5. Dilutions, methods, volumes used, and rates of application.
6. Areas of application.
7. Water source for application.

- C. Sample Warranties: For special warranties.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A specialist who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment and products in jurisdiction where Project is located and who employs workers trained and approved by manufacturer to install manufacturer's products.

1.5 WARRANTY

- A. Soil Treatment Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor, certifying that termite control work consisting of applied soil termiticide treatment will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

1. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT

- A. Termiticide: EPA-Registered termiticide acceptable to authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation.
 - 1. Service Life of Treatment: Soil treatment termiticide that is effective for not less than three years against infestation of subterranean termites.
 - 2. Ensure that products and application is compatible with Owner's ongoing termite treatment and inspection contact in force for adjacent buildings.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Remove extraneous sources of wood cellulose and other edible materials, such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.
- B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated.

3.2 APPLYING SOIL TREATMENT

- A. Application: Mix soil treatment termiticide solution to a uniform consistency. Distribute treatment uniformly. Apply treatment at the product's EPA-Registered Label volume and rate for maximum specified concentration of termiticide to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction.
 - 1. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
 - 2. Foundations: Soil adjacent to and along the entire inside perimeter of foundation walls; along both sides of interior partition walls; around plumbing pipes and electric conduit penetrating the slab; around interior column footers, piers, and chimney bases; and along the entire outside perimeter, from grade to bottom of footing.
 - 3. Masonry: Treat voids.
 - 4. Penetrations: At expansion joints, control joints, and areas where slabs and below-grade walls will be penetrated.
- B. Post warning signs in areas of application.
- C. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION 313116